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ARISTOTLE ON TELEOLOGY

MONTE RANSOME JOHNSON

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CLARENDON PRESS · OXFORD

OXFORD
UNIVERSITY PRESS

Great Clarendon Street, Oxford OX2 6DP

Oxford University Press is a department of the University of Oxford.
It furthers the University's objective of excellence in research, scholarship,
and education by publishing worldwide in

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Guatemala Hungary Italy Japan Poland Portugal Singapore
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Published in the United States
by Oxford University Press Inc., New York

First published 2005

British Library Cataloguing in Publication Data
Data available

Library of Congress Cataloging in Publication Data
Johnson, Monte Ransome.
Aristotle on teleology / Monte Ransome Johnson.
p. cm.
Includes bibliographical references (p.) and indexes.
1. Aristotle. 2. Teleology. I. Title.
B491.T4J64 2005 124—dc22 2005020165

Typeset by Newgen Imaging Systems (P) Ltd., Chennai, India
Printed in Great Britain
on acid-free paper by
Biddles Ltd., King's Lynn, Norfolk

ISBN 0–19–928530–6 978–0–19–928530–3

1 3 5 7 9 10 8 6 4 2

Acknowledgements

I would first like to thank those who vetted the complete book in one or more of its versions: Brad Inwood, Ian Hacking, Doug Hutchinson, Lloyd Gerson, Ronnie DeSousa, Jim Lennox, Margaret Cameron, Stephen Menn, Susan Sauve Meyer, Jennifer Whiting and the editors of the series and at the press, Julia Annas, Lindsey Judson, and Peter Momtchiloff. Their comments have saved me from countless errors and considerably improved the final product, and they will have tried to talk me out of all the errors and inadequacies that remain. Thanks also to Robert Wisnovsky and Taneli Kukkonen for giving me access to their (then) unpublished manuscripts on teleology in Arabic philosophy. Special thanks to the Greek reading group at the University of Toronto, with whom I read Theophrastus' *Metaphysics* in 1998–9 and Iamblichus' *Protrepticus* in 1999–2000. Those readings and discussions with professors, colleagues, and friends were a contributing cause to this book; although I'm sure the whole lot of them would respond to my book in their usual way, with unhesitating criticism.

Special thanks to my mother, Tish Johnson, for support from the beginning to the end.

Two Canadian universities and departments of philosophy materially supported the research for this book. The University of Toronto provided an International Student Scholarship and Open Graduate Fellowship from 1998–2002, as well as a Postdoctoral Fellowship in the Humanities from 2002–3. The Killam Foundation provided a Sir Isaac Walton Killam Postdoctoral Fellowship at the University of British Columbia from 2003 to 2004. Green College at the University of British Columbia also provided a Green College Research Scholarship for 2003–4.

Monte Ransome Johnson

Seattle
December 2004

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Contents

PART II: TELEOLOGICAL EXPLANATIONS IN NATURAL SCIENCE

List of Tables

Abbreviations

Anima	*De Anima* (On the Soul)
Ath	*Athenian Constitution*
Cael	*De Caelo* (On the Heavens)
Cat	*Categoriae* (Categories)
Div	*De Divinatione per Somnium* (On Prophesy in Sleep)
EE	*Ethica Eudemeia* (Eudemian Ethics)
GA	*De Generatione Animalium* (Generation of Animals)
GC	*De Generatione et Corruptione* (On Generation and Destruction)
HA	*Historia Animalium* (History of Animals)
IA	*De Insessu Animalium* (On Animal Progression)
Insomn	*De Insomniis* (On Dreams)
Int	*De Interpretatione* (On Interpretation)
Juv	*De Juventute et Senectute* (On Youth and Old Age)
Long	*De Longitudine et Brevitate* (On Length and Shortness of Life)
Mech	*Mechanica* (Mechanics)
Mem	*De Memoria et Reminiscentia* (Memory and Recollection)
Meta	*Metaphysica* (Metaphysics)
Meteor	*Meterologica* (Meteorology)
Motu	*De Motu Animalium* (On Animal Motion)
MM	*Magna Moralia* (Great Ethics)
Mund	*De Mundo* (on the Cosmos)
NE	*Ethica Nicomachea* (Nicomachean Ethics)
PA	*De Partibus Animalium* (On the Parts of Animals)
Phys	*Physica* (On Nature)
Poet	*De Poetica* (Poetics)
Pol	*Politica* (Politics)
Post	*Analytica Posteriora* (Posterior Analytics)
Prior	*Analytica Priora* (Prior Analytics)
Prob	*Problemata* (Problems)
Protr	*Protrepticus Philosophias* (Exhortation to Philosophy)

Resp	*De Respiratione* (On Respiration)
Rhet	*Ars Rhetorica* (Art of Rhetorical)
SE	*Elenchi Sophistici* (Sophistical Refutations)
Sens	*De Sensu et Sensibilibus* (On Sense and Sensibilia)
Somn	*De Somno et Vigilia* (On Sleep and Waking)
Top	*Topica* (Topics)

Aristotle is cited according to book and chapter, as well as page, column, and line, in the edition of I. Bekker (*Aristoteles Graece ex recensione Immanuelis Bekkeri*, 2 vols., Berlin, 1831). All translations are mine, based on the editions in the *TLG* (*Thesaurus Linguae Graecae canon of Greek authors and works*, 3rd edn. Oxford, 1990), unless otherwise noted.

All other abbreviations of classical works follow those in the LSJ (*Greek-English Lexicon*, compiled by H. G. Liddell and R. Scott, rev. H. S. Jones, 9th edn. Oxford, 1940). References to earlier Greek philosophers are to DK (*Die Fragmente der Vorsokratiker*, ed. H. Deals and W. Kranz. 3 vols. 6th edn, Berlin, 1951) References to Plato are to the page, column, and line numbers found in the OCT (Oxford Classical Texts, *Platonis Opera*, ed. J. Burnet, 5 vols. Oxford, 1900–22). References to Greek commentators are to the *CIAG* (*Commentaria in Aristotelem Graeca*, ed. H. Diels. Berlin, 1892–1909).

Further information on texts and translations, commentaries, other classical writers, and secondary sources, is provided in the Bibliography.

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Introduction

The reason why an introduction appears first, although it is typically written last, could be as follows: genetic and explanatory orders are reversed in complex creations. In the order of exposition, that which something is for—its end—comes first, and the features necessitated by this condition follow. Accordingly, I will take the opportunity of this introduction to indicate the purpose of this book, which is twofold: (1) to determine how ends are used by Aristotle as explanations in natural philosophy, and (2) to determine what the limits of that kind of explanation are. Ends and limits are concepts that Aristotle himself brings together in several crucial passages that bear on his teleology.[1]

A thorough study of Aristotle's teleology can tell us a lot about Aristotle's philosophy, about Greek philosophy generally, and even about contemporary philosophical, scientific, and ethical problems of scientific explanation and causality. As I argue in the conclusion, it can also change the way we view and relate to nature.

How can a study of teleology contribute to our understanding of Aristotle or his place in Greek philosophy? The answer to this question might be thought too obvious. In a recent comprehensive study of cause and explanation in Greek philosophy, covering more than a millennium, teleology is said to be the central issue.[2] Teleology is thought by many to be the key to Aristotle's thought.[3]

[1] 'We seek the reason why up to this point, and then we think we know, when it is not the case that this either comes about or is because something else does; for the last term is in this way an end and a limit' (*Post* i 24, $85^{B}27$–30); 'all practical processes of thinking have limits—they all go on for the sake of something else, and all theoretical processes come to a close in the same way that accounts do' (*Anima* i 3, $407^{a}23$–25); 'nature flees from the infinite; for the infinite is imperfect, and nature always seeks an end' (*GA* i 1, $715^{B}14$–16); 'all living things both move and are moved for the sake of something, so that this is the limit of all their movement—that for the sake of which' (*Motu* 6, $700^{B}15$–16); 'the reasonable person, at least, always acts for a purpose; and this is a limit, for the end is a limit' (Meta i 11, $994^{b}16$); 'For the end is a limit (τὸ γὰρ τέλος πέρας ἐστίν)' (*Meta* ii 2, $994^{b}16$); 'we apply the term "limit" . . . also to the end of each thing, and of this nature is that towards which the movement and action are' (*Meta* v 17, 1022a4–7), 'there is an end of the things we do, which we desire for its own sake . . . we do not choose everything for the sake of something else, for then the process would go on to infinity, so that our desire would be empty and vain' (*NE* i 1, $1094^{a}18$–21).

[2] 'Whether . . . nature is such as to be completely describable without remainder in terms of purely mechanical laws of working, or whether rather nature demands to be understood in teleological terms, is the central question of Greek philosophical science' (Hankinson 1998, p. 6).

[3] 'If Aristotle is known for anything, it's his teleology' (Gotthelf and Lennox 1987, PIAB, p. 199); 'This most teleological of all thinkers, at least by reputation and upon the basis of many texts in his corpus' (Oates 1963, p. 251); 'Aristotle—the arch teleologist' (Veatch 1992, p. 55); 'much else in Aristotle's thought, from his ethical theory to the theory of substance . . . depends centrally on his natural teleology' (Gotthelf 1997, p. 82); 'The intuitive notion of functions and what they explain is basically Aristotelian' (McLaughlin 2001, p. 211).

Despite near unanimity on the importance of teleology to Aristotle, there is no consensus, but rather widespread disagreement, both about the general character of Aristotle's teleology, and about many specific issues. A comprehensive study of his remarks is needed in order to resolve several persistent interpretative problems and technical difficulties that can no longer be resolved in a piecemeal fashion, since the central issue is how apparently mutually exclusive conceptions of teleological explanation can be reconciled in a coherent interpretative framework. Is teleology about causation or explanation? Does teleology exclude or obviate mechanism, determinism, or materialism? Is teleology focused on the good of individual organisms, or is god or man the ultimate end of all processes and entities? Is teleology restricted to living things, or does teleology apply to the cosmos as a whole? Does teleology identify objectively existent causes in the world, or is it merely a heuristic for our understanding of other causal processes? Even apart from these issues debated with extraordinary depth in the community of Aristotle and Greek philosophy scholars, there are serious popular misconceptions about Aristotelian teleology that must be addressed. For example, Aristotle is often characterized as a naïve or uncritical teleologist. Detractors reject his supposed panglossianism,[4] mysterious entelechies, magical pneuma,[5] obscure natures, hidden essences,[6] backwards causation,[7] animism,[8] and anthropomorphism.[9] Even supporters have sometimes understood his teleology to necessitate such undesirable doctrines as vitalism,[10] creationism,[11]

[4] 'Pangloss taught metaphysico-theologo-cosmolo-nigology. He proved incontestably that there is no effect without a cause . . . "It is proved," he used to say, "that things cannot be otherwise than as they are; for as all things have been created for some purpose, they must necessarily be created for the best purpose. Observe, for instance, the nose is formed for spectacles, therefore we wear spectacles. The legs are visibly designed for stockings, accordingly we wear stockings . . . since pigs were made to be eaten, we eat pork all the year round" ' (Voltaire's *Candide, or Optimism* (1758), p. 20, trans. J. Butt).

[5] Balme complains: 'tradition lapsed into philosophy-fiction, inventing such *dei ex machina* as a hypostasized Nature supervising an overall teleology, or a cosmic control operated by the Unmoved Mover, or a living universe, or mysterious entelechies and magical pneuma within animals' (1980, p. 291).

[6] Karl Popper says, 'methodological essentialists, for instance Aristotle . . . all agreed with him [Plato] in determining the task of pure knowledge as the discovery of the hidden nature or Form or essence of things' (1945/1966, p. 31).

[7] 'Aristotelian goal-directed causality . . . appeared to put the cart before the horse—explaining a cause before its effects—and thus to require "backwards causation" (Buller 1999, p. 5); "[teleological explanation] might presuppose either reverse causation or minds' (Nissen 1997, p. vii).

[8] Gomperz speaks of Aristotle's 'extreme teleological view of nature and the, so to speak, atavistic tendency to assume the animation of all nature' (1909, p. 171); 'Aristotle argued that a falling body accelerated because it grew more jubilant as it found itself nearer home' (Skinner 1971, p. 6).

[9] 'Modern science arose in opposition to Aristotelian thought . . . and there has since been a pronounced tendency, already noted, to eschew Aristotelian concepts whenever possible. There have not been wanting scientists and philosophers who have insisted that the very concept of a cause is quite worthless, being "anthropomorphic" in origin' (Taylor 1967, p. 57). The charge is leveled earlier by Meyer 1919.

[10] For example, Rist: 'there is some kind of desire inherent in matter' (1965, p. 342).

[11] 'Aristotle seems to regard nature as a designing power . . . not merely an immanent force, but a person having reason and foresight' (Allan 1952, p. 33). A recent example: 'Galen did not reject Aristotelianism entirely. His explanation of natural processes such as the transformation of matter depended on Aristotelian concepts, and he was convinced, like Aristotle, that the body had been carefully

and anthropocentrism.[12] I try to show that all of these criticisms and interpretations are misplaced, and that they can be eliminated in the process of addressing the scholarly disputes mentioned earlier.

What can a study of Aristotelian teleology tell us about our own philosophical, scientific, and ethical problems? Because the Aristotelian corpus is a powerful investigative resource and critical tool, Aristotle's theory of teleology, in its application to such diverse disciplines as physics, biology, ethics, and politics, offers an opportunity to survey the uses and abuses of teleological reasoning across a broad spectrum of philosophical interest. It is widely held that the scientific revolution of the sixteenth and seventeenth centuries turned on the rejection of final causes and the establishment of a mechanistic world picture. A possible result of the survey is that we can better understand what renaissance and modern scientists and philosophers were positioning themselves against when they rejected final causes, if that is in fact what they have done. And it can also help evaluate in what respects their arguments were and are right and have proved productive, and in what ways they were wrong, failed to appreciate all the alternatives, and have inhibited a better understanding of what a scientific explanation is.

In part, what I want to do in this study is reopen a line of Aristotelian interpretation that originated in the early twentieth century. The interpretation I have in mind recognized that the most important feature of Aristotelian teleology is that it presents an alternative to the anthropocentric, creationist, and providential schemes of teleology that were favored by Aristotle's predecessors, and were later popular in the commentarial tradition's appropriation of Aristotle, and in the early modern period's natural theology. This point of view is clearly expressed by Zeller,[13] Gomperz,[14] and Ross.[15] Although the position has also been maintained more recently,[16] it has

designed by a provident and purposeful creator' (Nutton 2002, p. 801). Chroust 1973 has tried to commit Aristotle to such a view with his discovery of a 'teleological proof for the existence of god' in Aristotle's lost work *On Philosophy*.

[12] Examples: David Sedley's affirmative response to the question in the title of his paper, 'Is Aristotle's Teleology Anthropocentric?' (1991); Hughes 1975, pp. 64–5 and 1985, p. 73.

[13] 'The most important feature of the Aristotelian teleology is the fact that it is neither anthropocentric, nor is it due to the actions of a creator existing outside the world or even of a mere arranger of the world, but is always thought of as immanent in nature. What Plato effected in the *Timaeus* by the introduction of the world-soul and the Demiurgus is here explained by the assumption of a teleological activity inherent in nature itself' (Zeller 1883/1955, sec. 48).

[14] 'Aristotle's teleological interpretation of the universe outgrew the cramping bounds by which that conception had been confined in the thought of Xenophon, perhaps of Socrates. It is not man and the profit that he draws from the well-ordering of the universe that stands in the foreground of his contemplation. It is rather the well-ordered beauty of the cosmos itself that determines his judgment, wherein he resembles Anaxagoras, Diogenes of Apollonia, and Plato' (Gomperz 1909, p. 132).

[15] 'Aristotle's teleology is, it will be seen, an "immanent" teleology. The end of each species is internal to the species; its end is simply to be that kind of thing, or, more definitely, to grow and reproduce its kind, to have sensation, and to move, as freely and efficiently as the conditions of its existence—its habitat for instance—allow. Only once, perhaps, does Aristotle suggest (and only doubtfully) that a characteristic of one species might be designed for the sake of another' (Ross 1923, p. 129).

[16] Most notably by Balme 1965, Grene 1972, Nussbaum 1978, Berti 1989/90, Lennox 1992, and Wardy 1993.

neither been confirmed through a comprehensive survey of Aristotle's works, nor been brought to bear on more general philosophical issues.

For Aristotle, teleological explanations explain how animal parts and behavior are 'adapted' to their environment, and not how the environment is adapted to the needs of animals or other organisms (including humans). In this way, Aristotle's explanations are more like contemporary biological theories of evolutionary adaptation,[17] and quite different from either 'the teleological proof' or 'design argument' employed by natural theology,[18] or its contemporary cosmological counterpart, 'the anthropic principle'.[19]

I also believe strongly that Aristotle's teleology can change the way we view and relate to other natural entities. Aristotle defines nature as an internal principle of change, and as an end. He shows us how ends and goods can and must enter into scientific explanations. Every natural substance is an end, and is identified as the beneficiary of its own parts and motions. Aristotle thus provides us with a way to think about goods as natural phenomena, as objective causes out there in the world, and not merely as products of the human mind. Just as he shows how a thing's nature can be the basis for explaining its parts and behavior without any reference to an intelligent designer, so he shows how the nature of a thing, especially an organism, can be the basis for explaining its end and good without any reference to human interests and ends.

I contend that this presents a challenge to anthropocentrism, pervasive or dominant though it is. Anthropocentrism is the position that human beings are the center—or rather the end—of everything; everything has value or is good only in relation to human beings. Some versions of anthropocentrism are anti-teleological, such as those predicated on the reduction of the explanation of all non-human organisms to 'efficient causes'. Aristotelian arguments that expose the theoretical shortcomings of this view force us to look beyond Cartesian machines and Skinnerian behavior-systems that discount the value of all living things besides humans. Other versions of anthropocentrism are themselves teleological. For example, the Stoics

[17] 'Aristotelian "why" questions are quite legitimate in the study of adaptations, provided one has a realistic conception of natural selection and understands that the individual-as-a-whole is a complex genetic and developmental system' (Mayr 1983, p. 332). Adaptation refers to characteristics that improve the chance of an organism reproducing (whether physiological or behavioral), and so are favored by natural selection (cf. *Unwin-Hyman Dictionary of Biology*, second edition, 1995, s.v. adaptation). Obviously this is on the face of it very different than Aristotle's theory, but my point is that Aristotle's position is not as different from this as it is from teleological arguments in natural theology, or anthropic cosmological principles. See also: Gotthelf 1988; Lennox 1993; Depew 1997.

[18] 'The world exhibits teleological order (design, adaptation); therefore, it was produced by an intelligent designer' (Alston 1967).

[19] 'It is not only that man is adapted to the universe. The universe is adapted to man. Imagine a universe in which one or another of the fundamental dimensionless constants of physics is altered by a few percent one way or the other? Man could never come into being in such a universe. That is the central point of the anthropic principle. According to this principle, a life-giving factor lies at the center of the whole machinery and design of the world' (J. A. Wheeler, 'Forward', in Barrow and Tipler 1986, p. vii).

embraced a cosmic teleology which held that all plants and animals function primarily for the sake of humans. Aristotelian arguments can show that such versions of teleology are theoretically incoherent and scientifically unsound.

Some influential scholars have even maintained that Aristotle's own teleology is anthropocentric. One of my main objectives is to refute that interpretation. It is true that there are passages in which Aristotle discusses the value of natural things like plants and animals to humans, treating such entities as instrumentally valuable. These passages deserve our closest attention because they show a philosopher whose inclinations go the other way grappling with a view virtually unanimously held by his predecessors. But it would be a grave mistake to infer from Aristotle's discussion of the instrumental value of plants and animals that Aristotle therefore holds that such natural substances do not at the same time have intrinsic ends independent of their instrumental value to humans. For Aristotle insists that these ends are in the final analysis more important, even for human success, than the instrumental uses of natural things. While the artificial ends of plants and animals are only instrumentally useful to us, the natural ends of plants and other animals are intrinsically valuable and, as objects of contemplation, have paramount significance for the ultimate end of human life.

Aristotle gives good reasons—scientific and ethical reasons—why we ought to value other natural things more for their own ends than for what we can do with them. Sure enough, humans need to use natural substances, including other organisms, instrumentally. The development of techniques of hunting, agriculture, and animal husbandry is a clear manifestation of that need. But Aristotle argues that these techniques, like all technologies, have a natural limit, the transgression of which is *contrary to nature* and ignoble. That limit is what is necessary for our survival and functioning, in accordance with our own natural needs and functions (which, Aristotle holds, can be objectively determined for humans, just as it can for other animals).

We have overcome the Aristotelian view that the earth is at the center of the spatial universe, but we still need to come over to the Aristotelian view that humans are not at the center of the axiological universe. Thus I think that a study of Aristotelian teleology, in addition to being an intrinsically valuable exercise, can be justified instrumentally on the grounds that it has something to show us about our relationship to nature.

I conclude this introduction with an abstract of the argument that follows. Aristotle holds that natural science is knowledge that comes about through demonstration of the causes of natural kinds. Most important is 'the cause for the sake of which'—the end. The identification of a natural end initiates the process of explanation and constitutes the basis for all objective knowledge about natural kinds—stars, elements, plants, animals, humans, and cities. The determination of the ends of natural kinds also indicates how other causal factors, such as matter and necessity, are to be integrated into an explanatory account of their parts and behavior.

Aristotle is commonly considered the inventor of teleology, although the exact term 'teleology' originated in the eighteenth century. If teleology means the use of ends and goals in natural science, then Aristotle should be regarded rather as a critical innovator of teleological explanation. Teleological notions were widespread among his predecessors, but Aristotle rejected their conception of extrinsic causes such as mind or god as the primary causes for natural things. Aristotle's radical alternative was to assert nature itself as an internal principle of change and an end, and his teleological explanations focus on the internal and intrinsic ends of natural substances—those ends that benefit the natural thing itself. To these he contrasted incidental ends of natural things, such as possible uses of the thing that do not serve its own functions and interests.

Aristotle's use of ends was subsequently conflated with incompatible 'teleological' notions, including proofs for the existence of a providential or designer god, vitalism and animism, opposition to mechanism and non-teleological causation, and anthropocentrism. I aim to correct these misrepresentations through an elaboration of Aristotle's methodological statements, as well as the explanations actually offered in the scientific works. Although Aristotle's philosophy sometimes suffers from failed extrapolation of teleological principles, still it succeeds in challenging the anthropocentric conception of nature, and rising above the banausic perspective which views all natural things as instruments for human ends, to a loftier viewpoint from which natures can be observed and appreciated as their own goods.

In the first chapter, I offer a brief overview of the controversial history of the interpretation of Aristotelian teleology. The Greek, Arabic, and Latin commentarial traditions sought to unify Aristotle's thought with the Platonic demiurge, Islamic faith, and the Christian god, and used his philosophy to develop arguments or proofs for the existence or the qualities of god. In the early modern period, this effort flourished in the discipline of natural theology, which pointed to natural things as evidence of god's design and providence. The term 'teleology' was invented in this context. Philosophers such as Bacon, Descartes, and Spinoza criticized the excesses of teleology and final causes in natural science, and painted a mechanistic world picture that they opposed, rhetorically at least, to the scholastics' dependence on final causes. Eventually, Kant was compelled to confront the apparent antinomy between teleology and mechanism in the finale to his critical philosophy, *The Critique of Teleological Judgment*. Kant endorsed the heuristic value of teleological explanation, and considered humans the ultimate end of nature. These influences are sources of possible confusion and anachronism in the interpretation of Aristotle. One can get a clearer picture of Aristotle's own concerns by examining a text written in the milieu of Aristotle's own school, Theophrastus' *Metaphysics*. Theophrastus expresses reservations and concerns about the excessive use of teleological principles and slogans, and about the extent to which the universe can be characterized as ordered for the sake of some overall purpose or good. I argue that these are concerns that Aristotle shared with his colleague and successor, and addressed in his own works.

In the second chapter, the way is cleared for a discussion of Aristotle's teleology by introducing in broad terms his conception of cause and explanation. Aristotle says that all causes (including nature, necessity, luck, and so forth) fall under 'four headings'. The causes are crucial to scientific knowledge: demonstration involves a syllogism in which a cause is the middle term. It is necessary to see how this works for three other kinds of cause, before introducing teleological explanations and describing how the cause 'for the sake of which' should work in demonstrations. Aristotle himself raises the most important issues that uniquely pertain to this latter kind of explanation, such as temporal sequence, and integration with material and efficient causation. The chapter ends with a discussion of the crucial distinction between explanatory and non-explanatory causes (or intrinsic and incidental causes), and how these relate to theoretical and practical knowledge.

In the third chapter, we will discuss at length the specific terms and concepts of Aristotle's teleology. Teleological explanations involve what Aristotle consistently calls 'the cause for the sake of which'. This locution is said to have two senses: aim and beneficiary. The distinction has major and underappreciated significance for the interpretation of Aristotle's teleology. But its importance can be seen in connection with other teleological terms and phrases, such as the methodological principle that 'nature does nothing in vain', normative terminology such as 'good' and 'noble', and the family of terms containing the root TELE-, including the noun *telos* ('end'), the adjective *telion* ('complete'), and the verb *teleiousthai* ('to complete').

In the fourth chapter, we discuss Aristotle's dialectical interrogation of his predecessors. Some of the most important discussions of teleological ideas occur in the context of Aristotle's criticisms of his predecessors' accounts of natural things. According to Aristotle, Empedocles tried to account for natural things by the cause of luck, Anaxagoras by intelligence, Plato by form, and Democritus by necessity. Aristotle co-opts what is successful in these strategies, but at the same time criticizes them for failing to account for the regularity with which natural things are generated for the sake of their own ends. By examining these criticisms, one can see how Aristotle could have dealt with other philosophers whom later commentators have considered teleological (such as Diogenes of Apollonia in his use of intelligence and air, and Xenophon's Socrates in his postulation of a providential god designing and arranging everything for the sake of humans). Aristotle considers these causes—luck, intelligence, and god—to be extrinsic causes that cannot on their own present a satisfactory explanation of natural kinds such as plants and animals. His own proposal is that nature is an internal principle of change and an end, and that it is with reference to such a cause that natural phenomena and their regularity must be explained.

Having discussed the history, terms, logic, and available alternatives to Aristotelian teleology, in Part II we examine the actual teleological explanations offered by Aristotle of natural substances. The order in which the examination

will proceed follows the syllabus for the study of nature put forth by Aristotle himself, in the first chapter of the *Meteorology*.

> We have previously spoken about [**a**] the primary causes that are natural (περὶ μὲν οὖν τῶν πρώτων αἰτίων τῆς φύσεως) and [**b**] about all the natural motions, and [**c**] again about the upper motions of the stars which have been ordered, and [**d**] about the corporeal elements, how many there are and what they are like, and how they change into others, and [**e**] about generation and destruction generally. [**f**] It remains still to theorize about a part of this inquiry (μεθόδου), which all our predecessors called meteorology (338ª20–26) . . . [**g**] Having discussed these, we can theorize about what way we are able to demonstrate with respect to animals and plants, both generally and separately (καθόλου τε καὶ χωρίς). For then we would have almost reached the end (τέλος) of everything we wanted to speak about from the beginning (ἐξ ἀρχῆς) (*Meteor* i 1, 339ª5–10; cf. *Sens* 1, 436ª1–17)

This syllabus, as it were, follows a scale of increasing complexity: from general principles and definitions, through elementary motions, to more complex elemental changes, including a vast variety of motions and affections of elements in the region between the earth and the moon, and finally on to the complexities of plant and animal growth, motion, and behavior. We can continue with this train of thought onto the even more complex and difficult stations of human action and political organization.

In Chapter 5, we examine Aristotle's teleological conception of change and motion at the fundamental level of the elements. Aristotle conceives of natural motion and change in general teleologically, as a condition of completion with respect to something's capacities. This is clear on the elemental and every subsequent level of motion and change. The circular motion of celestial bodies (which are composed of the element ether), for example, is the completion of the capacity for perfectly rational motion. Stellar rotation is for Aristotle the paradigm of a teleologically explicable activity, and he supports this claim with evidence from observation, theory, and tradition. Nevertheless, Aristotle's account generates some perplexities, the resolution of which show much about Aristotle's overall methodology. The four terrestrial elements (earth, water, air, and fire) are teleologically explicable because their motion can be completed when they arrive at their natural place in the cosmos, and because through cyclical transmutation they resemble the circular motions of the heavenly bodies. Although Aristotle is clear in his rejection of vitalism or animism, he does hold that the terrestrial elements themselves are the recipients of an extremely attenuated benefit through their existence and everlasting activity. This benefit, not the possible incidental benefits to animals or humans, is crucial to the teleological explanation of rainfall, which is otherwise explained by reference to necessity, moving and material factors alone.

In Chapter 6, we will introduce Aristotle's use of teleological explanations of living things by considering the problems and principles unique to the life sciences. The investigation of living things is, for Aristotle, another aspect of the science of nature, one that studies complex or organic natural bodies (substances), their parts, movements, and behavior. Elements make up homogeneous and heterogeneous

parts or organs. The relationship of these parts to the organisms made up of them is teleological: flesh and hands exist for the sake of the whole organism, specifically the capacities of its soul, which can themselves be ordered serially on a hierarchy of increasing complexity (reproduction, nutrition, perception, locomotion, prudence, knowledge, etc.). Although the more complex parts and capacities come into being after the simpler, the simpler exist for the sake of the more complex. Thus there is an inversion of the genetic and explanatory orders in the case of organisms, although a study of Aristotle's account of explanation generally and animal generation specifically reveals that this inversion does not, as has been argued, require 'backwards causation'. The end of an organism is the basis of all subsequent explanation of its shape, parts, and behavior (form, matter, and movements), and is thus not merely a heuristic for some more basic kind of explanation (like a materialist or mechanistic one).

In Chapter 7, the foregoing account will be fleshed out in an examination of Aristotle's explanations of specific parts and behaviors of living things, especially animals. There are several techniques for explanation of normal cases, and Aristotle has also developed a theory of how to account for non-normal cases, such as freaks and spontaneously generated organisms. With respect to normal cases there are, in addition to the intrinsic ends, incidental ends of organisms, such as the use of plants or animals for food, clothing, transportation, entertainment, labor, and so forth. But these ends are not explanatory of the parts or motions (i.e. behaviors) of the animals in question. They are much like the incidental benefits of rainfall in that this kind of benefit has no role to play in the scientific explanation of the natural substance. Aristotle simply does not give any teleological explanations of organisms, at least not in the biological works, that suppose that a characteristic of one kind of organism can be explained by reference to its benefit to another kind of being, such as another animal, humans, the universe as a whole, or god.

In Chapter 8, I discuss Aristotle's teleology in relation to human beings. This is the most complicated case, not only because humans are the most complex organisms, but also because it is humans that can gain knowledge about their world through teleological explanations, and can use teleology and technology in order to organize and improve their own lives and activities. Humans can use other natural things not in accordance with those things' own ends but, technologically, for human ends. For instance, the elements are also involved in teleological explanations when an agent uses them intentionally in accordance with a craft. An example of this would be the farmer using water to irrigate his crops, or a smith using metals from the earth to make a cup. When we use natural substances for our own purposes, that is, for ends incidental to the substances themselves, we are engaged in goal-directed activity of which we are ourselves the end. This kind of deliberate and intentional human action is, for humans, the clearest and most obvious case of what is teleologically explicable, because we are ourselves conscious of the ends. Aristotle's extensive and careful use of the model of arts in

his discussion of the teleological aspects of natural things is due to the fact that technology is more familiar to humans than other natures, not because he thinks that technology is fundamental to nature. On the contrary, he holds that art imitates nature.

Humans, like elements, stars, plants, and animals, have their own intrinsic motions, functions, and goods. Chief among these Aristotle holds to be contemplation, the activity of theoretical wisdom. Theoretical wisdom differs from practical wisdom in that the latter grasps the means to produce a certain effect for human ends. Theoretical knowledge, on the other hand, is focused on the effects of nature, and grasps their causes, independently of any human needs. The objects of theoretical knowledge include the gods and stars, but the humbler living things as well.

Thus human practical wisdom does not determine all goods, as if all other natural substances exist or function primarily for the sake of human beings. Theoretical wisdom reveals that there are goods that exist independently of human goods. As Aristotle says, 'the good is different for humans and fishes' (*NE* vi 7, $1141^{a}22$–23). It would be slavish to keep asking of things like plants and animals 'what's the use' or 'what's the payoff for us', as one must in practical reasoning, such as that involved in farming, fishing, or animal husbandry. The person who could only see natural things as instruments for human use does not understand the difference between a cause and a joint cause, or between an intrinsic good and an incidental good. This is why when Aristotle specifies how the natural scientist should indicate the cause for the sake of which, he says: 'because it is better this way, not absolutely, but with respect to the substance of the thing concerned' (*Phys* ii 7, $198^{b}8$–9).

Social, political, and rational animals present unique problems, but Aristotle treats them nonetheless as natural bodies and substances, and so explains them by the methods developed in the science of nature in general. The account of human ethics, for example, commences by establishing the function or functions of the human organism in a parallel fashion to the determination of the functions of other natural entities. In a similar way political science is treated as a matter of figuring out the function or functions of cities, and other human organizations. We will examine how Aristotle depends heavily on analogical reasoning in order to apply teleological explanations to ethics and politics. Within humans, certain capacities and functions are subordinated to others, within families certain members are subordinated to others, within environments certain organisms are subordinated to others, and within cities, certain individuals are subordinated to others. The problem with this extension of teleological explanation is that it requires treating individuals as parts ('instruments' or 'organs') of natural groups considered as wholes, so that the part–whole framework can be applied and yield explanatory results, as it did in the teleological explanation of organisms. But since such groups have lesser degrees of unity than organisms, there are serious limitations to the application of such explanatory techniques. The case reveals a

failed extrapolation using methods proper to the explanation of organisms for the explanation of ethical relationships and political institutions. Some of Aristotle's unhappy remarks about the natural justification for slavery, patriarchy, and war result from overstretching teleological explanations to things that are not genuinely substances.

In Chapter 9, I discuss the most general application of Aristotelian teleology—to the cosmos as a whole. In Aristotle's ontological and cosmological remarks one finds further confirmation that teleological explanations are supposed to be applied to the study of specific natural substances. Aristotle uses ends to identify and indicate the limits that he believes are necessary to block explanatory regression. On the most general level, this is used to account for the cause of motion and change in general. But the assertion that motion and change in general are end-oriented does not imply an overall or holistic teleology in Aristotle. This is because he does not consider a teleological assertion explanatory until the specifics of the aim and, most importantly, the beneficiary of the motion have been identified, as a careful reading of the dialectical context in which Aristotle carries out his investigation of the cosmological implications of teleology reveals.

Aristotle thinks that the fact that things function well in nature needs a general explanation. But the explanations he offers invariably make reference to specific natural substances. He is wary of attempts to generalize about a generic, overall good, which he holds has little or no explanatory power. Frankly, even if he had wanted to claim that everything relates to some one good, his actual theory of teleological explanations was in no way robust enough to explain everything with reference to such a good. His teleological explanations in the works on nature make reference to the good of specific kinds of things—stars, elements, plants, animals, humans, families, and cities—and not just to human beings, god, or some other overarching cosmic good. The conclusion of his theological treatise, *Metaphysics* xii 10, begins by raising an *aporia* about the overall good, but ends by criticizing various answers offered by others. For his own position, he maintains that nature is a principle of the good for each kind of thing individually.

In the conclusion, we will attempt to arrive at an estimation of the scientific vitality of Aristotle's teleological views. But it will be argued that Aristotle's teleology, whatever its scientific merits, still has promise for axiology—the theory of values—in offering us a naturalistic account of goods. By showing how goods can be conceived independently of human interests, Aristotle shows us a way to rise above the banausic perspective of anthropocentrism to a theory of value that recognizes the intrinsic good of natural things.

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PART I

TELEOLOGY AS A CRITICAL EXPLANATORY FRAMEWORK

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1

Historical Background to the Interpretation of Aristotle's Teleology

This chapter examines the powerful historical circumstances and trends that have influenced the interpretation of Aristotelian teleology.[1] Only once several possible sources of confusion and anachronism have been exposed will it be possible to introduce and evaluate Aristotle's methodology of teleological explanation.

The biggest threats to an accurate interpretation of Aristotle are two mutually exclusive teleological perspectives that have been introduced by commentators and philosophers who were (reasonably enough) less interested in an accurate interpretation of Aristotle than in other theological and scientific concerns. By way of introduction these may be labeled the natural theology perspective, and the heuristic perspective. Briefly, the natural theology perspective employs teleology in the service of creationist theology, specifically proofs for god. The heuristic perspective holds that scientific explanations referring to ends are merely heuristic aids to our understanding of natural phenomena, but are in principle reducible to explanations that refer either to material causes ('materialism'), or to these and 'efficient' causes ('mechanism').

In Chapters 2–10, I will argue that Aristotle explicitly rejected both the natural theology perspective and the heuristic perspective. In the present chapter, I will attempt, as concisely as possible, to describe the process by which the natural theology and heuristic perspectives were insinuated into the interpretation of Aristotle.

The following stand out as decisive historical circumstances bearing on the interpretation of Aristotelian teleology. First is the legacy of the commentarial tradition, which sought to unify Aristotle's thought in several different ways. In the earliest period, Peripatetic commentators such as Alexander of Aphrodisias worked to iron out apparent inconsistencies in Aristotle's writing and develop it into a more or less unified system of thought. Next, Neoplatonic commentators sought to unify Aristotelianism with Platonism. Later, philosophers writing in Arabic, such as Avicenna and Averroes, developed the work of their Greek predecessors in order to unify Aristotelian philosophy with tenets of Islam. Eventually, as more and more

[1] This chapter is neither a comprehensive history of Aristotelian commentary and exegesis (for an overview of which see Minio-Paluello 1970), nor a comprehensive history of all kinds of teleological argument (for which see Barrow and Tipler 1986, chs. 1, 2).

of Aristotle's texts were recovered in the West, Latin commentators, pre-eminently Thomas Aquinas, built on this work in their own effort to join Aristotelian philosophy with the creator god of Christianity. The steady appropriation of Aristotelian philosophy for such theological purposes focused teleological notions onto arguments and eventually proofs for the existence or qualities of god.

Later, in the period of the scientific revolution, these positions would be developed into the discipline of natural theology. This in turn lent itself to the notion of an independent science of ends—'teleology' understood in opposition to 'mechanism'. At the same time, there had been a movement, growing since at least the scholastic period, to restrict final causes and teleological explanations to intentional agents, either humans or god. Teleological explanations in other domains were either eliminated or interpreted as being mere heuristic aids to understanding. This critique of final causes eventually led, in the early modern period, to a general critique of the usefulness of final causes in natural philosophy and science. Natural theology and the critique of final causes obviously did not sit well together, and Kant was compelled to try to rectify the ambivalence of the new science to final causes in the finale of his works of critical philosophy, *The Critique of Teleological Judgment*. The result was a powerful expression of the heuristic perspective on teleology.

All of these movements, then, have influenced the interpretation of Aristotelian teleology, and thus it is worth briefly expanding on the capsule history just provided. After that, we will return to Aristotle's own milieu, and examine some considerations about teleological explanations expressed by Aristotle's colleague and immediate successor. Theophrastus, in a treatise probably composed during Aristotle's lifetime, expresses some concerns about teleological explanation that I argue Aristotle shared. It turns out that Theophrastus' work (which, although increasingly being read in its own right, has not yet been brought to bear on the interpretation of Aristotle), generally casts more light on the nature of Aristotle's teleology than do the commentaries.

1.1 GREEK, ARABIC, AND LATIN COMMENTARY

Commentaries on Aristotle frequently try to iron out apparent inconsistencies of argument within or between texts in the corpus.[2] But often commentators are

[2] The first work directly commenting on Aristotle for which we have evidence begins about the middle of the first century BCE (Gottschalk 1990, p. 55). Before then the Aristotelian corpus was not available in the systematized form we now have it. Sometime between 60 and 20 BCE, a man named Andronicus is thought to have completed the edition of Aristotle's works that remains the basis for our own Aristotelian corpus. (For the speculation of an earlier date, see Gottschalk 1990, pp. 62–3. Long 1989, p. 530, represents the standard view; cf. Sorabji 1990a, pp. 1 f. The standard position has been criticized by Barnes 1997.) Andronicus' edition of Aristotle is thought to have profoundly influenced all subsequent generations of Aristotelian commentators, and its effects are still apparent today. Andronicus' arrangement of the texts, and his own biographical and exegetical works on Aristotle,

concerned to make the arguments consistent with more than just Aristotle's own arguments. The attempt to reconcile Aristotle with Plato, and later with Muslim and Christian thought, was more often the aim of the Aristotelian commentators than was the narrow interpretation of the Aristotelian texts.[3]

For our purposes, this effort begins with the Peripatetic commentators Alexander of Aphrodisias (appointed chair of Aristotelian studies between 198 and 209) and Themistius (fl. *c*.350–80). Both commentators were concerned to present a unified teleological account of both motion and the soul, which is encouraged by Aristotle's definitions of both of these in terms of 'being in a state of activity' (ἐντελέχεια). In order to do so, they invoked the vague and malleable concept of 'completion' or 'perfection' (τελιοτής), transforming it from the modest use to which it was put by Aristotle himself.[4] Neoplatonic philosophers would later exploit these concepts in their effort to harmonize the philosophy of Aristotle with Plato. Another major issue confronting Alexander as a defender of Aristotelian ideas was the apparent inadequacy of Aristotle's position on providence. Aristotle was interpreted and criticized (probably by Platonists) as holding that divine providence applies to the heavens only and not the sublunary world.[5] Alexander wrote an independent treatise *On Providence* in which he responded to these criticisms by arguing that Aristotle did hold the sublunar world to be the object of divine providence, but specified as the mechanism for this the souls of celestial bodies which through their continuous rotation perpetuate the living things down here.[6] An implication of this view, whatever its fidelity to Aristotle, is that the celestial rotations are the primary causes of the changes in the sublunary world, in particular of the generation and destruction of living things. The Platonists to whom Alexander

'presented Aristotle's philosophy as a system like those of the Stoics and Epicureans' (Gottschalk 1990, p. 65). While there are certainly systematizing tendencies apparent in Aristotle's works themselves—for example, extensive cross-referencing, architectonic division of the sciences, programmatic syllabi (e.g. *Meteor i* 1, 338ª20–339ª10 and *Sens* 1, 436ª1–18) and application of general principles to a vast array of subjects—it is nonetheless clear that the ultimate source for our edition was edited and adapted to the demands of the kind of systematic ordering exemplified by the great Hellenistic schools. Whether or not a man named Andronicus was responsible for all this, it is clear that the condition of Aristotelian texts at this time inevitably created the need for a great amount of exegesis, in order to iron out the details of the Aristotelian system and to account for its apparent internal inconsistencies.

[3] In connection with this decisive historical circumstance of Aristotelian interpretation should be mentioned the effect of the commentarial format itself on the interpretation of individual texts. Helen Lang in her study of commentaries on Aristotle's *Physics* (1992) has convincingly described the distorting effects of the format, as utilized by writers from Philoponus (6th cent. CE) through Buridan (14th cent. CE). Aristotelian commentators 'radically restructure Aristotle's arguments, with striking results first for problems and their solutions within physics and finally for physics itself' (Lang 1992, p. 14). Thus when taking into account the value of these interpretations one must consider both the structure of the subject text (the commentarial format) and the restructuring of the object text (the Aristotelian text as constituted in Andronicus' edition and its successors).

[4] Wisnovsky 2003a, pp. 4–5, 43–59. The following account of the Greek commentators and of philosophers writing in Arabic is deeply indebted to Wisnovsky 2003a and 2003b.

[5] Sharples 1983, p. 25.

[6] Sharples 1983, p. 26; Hankinson 1998, p. 356. A discussion of providence survives in Alexander's *On Fate* XVII.

was responding had distinguished between 'instrumental' causes and true efficient causes, and Alexander borrowed their distinction in order to distinguish the immediate causes of generation and destruction in the mundane realm, and the true causes of the divine celestial realm.[7] As we will see, this distinction was to have far-reaching consequences for the Neoplatonic appropriation of Aristotelian teleology mentioned above.

The Neoplatonic project of harmonizing the thought of Plato and Aristotle required adapting Aristotle's philosophy to the fundamentally Platonic doctrines that the soul is separable from matter, and that god is an efficient (not just final) cause of the motion and order of the world. The second goal involved interpreting Aristotle's theory of four kinds of cause as having straightforward application in Plato's cosmology as represented in *Timaeus*. This requires some serious exegetical tweaking, to be sure, since Aristotle himself criticizes Plato for having failed to make use of more than two kinds of cause recognized by Aristotle.[8] Syrianus (d. *c.*437) apparently invented a scheme for just this purpose, which was expanded upon by Proclus (*c.*411–85). Proclus distinguished between transcendent causes, which operate in the eternal superlunary spheres, and immanent causes, which operate in the sublunary spheres of generation and destruction.[9] Transcendent causes include the final, the efficient, and the paradigmatic causes, which are said to be 'transcendent of or extrinsic to their effects'; immanent causes include the formal, the material, and the instrumental causes, which are said to be 'immanent or intrinsic to their effects'.[10] We have already seen that the instrumental cause was considered by Alexander to be an efficient cause operating in the mundane realm (as opposed to a true efficient cause, in the heavenly realm). The paradigmatic cause was, similarly, a Platonic form separate from the mundane world, as opposed to the form immanent in substances in the mundane world.[11]

The six causes were sometimes associated with specific stations of Neoplatonic cosmology; so the transcendent causes could be identified with the Good (the final cause), the Ideas (the paradigmatic cause), and the Demiurge (the efficient cause).[12] As a matter of Aristotelian interpretation, however, the distinction between transcendent and immanent causes was invoked in order to prioritize the

[7] Wisnovsky 2003b, p. 56; citing Simplicius, *In Phys* 2 315.12–18, 316.6–14, 317.23–8.

[8] 'This then is what Plato's determined regarding what we are investigating. From this interpretation it is clear that he used two causes only (δυοῖν αἰτίαν μόνον), the "what it is" of something, and the matter relative to it, for the forms are the cause (αἰτια) of what it is to be something for the others, but the one [is the cause of what it is to be] of the forms; and what is the matter—the substratum—of which the forms are predicated for sensible things, he said that it is this dyad, the great and the small. Further, he assigned to each of these elements [the one and the dyad] the cause (αἰτίαν) of the good and the bad respectively' (*Meta* i 6, 988ª7–17).

[9] Wisnovsky 2003b, p. 59. The distinction can, according to Proclus, be traced back to Syrianus' teacher (and hence Proclus' scholarly 'grandfather'), Plutarch of Athens (Proclus, *in Parm* 1058.21–9.19).

[10] Wisnovsky 2003a, pp. 68–9, pp. 93–4.

[11] For the paradigmatic and instrumental causes, see Hankinson 1999, pp. 326–7.

[12] Wisnovsky 2003b, p. 60.

final and efficient causes above (literally and figuratively) the formal and material causes, which were considered merely 'conjoint' or 'contributory' causes.[13] This use of the distinction was subsequently influential, having been adopted by, among others, the Greek commentators Ammonius, Philoponus, Simplicius, and then, as a result, the Muslim philosophers Alfārābī and Avicenna.

The association of the final and efficient causes facilitated the position that god is an efficient cause of the world, in addition to a final cause. The position is definitely attributable to Ammonius (435–517), both through what was preserved of his teaching by Asclepius,[14] and by the testimony of his pupil Simplicius (wrote after 529), who said: 'My teacher Ammonius wrote a whole book offering many proofs that Aristotle thought god was also an efficient cause of the whole cosmos' (Simplicius, *In Phys* 1363, 4–12).[15] Ammonius' motivation was the reconciliation of Plato and Aristotle, specifically the demiurge of *Timaeus* with the unmoved mover of *Metaphysics* xii.[16] Simplicius puts the matter thus: 'That Aristotle says god or the prime mover is a final cause (τελικόν), no one disputes. But that he also says god is an efficient cause (ποιητικόν) is justified, I think, by his calling, in the definition of causes in the second book of the *Physics*, the efficient cause (ποιητικὸν αἴτιον) that whence comes the origin of change' (Simplicius, *In Phys* 1361, 11–14). Simplicius adduces several Aristotelian passages in addition to the authority of his teacher Ammonius to support his claim.[17] Another student of Ammonius, Philoponus (*c.*490–570), also attributes to Aristotle the position that god is both an efficient and final cause of the universe, perhaps more out of a motivation to reconcile Aristotle's god with the Christian god than with Plato's demiurge.[18]

The transmission into Arabic philosophy of Aristotelian ideas and terminology[19] was from the beginning mediated by Neoplatonic concerns and innovations.[20] These would, in turn, have a decisive influence on the interpretation of the Aristotelian texts in the thirteenth century by philosophers writing in Latin. Avicenna (*c.*980–1038) used the division of causes into the transcendent (final and efficient) and immanent or internal (matter and form) in several different ways.[21] First, the distinction was serviceable for the doctrine of the separability of the soul, since the soul's identification with the final cause assures its transcendence of the corruptible world, despite its immanent character as form. As a final

[13] Wisnovsky 2003b, p. 61.
[14] Verrycken 1990, pp. 205, 205 n. 35.
[15] See Sorabji 1990b, p. 185 f.
[16] Simplicius, *In Phys* 1360, 28–31. See Verrycken 1990, p. 216 n. 137. Cf. Wisnovsky 2003a, p. 61 f.
[17] *Phys* ii 3, 194^{b}29, *Cael* i 4, 271^{a}33, i 9, 279^{a}27, *GC* i 3, 318^{a}1, *Meta* i 3, 984^{b}15.
[18] Philoponus repeats the point often that Aristotle's unmoved mover is an efficient cause (*In Phys* 298.6–10, 304.5–10, *In GC* 136.33–137.3, 152.23–153.2, 297.15–24; Verrycken 1990, p. 224). It has been argued that later in his career, as a 'Christian philosopher' as opposed to an 'Alexandrian Platonist', Philoponus changed his position and rejected the view of Aristotle's god as an efficient cause, limiting it to a final cause (Verrycken 1990, pp. 225 f.). See Sorabji 1990b, pp. 185 f.
[19] For a thorough discussion of the translation of Aristotelian teleological concepts from Greek into Arabic, see Wisnovsky 2003a, pp. 99–112.
[20] Wisnovsky 2003a, p. 113.
[21] For the texts and an analysis see Wisnovsky 2003a, pp. 129–33.

cause and efficient cause the soul subsumes formal causality. The subsuming is to some extent facilitated by linguistic conflation of the final cause (an end) and the so-called perfecting cause (a form which as an agent pursues an end). The conflation was a product both of the attempt to square the meaning of ἐντελέχεια in the definitions of soul and motion by appealing to a notion of 'perfection' (an effort going back to Alexander) and of choices made in the translation from Greek to Arabic.[22] This conflation had the result that 'Arabic philosophers such as Avicenna allowed the final cause an even greater spectrum of causality than the Greek philosophers had' (Wisnovsky 2003a, p. 131). This came at the cost of a model of souls that requires intentional agency, that is, living things deliberately moving or changing things for the sake of something. The model is problematic in its application to plant and animal souls but, on a cosmic level, god can be considered such an agent.

Thus the distinction between transcendent and immanent causes was also serviceable for Avicenna's proof for the existence of god. Avicenna applied his distinction between existence and essence to the Neoplatonic distinction between transcendent and immanent causes, holding that the formal and final causes were the cause of essence, while the efficient and material causes were the cause of existence. Avicenna distinguished between what is 'contingent in itself but necessary through another' and 'necessary through itself'. Composites of matter and form are in themselves contingent things—why a thing is this and not that is a contingent fact—and so the necessity of their existence can only be due to something extrinsic and transcendent that is their efficient and final cause. This cause, necessary through itself barring a regress of contingent causes, is god. It follows from the fact that god is necessary to bring contingent beings into existence, that god exists. In this way, Avicenna subsumes all causes by the final cause. For example, he says, 'the end is the cause of all the causes . . . so when there is an end, it is the cause of all the causes' (*Philosophy for Ala-ad-Dawla*, 54, 9–10 and 55, 2)[23] and 'something may be caused with reference to its essence and its inner reality, and it may be caused in terms of its existence . . . the final . . . is the efficient cause of the efficient cause' (*Pointers and Reminders*, 139, 14–20).[24] The mechanism of this causality is, in accordance with the Neoplatonic cosmology of procession and recession, god's superabundance acting first as an efficient cause of generation, and then moving things as a final cause or end. God's superabundance was confirmed on the basis of his 'perfection'—an Aristotelian term that we have seen had been transformed through Neoplatonic commentary into a device permitting the construction of a theologically correct cosmology.

Averroes (*c.*1126–98) criticized Avicenna's proof for its excessive Neoplatonic aspects. He argued that Avicenna's conception of something that was 'contingent in itself but necessary through another' was incoherent on Aristotelian grounds;

[22] Wisnovsky 2003a, pp. 131–3.

[23] Wisnovsky 2003a, L38, p. 168. I have used the translations of Avicenna's titles in Gutas 1988.

[24] Wisnovsky 2003a, L40, p. 169. See also the texts translated by Wisnovsky at pp. 161–3 (L36), 163 (L37), 149 (L40, 41).

that which is necessary is eternal and hence contrary to the contingent. Averroes reverted to the proof for god's existence as a necessary first mover that he found in the final book of the *Physics*, claiming that this is 'the best method to follow . . . and the nearest to strict truth' (*Incoherence of the Incoherence*, trans. Van der Bergh, p. 393). He also countenanced arguments from design of a more popular character[25] in his work on natural theology, *The Exposition of the Methods of Proof*, in which he elaborated what is often called a 'teleological' argument or proof for the existence of God.[26] In it, he appealed to arguments both from natural motion and from design in order to prove god's existence and providence and, what is more, he attributed such arguments to Aristotle.[27]

Robert Wisnovsky has called the attempt by Neoplatonists to harmonize the philosophies of Plato and Aristotle the 'Ammonian synthesis', and he has traced the influence of the parties to this synthesis on Avicenna and his predecessors. His discussion of Avicenna's attempt to harmonize the Neoplatonized Arabic Aristotelianism with tenets of the Muslim faith suggests the label 'Avicennean synthesis'. Despite their disagreements on points of detail, Averroes was influential on this synthesis, and then subsequently on what we might call the 'Thomistic synthesis', meaning the attempt to harmonize Neoplatonized Aristotelianism with Christian theology.

[25] Such arguments had already been advanced by Ghazali on the basis of passages from the Quran (e.g. 2:164), and indeed by several earlier philosophers and theologians. Davidson (1987, pp. 213f.) has argued that the source of these arguments can be traced back to Cicero's *On the Nature of the Gods*. Cicero's work influenced patristic literature, especially the fifth-century Theodoret's treatise *On Providence*, which was transmitted into an Arabic treatise, extant under the title *The Book of Proofs and Reflection regarding Creation and Divine Governance*. This treatise was widely influential on Arabic and Hebrew literature; the treatise *The Wisdom in God's Creatures*, attributed to Ghazali, contains extensive excerpts of it.

[26] Averroes, Al-Kashf 'an Manahij Al-Adilla (*The Exposition of the Methods of Proof*), trans. Najjar (2001). Davidson has argued that Averroes' encouragement of such a proof is 'not scientific and philosophic' (1987, p. 229), since such design arguments tend to depend on anthropocentrism (strictly the view that all goods exist for the sake of humans), which Averroes was determined to reject on the grounds that the superior cannot exist for the sake of the inferior (Davidson 1987, pp. 230–1). Davidson concludes, 'the sole proof of the existence of God which meets the standards of serious philosophers would be Aristotle's proof from motion' (1987, p. 231). But the passage that Davidson cites as evidence that Averroes considered the proof from motion the only 'serious philosophical' one (*Incoherence*, pp. 393–4) simply says that the proof is the 'the best . . . nearest the truth . . . [and] in my opinion sufficient'. Kukkonen (2002) has argued against Davidson that Averroes is most serious about the proof, even if he must assign it an inferior status as an inductive argument.

[27] A strong piece of evidence in favor of Kukkonen's argument against Davidson (see previous note) is the following comment of Averroes on Aristotle's *Metaphysics* xii: 'It must be known to you that this is Aristotle's view concerning providence, and that the problems arising about providence are solved by <his view>; for there are people who say that there is nothing for which god does not care, because they claim that the Wise must not leave anything without providence and must not do evil, and that all his actions are just. Other people refuted this theory through the fact that many things happen that are evil, and the Wise should not produce them; so these people went to the opposite extreme and said that therefore there is no providence at all. The truth in this is that providence exists, and that what happens contrary to providence is due to the necessity of matter, not to the shortcomings of the creator, so that some people carried on their reflection on this to the point that they said that there are two gods, a god who created evil and a god who created good' (Averroes, *Commentary on Aristotle's Metaphysics Book Lambda* [ad 1075a], 3:1715.1–11, tr. Genequand).

It is through the translation of Averroes into Latin that the argument about god as both moving and final cause became known to and adopted by thirteenth-century scholars, including Thomas Aquinas (1225–74).[28] Aquinas offered a number of proofs for the existence of god, in several different works. In the relatively early *On Truth*, which prefigures the famous fifth argument in the *Summary of Theology*, a 'teleological' proof is couched in terms of a response to what he characterizes as two Greek views, one recognizing the existence of material causes only, the other recognizing only efficient and material causes. Still other Greek philosophers, he points out, have shown that such causes cannot account for the existence of goodness, except by chance. But chance cannot account for the regularity of the good. So far the argument follows Aristotle closely enough (e.g. *Metaphysics* i 3–4 and also *Physics* ii 8). But Aquinas further argues that it follows from the fact that there are goods regularly attained by beings lacking intellect that the world must be ordered by an intellect that makes such ends attainable in nature. This shows the existence of a providential being, which is as far as the argument goes in *On Truth*, but it is offered as a proof for the existence of god in the *Summary of Theology*.[29] In the *Summary against the Gentiles*, he offered a different argument from the harmonious order of the universe, which he attributes to John Damascene.[30] The greater part of the argument there, however, is devoted to the proof from the first cause of motion borrowed from Aristotle's *Physics* viii.

In his commentary on the *Physics*, Aquinas argued against Averroes' view and against the view that the creation is eternal and that things were not created after having not existed (Aristotle, *Cael* i 12). But he agreed with Averroes and the tradition that god is moving and final cause.[31] In arguing that god is both an efficient and final cause, Averroes held that efficient and final causes are, ultimately, identical. This is also a conclusion of Aquinas' commentary on Aristotle's *Physics*.

A problem for such a view is to explain how the efficient cause can be the final cause. The solution, as anticipated by Avicenna, is to use a model of conscious agency, since agents are efficient causes that act for the sake of ends. In this way, Aquinas justifies an expansion of god's causal power from final to efficient causality through an appeal to the Avicennean position that the final cause is the cause of the other causes:

another meaning of cause is found in other causes, i.e. insofar as the end or the good has the nature of a cause. And this species of cause is the most powerful of all the causes, for the

[28] Sorabji 1990b, pp. 193–4.

[29] *De Veritate*, q.5, a.2; *Summa Theologiae* I, q.2, a.3. For a thoroughgoing summary, see Wippel 2000, pp. 410–13, 480–5.

[30] *Summa Contra Gentiles* I.13.

[31] He says: 'even Averroes admits in *De Substantia Orbis* that god causes the heavens not only in respect to its motion, but also in respect to its substance. This could not be unless it had its existence from him. But it only has eternal existence from him. Therefore it has its eternity from another. And Aristotle's words are also in agreement with this when he says in *Metaphysics* v [1015^{b}9–10] and above at the beginning of Book VIII that there are certain necessary things which have a cause of their necessity' (Aquinas, *In Phys* viii 1154, cf. 1152).

final cause is the cause of the other causes. It is clear that the agent acts for the sake of the end. And likewise it was shown above in regard to artificial things that the form is ordered to use as to an end, and matter is ordered to form as an end. And to this extent the end is called the cause of causes. (In *Phys* ii 186[32])

What is striking about this passage and its cognates is the emphasis on a determination of the final cause as the antecedent necessary and sufficient condition for an effect, as opposed to a determination of the final cause as an explanation for a given event. The question for Aquinas is not: How do final causes explain? But rather: How do final causes prove the existence of god? Aquinas evidently conceived of physics as a study that culminates in the proof of god's existence, not a scientific explanation of the motion of natural things.[33]

Although it is easy to attribute the persistence of the position that god is both a final and efficient cause to Neoplatonic, Muslim, or Christian ideology, there can be no doubt that those who entered into the dispute, from Ammonius to Aquinas, presented themselves as if they were offering the correct interpretation of Aristotle. Aquinas, for example, warns against misinterpreting Aristotle for the sake of reconciling him with Christian teachings (*Commentary on the Physics* viii, 986), but clearly does not think that the case of god as moving and final cause fits into that category. Even where the view would seem to run up against the fact of Aristotle's belief in the eternity of the world, Aquinas is careful to make the relevant distinctions, while at the same time maintaining his role as Aristotelian exegete.[34]

In the sequel we will see how the emphasis on the efficient nature of final causality in late medieval philosophy leads to the charge that final causes lack explanatory force. After all, they do not seem to provide any explanation beyond that of the efficient cause itself. On the one hand, such a charge is somewhat misplaced, since in the contexts we have been examining final causes are not being utilized as generators of explanations in natural science, but as a component of a theological proof. On the other hand, such criticisms proved highly productive since scholastic and renaissance Aristotelians were obliged to criticize this concept of final causes and, in so doing, once again reoriented the interpretation of Aristotelian teleology.

1.2 SCHOLASTICISM AND THE SCIENTIFIC REVOLUTION

The received intellectual tradition has it that, in the sixteenth and seventeenth centuries, revolutionary philosophers and scientists began to curtail and reject the

[32] Also, 'but the end is prior to the efficient cause insofar as it is bringing something about in a substance and its complement since the action of the efficient cause is completed only on account of the end' (*De principiis naturae IV*, 25).

[33] Lang 1992, pp. 164–8. For an account of Aquinas' view on nature that discusses his attempt to accommodate the Platonic technomorphic model in an Aristotelian framework suitable for creationist theology, see Honnefelder 2000, pp. 76–83.

[34] See, for example, *In Phys* viii 974.

teleology of the medieval and scholastic Aristotelians, abandoning final causes in favor of a purely mechanistic model of the universe. The perspective is well represented by the words of Alexandre Koyré:

> The disappearance—or destruction—of the cosmos means that the world of science, the real word, is no more seen, or conceived, as a finite and hierarchically ordered, therefore qualitatively and ontologically differentiated, whole, but as an open, indefinite, and even infinite universe, united not by its immanent structure but only by the identity of its fundamental contents and laws . . . This, in turn, implies the disappearance—or the violent expulsion—from scientific thought of all considerations based on value, perfection, harmony, meaning, and aim, because these concepts, from now on *merely subjective*, cannot have a place in the new ontology. Or, to put it in different words: all formal and final causes as modes of explanation disappear from—or are rejected by—the new science and are replaced by efficient and even material ones. Only these latter have right of way and are admitted to existence in the new universe of hypostatized geometry. (1950/1965, pp. 7–8, emphasis in original)

Indeed, Bacon (1561–1623),[35] Descartes (1596–1650),[36] and later Spinoza (1632–77)[37] appear to have renounced the final causes of the scholastic Aristotelians and to have advocated the elimination of final causes from scientific explanation (at least in cases that do not involve intentional agency). Their revolution is supposed to have paved the way for a scientific notion of cause and the triumph of the mechanistic world picture. Modern science, which on this view operates almost exclusively with their notion of cause, has thoroughly expurgated the final vestiges of teleology.[38]

[35] 'The treating of final causes in physics has driven out the inquiry of physical ones, and made men rest in specious and shadowy causes, without ever searching in earnest after such as are real and truly physical. And this was done not only by Plato, who constantly anchors upon this shore; but by Aristotle, Galen, and others . . . All which are properly alleged in metaphysics; but in physics are impertinent, and as remoras to the ship, that hinder the sciences from holding on their course of improvement, and in introducing a neglect of searching after physical causes' (*Advancement of Learning*, iii.4, p. 141; Cf. *New Organon* I.48, 65).

[36] '*That we must not inquire into the final, but only the efficient causes of created things.* Finally we shall not seek for the reason of natural things from the end which god or nature has set before him in the creation . . . But regarding him as the efficient cause of all things, we shall merely try to discover by the light of nature that he has placed in us, applied to those attributes of which he has been willing we should have some knowledge, what must be concluded regarding the effects that we perceive by the senses' (*Principles of Philosophy* I.28; Cf. *Meditations* IV; *Replies to Objections* IV; Letter of August 1641 to 'Hyperaspistes' in AT iii, pp. 422 f.). See also Des Chene 2001, pp. 117–19.

[37] Appendix to *Ethics* I.

[38] 'The concepts of material and formal causes are archaic . . . final causes have likewise long since been expurgated from physics . . . Partly because of the rise of physical science and the accompanying demise of Aristotelian modes of thought, the concept of cause is now generally that of an efficient cause' (Taylor 1967). 'The scientific revolution began with the denial of final causes' (Clark 1995, para. 13). 'Aristotle invoked final causes throughout his scientific works, including many cases that appear not to involve genuine purpose (as when webbed feet are said to be for swimming). An emphasis on teleological explanation (shared by Plato) characterizes most subsequent Western philosophy of science until the seventeenth century' (Mackie 1995). 'With the rise of modern science in the 16th and 17th centuries, interest was directed to mechanistic explanations of natural phenomena, which appeal only to efficient causes; if teleological explanations were used, they took the form not of saying

If this were true, then it would be desirable to have a cogent account of what exactly it was that the revolutionaries all agreed to reject. Perhaps this book can be useful on this score for some readers. I suspect, however, that the picture needs to be qualified by the following considerations. First, the major philosophical figures associated with the scientific revolution, even Spinoza,[39] did not without qualification reject final causes. Second, later prominent scientific revolutionaries, such as Gassendi (1592–1655),[40] Boyle (1627–91), Newton (1642–1727),[41] and Leibniz (1646–1716)[42] actively countenanced final causes, even in the context of natural science. This is seen nowhere more clearly than in Boyle's fascinating *Disquisition about the Final Causes of Natural Things, wherein it is Inquir'd, Whether, And (if at all) With what cautions, a Naturalist should admit Them?* (1688).[43] Now these final

(as in Aristotelian teleology) that things develop toward the realization of ends internal to their own natures but of viewing even biological organisms as machines ingeniously devised by an intelligent being' (*Encyclopaedia Britannica* 2002, s.v. teleology). Cf. Burtt 1954, pp. 98–9; Dijksterhuis 1961; Barbour 1971, p. 50; Grene 1972, p. 397; Wright 1976, p. 2; Woodfield 1976, p. 8; Schmitt 1983, p. 5; Osler 1996, pp. 388–9; Asma 1996, pp. 27 f.; Nissen 1997, p. vii; Kullmann 1998, pp. 29–34; Garrett 1999, pp. 311–12; Dusek 2001, pp. 81–5; McLaughlin 2001, pp. 20 f.

[39] Don Garrett has challenged the standard view in an insightful and probing article. He argues that, 'although Spinoza maintains a certain rhetorical distance from the Aristotelian vocabulary of final causes, he fully and consistently accepts the legitimacy of many teleological explanations . . . it is not Leibniz but Spinoza who holds the position on teleology and teleological explanation nearest to that of Aristotle' (1999, pp. 311–12). The basis of his argument is the distinction between 'final causes' assumed as intrinsic to nature, and 'final causes' in accordance with an intelligent designer. As we will see, this is a crucial distinction to grasp in order to understand Aristotle's teleology, and how it is different from his successors.

[40] Gassendi's creationist theology involved god in everything from the creation of the atoms and the ordering of the cosmos to meteorological events. He also argued that god created animals. He actively countenanced final causes in the explanation of organisms, *against* the Greek atomists' account, invoking Aristotelian arguments to this end in section III, book III of the *Syntagma Philosophiae* (see the third chapter on 'Of the use of the parts of animals', *Op*. vol. ii, pp. 226–37). See Johnson 2003, pp. 340–3.

[41] 'We know him [sc. God] only by his most wise and excellent contrivances of things, and final causes . . . a god without dominion, providence, and final causes is nothing else but Fate and Nature. Blind metaphysical nature could produce no variety of things. All that diversity of natural things which we find suited to different times and places could arise from nothing but the ideas and will of a Being necessarily existing . . . God, to discourse of whom from the appearance of things, does certainly belong to natural philosophy' (*Philosophiae Naturalis Principia Mathematica*, 3rd edn., Book III, General Scholium). See also the correspondence with Richard Bentley.

[42] Leibniz defended the use of final causes in natural philosophy: *A Specimin of Dynamics* (AG 126); *On Nature Itself,* sec. 4; *Monadology,* sec. 79–90; *Against Barbaric Physics* (AG 319). He even translates and quotes with approval the Platonic Socrates demand for research into final causes in *Discourse on Metaphysics,* sec. 19–22, *Two Sects of Naturalists* (AG 281–4); cf. *Letter to Molanus* (AG 242).

[43] See Lennox 1983. Boyle concludes, 'all consideration of Final Causes is not to be banish'd from Natural Philosophy: but that 'tis rather Allowable, and in some cases Commendable, to Observe and Argue from the Manifest Uses of Things, that the Author of Nature Pre-ordain'd those Ends and Uses' (1688, p. 151). The disquisition is too rich and multifarious to summarize. But we can get an idea of just how far Boyle was willing to go by considering something he says about Aristotle. Apparently Aristotelians do not recommend the study of Final Causes enough for Boyle, for even if they give them, they do not in addition give thanks to the creator who created it all: 'I think this reflection may justly serve to Recommend the Doctrine about Final Causes that we embrace, to Philosophers that are truly pious . . . And therefore the Ancient Aristotelians, who look'd upon the World as Eternal and Self-existent in a Condition like its present System; did not use to Thank *God* for the benefits they

causes are all defended from the perspective of natural theology, but the point is that the major scientific revolutionaries did not absolutely reject final causes, as they are so frequently said to have done. Third, the scientific revolutionaries were hardly the first philosophers to critique the abuse of final causes: prominent scholastics had already undertaken to do just that. (As we will see later, that tradition goes back to Aristotle himself). This last point has not been appreciated until very recently. Dennis Des Chene contends, 'Descartes and those who subscribed to his polemics exaggerated the sins of their opponents, ascribing to the Aristotelians views that Aristotelians would have repudiated' (1996, p. 169). The evaluation is based on the fact that the major criticisms of Aristotelian final causes at the time—that they are animistic, and superfluous given adequate efficient causes—cannot really be said to apply to the Aristotelians (such as Scotus, Ockham, Buridan, and Suárez) whose works were read in the milieu of those who leveled the criticism .

On the other hand, Avicenna's and then Aquinas' generation of the efficient (and all other) causes from the final, a position that had great influence, called for a response. Aquinas' position on the nature and priority of final causality was related to his position on the ultimate identity of moving and final causality in god, itself a position with a long history, going back at least to the Greek commentators, as we saw. The position is more or less maintained by Duns Scotus (*c.*1265–1308), albeit in a somewhat altered and certainly more complicated form, in his influential proof of the existence of god (*Opus Oxoniense*, I, dist II, q. i; 1987, pp. 35–52). The main thrust of that proof is that there has to be a first (efficient) mover, and there has to be a first reason to move, and that these in turn must be identical; the entity in which they are identical is god. Notice that there can be here no charge of animism in this use of final causality, since the final cause is itself an intelligent agent. Scotus accepted the Avicennean views that the end is the cause of causes, and the old Neoplatonic distinction, transmitted by Avicenna, between immanent and transcendent causes.[44] Furthermore, he held with Aquinas the view that if natural agents (such as brutes) act for the sake of an end then this must be due to the intelligent voluntary agency of god acting as an efficient cause; 'final causes in nature depend on some other intelligent voluntary agent ordering them to an end'.[45] These positions are effective means to a proof for god, but are problematic in the context of the scientific explanation of natural agents; clearly Scotus was concerned more with the former than the latter.

William of Ockham (1285– *c.*1347), on the other hand, was greatly concerned with the method of explanation and the scientific status of final causality. Ockham in effect pre-empts the charge of animism by explicitly restricting the application of final causes to the actions of intentional agents, and thus suggesting efficient

receiv'd from things Corporeal: Tho' some of them thought themselves Oblig'd to thank *Nature*; which they look'd upon as acting with Design, and proposing to her Self for Ends, the Welfare of the Universe, and of Men' (pp. 118).

[44] Adams 2000, pp. 157–8.

[45] Adams 2000, p. 170, citing *De Primo Principio* IV, sec. 4.13; see also Adams 2000, p. 162.

causality as the basis for the explanation of natural things. This is a very important move in the history of Aristotelian interpretation, and it seems to have won acceptance by many of Ockham's contemporaries and successors, and so it is worth briefly elaborating his position.

Ockham clearly distinguishes final from efficient causes,[46] and argues that sometimes one belongs to a thing, sometimes the other does, and sometimes both do (*Quodlibidal Questions* iv 1, p. 294). His point is that, *contra* Aquinas and Scotus, it is possible for final or efficient causes to belong to a thing without the other also belonging to it. Ockham does agree that god is both a final and efficient cause (*Quodlibidal Questions*, p. 295), but he also argues that, 'it cannot be sufficiently proved that every effect has a final cause' (*Quodlibidal Questions*, p. 295). Ockham has in mind all effects not caused by intentional agents. He says: 'the existence of the end is not required in order for the effect to be produced. Nonetheless, in intentional agents it is required that the end be loved and desired efficaciously' (*Quodlibidal Questions*, pp. 298–9). Ockham also makes it clear that he is advancing an interpretation of Aristotle:

> the philosopher's arguments all apply just to an agent that is able to fail and fall short without any change at all in the concurring agent or the patient or the other dispositions. The only sort of agent like this is a free agent . . . the arguments in question do not establish that other agents have a final cause . . . the question 'For what reason?' is inappropriate in the case of natural actions . . . it is no real question to ask for what reason a fire is generated, this question is appropriate only in the case of voluntary actions. And so it is right to ask for what reason they are fighting, since they are fighting voluntarily in order that they might dominate. And it can be proved evidently through experience (and in no other way) that a free agent acts because of an end. And in such actions the effect sometimes has a final cause that is distinct from its efficient cause and sometimes has an end that is not distinct from its efficient cause. (*Quodlibidal Questions* iv 1, p. 299 trans. Freddoso and Kelley)

What is really interesting about this position is that its acknowledgement ought to complicate the popular perception of a radical break in the seventeenth century from scholastic Aristotelianism and a turn away from final causes. The fourteenth-century Ockham more strictly limits the scope of final causality than even Bacon. For Bacon thought that final causes were appropriate with respect to all kinds of non-intentional entities or modes (such as the existence of eyelids or the toughness of animal hides), provided the context is what he calls 'metaphysical'—as opposed to 'physical'.[47] Even Descartes did not absolutely deny the existence of

[46] He defines a final cause as 'being loved and desired efficaciously by an agent, such that an effect is brought about', and an efficient cause as 'that which is such that something else follows upon its existence or presence' (*QQ* iv 1, p. 294).

[47] He says: 'these final causes, however, are not false, or unworthy of inquiry in metaphysics, but their excursion into the limits of physical causes hath made a great devastation of that province; otherwise, when contained in their own bounds, they are not repugnant to physical causes . . . these two kinds of cause agreeing excellently together; the one expressing the intention, and the other the consequence only' (*Advancement of Learning* iii 4, pp. 142–3).

finality,[48] certainly not with respect to voluntary actions and intentional agents. Rather he restricted them to that, just as Aristotelians like Ockham had. For this reason Des Chene concludes: 'Descartes' views here are rather the culmination of a trend rather than a radical departure' (1996, p. 394).[49]

It is true, however, that most Aristotelians, especially those of the Renaissance period, generally made less restrictive use of final causes than Ockham, and it is probably they that critics of final causality, such as Bacon and Descartes, had in mind. For example, the Coimbrans (late sixteenth- and early seventeenth-century Jesuit philosophy professors at the University of Coimbra in Portugal who wrote influential commentaries on Aristotle's works)[50] seem to have embraced global creationist teleology.

> Nothing superfluous or without an end has been brought about by God, although to the ignorant it may at first glance seem so, just as someone might judge the tools in some craftsman's workshop to have been multiplied beyond necessity, because he is ignorant of their uses. (Coimbra, *In Phys* 2c9q1a3, 1:326; trans. Des Chene 1996, p. 176)

The Coimbrans explain the existence of minute animals, for example, in terms of their beauty and interaction with other beings, and even animals hostile to humans 'should at least be praised for reminding us to esteem that other better life, in which there is the greatest security . . . it was useful to man that he should encounter some beneficial things, and some harmful, so that in avoiding one and striving after the other he should exercise his power of reason' (Coimbra, *In Phys*, 2c9q1a3, 1:327 trans. Des Chene 1996, p. 177). Such so-called explanations show the anthropocentric orientation of the Coimbrans' use of final causes, which is also integrated into a comprehensive hierarchy, as:

> It is established by the law of nature that things of inferior grade are rendered to the more excellent, especially if they can sometimes make use of them . . . the form of an element, the most contemptible of all, is ordained to [the use of] the form of a mixed body; the form of a mixed body to the vegetative; the vegetative is possessed by the sensible; and this again by the rational soul, which embraces all ranks and perfection of forms . . . man, by the inborn right of his nobility, and the prerogative of the more eminent form, summons the whole body of nature, and claims it for himself. (*In Phys* 2c9q2a1; 1:328, trans. Des Chene 1996, p. 183)

[48] Descartes believes that god makes use of both final and efficient causes, but that we can only know the latter. That should not be taken as a blanket denial of the existence of final causes. He also uses ends in the account of the senses at the end of the sixth meditation, and in the physiological descriptions of *L'Homme* (Des Chene 2001, pp. 119–22).

[49] In what follows I am deeply indebted to Des Chene's studies, 1996, 2000, 2001.

[50] I am quoting from their commentary on Aristotle's *Physics* (In Phys.), which was published in 1594. About their commentaries in general: 'These commentaries had a wide distribution and broad influence throughout the seventeenth century in Europe, North and South America, Africa, India, and the Far East, including both Japan and China' (Doyle 2001, p. 15). C. S. Peirce called them 'commentators than whom no authority is higher' (Doyle 2001, p. 21). For a fascinating discussion of a Coimbran commentary on *Categories* translated into Chinese in the seventeenth century, see Wardy 2000.

The problem with this gradation of finality is that the lower grades ('natural agents' and animals) will have to be thought of either as ends only in a secondary sense, or else in connection with the ends of the highest grades ('rational agents', i.e. humans). The Coimbrans clearly related ends of all lower beings to humans. Suárez (1548–1617) simply argued that they do not have ends in the strict sense; for lower beings,

> there is no final causality, properly speaking, but only a tendency to a certain end . . . the adequate principle of these actions is not just the proximate natural agent, unless perhaps *secundum quid* [i.e. with respect to the order of efficient causes] . . . but absolutely the chief [principle] is the first cause, and so an adequate principle of such actions includes an intellectual cause intending their ends. (Suárez 1597, *Disputationes metaphysicae* 23§10¶ 6, *Opera* 25:887, trans. Des Chene 1996, p. 195).

This way of understanding the finality of inanimate objects (natural agents)—by making them into instruments of an intellective agent, in the final analysis god, has the virtue of avoiding the charge of animism. Whether it holds up as an interpretation of Aristotle—which it is evidently intended to do—will have to be resolved later.

With respect to brute animals, it was widely supposed that efficient causes could not account for animal behavior, especially complex behavior like the building of nests by birds, and the spinning of webs by spiders. Hence it should be noted that although the Coimbrans subordinate the ends of brutes to rational agents (i.e. humans), they do not deny that such animals themselves have ends and engage in end-oriented activity. Those who account for animal behavior according to efficient causes alone tend to deny that plants and animals move themselves or are themselves ends. The anti-Aristotelian Descartes famously maintained this position. But in the Aristotelian camp, Buridan (1300–58) had already maintained the position, though in a different form:

> the swallow, when it mates, nests, and lays eggs, no more thinks of the young which are to be generated than a tree, when it leafs and flowers, thinks of its fruit. Nor do the mating, nesting, and egg-laying of the swallow depend in their existence and order on the young . . . rather the form and nature of the swallow and celestial bodies at the appointed times and God by his infinite wisdom determine the swallow to mate, and from that follows the generation of eggs, and then, when the swallow is so disposed by its nature together with celestial bodies and God, all of them determine it to nest building and then to egg laying . . . All these issue from divine art and celestial bodies and particular agents, both extrinsic and intrinsic. (Buridan, *In Phys* 2q13, p4orb, trans. Des Chene 1996, p. 199)

In this passage Buridan applies the Ockhamist position, that intelligent agents alone are final causes, to the case of brutes and plants. The workings of non-rational (i.e. non-human or non-divine) agents are accounted for by efficient causes, their finality residing either in the art of god, as with Scotus, or in their usefulness to higher grades of nature, especially humans, as with the Coimbrans. The most radical extension of this logic, while still remaining within an 'Aristotelian' framework, is

evident in Hurtado de Mendoza's *Cursus* (1624), where all questions about final causes are treated not in the context of *Physics*, but 'instead among disputations about the will' (Des Chene 1996, p. 169).

The upshot of all this is that we have to recognize that already in the scholastic period there were considerable controversies about how to interpret teleology and the scope of final causes. On the issue of final causes, the debate about the interpretation of Aristotle displayed the same scope of controversy as existed between the early modern philosophers and scientific revolutionaries.

1.3 NATURAL THEOLOGY AND THE CRITIQUE OF TELEOLOGY

The exact term 'teleology', or its equivalents in other languages, is not attested before 1728,[51] when the German philosopher Christian Wolff, writing his Latin *Rational Philosophy or Logic*, recommended *teleologia* as a name for that part of natural philosophy (*philosophiæ naturalis pars*) which explicates the ends of things (*fines rerum explicat*). '*Dici posset Teleologia*' (Wolff 1728a, *Philosophia rationalis sive logica,* sec. 85).

Wolff considered it a most important task to discover hidden parts of philosophy that needed to be brought to light and organized into a system.[52] Although discussion of 'final causes' and their role in physics and other natural sciences was commonplace in eighteenth-century philosophy, and had been for a long time before that, Wolff evidently felt that the study of final causes required designation as a separate discipline.[53]

For Wolff, there is a general and a specific aspect of physics, and the specific aspect includes cosmology, meteorology, oryctology (the science of minerals), hydrology, phytology, and physiology. An examination of Wolff's table entitled 'The parts of philosophy' in the *Rational Philosophy* (Wolff 1728a, Tabula IV, pp. 13–17) shows that the term 'teleology' was contrived on the model of such terms, and others that occupied different sectors of his disciplinary matrix, like technology, theology, physiology, and psychology. The organization of the table, which is the conspectus of Wolff's disciplinary taxonomy, gives the impression that teleology and experiment are correlative methods of physics. But Wolff in fact holds teleology itself to be a special science, distinct from physics (which explains

[51] *OED* s.v. teleology; Owens 1968, p. 159; Lennox 1992; McLaughlin 2001, p. 16 and n. 1.

[52] 'There are many philosophical disciplines which still lie hidden. At the proper time they will be brought to light as learned men apply themselves seriously to philosophy . . . Our humble task is to help organize the parts of philosophy even though not all of the philosophical disciplines have yet been discovered' (Wolff, *Discursus*, sec. 86).

[53] In this respect he was in vague agreement with Bacon, who thought that final causes should be studied in a discipline separate from physics, which he called 'metaphysics'.

according to efficient causes). This is clear from what he says in the *Preliminary Discourse on Philosophy in General* in the *Rational Philosophy*.

> A twofold reason can be given for natural things. One reason is to be found in the efficient cause, and the other reason in the final cause. Reasons which are sought in the efficient cause belong to the sciences which we have already defined. Besides these sciences there is still another part of natural philosophy which explains the end of things. There is no name for this discipline, even though it is very important and most useful. It could be called teleology. (Wolff 1728b, sec. 85, trans. Blackwell)

> Physics must precede teleology. Physics demonstrates the efficient causes of natural things, while teleology demonstrates their final causes. Now final causes are seen after the efficient causes have been recognized. (Wolff 1728b, sec. 100, trans. Blackwell)

The story of the adoption of the term begins with the eighteenth-century physicist and inventor George Lewis Lesage of Geneva, who proposed to advance a 'theory of the ends of nature and art' in a book entitled *Teleology*. As Paul Janet points out, 'by this work he responded to the desire of Wolff, who in the preface of his *Logic*, had uttered the wish that the doctrine of ends were handled apart, as a body of distinct science' (Janet 1876, p. 439). According to Janet, Lesage's *Teleology* would have stood out 'from the treatises of physical teleology so numerous in the 18th century' (p. 445), insofar as it would have stated general principles, rules, and theorems about teleology, instead of just specific examples. Janet is referring to works of 'natural theology' (also called 'physical theology') that were common throughout the seventeenth century, and even thereafter throughout the eighteenth century, especially in England.[54] Unfortunately, Lesage's *Teleology* was never brought to completion, and its fragmentary status has plunged the work into obscurity. But it is clear enough that the technical term teleology was in widespread use in scientific and philosophical circles by the second half of the eighteenth century. Further, it is clear that the works of natural theology are an extension of the strategy—an ancient one, as we have seen—of utilizing final causes in nature as evidence for the existence and providence of god.

This is the milieu that spawned Kant's *Critique of Teleological Judgment* (Part 2 of *The Critique of Judgment*, 1790). This work has had a lasting influence, and a

[54] The forerunner of these works is clearly Boyle's *Final Causes of Natural Things* (London, 1688). For the eighteenth century, the following are just a sample of titles: W. Derham, *Physico-Theology* (London, 1714) and *Astro-theology* (1715); John Ray, *Wisdom of God manifested in the Works of Creation* (1714); Consider some of the titles by the 'naturalist' Lesser: *Hélio-théologie* (1744); *Litho-théologie* (1757); *Testaceo-théologie* (1744); *Insecto-théologie*, etc. (See Janet, p. 62 n. 1.) In the nineteenth century the movement was at its peak with, most famously, W. Paley, *Natural Theology* (London, 1802), and the *Bridgewater Treatises*, which were printed and reprinted continuously in London from 1833. Here are some illustrative titles: *On the power, wisdom, and goodness of god as manifested in the adaptation of external nature to the moral and intellectual constitution of man* (T. Chalmers, 2 vols., London, 1833, 8th edn. 1884); *Astronomy and general physics, considered with reference to natural theology* (W. Whewell, 2 vols., London, 1833); *Animal and vegetable physiology, considered with reference to natural theology* (P. M. Roget, 2 vols., London, 1834, 5th edn. 1870); *Geology and Mineralogy, considered with reference to natural theology* (W. E. Buckland, London 1836, 9th edn. 1860). For a more complete catalogue, see Barrow and Tipler 1986, p. 117 n. 154.

close examination of some of its main tenets reveals that many of its distinctions have had a great, even if indirect, influence on the post-Kantian interpretation or reconstruction of Aristotelian teleology. In fact, as we will see, it is possible to detect a Kantian strain in much of the twentieth-century work on Aristotle's teleology.

Basic to Kant's critique is the distinction between intrinsic (or immanent) finality and extrinsic (or relative) finality. The former pertains to a natural kind; the latter depends on usability or adaptability by others, and does not warrant absolute teleological judgment (p. 369). Extrinsic finality is defined as 'the finality that exists where one thing in nature sub-serves another as means to an end' (p. 425). Thus there is a relative finality of certain 'products of nature' to humans—for all those things that are adaptable to human use. Individual organisms are the only things that are ends and they supply natural science with the basis for teleology (pp. 375–6). When humans relate to other organisms as means, only an extrinsic or relative finality obtains (p. 378).

Kant discusses the apparent antinomy of teleology and mechanism. Mechanism he considers the basis of all research in physical sciences. But organisms apparently cannot be accounted for solely on the basis of mechanism. So the following dialectic arises:

1. *Thesis*: All production of material things and their forms must be estimated as possible on mere mechanical grounds.

2. *Antithesis*: Some products of material nature cannot be estimated as possible on mere mechanical laws (that is, for estimating them quite a different law of causality is required, namely, that of final causes). (p. 387)

If these principles of investigation are extended to the physical objects themselves, then the following antinomy results:

3. *Thesis*: All production of material things is possible on mere mechanical laws.

4. *Antithesis*: Some production of such things is not possible on mere mechanical laws. (p. 387)

The propositions of the antinomy (3 and 4) contradict each other, so one of them must be false. But since reason cannot prove one or the other of them *a priori*, we have to abandon them as objective principles for determinate judgment (p. 387). That leaves us with 1 and 2 ('the dialectic of teleology and mechanism'), which do not contradict, and are not principles of the objects themselves, but only 'maxims' or 'regulative principles of inquiry'.

Thus teleology is of heuristic value to natural inquiry. One must account for nature, 'as far as we can' (p. 388, cf. p. 413) on mechanical grounds, but in cases where we can go no further, and so need to invoke final causes (that is, in the case of organisms), we are entitled to do so in order to aid our reflection on them. But it does not follow that the objects themselves are not possible solely on a mechanism of nature; rather, it is only a limitation of human reason that we cannot discover the mechanism and so are forced to have recourse to ends. The principle (of looking

to final causality to judge things in nature) is merely subjectively valid and not an objective principle of nature (sec. 72, p. 389). We do not observe the ends in nature, but 'only read this conception into the facts as a guide to judgment in its reflection upon the products of nature' (sec. 75, p. 399).

Although it cannot be said that material things require the agency of a cause that pursues designs, it can be said that 'by the particular constitution of my cognitive faculties the only way I can judge of the possibility of those things and of their production is by perceiving for that purpose a cause working designedly' (sec. 75, pp. 397–8). It follows that final causality is 'absolutely necessary' (p. 398) for the empirical employment of reason in the investigation of nature. So Kant says: 'It is, I mean, quite certain that we can never get a sufficient knowledge of organized beings and their inner possibility, much less get an explanation of them, by looking merely to mechanical principles of nature' (p. 400). Even a being with superior, but still finite, powers would be in the same position:

> we can never get rid of the appeal to a completely different source of generation for the possibility of a product of this kind, namely that of a causality by ends. It is utterly impossible for human reason, or for any finite reason qualitatively resembling ours, however much it may surpass it in degree, to hope to understand the generation even of a blade of grass from mere mechanical causes. (*Judgment*, sec. 77, p. 409)

A corollary of the impossibility of the elimination of teleology is that teleology and mechanism must not contradict: nature should be estimated according to both kinds of principles (sec. 77, p. 409; cf. p. 379). But although neither mechanism nor teleology can be eliminated from the investigation of nature, and the employment of both is necessary in diverse aspects of natural science, still one and the same thing cannot be explained both teleologically and mechanistically. Kant's example: if I explain a maggot as a 'product of the mere mechanism of matter' then I cannot 'turn around and derive the same product from the same substance as a causality that acts from ends' (sec. 78, pp. 411–12). Furthermore, because some things must be estimated according to final causality, namely organisms, and we cannot once and for all determine how far the mechanical mode of explanation will take us, it follows that in the case of organisms mechanism is subordinate to teleology (p. 415).

Kant believes teleology to be indispensable to natural science, and he recognizes that 'natural teleology forms a part of physics, and is a method applicable to the solution of the problems of physics' (sec. 68, p. 382). Thus it is compatible with other methods in physics. But since teleology is only a reflective principle of judgment and not a determinate one (like mechanism), it cannot form a science itself, a doctrine of science, or a separate branch of science. In Kant's terms, it is only a 'critique of a particular cognitive faculty, namely judgment' (sec. 79, p. 417).

Although it is possible to consider as relatively final whatever products of nature humans can use or adapt to their own purposes, it in no way follows that these things were predestined for human use (p. 368). In fact, 'if we go through

the whole of nature we do not find in it, as nature, any being capable of laying claim to the distinction of being the final end of creation' (sec. 82, p. 426). Just as it is possible to construct an anthropocentric teleology (as Kant goes through the exercise of doing), a reverse anthropocentric teleology—a phyto-centric teleology—is just as conceivable (p. 427). Nature subjects humans equally to all operations of its mechanism (p. 427), and 'is far from having made a particular favorite of man or from having preferred him to all other animals as object of his beneficence' (sec. 83, p. 430).

Nonetheless, because humans are the only beings on earth that possess understanding, and thus can represent ends as the object of deliberate choice, a human is 'certainly titular lord of nature' (p. 431). Humans are entitled to regard humans as the ultimate end, since they are the space in which nature can go beyond itself, into the kingdom of freedom. And since culture is the final product of all free choice collectively considered, 'it is only culture that can be the ultimate end which we have cause to attribute to nature in respect of the human race' (p. 431). And since human existence involves the highest end, it is an end 'to which he may subject the whole of nature' (sec. 84, p. 435). And if we operate under the assumption that there must be an interconnection of all ends,

> then man is the final end of creation. For without man the chain of mutually subordinated ends would have no point of attachment. Only in man, and only in him as the individual being to whom the moral law applies, do we find unconditional legislation in respect of ends. That legislation, therefore, is what alone qualifies him to be a final end to which the entire nature is teleologically subordinated. (pp. 435–6)

These themes, the antinomy of mechanism and nature, the heuristic value of final causes, and anthropocentrism, lurk large in the following study: they are central to the interpretation and evaluation of Aristotelian teleology. And yet Kant doesn't mention Aristotle in his critique of teleology.[55]

The first philosopher I have found who explicitly invokes Aristotle in a discussion of 'teleology' is Hegel. He does so in the context of the distinction between internal and external teleology, which he borrowed from Kant: 'the determination of life by Aristotle already contains this internal purposiveness; hence it stands infinitely far above the concept of modern teleology which had only finite, or external, purposiveness in view' (*The Encyclopaedia of the Philosophical Sciences in Outline*, 1817, 3rd edn. 1830, part 1, 'The encyclopaedia logic' sec. 204). For Hegel, teleology is not in direct opposition to mechanism, but rather is a unity of mechanism (the doctrine that the world as a whole and natural entities operate on mechanical principles) and 'chemism' (the doctrine that the world as a whole and

[55] Kant does not indulge in a discussion of the history of teleology: he mentions Anaxagoras and Plato (*Judgment*, p. 363, his source is obviously *Phd* 96b f.), and Epicurus (p. 393), but these are only anecdotes. Aristotle is very conspicuously absent from the discussion, even though echoes of him are unmistakable. For instance, Kant says: 'in such a product nothing is in vain, without an end' (*Judgment*, p. 376). Ginsburg 2004 has recently shown, in a penetrating and far-reaching article, that Aristotle is a major influence on Kant's views about science generally and teleology specifically.

natural entities operate according to the operation and arrangement of chemical principles). Hegel's position cannot be said to have had a great influence on subsequent Aristotelian interpretation, except to the extent that some contemporary interpreters of Aristotle agree with Hegel that Aristotle advocates only an 'internal' teleology. It is apparent that the notion of chemism cannot resolve the antinomy of mechanism and teleology discussed by Kant, at least if the subsequent history of chemistry, in particular biochemistry, is concerned.[56]

What importance does the history of the technical term 'teleology' have then for an account of Aristotelian teleology? One thing is the fact that it is only in the modern period that the exact question—What is the nature of Aristotelian teleology?—has been asked. In deciding not only on our answer to the question, but on the meaning of the question itself, we must be aware of the initially highly reified condition of the concept of teleology. It is first proposed as a designation for a separate science coordinate with physics, and then subjected to a critique as a concept of reflective judgment, and then deployed dialectically in opposition to mechanism.

1.4 THEOPHRASTUS AND TELEOLOGICAL APORIAI

Although Aristotle is commonly held to be the inventor of teleology,[57] we have now seen that, technically, he was not. And if we speak non-technically, and so somewhat anachronistically, it is still clear that he was not the first philosopher to have advanced teleological explanations. He was, historically speaking, a developer and refiner of teleological ideas that had been growing in popularity in the decades immediately before and after his birth. As far back as Anaxagoras and Diogenes of Apollonia, philosophers were invoking quasi-teleological notions. By the time of Socrates, the idea that everything in the world has been designed for some purpose (i.e. for humans) was common: Xenophon represents Socrates as a retailer of such positions. Plato represents Socrates as a critic of Anaxagoras for failing to use purposive notions often or well enough. Plato himself develops a cosmology and theology that assigns primacy to the determination of the purposes of things in accordance with the intentions of an intelligent and providential designer.

Aristotle was, however, the first philosopher to examine critically the methodology of teleological explanation, and to argue for limits to its application in specific scientific contexts, such as physics, life sciences, and anthropology. His approach to ends and purposes is aporetic—he scrutinizes proffered explanations of things and processes. He says, 'concerning each kind of nature there is

[56] Aristotle's 'chemical' treatise, *Meteor* iv, discusses the transition between inorganic and organic substances in ch. 12. But since he treats inorganic substances (the four elements) teleologically themselves, not 'mechanically', there is not much of an analogy to the 'chemism' of Hegel's dialectic.

[57] 'Aristotle is universally credited with inventing the concept of teleology' (Lang 1989, p. 569).

perplexity and a need for investigation' (περὶ ἑκάστην φύσιν ἀπορίαν ἔχει καὶ δεῖται σκέψεως)' (*EE* 1214[a]9–10). He shows how factors such as chance, purpose, craft, necessity, matter, and so forth, play different roles in explaining the regularity of diverse natural kinds and processes. Sometimes the solution is to invoke multiple causal factors, while at other times the solution is to eliminate or qualify certain of them.

It has been persistently unappreciated to what extent he was also a critic of the earlier use of purposes and goals, and worked to reign in abusive teleological explanations. Like his contemporary and associate Theophrastus (372–287 BCE), Aristotle was concerned to determine specific 'standards' (ὅροι, 'canons' or 'limits')[58] for teleological explanation. It is worth briefly examining Theophrastus' call for a determination of specific standards on the application of the kind of explanation that involves 'the cause for the sake of which', because I think that his discussion reveals a concern that Aristotle shared and endeavored to follow in his specific inquiries.[59]

Were it not for the fact that Aristotle showed such great concern about it himself, the question of the appropriate limits of teleological explanation might be considered a Theophrastean question.[60] For Theophrastus, in his short treatise *Metaphysics*, explicitly raises the problem of the appropriate role of purposive and normative terminology in scientific explanation, with respect to everything from the heavenly bodies to the structure of the bubble,[61] and everything in between, including plants and animals, and their behaviors and parts.

Theophrastus' treatise is not a commentary on Aristotle.[62] It is not meant to explain the thought of Aristotle or anyone else. (Theophrastus names and criticizes many philosophers, such as Plato and Speusippus, but he never mentions Aristotle explicitly. It is possible that this is because his *Metaphysics* was composed while Aristotle was still alive.) The treatise is aporetic.[63] It discusses things that seem irrational or absurd (ἄλογον, παράλογον, ἄτοπον), gives a reason for mentioning them, suggests possible solutions, and discusses the merits and likelihood of the solutions. The conclusion or resolution of an aporia is frequently accompanied by a qualification, and its complications are discussed. We find interrogation

[58] 'It is clear that for the inquiry into nature, too, there should be certain standards (ὅρους), such that by referring to them one can appraise the manner of its proofs, apart from the question of what the truth is, whether thus or otherwise' (*PA* 639[a]12–15, trans. Lennox, CLAR).

[59] Theophrastus was Aristotle's pupil and immediate successor. We know that he worked directly with Aristotle for about thirty years, and continued after Aristotle's death many of the projects envisioned in the school after Aristotle's death.

[60] Lennox takes Theophrastus' text to contain a critique of the excesses of Aristotelian teleology (1985b). Repici (1990) criticizes Lennox's position by documenting much agreement between Aristotle and Theophrastus. But see Lennox's response (2001a, pp. 226–7), which makes it clear that he sees Theophrastus' arguments as a concern shared by Aristotle.

[61] For the 'bubble' see also Plato, Tim 66[b]4; [Aristotle] Prob 913[a]19–33, 936[b]1–9; 939[a]25–7.

[62] It is possible that the treatise was written during Aristotle's lifetime, perhaps before *GA* (Most 1988, p. 233). Cf. Lennox 1985b; Van Raalte 1988.

[63] Van Raalte 1993, pp. 2–7; Laks and Most 1993, pp. xxiii–xxvii.

and critique of various positions, but no ultimate commitment to an answer or advocacy of an alternative. (This is a method that Aristotle himself frequently follows, as we will see). Theophrastus justifies the procedure methodologically: 'perception both observes the differences and seeks the causes; or perhaps it is more in accordance with reality to say that it provides the thinking faculty with suggestions, some by simply seeking, others by producing in it a perplexity (ἀπορίαν) through which, even if it is unable to advance, some light appears in what is lit if one seeks further' (8^b12–16, trans. Van Raalte).

An important implication of the aporetic attitude of Theophrastus' treatise is that in it we do not find a definite rejection or acceptance of teleological explanations, either generally or with reference to any of the many examples adduced by Theophrastus. What we have is a demand for evidence or proof that a process or thing is for the sake of something. What Theophrastus rejects is the uncritical assumption that everything without qualification is explicable according to final causality. That is why he calls into question general teleological formulae such as: 'all things are for the sake of something and nothing in vain' (τοῦ πάνθ' ἕνεκά του καὶ μηδὲν μάτην) (10^a22–3); 'for the sake of something and towards the best' (τοῦ θ' ἕνεκά του καὶ εἰς τὸ ἄριστον) (11^a1–2); 'nature strives for the best in all things, and where possible makes them eternal and orderly' (τὴν φύσιν ἐν ἅπασιν ὀρέγεσθαι τοῦ ἀρίστου καὶ ἐφ' ὧν ἐνδέχεται μεταδιδόναι τοῦ ἀεὶ καὶ τοῦ τεταγμένου) (11^a5–7); 'where the better is possible, there it never fails' (ὅπου γὰρ οἷόν τε τὸ βέλτιον, ἐνταῦθα οὐδαμοῦ παραλείπει) (11^a8–9).

Theophrastus raises aporiai about teleological explanations with respect to the cosmological, meteorological, and biological domains, and the aporiai have a common structure. His criterion for whether or not something is teleologically explicable is as follows: If an explanation of a given phenomenon according to necessity, accident, or spontaneity is equally plausible, then it has not been shown that the phenomenon is necessarily teleologically explicable. Theophrastus raises the possibility that perhaps incidental causes, necessity, and spontaneity can just as plausibly as 'the cause for the sake of which' account for such phenomena, including the motions of the heavenly bodies and other living and non-living things.

> With regard to the issue that all things are for the sake of something and nothing is in vain, the delimitation required is not easy anyway (as is said frequently: where should we begin, and with what sort of things should we end up?), and some things in particular are difficult because they do not seem to be such, but some of them coincidentally, others by some necessity—as in the case of the heavenly bodies and of the majority of things on earth. (*Metaphysics*, 10^a21–7)

Theophrastus adduces many examples and asks whether accident, necessity, or spontaneity could possibly provide an equally plausible explanation.[64]

[64] The examples are numerous, but fall into three groups. *Cosmology*: Various aspects of the motions of the heavenly bodies do not seem to be for the sake of anything. Why do the heavenly bodies move at all instead of remaining at rest? Why do they move only in circular motion, and not with

In later chapters, the details of his examples and their treatment in the works of Aristotle will be examined. Then it will become clear that Aristotle explicitly treats the examples and in fact formulates his position on teleological explanations in light of such concerns. Many medieval, Renaissance, and contemporary debates about Aristotle's teleology are prefigured in Theophrastus' work; for example, whether rainfall and the motions of the elements are teleological, whether teleology is anthropomorphic, whether teleology requires a conscious agent, or whether teleology is otiose given adequate efficient causal explanation. A close examination of Aristotle reveals that such concerns are actually present in his own work.

The big issue for Theophrastus is that the difficulties in providing accounts of the cause for the sake of which in cosmology, meteorology, and biology call into question the extent of order in the cosmos.

> But again, the actual assignment of a formal account to each entity by referring to something for the sake of which in all cases is difficult, in the case of animals and plants and in the very bubble;—unless it happens through the order and change of other things that all sorts of shapes and varieties of things in the air and on earth arise; the main example of which according to some are the facts of the yearly return of the seasons, on which generations of animals, plants, and fruits depend—the sun being, so to speak, the begetter. These questions too call for an inquiry into them somewhere here, requiring as they do a delimitation of how far the ordered extends, and why more of it is impossible or the change would be for the worse. (*Metaphysics*, 7^{a}19–b8, trans. Van Raalte)

the great variety of motions of other ensouled things? Are the heavenly bodies moving themselves for a purpose, or under the influence of a mover? What is the relation between the movements of the heavenly and mundane bodies? The bodies that move in a circle do not seem to be for the sake of anything (καὶ τὸ ἀνήνυτον καὶ οὗ χάριν ἀφανές, 5^{a}17). Their circular motion, although it is the first, does not appear to be the best (εἰ δ' οὖν τῆς κυκλικῆς αἴτιον τὸ πρῶτον, οὐ τῆς ἀρίστης ἂν εἴη, 5^{b}7–8), because the motion of the best is rather that caused by thinking soul. On the other hand, it is questionable whether the bodies that move about the center are even part of the cosmos, or whether they happen incidentally under the influence of the circular rotations of the heavens (συμβαίνει γὰρ οἷον κατὰ συμβεβηκὸς ὑπὸ τῆς κυκλικῆς περιφορᾶς, 5^{b}23–5). It is even possible to raise the question whether the motion of the first heaven itself is due to its essence, or to accident (κατὰ συμβεβηκός, 6^{a}9–10). *Meteorology*: Various oceanographic, climatic, meteorological, and geological phenomena seem not to be for the sake of anything. For example: the incursions and reflexes of the sea, droughts and humidities, destructions and generations of topographic features of the earth, etc. *Biology*: Various biological phenomena do not seem to be for the sake of anything. For example: male nipples, menstruation, beards and hair growth in general, the enormous horns of deer, the violent nature of heron copulation, and the futile existence of the day fly. Finally, plants have shape and definite nature, but what for? A great variety of inanimate objects, plants, and animals, appear to be explicable by appeal to environmental and climatic factors such as the changes in seasons, whose profound effects on the things in the air and on the earth can themselves be traced back to the sun which is, 'so to speak, their begetter' (7^{b}5). The most important facts about animal generation and nutrition seem not to be for anything but rather due to concurrence and other necessities (οὐθενὸς γὰρ ταῦθ' ἕνεκα, ἀλλὰ συμπτώματα καὶ δι' ἑτέρας ἀνάγκας, 10^{b}18–19). Theophrastus also finds plausibility in the account that most things acquire their forms and differences 'spontaneously' (τῷ αὐτομάτῳ, 10^{b}27) and through 'the rotation of the whole' (10^{b}27–11^{a}1). This is very curious, given the fact that, as Balme points out, Theophrastus, in botanical contexts at least, 'expresses reluctance to accept evidence of true spontaneity, preferring to suppose that production is due to seeds latent in the ground or brought by rain and streams' (1962, p. 102, cf. 104).

Theophrastus seems to assume that the incomplete analysis of the extent to which things can be accurately explained as existing for the sake of something—some good—calls into question the extent of order itself in the universe. We might think this a strange assumption. We have become accustomed to thinking about order without purpose, intention, design, ends, or goods. But Theophrastus wonders how can there be said to be order without an identification of something for the sake of which the order exists. It poses an interesting question, even for us: what exactly do we mean by 'order' when we describe organization without any reference to ends, purposes, or goods? Furthermore, if we are able to determine more and more order in nature and the universe without reference to ends, then we call into question the existence of any ultimate purpose in or of the world.

There is a familiar flip-side to so-called 'teleological arguments' like those that have been employed in proofs for a god, who designs and orders things for the good: every identifiable case of what is futile, ugly, or disordered, or bad counts as an argument against any ultimate purpose or good in the universe, and seems to show that it as a whole exists in vain. This is why Theophrastus calls for an investigation (σκέψιν) into the measure of order in the universe. And he hints at an interesting possible solution to the problem of why there should not be more order or good in the universe when he calls for an investigation of 'why it is impossible that the order be extended further, or else the change would be for the worse' ($7^{b}5$–8). Here we see the seeds of a kind of theodicy, almost a 'best of all possible words' position, but with reference to order itself instead of god: were there to be more or less order, then there would be less good—the change would be for the worse (εἰς τὸ χεῖρον).

But Theophrastus initially requires a survey or 'delimitation' of how far order itself extends. Alas, 'the delimitation is not easy' (ὁ ἀφορισμὸς οὐ ῥᾴδιος, $10^{a}23$). Nonetheless, Theophrastus insists that it is necessary to establish limits (ὅρους, $11^{a}2$) on the use of teleological principles, and not to put them down indiscriminately or to apply them to everything without qualification (οὐκ ἐπὶ πάντων ἁπλῶς, $11^{a}3$). Later in this book it will be made clear that these are also Aristotle's concerns, and that they motivate the Stagirite to call for discrimination and limits in the application of teleological notions. This is already evident in Aristotle's programmatic statements about explanation, such as *Physics* ii 7 and *Parts of Animals* i 1. A thorough analysis of such texts, and of the specific examples mentioned by Theophrastus and Aristotle, should make it clear that Aristotle could not have disagreed with the following remark, with which Theophrastus ends his treatise on *Metaphysics*:

> But these things should be inquired into. As has been said at the beginning: one should try to grasp some limit, both in nature and in the being of the whole, both of the <explanation of things as being> 'for the sake of something' and of the impulse towards the better. For this is the starting-point of the study of the whole, in what things reality consists, and how they relate to one another. ($11^{b}24$–$12^{a}2$, trans. Van Raalte)

2

Preliminary Study of Aristotle's Causes

Aristotle refers to the causes or kinds of explanation by different names in various works. In *Metaphysics* i 10, he refers to 'the causes named in *Physics* [ii 3]' ($993^{a}11$, cf. $983^{a}31$), but uses different names for the causes in each passage, and both of these are different still from those used in *Posterior Analytics* ii 11 and *Generation of Animals* i 1. The entry on αἴτιον in the 'metaphysical lexicon' of *Metaphysics* v 2, $1013^{a}24$–$14^{a}25$ is identical to (a doublet of) *Physics* ii 3, $194^{b}23$–$5^{b}21$. In this chapter, we will make a preliminary of investigation of how the various terms used by Aristotle to represent and distinguish causes should be translated and interpreted. We will then examine how Aristotle expects these causes to work in scientific explanations. This will lead up to an in-depth investigation of the terminology of teleological causation in the next chapter.

2.1 RESPONSIBILITY, BLAME, AND CAUSE

The core notion of αἴτιον is responsibility.[1] Recent scholarship has exposed the pre-philosophical significance of the term in fifth-century medical, legal, and historical literature, the study of which casts some light on Plato's and Aristotle's concern to determine its most important sense or senses. But by the time Aristotle gets around to enumerating 'the four causes' (αἱ αἰτίαι τέτταρες), he has in mind terms that are already fully technical, and whose senses have been carefully systematized.

The term αἴτιον is translated into English as 'cause' or 'explanation'. The problem with 'cause', at least in English-language contexts, is that the term is heavily laden with customs that stem from its wide use in that language's rich philosophical

[1] Frede 1987; Lloyd 1995, pp. 541, 546; Furley 1996, n. 2; Sedley 1998, p. 115 '*Aition* is just the neuter of the adjective "*aitios*" which originally meant "culpable, responsible, bearing the blame", whereas the "*aitia*" is the accusation, what somebody is charged with having done such that he is responsible for what happened as a result' (Frede 1987, p. 223). Frede has a rich discussion of a terminological distinction, evidently emphasized by Chrysippus, and which had a major influence on the subsequent development of the notion of cause, between *aition* ('cause'), and *aitia* ('account of the cause'), but he also points out that the distinction is not recognized by Aristotle (pp. 222, 223).

discussions (causes precede effects, constant conjunction, spatial-temporal contiguity, etc.). If we consciously or unconsciously import these customs into our interpretation of Aristotle, then we can create problems that are otherwise specious, for example 'backwards causation'. It is not that these discussions of cause are irrelevant to the interpretation of Aristotle. But if we cannot shake modern sensibilities about cause (such as that causes are events), then we are unlikely to get anything out of—or even understand—Aristotle's account.[2]

On the other hand, the term 'explanation' has been criticized[3] insofar as it 'normally refers to a proposition or set of propositions—a verbal item' (Furley 1996, p. 60), and so runs the risk of missing that 'Aristotle uses *aition* to refer to a fact or state of affairs or a thing or person' (ibid.) But I don't see that any clarity is gained by denying that an *aition* is an explanation. Aristotle could use explanations to refer to facts and states of affairs of things and people. The four kinds of explanation, as causes, are a scheme for representing facts and states of affairs of people and things. Perhaps the phrase 'causal explanation' captures what Aristotle means. The situation is substantially similar to the status of Aristotle's categories: Aristotle never says if they are supposed to be about words, thoughts, or things. Despite the quarrel about this, which has a history of more than two thousand years, we have no strong grounds for choosing any one over the others, and that is likely because Aristotle himself does not perceive a forced choice, even if his commentators do. Likewise there is no reason to insist that αἰτίαι must be either 'things' or 'verbal notions' and not both. To do so is to present a solution to a non-existent problem, and a highly problematic solution at that.[4] Aristotle routinely invokes 'verbal notions' in his discussion of αἰτίαι, such as: that they are *middle terms* in syllogisms (*Post* ii 11) and that τὸ εἶδος is the *account* of what it is to be (ὁ λόγος ὁ τοῦ τί ἦν εἶναι, *Met* i 3). Nevertheless, the term 'cause' will serve well to underscore Aristotle's belief in the real existence of his modes of explanation in facts and states of affairs.

[2] Cf. Charleton 1970, p. 98; Moravcsik 1975 and 1991, pp. 32–3; Annas 1982; Freeland 1991, p. 50.

[3] The objections of Freeland 1991 to the explanatory account of *aitia* seem to me very weak. Briefly, they are: (1) explanations stand in an unclear relation to Aristotle's view of the metaphysics of causation (p. 50); (2) Aristotle's 'canonical presentation' of explanation is in *Posterior Analytics*, but this is distinct from the *Physics* (pp. 50–1); and (3) the notion of explanation is not itself transparent. Each of these arguments will be addressed in due course, particularly the third, which Freeland labels 'the most pressing problem' (p. 51). The point of this book, in part, is to show how Aristotle uses teleological explanations to account for natural kinds and processes (like stellar rotation, elemental transmutation, plant geotropism, animal locomotion, human action, and so forth). As for the claim that viewing *aitiai* as explanations does not fit the 'canonical presentation' of explanations, Freeland does not adequately examine *Posterior Analytics* ii 11, which is devoted to showing how the four causes work in a scientific demonstration. (She makes no reference to the chapter itself, but treats it indirectly by referring to Barnes' commentary and the valetudinarian example in her sec. III.)

[4] For a better approach, which shifts the question from 'How do we explain various parts of reality?' to 'What features or parts of reality make these intelligible?' see Moravcsik 1991. Here is a very sensible defense of the notion that *aitiai* are explanations: 'Aristotle's theory of *aitia* is a correspondence theory of explanations, thus dealing at once both with the world and with the ways in which we explain the world' (1991, p. 31). See also Moravcsik 1975.

2.2 THE FOUR KINDS OF CAUSES

We have become accustomed to talking about 'the four causes': the efficient cause, the material cause, the formal cause, and the final cause. What has become known by the phrase 'the four causes' is more precisely 'four modes into which cause falls' (αἴτια εἰς τέτταρας πίπτει τρόπους, *Phys* ii 3, 195[a]15; cf. *Meta* xii 5, 1071A7–8.). Aristotle calls all of the following causes, although they are not traditionally named as one of 'the four causes':[5] luck and spontaneity (*Phys* 195[b]31), intelligence (*Phys* 198[a]12), nature (*Phys* 198[b]4), and necessity (*Phys* 198[b]11). Each one of them falls into one or more of the four modes of cause.

Aristotle does not use the formula 'the X cause', where X is the name of one of the four αἰτίαι. Specifically, Aristotle never uses the term 'the final cause' (τὸ τελικὸν αἴτιον). Aristotle generally uses a substantive expression like ἡ ὕλη ('the matter'), τὸ εἶδος ('the form'), ἡ ἀρχη τῆς κινήσεως ('the source of motion'), or 'the for the sake of' (τὸ οὗ ἕνεκα).

> that there are these causes and this many is clear. And since all knowledge of nature concerns the four causes (αἱ αἰτίαι τέτταρες), it is naturally necessary to demonstrate the reason (τὸ διὰ τί ἀποδώσει) in all these ways: the matter, the form, the mover, the for the sake of which (τὴν ὕλην, τὸ εἶδος, τὸ κινῆσαν, τὸ οὗ ἕνεκα). [**b**] Three of these often coincide in one. For the what it is and the for the sake of which are one, and the source of motion is the same in kind as these, as in the case where a human be gets a human—and many things are changed as well as change others, and things which are not so changed are no longer natural (οὐκέτι φυσικῆς). (*Phys* ii 7, 198[a]21–8)

It is widely held that the invention of an adjectival expression, combined with 'cause' (e.g. 'the material cause') was the work of the scholastics.[6] But the term 'efficient cause' is already used by Cicero, in his book *De Finibus*, or *On Ends*,[7] even though he never uses the term 'final cause' (he uses simply *finis* to refer to τέλος). In Greek, the term 'the final cause' (τὸ τελικὸν αἴτιον) is used by Alexander of Aphrodisias,[8] Philoponus,[9] and Simplicius,[10] and so was already in antiquity a standard term of art.

[5] The *OED*, s.v. cause [5] says 'the four causes of Aristotle were: the efficient cause, the final, formal, material'.

[6] Janet 1876, p. 1 and n. 1; 'Ce sont scolastiques qui ont transformé ces substantives en adjectives' (Lerner 1969, p. 31); and *OED* s.v. material (material cause).

[7] *causam efficiendi*, I.vi.18; cf. *efficiens causa*, Seneca, Ep. 65.14.

[8] Alexander: *In Meta* i, 14.9, 62.6; ii, 160.2,3,4,5,6; iii, 182.31; v, 350.11; also [Alexander] *In Meta* 544.11, 635.11,15,17, 718.7, 828.35.

[9] Philoponus, commenting on Phys ii 3 (195[a]15), says that Aristotle 'summarizes them in concise groups, so that the kinds of enumerated causes are four, the material cause, the formal, the productive, the final' (Ἀνακεφαλαιοῦται τὰ εἰρημένα ἐν συντόμῳ, ὅτι τέσσαρές εἰσι τῶν ἀπηριθμημένων αἰτίων οἱ τρόποι, τὸ ὑλικὸν αἴτιον τὸ εἰδικὸν τὸ ποιητικὸν τὸ τελικόν, *In Phys* 246.24–247.1).

[10] 'And this is the cause, he says, as end of the others, and as good and that for the sake of which everything comes to be. For the final cause wants to be the best and the good' (τὸ δέ ἐστιν αἴτιον, φησίν, ὡς τέλος τῶν ἄλλων, καὶ ὡς ἀγαθὸν καὶ οὗ ἕνεκα πάντα γίνεται. τὸ γὰρ τελικὸν αἴτιον τὸ

Aetius (a doxographer possibly of the late first century CE) gives a trite summary of αἱ αἰτίαι τέτταρες in terms of prepositional phrases to which they correspond. What is interesting about the phrases that he uses is that they are somewhat different from those we see used in Aristotle. 'The *out of which* is called the matter, and the *from which* the mover, and the *according to which* the form, and the *through which* (i.e. because of which) the end (τό τε ἐξ οὗ λέγοντα τὴν ὕλην, καὶ τὸ ὑφ᾽ οὗ τὸ ποιοῦν, τὸ καθ᾽ ὅ τὸ εἶδος, τὸ δὲ δι᾽ ὃ τὸ τέλος) (*Placita*, i.11.4, ed. Diels, *Dox. graeci*, p. 310b79). Aetius' summary reminds us that the causes correspond to commonplace prepositional and interrogative terms in the Greek language.[11] This is because they are kinds of explanation and various modes of responding to such questions as: Out of what? Owing to what? According to what? Because of what? Although we must remain attentive to Aristotle's own language, of course, we must not be so rigid as to fail to translate fully and effectively the terms into our own language.[12] Thus calling attention to the distinctions between the English interrogative terms to which the Aristotelian causes answer is wholly appropriate. Commentators have independently made an important point about teleological causes in so doing: 'The teleological explanation does not say how things happen but why' (Balme 1965, p. 3); 'Final causality does not explain *how* something happens or what brings it about; it explains *why* it happens' (Kahn 1985, p. 189, emphasis in original, with no reference to Balme).

When we think in terms of responses to various kinds of simple interrogations (like 'Why?' or 'How?'), Aristotle's insistence that we distinguish between four kinds of cause may seem uncontroversial, even trivial. And yet it has been vehemently rejected many times over. A typical and admirably concise explanation for this is Bunge's.

> The Aristotelian teaching of causes lasted in the official Western culture until the Renaissance. When modern science was born, formal and final causes were left aside as standing beyond the reach of experiment; and material causes were taken for granted in connection with all natural happenings—though with a definitely non-Aristotelian meaning, since in the modern world view matter is essentially the subject of change, not 'that out of which a thing comes to be and persists'. Hence of the four Aristotelian causes only the efficient cause was regarded as worthy of scientific research. (Bunge 1959, p. 32)

βέλτιστον καὶ τὸ ἀγαθὸν θέλει εἶναι, Philoponus, *In Phys* 248.2–4); 'The fourth cause he presents is the final; this is that with which we answer, when asked, for the sake of what does that which comes to be come to be' (τέταρτον αἴτιον προστίθησι τὸ τελικόν, τοῦτο δέ ἐστιν ὃ ἀποκρινόμεθα ἐρωτηθέντες, τίνος ἕνεκα γίνεται τὸ γινόμενον, Simplicius, *In Phys* 9.315.30–1).

[11] On the 'metaphysics of prepositions' as a later development prefigured by Aristotle, see Hankinson 1998, p. 338.

[12] Recent work has shown how it is possible to accomplish the translation of Aristotle's categorical terms, which also correspond to interrogations, into a completely alien language and philosophical environment. See Wardy 2000. As Mann 2000 points out, linguistic determinism is not decisive because we are not simply dealing with 'common-sense' notions, but rather with common-sense notions that have become technical scientific and metaphysical concepts.

There is much to disagree with here. I have already called into question, though the decisive arguments are far beyond the scope of this book, the claims both that *Aristotle's* teaching of causes was in effect until the Renaissance, and that his causes were not in effect after it. The claim that formal and final causes 'were left aside' can only be true on a misunderstanding of what things Aristotle considers to fall within those kinds of causes. Bunge does not seem aware of what kinds of things are 'formal and final causes' for Aristotle. He goes looking for 'forms' and 'final causes' in nature, fails to find them, and so asserts that they are undiscoverable in experiment. Had he sought syllables, the octave, artifacts, biological kinds, psychological functions, cybernetic control systems, and so forth, he could have discovered 'forms and final causes'. That they have been left aside in modern science is, from this perspective, as wrong as the assertion that modern science has left Aristotle's concept of matter aside in exchange for a view of matter as 'essentially the subject of change'. (That is precisely what Aristotle says that matter is.[13]) Finally, the claim that only Aristotle's efficient cause was retained as worthy of scientific research is false,[14] if only because contemporary positions on efficient causality would exclude many things that Aristotle considers paradigmatic of such causality (such as seeds and builders).

The Cause 'Out of Which'

An example of great variation in Aristotle's causal terminology is the way Aristotle refers to the kind of cause that has been generalized as matter or the material cause. A review of the Greek terms (*Post* ii 11: τὸ τίνων ὄντων ἀνάγκη τοῦτ᾽ εἶναι; *Phys* ii 3=*Meta* v 2: τὸ ἐξ οὗ γίγνεταί τι ἐνυπάρχοντος; Meta i 3: τὴν ὕλην καὶ τὸ ὑποκείμενον; *GA* i 1: ἡ ὕλη) shows that the appellation 'matter' translates only the terms as listed in *Metaphysics* i 3 and *Generation of Animals* i 1. In the *Metaphysics* we have an explicit reference to 'the matter, I mean the subject [of change]', showing that Bunge's 'modern world view [of] matter [as] essentially the subject of change' is not in fact 'definitely non-Aristotelian'. In the *Analytics*, the cause is called 'the things which, when they are, this must be'. We will discuss the role of this cause in demonstrations in due course. For now it is important to note that in the *Analytics* (and the *Organon* as a whole) there is no mention of matter at all. In the *Physics*, where there clearly is an operative notion of matter, Aristotle considers it to be but one example among many that exemplify 'the cause out of which':

> Letters are the cause of syllables, their matter of artifacts, fire and the like of other bodies, their parts of wholes, and the hypotheses of the conclusion, as the cause out of which (τὸ ἐξ οὗ αιτια); and the one group, the parts and so on, are causes as the underlying thing, while the other group, the whole, the composition and the form, are causes as 'the what it was to be' (τὸ τί ἦν εἶναι). (*Phys* ii 3, 195^{a}16–21; Cf. *Meta* v 2, 1013^{b}17–21)

[13] But Aristotelian 'matter' is importantly different from the modern concept of matter, correctly conceived, as pointed out by Code 1987.

[14] For a direct contradiction of this claim, see Cartwright 1999.

Thus this kind of explanation or cause is only by synecdoche called 'matter' or 'the material cause'.[15] The cause primarily signifies that out of which anything is made, whether that be raw materials, parts, or even letters and arguments. Of course, the notion of matter and Aristotle's adoption of the elemental theory of it is of major import to his physics (and receives intense concentration in the *Metaphysics*). But at this stage of our study it will be necessary to broaden our conception of this kind of cause to include things like premises in demonstrative syllogisms making a certain modal claim (i.e. 'the things which, when they are present, this [other thing] must be', as in *Post* ii 11) and the parts of animals (including not just the elements, but their so-called 'homogenous' and 'heterogeneous' parts as well). It will be unacceptable to think simply of 'matter' in cases where Aristotle is using this kind of cause to explain how elements and parts relate by necessity to certain functions 'for the sake of which'.[16]

'Whence the Source of Change'

To see how expansive is Aristotle's conception of this kind of cause, we may again quote some of his examples:

'whence the primary source of change or rest' [is a kind of cause], for example: the man who has deliberated is a cause, the father is cause of the child, and in general that which makes something of that which is made, and that which changes something of that which is changed. (*Phys* ii 3, 194^{b}29–32)

The source (or beginning, or origin) of motion (or change) is often called 'the efficient cause'. This rendering is somewhat problematic, at least if we have in mind the modern notion of an efficient cause along the lines that Bunge (quoted above) and others conceive it. This kind of cause, for Aristotle at least, applies not just to events, like earthquakes and motions of colliding bodies, but also to entities like people and artifacts. Furthermore, it does not require spatial-temporal contiguity.[17] In short, it is whatever active principle initiates change (or rest), whether this is a billiard ball or a doctor.

That which is active (τὸ ποιητικὸν) is a cause as 'whence the beginning of change' (ὅθεν ἡ ἀρχὴ τῆς κινήσεως). But 'the [cause] for the sake of which' is not active (τὸ δ' οὗ ἕνεκα οὐ ποιητικόν). That is why 'health' is not active, except metaphorically. For whenever the agent is there, the patient becomes something; but when conditions [e.g. of health] are present, the patient no longer becomes [something], but already is [something, e.g. healthy]. And the forms and the ends are states, but matter, insofar as it is matter, is passive. (*GC* i 7, 324^{b}13–18)

[15] For a discussion of the expansive analogical nature of this cause and why it should not simply be identified with matter, see Pellegrin 1986, p. 143, and Lloyd 1996, pp. 158–9.

[16] Cf. Moravcsik 1991, p. 35.

[17] Cf. Moravcsik 1974, p. 629, and 1991, p. 35.

Aristotle's own technical locutions for this kind of cause consistently provide this latitude (*Post* ii 11: ἡ τί πρῶτον ἐκίνησε; *Phys* ii 3=*Meta* v 2: ὅθεν ἡ ἀρχὴ τῆς μεταβολῆς ἡ πρώτη ἢ τῆς ἠρεμήσεως; *Meta* i 3 and *GA* i 1: ὅθεν ἡ ἀρχὴ τῆς κινήσεως). Hence it seems justified to translate his entire phrases, and not to substitute a more concise formula, especially since the chosen formula by now has connotations inappropriate to Aristotle's notion.

Part of the locution that gets dropped out in the phrase 'the efficient cause' is the relative adverb ὅθεν 'whence' or 'from where'. One should compare the impression created by the terms of the previous cause, 'out of which'.[18] The appearance of the adverb strongly suggests that the cause operates externally, and the examples bear this out (a father of a son, a maker of a product, etc.). Now there will be exceptions to this—things whose principle of motion and rest is internal, not external, to them. This is, in fact, how Aristotle defines 'nature'. But it is important, precisely because of this point, that the term indicating that the cause implies a location be preserved in the translation.

The Form and 'What It Is to Be Something'

The term εἶδος is usually translated 'form' in the works of Plato. Aristotle uses the term to mean this, but also to mean just 'kind' (a standard, non-technical Greek usage, which became technical with Plato). Both Plato and Aristotle use it as a synonym for γένος ('kind' or 'race'). It is necessary to retain both of the terms, form and kind (and even species, though not in a rigid taxonomical sense), in order to translate accurately the term in the various (and extremely diverse) contexts in which it appears.[19] The problem with the phrase 'the formal cause' is that it covers over this crucial ambiguity in the term. Another problem is that it covers over somewhat problematic terminology that Aristotle often uses to refer to this kind of cause.

In order to get an idea of how expansive yet again is Aristotle's notion of this kind of cause, we may begin with still another list of examples:

> According to another [manner of speaking], the form or model is a cause; this is the formula of what it is to be some thing, and its kinds—for example, the cause of the octave is the ratio of two to one, and more generally number—and the parts which come into the account. (*Phys* ii 3, 194^{b}26–9)

We have already seen above, in the discussion of the cause 'out of which', various examples of the kind of cause usually referred to as 'the formal cause': syllables,

[18] Suárez says: 'the agent is a principle of the action or change solely by virtue of the fact that the action or change emanates from the agent and bears an essential relation to the agent as to an external principle on which it depends. And it is this proper concept and relation that is made manifest by the term 'whence' (a term equivalent to the phrase 'from which'), which is properly attributed to the efficient cause. For the material principle is, by way of contrast, that 'out of which'' (*Disputationes metaphysicae* XVII, 581ab, trans. Freddoso).

[19] Balme 1972, p. 74; Grene 1972, p. 409. Cf. Lennox 1987b, pp. 122–3; Pellegrin 1986, p. 34, and ch. 2.

artifacts, bodies, wholes, and conclusions. Aristotle said that these, 'the other lot, the whole, the composition and the form, are causes as "the what it was to be" (*Phys* ii 3, 195ª20). The form is thus an instance of the cause referred to by the cumbersome phrase 'the what it was to be'. This is further evidenced by the fact that the phrase occurs in three of the four lists of the four causes; but the term for form infrequently appears in these lists (*Post* ii 11: τὸ τί ἦν εἶναι; *Phys* ii 3=*Meta* v 2: τὸ εἶδος καὶ τὸ παράδειγμα, ὁ λόγος ὁ τοῦ τί ἦν εἶναι; *Meta* i 3: τὴν οὐσίαν καὶ τὸ τί ἦν εἶναι; *GA* i 1: ὁ λόγος τῆς οὐσίας).

τὸ τί ἦν εἶναι is often translated 'essence'. But the term 'essence', like 'cause', is heavily laden with customs, baggage, and ambiguities (necessary and sufficient conditions, secret natures, etc.), which do not really apply to Aristotle. It is common to attack Aristotelian 'essentialism' (a term invented by Karl Popper in 1945 (*The Open Society and its Enemies*, vol. 1, p. 31[20]), but what is attacked (e.g. 'secret natures') is more often than not a caricature of a position that Aristotle actually countenances. It is debatable, for example, whether what Quine calls 'Aristotelian essentialism' has anything to do with anything in the Stagirite's texts, which might account for the fact that Quine does not bother to refer to any of them.[21] On the other hand, there has recently been an exciting revival of self-consciously 'Aristotelian' theories of causation,[22] meaning,[23] and identity,[24] which in various ways utilize the notion of 'essence' more or less promisingly. (We will have occasion to consider these projects only insofar as they bear on Aristotle's teleology.)

τὸ τί ἦν εἶναι literally translated reads 'the what it was to be'. For the present purposes, this is another case where awkward phrases make elegant translations if the source phrase is awkward in the original. The term 'essence' is much too smooth for this unwieldy expression. Contained in the phrase τὸ τί ἦν εἶναι is an odd juxtaposition of finite and infinite forms, the imperfect (ἦν) and the infinitive (εἶναι), and if at all possible our translations should not cover this up.

[20] I owe this observation to Polly Windsor. Popper says in a later work, 'the school of thinkers whom I propose to call methodological essentialists was founded by Aristotle' (1957, p. 28).

[21] Quine 1966 (a talk given in 1953), pp. 173–4. White (1972) argues that there is little connection between Quine's essentialism and Aristotle's. Cohen (1978) endeavors to show that Aristotle is committed to a version of essentialism 'stronger' than Quine's. Another comparison is to Kripke's essentialism, which Witt (1994, ch. 6) distinguishes from Aristotle's theory of substance. For a separate debate, in which Aristotle's views on 'essentialism' are criticized as ideologically nefarious, and then defended, at least in part, see Curran 2000. Her article shows a further symptom of the problem I have been discussing. In a note, she says, 'The term "essence" is a translation of a number of distinct Greek terms, e.g. "*ousia*", "*to ti en einai*", and one task in understanding Aristotle is to figure out how all these terms are related' (p. 331). It is true that we should figure out how the Greek terms are related, but not because they have been linked by later writers and all translated with the term 'essence'. By looking at the problem that way we run the risk of back-translating a problem into Aristotle that simply is not there.

[22] For example, Cartwright 1989, and Ellis 2001 and 2002.

[23] For example, Charles 2000, and Modrak 2001.

[24] For example, Wiggins 2001, van Inwagen 1990, Rea 1998.

The phrase τὸ τί ἦν εἶναι is, grammatically, an articular infinitive that encloses Aristotle's primary category,[25] substance (τί ἐστι λέγει καὶ οὐσίαν, *Top* i 9, $103^{B}30$–31). It responds to the commonplace and technical-dialectical question: τί ἐστι—what is it? In the parlance of Academic debate (the forum in which the term was probably invented), the most general—and therefore abstract—answer to this question is τὸ τί ἦν εἶναι ('that which it is to be something'). Aristotle uses the term in this way both in dialectical contexts in response to the τί ἐστι question, and with reference to his category of substance. It is possible that the imperfect tense of ἦν is the so-called 'philosophical imperfect'—referring not to something that actually happened in the past, but rather to something that was mentioned a short while ago (perhaps in some previous lines of a competitive dialectical exchange). We use the imperfect similarly in English when we say, 'What *was* your name?' to someone we were introduced to earlier (as opposed to 'What *is* your name?').[26]

We are told by Diogenes Laertius that Antisthenes was 'the first to define "account" by saying that "an account is the thing which sets forth what a thing was or is"' (λόγος ἐστὶν ὁ τὸ τί ἦν ἢ ἔστι δηλῶν)' (D.L. VI.3). This is directly pertinent to Aristotle's terminology. Aristotle defines the cause we are discussing with the words 'the account of what it was to be something' (ὁ λόγος ὁ τοῦ τί ἦν εἶναι, *Phys* ii 3=*Meta* v 2).[27] And τὸ τί ἦν εἶναι is in several places connected by Aristotle with the definition of a thing. To be more specific, it indicates the object of a definition—what is being defined: 'what it is for something to be', whose formula is definition, is also called the substance of each thing' (ἔτι τὸ τί ἦν εἶναι, οὗ ὁ λόγος ὁρισμός, καὶ τοῦτο οὐσία λέγεται ἑκάστου, *Meta* v 8, $1017^{b}21$-2).[28]

This fact opens up a more speculative possibility, but one instructive to consider. Plato and Aristotle use the term to indicate duration, as in 'that at which all things aim, this was [always or all along] a good (οὗ πάντες ἐφίενται, τοῦτ᾽ ἀγαθὸν ἦν)' (*Rhet* $1363^{A}8$–9).[29] Consider as a translation for τὸ τί ἦν εἶναι 'that which something [always or all along] was to be'. This could apply to Aristotle's account of generation, which holds that the form pre-exists before an embodied thing comes to be in matter.[30] This is especially important in cases of biological generation and development. For in such cases, not every phase of development is the basis for its explanation, but only the animal 'in a state of completion' (ἐντελέχεια), i.e. a fully mature adult, which corresponds to its form. Something persists through the embryonic, infant, pubescent, adult, and geriatric stages. The definition and

[25] Lennox 2001b, p. 151.

[26] This account of the imperfect, and the example, are due to Stephen Menn (personal correspondence). Cf. Ross, *Aristotle's Metaphysics,* vol. i, p. 127.

[27] *Phys* ii 3, $194^{B}27$=*Meta* v 2, $1013^{A}27$.

[28] Cf. *Meta* $1030^{A}6$–7, $1031^{a}12$, $1042^{a}17$. See also Modrak 2001, p. 156.

[29] Cf. Plat. *Theaet* 156a (Ross, *Aristotle's Metaphysics,* vol. ii, p. 127). As Susan Meyer pointed out to me, this would mean that the imperfect functions something like the gnomic aorist here (for which see Smythe sec. 1931).

[30] See: *Meta* $1032^{B}11$–12, $1034^{B}12$–13, and $1072^{B}30$–$73^{A}3$. See also Ross, *Aristotle's Metaphysics,* vol. ii, p. 127.

substance of biological entities refers to a fixed point in a continuous development. And the locution τὸ τί ἦν εἶναι might indicate a concern about how the elements of definition and explanation make reference to a certain stage in a thing's developmental history. Certainly Aristotle was concerned with this issue,[31] and it is in fact explicit in his outline of the causes at *GA* i 1 where he says that the end and 'the account of the substance' should be identified:

> For there exist four causes, (1) the for the sake of which as the end, and (2) the account of the substance, and these should be regarded as almost one and the same
>
> ὑπόκεινται γὰρ αἰτίαι τέτταρες, τό τε οὗ ἕνεκα ὡς τέλος καὶ ὁ λόγος τῆς οὐσίας, ταῦτα μὲν οὖν ὡς ἕν τι σχεδὸν ὑπολαβεῖν δεῖ (*GA* i 1, 715^{a}4–6)

Whether or not it played a part in Aristotle's formulation of the locution τὸ τί ἦν εἶναι (and there is no direct evidence that it did), what I have just said will be shown to be crucial to our study, later, when we see how it is that teleological explanations involve causes that seem to postdate their effects in time. For now, we move on to discuss the explanations generally.

2.3 KNOWLEDGE, DEMONSTATION, AND CAUSAL EXPLANATION

After having laid out the basic problem of how knowledge is acquired in the first chapter, Aristotle opens the second chapter of *Posterior Analytics* by saying, 'we think we understand something *simpliciter* (and not, in the sophistic fashion, incidentally) whenever we think we are aware both that the cause (αἰτίαν) because of which the object exists is its explanation (αἰτία), and that it is not possible for this to be otherwise' (*Post* i 2, 71^{b}9–12, Clar; cf. 75^{a}35, 93^{a}4, 94^{a}2). Demonstrative knowledge requires a syllogism of which the cause or explanation is the middle term.[32] In *Posterior Analytics* ii 11, Aristotle names the four kinds of cause, and proceeds to discuss how it is that each can play the explanatory role of middle term in a scientific demonstration. The chapter is strangely ignored by some recent commentators.[33] But it offers key insights into

[31] See, e.g. *PA* i 1, 639B11–19, 640^{A}24–25, and *GA* ii 6, *passim*.

[32] See, inter alia, *Post* 74B30–32, 89^{a}16, 89^{b}15, 90^{a}7, 93^{A}7–8, 94^{A}23–24, 95^{A}11–12, 98^{b}10.

[33] McKirahan in his monograph on *Posterior Analytics* strangely brushes off the chapter: 'we should not expect any of the four "causes" to apply here, since they are introduced in the *Physics* in a context alien to demonstrative science' (1992, pp. 229–30). A monograph on explanation in *Posterior Analytics* does not index the chapter at all (Golden 1996). Perhaps the reason for this is mentioned by Ross and Barnes who, in their commentaries, call the chapter 'one of the most difficult in Aristotle' (Ross, p. 638; Barnes, p. 215). Freeland 1991 deals with the text very awkwardly. She does not refer to Aristotle's arguments, but refers us to Barnes' commentary at the outset of a discussion criticizing van Frassen (Freeland 1991, p. 63 n. 38). Earlier she had asserted that Aristotle's 'canonical presentation' of explanations in *Posterior Analytics* does not use the causes (see above on n. 3). She says

how Aristotle expects teleological explanations to utilize causes in scientific demonstration.[34]

In *Posterior Analytics* ii 11, the first named cause is 'the things which, when they are, this must be' (τὸ τίνων ὄντων ἀνάγκη τοῦτ᾽ εἶναι). This is the kind of cause that Aristotle later calls 'the out of which cause', and is in other works sometimes identified with matter. Later in the chapter Aristotle will talk about the special relationship between this kind of cause and 'the cause for the sake of which' (τὸ ἕνεκα τίνος). His discussion will be about how necessity and 'the for the sake of which' are related, and elsewhere this is seen to be an issue of what kind of matter something must necessarily be made out of. Outside *Posterior Analytics*, Aristotle develops a unique conception of necessity ('hypothetical necessity') that applies to the teleological explanations of living things as well as to some artifacts, and indicates a special relation between the cause for the sake of which and matter (*Phys* ii 9, *PA* i 1).[35]

In *Posterior Analytics* ii 11, the example for this kind of cause does not involve matter at all.[36] Instead, we have a geometric question: why is the angle in the semi-circle a right angle? The terms are symbolized as follows.

(A) right angle

(B) half of two right angles

(C) angle in a semi-circle

of *Physics* ii, 'he is utilizing a notion of explanation distinct from that set forth in *Posterior Analytics*' (p. 63). It is later explained that, 'in his *Physics* ii discussion Aristotle aims to highlight certain differences among the four causes, while in the *Posterior Analytics* he attends to the common features of their formal (i.e. syllogistic) representability' (p. 65). But the fact that there are differences in presentation does not warrant the claim that they are distinct notions: certainly, he emphasizes differences, but that does not mean that he has a 'distinct notion of explanation'. Freeland does not establish that the treatment of causes is fundamentally different between the two texts. After all, Aristotle begins *Post* ii 11 by distinguishing the four kinds of cause, and he proceeds to show how they work syllogistically by giving four different examples, during which he draws a lot of distinctions between the kinds of explanation. The only other texts Freeland refers to in support of her point are biological treatises where to her it is 'evident' that Aristotle emphasizes differences between the kinds of account (what Freeland calls 'purposive or efficient or material', p. 65). But where he does make such distinctions, the evidence supports the opposite of her conclusion. For example, in *PA* i 1, Aristotle discusses how demonstrations in natural science with reference to the cause for the sake of which differ from demonstrations using absolute necessity (*PA* i 1, 640^{a}1–9). Thus there is no good reason to think that *Posterior Analytics* should not be taken seriously for the interpretation of Aristotle's theory of causal explanation.

[34] Bolton 1995 makes excellent use of the chapter. Although I disagree with his account of the implications of *Post* ii 11 for Aristotle's natural teleology, and will argue against it below, I am indebted to his discussion of this chapter for making me realize how crucial it is for understanding all other applications of the teleological explanation. See also Annas 1982, p. 322; Detel 1997; Lennox 2001c, pp. 134–7.

[35] Lennox 2001a, pp. 102, 112, and 2001b, pp. 134–7.

[36] Aristotle makes it clear elsewhere (*Phys* ii 3, 194^{b}23–6), that matter is only one instance of this kind of cause ('that out of which') among several others.

The syllogism constructed out of these terms looks like this.

1. (A) A right angle inheres in (ὑπάρχει) (B) half of two right angles.
2. (B) Half of two right angles inheres in (C) the angle in a semi-circle.
3. (A) A right angle inheres in (C) the angle in a semi-circle.

The middle term (B, 'half of two right angles') is thus said to be the cause—i.e. the explanation—of why the angle in the semi-circle is equal to a right angle, because the right angle and the angle in the semi-circle are necessarily equal, since they are both equal to half of two rights.

As for the second kind of explanation, 'what it is to be something' (τὸ τί ἦν εἶναι), Aristotle does not give an example here, but refers to an example just given in *Posterior Analytics* ii 10. We can provide symbols for it as follows: (A) noise in the clouds; (B) fire extinguished in the clouds; (C) thunder. We represent its syllogism like this:

1 (A) Noise in the clouds inheres in (B) fire extinguished in the clouds.
2 (B) Fire extinguished in the clouds inheres in (C) thunder.
3 (A) Noise in the clouds inheres in (C) thunder.

And here we have a demonstration by means of the cause that states 'what it is to be something'. For we can answer the question 'Why does thunder cause noise in the clouds?' by stating a definition of thunder, the middle term in the demonstrative syllogism: because thunder is fire extinguished in the clouds.

As for the explanation which states 'what first moved it' (ἡ τί πρῶτον ἐκίνησε), Aristotle gives the following example. Why did the Persian war come about for the Athenians? Answer, because the Athenians launched an offensive, attacking Sardis with the Eritreans. Aristotle offers the following symbols.

(A) War
(B) Launching an offensive
(C) Athenians

Let's make a syllogism out of it.

1. (A) War inheres in (B) launching an offensive.
2. (B) Launching an offensive inheres in (C) the Athenians.
3. (A) War inheres in (C) the Athenians.

And so, again, we have an explanation of why the Persian war happened: because the Athenians launched an attack. The cause of the war was the movement initiated by the Athenians by launching an attack.

2.4 DEMONSTRATION THROUGH 'THE CAUSE FOR THE SAKE OF WHICH'

When Aristotle gets to 'the for the sake of which' (τὸ τίνος ἕνεκα) he immediately gives two examples, from the domain of intentional action and craft: (1) why does one walk? and (2) why is a house built? The answer is: (1) for the sake of health, and (2) for the sake of protection (τὸ μὲν ἕνεκα τοῦ ὑγιαίνειν, τὸ δ' ἕνεκα τοῦ σῴζεσθαι, 94^{b}10–11). Aristotle says that the διὰ τί ('reason why') and the ἕνεκα τίνος ('for the sake of which') are effectively the same (οὐδὲν διαφέρει).

Let's take the house example first. Why does one build a house? For security and protection. Why does building a house provide security and protection?

(A) House

(B) Sheltering possessions from weather and intruders

(C) Security and protection

(Here I am filling in Aristotle's brief account.) Again, we have the structure, (A) inheres in (B), and (B) in (C). Thus how it is that a house provides security and protection is answered through a middle term: by sheltering possessions. Although (C) is the ultimate reason why (A) is built, the reason that people build houses for security can be explained by referring to the middle term.

But then the cause for the sake of which—(C) security—is not the middle term, and so does not appear to be, given the example at least, the key explanatory factor. In order to understand how it actually turns out to be, we have to examine the other example, the after-dinner walker.[37] The details of how the example is supposed to work are disputed. Aristotle applies the following symbols to the following terms, in the following order.

(C) walking after dinner (περίπατος ἀπὸ δείπνου)

(B) food not staying on the surface [of the stomach] (τὸ μὴ ἐπιπολάζειν τὰ σιτία)

(A) becoming healthy (τὸ ὑγιαίνειν)

[37] It is worth pointing out that Aristotle appeals to this example in many different contexts. Although it is clearly borrowed from a medical dispute, this example could justifiably be called the peripatetic example *par excellence*. Compare the following: 'an argument which denied that it was better to take a walk after dinner, because of Zeno's argument, would not be a proper argument for a doctor, because Zeno's argument is of general application' (*SE* 172^{A}8–9); 'Again, in the sense of end or that for the sake of which a thing is done, e.g. health is the cause of walking about (Why is he walking about? We say: To be healthy, and, having said that, we think we have assigned the cause)' (*Phys* 194^{B}32–35); 'the phrase "in vain" is used when one thing which is for the sake of another, does not result in it. For instance, taking a walk is for the evacuation of the bowels; if this does not follow after walking, we say that we have walked in vain and that the walking was in vain' (*Phys* 197^{B}22–25); 'we call a cause . . . (4) the end, i.e. that for the sake of which a thing is, e.g. health is the cause of walking. For why does one walk? We say "in order that one may be healthy", and in speaking thus we thing that we have given the cause' (*Meta* 1013^{A}33–35).

Commentators have reconstructed the syllogism in many different ways, using different interpretative translations, but have found the example to be unworkable. 'It is by no means easy to see what syllogism or quasi-syllogism he has in mind; the commentators are much puzzled by the passage and have not been very successful in dealing with it' (Ross, *Aristotle Prior and Posterior Analytics*, p. 643). Barnes calls the section on final causality 'miserably obscure' (1975, p. 218). Ross thinks that the middle term is 'healthy', and Barnes considers this possibility, and also that the middle term is walking ('perambulation' in Barnespeak). For what it is worth, Aristotle says: 'Let "making the food not stay on the surface" inhere in "walking after dinner" and let this be healthy (ἔστω δὴ τῷ ἀπὸ δείπνου περιπατεῖν ὑπάρχον τὸ ποιεῖν μὴ ἐπιπολάζειν τὰ σιτία πρὸς τῷ στόματι τῆς κοιλίας, καὶ τοῦτο ὑγιεινόν)' (*Post* 94^{b}14–16). Here, the middle term is not walking after dinner (C), or becoming healthy (A), but the food not staying on the surface of the stomach—i.e. good digestion (B). In the conclusion, (A) inheres in (C) ('walking after dinner is healthy'). Aristotle drives the point home: 'What is the cause (the for the sake of which), of A [health] inhering C [walking after dinner]? It is B: [food] not staying on the surface' (τί οὖν αἴτιον τῷ Γ τοῦ τὸ Α ὑπάρχειν τὸ οὗ ἕνεκα; τὸ Β τὸ μὴ ἐπιπολάζειν).

But, one objects, the middle term is supposed to be health, not 'food not staying'. (This is the argument on the basis of which both Ross and Barnes interpret 'health' to be the middle term, and then find the example poor or unworkable.) Here we run into the same problem as with the house: is not the explanatory cause 'for the sake of which' supposed to be security or health, not sheltering goods and digesting food?

Aristotle explicitly addresses the objection, stating that

> and this [the food not staying] is, as it were, the account for that [health]; for A [health] will be described thus. Why is B [not staying on the surface] [inherent] in C [walking after dinner]? Because this [B, food not staying] is healthy, this condition. It is necessary to transpose the accounts (μεταλαμβάνειν τοὺς λόγους) and this way each becomes more clear. (94^{b}19–23)

Given that the conclusion purportedly shows that (B) inheres in (C), we must have the following syllogism.

1 B [not staying on the surface] inheres in A [health].

2 A [health] inheres in C [walking after dinner].

3 B [not staying on the surface] inheres in C [walking after dinner].

So, if we ask the question, 'Why does food not stay on the surface of the stomach for those who walk after dinner?', the answer is that it is for the sake of health. Now compare this with the syllogism offered to explain why it is that walking after dinner causes health:

1 A [health] inheres in B [not staying on the surface].

2 B [not staying on the surface] inheres in C [walking after dinner].

3 A [health] inheres in C [walking after dinner].

Taking together the first premise (the major premise) in each of the previous two syllogisms, one can 'transpose the accounts' (μεταλαμβάνειν τοὺς λόγους) of health and food not staying on the surface of the stomach (i.e. good digestion). For the purposes of this explanation, health and good digestion are convertible. 'Transposing the accounts' means, in effect, taking health as a condition of the body in which the food does not stay on the surface of the stomach (i.e. good digestion),[38] and at the same time, taking 'food not staying on the surface of the stomach' as digestion that is necessary for health. When this is done, it becomes clear that inherent in the middle term (B) of the second syllogism (ostensively 'food not staying' but in account 'digestion inherent in health') is health.

Notice that transposition does not require that health be identical with or reducible to good digestion, any more than it is required that security be reducible to sheltering goods. If some of my goods are sheltered, then I have security, even if something else, such as my car or my cottage, is insecure. Similarly, if I have good digestion, then I have health, at least to that extent, even if I have a cold, or a sore foot at the same time. For the purposes of the explanation at hand, the accounts are convertible, even if good digestion is only one of a number of disjunctive necessary conditions for health. In *Posterior Analytics* ii 17, Aristotle makes it clear that this kind of conversion is possible. There he discusses 'the proper view of the interrelation between an explanation, that which it is explanatory of, and what it is explanatory for' (ἔχει δ' οὕτω τὸ παρακολουθεῖν τὸ αἴτιον ἀλλήλοις καὶ οὗ αἴτιον καὶ ᾧ αἴτιον, 99^{a}16–18). He points out that 'that which it is explanatory of' can have a wider extension than 'that which it is explanatory for'. For example, 'having the sum of exterior angles equal to four right angles' has a wider extension than either triangularity or squareness, but taken together it is coextensive with them (i.e. with all rectilinear figures). The same, he says, applies to the middle term (καὶ τὸ μέσον ὁμοίως, 99^{a}21). The example given here builds on an example from the previous chapter, in which he says deciduousness applies to that which the explanation is for as a whole, and if what the explanation is for is a species (e.g. vines, figs, etc.), then deciduousness must be taken to apply to each of the species of plants, so that 'the middle term and that which it is explanatory of must also be convertible' (καὶ τὸ μέσον ἴσον δεῖ εἶναι ἐπὶ τούτων καὶ οὗ αἴτιον, καὶ ἀντιστρέφειν, *Post* ii 16, 98^{b}35–6). Consider the following syllogism.

1. Plants whose sap coagulates are deciduous.
2. Broad-leafed plants are plants whose sap coagulates.
3. Broad-leafed plants are deciduous.

In *Posterior Analytics* ii 17, Aristotle points out that 'deciduousness is a universal attribute of the vine or fig, but has a wider extension than either, but it is not wider

[38] This is not as oversimplified as it appears. Digestion and in general the use of food is the activity of the vegetative ('nutritive') soul and thus the most basic function of every living thing (*Anima* ii 4, 416^{A}18 f., *PA* ii 3, 650^{A}2 f.). Digestion affects circulation, respiration, internal temperature maintenance, and so forth. See also Detel 1997, pp. 74–7 and King 2001, pp. 43–57.

than, but equal to all [the deciduous plants]' (99ª23–5). Thus we can continue the line of reasoning thus.

4. Vines are broad-leafed.
5. Figs are broad-leafed.
6. Vines and figs are deciduous.

Vines and figs, though not coextensive with deciduousness, are nonetheless convertible with deciduousness for the purposes of the explanation. So too with squares and triangles and 'having the sum of exterior angles equal to four right angles'. So too, returning to the main example with which we are concerned, for good digestion and health. Other things as well might be convertible with health, such as good respiration, good circulation, and so forth. But all we need in order to see how 'health' is a cause and a middle term in the explanation of why walking after dinner causes health, is how good digestion inheres in health, and vice versa, and so their accounts are transposable or convertible.

So the cause for the sake of which, 'health', is both a middle term and is explanatory. Thus we can explain both why Kant walked, for the sake of health, and by means of the very same process of reasoning, we can also explain how it is that walking after dinner causes health. In fact, the latter probably was a dispute in Greek medicine: why does walking after dinner cause health?[39] For Aristotle, the reason why, if it is to constitute knowledge, would have to be specified in the manner we have just represented. Walking after dinner causes health because it leads to proper digestion by forcing the food to sink into the stomach and digest properly.

This kind of explanation has a lot going for it, since it presents answers to multiple kinds of questions (Why does Kant walk? How does Kant's walking cause health?) in the same piece of demonstrative reasoning, through exhibiting various causal factors (the cause for the sake of which, and the moving cause), and their relations to one another. It is clear that the promise of this kind of explanation in cases like intentional action and craft motivated Aristotle to see how it could be brought to bear on explanations in natural science. But before we examine how Aristotle in fact implemented this model of demonstration in the natural sciences, in particular the life sciences, it is necessary to address two issues with reference to the present examples, because they are the key to understanding the modifications that make the implementation or adaptation possible. These issues are the apparent reversal of the causal order, and whether the teleological explanation is rendered otiose once ('efficient', 'material', or 'necessary') causal explanation can be discovered.

[39] In the Hippocratic writings, for example, it is indicated that those who suffer from diarrhea 'should not walk after meals' (*A Regimen for Health* 7, trans. Chadwick and Mann, p. 275). Notice that the medical writer uses similar reasoning to Aristotle in order to establish why one ought *not* walk after dinner for the sake of health.

2.5 TEMPORAL PRIORITY

In *Posterior Analytics* ii 11, Aristotle himself notes that the temporal sequence in the case of the cause for the sake of which is the reverse (ἀνάπαλιν, $94^{b}23$) of the case of the cause of motion. With the moving cause the example was the cause of the Persian war, and the temporal order was this: (1) launch an attack (Athenians against Sardia), (2) war (the Persian war). Whereas in the case of the cause for the sake of which, the temporal order is thus: (1) walk after dinner, (2) food not staying on the surface (health). In the first case, which explains according to the cause that states the origin of motion, the middle term (launching an offensive) comes first in time, and everything follows it (retaliation, war). But in the case of the cause for the sake of which, the middle term (health) occurs last, and everything precedes it (walking, food sinking).

This issue is important because a commonplace criticism of teleological explanation is that it involves 'backwards causation'. The objection has it that 'final causes' mysteriously reach back in time to the present and 'efficiently' cause things to happen. But in fact all that has happened is that the genetic and explanatory orders have been reversed. What he has said here makes it clear that the walking and the digestion come in time before the cause for the sake of which, but in account after. It is very easy to see how this is possible in the case of intentional action: I get it in my head that I want to be healthy, so I take a constitutional, the result of which is that I am healthy. Becoming healthy does not 'efficiently' cause me to take a walk, as backwards causality holds, rather, the purpose of becoming healthy is the explanation for my taking a walk, which is in turn the moving cause of my becoming healthy (because the food sinks and proper digestion results).

Notice that the issue of chronological order is complicated in explanatory contexts by virtue of the fact that some simultaneity of the premises may be required in order for the middle term to be affected by and affect the extremes. In the case of necessitating and moving causes, premises B and C are simultaneous (attacking, and causing war), just as in the case of the cause for the sake of which, premises B and A are simultaneous (proper digestion and health). (The latter case is proven simultaneous by the transposition of the accounts of the terms.) Further, C and B must relate chronologically in the order of the moving cause (I take a walk, then food is digested). It appears possible to describe the whole affair (taking a walk, digesting food, becoming healthy) according to either the cause of motion and necessity, or the cause for the sake of which. In fact, it is required that both causes be mentioned in the complete explanation. This brings us to the second issue.

2.6 INTEGRATING CAUSAL EXPLANATIONS

How can two different causes—one from necessity, the other teleological—be simultaneously explanatory? Is not a teleological explanation superfluous or even

impossible once a complete explanation of the necessary moving and material causes can be provided? Aristotle treats this issue in *Posterior Analytics* ii 11, 94^{b}27–95^{a}3. That Aristotle thinks both kinds of cause can be simultaneously explanatory is clear. He says plainly, 'it is possible for the same thing to be both for the sake of something, and out of necessity (ἐνδέχεται δὲ τὸ αὐτὸ καὶ ἕνεκά τινος εἶναι καὶ ἐξ ἀνάγκης)' (94^{b}27–8).

The example of the after-dinner walker was probably chosen because it illustrates easily how there can be a result both out of necessity (food descending in the stomach because it is sunk by walking) and with a view to an end (walking in order to become healthy). Aristotle gives two further examples of this. (1) Why does light pass through a lantern? (a) Because the fine body passes through the large pores of necessity[40] and (b) in order that we do not stumble in the dark (94^{b}28–31). (2) Why does it thunder? (a) Because when fire is extinguished in the clouds it sizzles and must make a noise and (b) in order to threaten the damned in Hades (94^{b}32–4).

We have already dealt with the explanation of thunder when describing the explanatory potential of the cause 'what the thing was to be'. We can also explain the same thing according to the origin of the motion and the cause for the sake of which.[41] Three different causes in this case are explanatory. Let us look at the syllogisms for the two we have not considered.

1. Fire excites the fine bodies of a wick.
2. Exciting fine bodies causes them to pass through the pores of a lantern.
3. Fire causes the fine bodies to pass through the pores of a lantern.

Here we have material and necessitating factors as explanatory of why light passes through a lantern. How does this relate to the following?

1. Fine bodies passing through the pores of a lantern (i.e. light) enable us to see.
2. Being able to see helps us not to stumble.
3. Fine bodies passing through the pores of a lantern help us not to stumble.

The middle term in both cases is explanatory, but in different ways. In the first case, it explains *how* light passes through a lantern, and thus gives a necessary cause. In the second case it explains *why* light is made to pass through the lantern, and thus gives a cause for the sake of which—a teleological explanation.[42]

Notice that there is absolutely no incompatibility between the two accounts. On the contrary, the accounts are interdependent. If the necessitating causes were

[40] An explanation he accepts here as 'good enough' (cf. 88^{A}14–17), but elsewhere rejects (*GC* 326^{B}6–28).

[41] The cause for the sake of which given here, on Aristotle's fully considered view, is not actually explanatory of thunder. (For the actual explanation of thunder, see *Meteor* ii 9.) As Balme points out, Aristotle often takes examples from common beliefs for the sake of illustration (1972, p. 101).

[42] Stephen Menn has pointed out to me that Aristotle presumably has in mind Empedocles' comparison of the lamp and the eye (DK 31B84), which gives a sort of design argument for the functionality of the eye.

not at work, then the cause for the sake of which would be in vain: no light would pass through the pores, we would not be able to see, and so we would stumble. And if the cause for the sake of which were not present, none of the necessitating causes would be; if we did not need to see in the dark, then we would not have required and so procured a lantern.

This compatibility of necessary (or material) factors and the cause for the sake of which is central to Aristotle's teleology and natural science: 'there are very many things of this sort, especially among things which are constituted by nature or are being so constituted; for nature makes them, on the one hand for the sake of something, and on the other out of necessity' (*Post* ii 11, 94^{B}34–37). Unfortunately, he does not here give any examples of natural substances (stars, elements, plants, animals, humans) being explained simultaneously through necessity and the for the sake of which. The examples refer to an artifact (the lamp) and a meteorological event (thunder); things whose explanation is more complicated in fact than the descriptions above suggest. But in general the teleological explanations given by Aristotle do conform to this pattern, especially in the biological works. And the general point is often reiterated.[43]

> Demonstration must proceed as follows (Δεικτέον δ' οὕτως): for example, respiration exists for the sake of this (τουδὶ χάριν), but this also occurs because of things out of necessity (διὰ τάδε ἐξ ἀνάγκης). (*PA* i 1, 642^{a}31–2)

> One must say they come to be on the one hand out of necessity, and on the other hand not out of necessity but for the sake of something (λεκτέον γίγνεσθαι τῇ μὲν ἐξ ἀνάγκης τῇ δ' οὐκ ἐξ ἀνάγκης ἀλλ' ἕνεκά τινος). (*GA* ii 2, 743^{b}16–18)

We will have an opportunity in Chapters 5–9 to examine those examples in detail, and also to consider the various kinds of necessity, including the special kind of necessity operative in teleological explanation ('hypothetical necessity').[44] This will occasion a discussion of issues stemming from the notion of multiple causation and simultaneous explanations, such as whether teleological explanations are otiose given adequate descriptions of necessitating factors. But what we have already shown is that Aristotle considers the various kinds of cause to function as explanations in demonstrative science, and that many such demonstrations are simultaneously explicative of the same thing.

[43] To which should be added these general remarks: 'it happens that . . . there are many explanations of the same thing, non-incidentally' (*Phys* ii 3, 195^{a}5); 'these are practically all the senses in which the causes are spoken of, and as they are spoken of in several senses it follows that there are several causes of the same thing, and in no accidental sense' (*Meta* v 2, 1013^{B}4–6); 'When one inquires what is the cause, one should, as causes are spoken of in several senses, state all the possible causes' (*Meta* viii 4, 1044^{a}32–34).

[44] Cooper (1985) points out that 'so many readers' think that Aristotle 'rejects Democritean [i.e. absolute] necessity' on the basis of *PA* i 1, and *Phys* ii 9. But Aristotle makes it clear here (and, as we will see, there as well), that natural necessity is fully consistent with teleological explanation, and that this kind of necessity is present in the case of things that are generated naturally. So the misinterpretation that Cooper calls attention to is another result of the failure to acknowledge the importance of *Post* ii 11. On this point, See also Charles 1988.

2.7 EXPLANATORY AND NON-EXPLANATORY CAUSES

Before moving on to consider Aristotle's teleological terminology, it will be useful to observe Aristotle's distinction between real causes and conjoint or cooperating causes on the one hand, and intrinsic and incidental causes on the other. For these distinctions are of great moment to the attempt to determine *limits* to Aristotle's use of teleology. If Aristotle is, as I have claimed, a critical reformer of teleology, then this observation will prove to be every bit as important as his positive doctrine of teleological explanations.

First of all, Aristotle recognizes the existence of many things that are not in themselves for the sake of anything and thus teleologically explicable. That is, their cause is not to be identified with the cause for the sake of which, but with some other cause, like matter or the moving cause.

> Many things are not natural functions, whether in general, or with respect to each individual kind, and so do not exist or come to be for the sake of anything. For eyes are for the sake of something, but gray eyes are not for the sake of anything, unless this be a specific condition of this kind of thing. Nor does this for the most part contribute to the account of the substance, but one must refer to the explanations about what comes to be by necessity in the matter and the moving principle.[45] (*GA* v 1, 778^{A}30–^{B}1)

This is a case where something is a concomitant or conjoint cause of something that is for the sake of something (i.e. teleologically explicable): in order for there to be an eye capable of seeing, the eye must be colored. Briefly, this is because the eye is a body, bodies have surfaces, and all surfaces are colored. But this does not mean that eye color is a cause of seeing, except as a contributing cause. The cause of eye color is not the end of seeing, but is rather caused by certain moving and material factors necessitated in the process of generating an eye. Another way to say this is that eye color is in an incidental, not intrinsic, relation to the function of an eye—seeing.

We will deal with Aristotle's doctrine of concomitant necessary causes in due course. For now we notice that the distinction between intrinsic and incidental causes has wide application for Aristotle.

> For just as a thing exists, so it is possibly a cause, either intrinsically or incidentally (τὸ μὲν καθ᾽ αὑτὸ, τὸ δὲ κατὰ συμβεβηκός). For the house-builder is intrinsically the cause of a

[45] And: 'Each thing exists for the sake of something, and comes to be through this and the rest of the causes, whatever pertains, in the account, either by existing for the sake of something [i.e. as an aim], or being the something it is for the sake of [i.e. as a beneficiary] (ἔστι μὲν οὖν ἕκαστον ἕνεκά του, γίγνεται δ᾽ ἤδη διά τε ταύτην τὴν αἰτίαν καὶ διὰ τὰς λοιπὰς ὅσαπερ ἐν τῷ λόγῳ ἐνυπάρχει τῷ ἑκάστου ἢ ἐστιν ἕνεκά του ἢ οὗ ἕνεκα.). Of the kind of things that don't come to be in this way, it is necessary to seek the cause in the motion or generation, assuming that in this their differences are constituted. For something has eyes from necessity, because an animal is supposed to be this kind of thing, and this kind of thing has eyes out of necessity. But that it has is this particular kind of eye is not a necessity, except in another way: because this kind of thing naturally acts or is acted upon in such a way' (*GA* v 1, 778^{b}10–19).

Table 2.1 Intrinsic and incidental moving causes of an artifact (statue)

Causes	Intrinsic causes	Incidental causes
Single, particular	Polyclitus	A sunburned male; a guitar-player
Single, general	A sculptor, an artist	A man, a human, a musician
Combined	This particular sculptor	A guitar-playing, sunburned male

house, incidentally a pale man or a musician. The intrinsic cause is definite, and the incidental indefinite. For the number of incidents for one thing is unlimited (τὸ μὲν οὖν καθ' αὑτὸ αἴτιον ὡρισμένον, τὸ δὲ κατὰ συμβεβηκὸς ἀόριστον· ἄπειρα γὰρ ἂν τῷ ἑνὶ συμβαίη). (*Phys* ii 5, 196^{b}24–9)

Consider as an example a man who sculpts: as a sculptor, he is intrinsically a cause of a sculpture. Suppose he also plays the guitar; then a guitar-player will be the cause of a sculpture. But being a guitar-player is incidental to his having sculpted something, for example the statue *Doryphorus*. And we can be more general about both the intrinsic and incidental factors, and we can also combine them in different ways. This all comes down to six things, according to Aristotle: the incidental and the intrinsic causes, particular and general causes, and particular or general combinations of causes.[46] For example, suppose we are trying to determine the 'causes' of the statue *Doryphorus*. Aristotle distinguishes as causes everything in Table 2.1. Despite appearances, this is not a case of multiplying entities unnecessarily. Aristotle distinguishes the various kinds of cause in order to indicate what kinds of causes are explanatory, and which are not,[47] that is, which of the possible causes (answers to the question) could yield scientific knowledge.

It is clear that incidental causes—non-explanatory causes—exist for every kind of cause, not just the for the sake of which, or the mover. Consider the intrinsic and incidental causes of the statue *Doryphorus*.

[46] Aristotle adds that each of these may also be taken 'actually or potentially' (*Phys* 195^{b}16). As Charlton (1970, p. 104) points out, actuality is taken with the particulars, and potentiality with the general: the statue is potentially made of metal, actually of bronze; potentially made by a man, actually by Polyclitus.

[47] Cf. Freeland 1991, who discusses the distinction between incidental and intrinsic causes in what initially is an attack on what she calls the 'virtually unanimous' interpretation of Aristotelian causes as kinds of explanations' (pp. 50–1). After the discussion of incidental causes, she begins to argue that 'Aristotle is a realist about explanations as well as causes' (p. 60). This, I think, is the right way to put it, because otherwise one is forced to make a distinction between causes and explanations that cannot be sustained, at least not as an interpretation of Aristotle. I think that the attribution to Aristotle of the view that there are 'causal laws' or 'natural laws' skirts the issue (against Freeland, p. 59), because the notion of a 'natural law' or 'law of nature' is deliberately ambiguous (as Aristotle himself says at *SE* 12, 173^{a}7 f.). At any rate, Aristotle never describes causes as laws, or compares them to laws. More often, he contrasts nature and law (e.g. *NE* v 8, 1133^{a}30, *Pol* i 6, 1255^{a}5), and he only uses a notion like natural law in one quite limited context, namely the limit of three dimensions in space (*Cael* i 1, 268^{A}13–14).

Table 2.2 Intrinsic and incidental moving causes of an artifact (statue)

Causes	Intrinsic causes	Incidental causes
Matter	Bronze	Delian metal
Mover, source of change	A sculptor, Polyclitus	A sunburned, musical man
Form	*Doryphorus*; a spear-bearer, chiastic	Shorter than Rodin's *Thinker*, missing a leg
End	Imitation, representation	Worth a lot of money; illustrative of what Varro calls stereotyped sculpture

Thus it is possible to say that 'Delian metal smelted on a Tuesday' is a cause of *Doryphorus*, just as it is possible to say that a sunburned guitar-player made the statue. But notice that none of the incidental causes will feature in a genuinely explanatory account of the production of *Doryphorus*. This is not to say that we do not want to know about the incidentals. In fact, they might be all that interest us about a particular sculpture like *Doryphorus*. Nonetheless, they do not contribute towards an explanation, because there are an infinite number of incidents for any given thing, and none of them relate directly to the thing being explained. We will further explore the ramifications of this when we consider luck as a cause.

The distinction between incidental and intrinsic causes gives rise to an aporia. How do we know that the causes we have identified for a thing are not incidental, and thus non-explanatory causes? Aristotle raises this difficulty with respect to teleological causation.

> One might raise an aporia. One can use each thing for that which it exists naturally, and otherwise, and either intrinsically or incidentally. For example, one might use the eye for seeing, and also for skewing seeing by squinting, so that one thing is seen as two. These are uses of the eye as an eye, but it is possible to use it in another way, incidentally, for example if one could sell or eat it. (*EE* vii 13 (viii 1), 1246^{a}26–31)

For anything that naturally has an end, it is possible to determine incidental ends. The eye exists for the sake of seeing, but also for the sake of a cow, who naturally has eyes, and benefits from being able to see with them. But notice the existence of other possible uses of an eye, which are incidental to these functions. The difficulty is that there are many, perhaps an infinite number of uses of an eye, and so how do we know which correspond to the scientific explanation of what an eye is? The solution is to come up with a means of distinguishing between uses (i.e. ends) of an eye that are natural from those that are incidental. Thus Aristotle makes a distinction between the intrinsic-natural uses of an eye, and the extrinsic-incidental uses of an eye. The former feature in a scientific explanation of the organ, but the latter do not. For that an eye is for seeing helps us to understand why it has the various parts that it does, how it was formed, and how it benefits that which naturally has it. But that we can eat the eye (or the rest of the cow for that matter), or dissect it for educational purposes, or lacquer it and use it for a

marble, do not feature in the specification of its intrinsic causes and ends. As Aristotle says elsewhere:

> That which happens to something else because of that thing's own nature I describe as intrinsic to it, and that which happens to it not because of its own nature, as incidental; e.g. if lightning strikes while a man is walking, that is a coincidence. But if because of itself, then intrinsically, for example, if an animal dies while being sacrificed. (*Post* i 4, 73^{b}10–15)

The distinction applies not just to ends, but to the moving cause as well. So Aristotle invokes this distinction in a discussion of animal motion.

> No doubt the soul may incidentally be moved by something else: an animal may be moved by force. But that which is intrinsically self-moved cannot be moved by something else, except incidentally, just as that which is good in itself or by its own nature can only incidentally be good because of or for the sake of something else (ὥσπερ οὐδὲ τὸ καθ' αὑτὸ ἀγαθὸν ἢ δι' αὑτό, τὸ μὲν δι' ἄλλο εἶναι, τὸ δ' ἑτέρου ἕνεκεν). (*Anima* i 3, 406B5–10)

Later we will see that Aristotle intends this argument to show that animals are unmoved movers. For now we will make the point that a cow has certain motions that it naturally engages in, and these are intrinsic to it, such as grazing, or going under a tree for shade. But a cow may also be picked up by a crane and loaded into a cattle car, or moved on a conveyor belt. These latter motions might be done to it for the sake of acquiring beef or leather. But such motions, because they are extrinsic to the cow, are incidental to it and do not feature in a scientific explanation of the motions of the cow. The same goes, as Aristotle says, for its goods. The motions of the cow are for the sake of its own good (finding grass to eat, or shade to lie under). I cannot explain why a cow moves in a certain way by referring to its usefulness to humans for food or clothing or labor.

According to Aristotle, there is a fundamental distinction between knowing the causes of something and knowing its possible uses. Knowing the causes of something belongs to theoretical knowledge, the objects of which are intrinsic causes or natures. Knowing the uses of something, on the other hand, is practical knowledge.

> with regard to theoretical science . . . there is no other part of astronomy or physics or geometry except knowing and contemplating the nature of the things which are the subject of those sciences, though nothing prevents them from being in a way incidentally (κατὰ συμβεβηκὸς) useful to us for much that we cannot do without. But the end of the productive sciences is different from science and knowledge (τῶν δὲ ποιητικῶν ἐπιστημῶν ἕτερον τὸ τέλος τῆς ἐπιστήμης καὶ γνώσεως). (*EE* i 5, 1216B10–18)

Certainly theoretical knowledge might be beneficial to one who has practical knowledge. That is just to say that knowledge of causes might be beneficial in the production of effects. But producing effects is not the end of theoretical knowledge, any more than knowing incidental causes is. Part of the reason for this is that there are an indefinite number of uses of a thing that are in an incidental relationship to the thing's nature (i.e. how it naturally came into being and subsists). As Aristotle states in a popular work that encourages the pursuit of theoretical

knowledge, to inquire only into the human uses of things is to fail to appreciate the difference between conjoint causes and real causes.

> To seek from all knowledge a result other than itself and to require that it must be useful is the demand of someone completely ignorant of how wide the gap is that, from the start, separates good things from necessary things; indeed they differ completely. For the things that are loved for the sake of something else and without which life is impossible should be called necessities and conjoint causes, while those that are loved for themselves, even if nothing else follows from them, should be called goods in the strict sense; for this is not desirable for the sake of that, and that for the sake of something else, and so on *ad infinitum*—this comes to an end somewhere. It is absolutely ridiculous, then, to demand from everything some benefit besides the thing itself, and to ask 'What's the payoff for us?' and 'What's the use?' For, in truth, as we say, such a person doesn't seem to know what's noble and good, nor to know the difference between a thing being a cause and it being a joint cause. (*Protr* 82.20–83.4)

These distinctions can be used to cast doubt on broad and expansive interpretations of Aristotelian teleology, such as the anthropocentric interpretation which holds that things exist and function primarily for human use. We will construct schemas throughout the book like the one presented above for the artifact *Doryphorus* in our examination of all kinds of natural entities that populate the Aristotelian cosmos: elements, plants, animals, and so forth. By distinguishing the intrinsic from the incidental causes of these things (especially the intrinsic from the incidental ends), we will be able to determine which ends, from the perspective of Aristotle's theoretical science, contribute to real knowledge of these entities, and which are incidental and so of interest only in the practical or productive sciences.

3

Teleological Notions

Aristotle is most terminologically consistent, from the *Organon* through the *Poetics*, when referring to his fourth kind of cause, the subject of this book. The constant phrase we encounter is οὗ ἕνεκα 'for the sake of which' or, formally, τὸ οὗ ἕνεκα 'the [cause] for the sake of which' (*Post* ii 11: τὸ τίνος ἕνεκα; *Phys* ii 3=*Meta* v 2: τὸ τέλος, τὸ οὗ ἕνεκα; *Meta* i 3: τὸ οὗ ἕνεκα, τἀγαθόν, τέλος; *GA* i 1: τὸ οὗ ἕνεκα ὡς τέλος). Aristotle discusses this phrase and its ambiguities extensively, and we will begin our study with a thorough examination of his direct discussion of it. Because he calls attention to the unique nature of the cause in central works (including *Physics*, *On the Soul*, *Metaphysics*, and *Eudemian Ethics*) this examination will provide an opportunity for us to offer in capsule the interpretation of Aristotle's teleology that the rest of this book explores in detail. After an examination of τὸ οὗ ἕνεκα, we will examine other key teleological phrases frequently used by Aristotle throughout his theoretical works: μηθὲν μάτην 'nothing in vain', τὸ τέλος 'the end', ἡ ἐντελέχεια 'the thing in a complete state', and normative terms like τἀγαθόν 'the good'.

3.1 THE CAUSE FOR THE SAKE OF WHICH

The words 'purpose' and 'aim' are commonly used as more elegant renderings of τὸ οὗ ἕνεκα. But as with τὸ τί ἦν εἶναι, it is more accurate here again to use an awkward English phrase like 'that for the sake of which' or, more technically, 'the [cause] for the sake of which' to translate the awkward Greek phrase. One reason for this is that the preposition ἕνεκα frequently appears by itself, combined with genitive nouns (e.g. 'for the sake of health'), or verbs (e.g. 'for the sake of walking', i.e., 'in order to walk'). Essentially, the phrase τὸ οὗ ἕνεκα signifies a causal reification of this 'for the sake of' or 'in order to'. There is a sense of the English word 'cause' that still resembles this, as when we speak of 'the cause of nuclear disarmament' or 'the cause of world peace'. Aristotle frequently uses the term χάριν 'in favor of' with the genitive as a synonym for ἕνεκα.[1] If we refer to the cause itself with the

[1] E.g. *PA* i 1, 642ª32; *GA* 717ª21; *Meta* i 2, 982ª15, *NE* i 1, 1094ª15; *Protr* 65.18, 80.27, 81.11, 82.9.

same terminology that we have to use in discussing actual teleological explanations, then we follow Aristotle's procedure and make it clearer what kind of cause and explanation we are dealing with.

Aristotle is well aware of the awkwardness of the phrase, and of its ambiguity. In no less than five different places, he points this out himself, and these are in the most important works in the corpus (*Phys* ii 2, 194^{a}35–6; *Anima* ii 4, 415^{b}2–3, 415^{b}20–1, *Meta* xii 7, 1072B1–3, *EE* vii 15, 1249^{b}15). In two different passages, Aristotle refers to an extended distinction between two senses of τὸ οὗ ἕνεκα:

> As we said in *On Philosophy*, that for the sake of which has two senses (διχῶς γὰρ τὸ οὗ ἕνεκα). (*Phys* ii 2, 194^{a}35–6)

> that for the sake of which is said in two senses, and it has been determined elsewhere (διττὸν δὲ τὸ οὗ ἕνεκα· διώρισται δ' ἐν ἄλλοις. (*EE* vii 15 (viii 3), 1249^{b}15)

Despite the extraordinary depth with which scholars have examined specific issues in Aristotle's teleology, this central distinction has received little attention. Three German scholars have written about it (once in English).[2] English commentators have strangely tended to disregard the distinction,[3] at least until very recently.[4] But an analysis of the passages in which the ambiguity of this phrase is discussed is central to resolving the problems of Aristotelian teleology. Let us begin with a celebrated passage from *On the Soul*.

> First we must discuss nutrition and generation. For the nutritive soul underlies the other souls, and it is the first and most common power of the soul, being that in virtue of which all the living things subsist. It is the function of this to generate and to use food. For that is the most natural of functions for living things (φυσικώτατον γὰρ τῶν ἔργων τοῖς ζῶσιν), as many as are developed and neither mutilated nor spontaneously generated: to produce another like itself, an animal an animal, a plant a plant, so that they participate in the eternal and divine as far as possible. For everything desires this, and does for the sake of this everything that it does naturally. For 'that for the sake of which' is twofold: that of which [i.e. the aim] and that for which [i.e. the beneficiary] (τὸ δ' οὗ ἕνεκα διττόν, τὸ μὲν οὗ, τὸ δὲ ᾧ.). Thus since it is not possible to share in the eternal and divine, because nothing among the perishable things is able to remain the same and one in number, each participates as possible, it shares in this, some more and others less, and remains not the same but like the same, not one in number, but one in form. (*Anima* ii 4, 415^{a}23–^{b}7)

[2] Gaiser 1969; Graeser 1972; Kullmann 1979, 1985, 1998.

[3] For example, Alan Gotthelf has said: 'the passages which identify or refer to two ways in which *to hou heneka* is "said", are intended to isolate the sense of "that for the sake of which" which plays a technical role in Aristotle's philosophy from an ordinary use, approximating "beneficiary", and as such are neither intended to nor do shed light on that technical sense' (1987, p. 210). R. D. Hicks, in his commentary on *De Anima*, remarked on the distinction at 415^{b}2: 'this is of the nature of a footnote. It is repeated below 415^{b}20. Probably either here or there it is out of place. We find it again, unnecessarily interrupting the argument, in Metaph. 1072^{b}2. . . . De Gen. An. ii 6 . . . Phys ii.2 . . . Eud. Eth. vii.15' (1907, p. 340). Ross in his commentaries offers glosses and cross-references, though he seems to be unaware of the passage in the EE.

[4] For some recent insightful discussion in English, see: Menn 2002, pp. 113–1; Richardson Lear 2004, pp. 75–83. In Italian: Fazzo 2002.

The nutritive soul is basic to living things not only because it is the condition *sine qua non* of their growth and survival (being the soul which controls the use of food), but also because it constitutes the faculty of generation (i.e. reproduction). The most natural function of a normal, mature living thing is 'to produce another like itself so as to participate in the eternal and divine so far as possible'. The mode of this participation is made clear by a distinction. Generic eternality, as opposed to individual immortality, is the closest plants and animals come to the divine, and so reproduction is 'that for the sake of which' the living thing 'does everything that it does naturally'.

This is where the distinction comes in. Aristotle says that 'that for the sake of which' is 'twofold' (διττόν): the aim or 'for the sake of which *of which* [genitive object]' (οὗ ἕνεκα-οὗ), and the beneficiary or 'for the sake of which *for which* [dative object] (οὗ ἕνεκα-ᾧ). Aristotle does not explain this further here; instead he uses the grammatical distinction as a warrant for the claim that living things naturally desire to reproduce.

The Greek commentators are of immense help here. Themistius explains the distinction[5] with two examples: action is for the sake of, on the one hand, happiness, and on the other hand, for the individual person 'acting out of self-interest'; medicine is for the sake of, on the one hand health, and on the other hand the patient. Happiness and health correspond to that for the sake of which *of which* (οὗ ἕνεκα-οὗ); the individual and the patient to that for the sake of which *for which* (οὗ ἕνεκα-ᾧ). Simplicius uses practically the same examples:[6] the virtuous man and the happy man are beneficiaries of virtue and happiness.

The upshot of these comments is that the two senses of 'for the sake of which' may be characterized as a difference between the aim of something and the beneficiary of the achievement of that aim. Ross glosses the distinction as between 'to attain which' and 'in whose interests'.[7] I will use the formulae 'for the sake of which

[5] 'That for the sake of which is twofold: that for which, and that for whom [sc. for whose benefit]. For, as was stated in the *Ethics*, the end of action is twofold: that for which is [defined as] happiness, and that for whom is each person [acting] out of self-interest. Indeed, someone chooses happiness on account of himself, and so as to achieve this for himself, as also in the case of medicine that for which is health, and that for whom is the patient. In nature too the same duality must be posited for the end, and that for which [nature] exists must be said to be what is divine and eternal, and that for whom [it exists] an [animal] having a soul and coming into existence' (Themistius, *In De An* 50, 11–16, trans. Todd).

[6] 'As that by which we live is twofold—being either the form or the informed [i.e. the form having been made in matter], so that for the sake of which, i.e. the end, is on the one hand perfection and goodness, on the other hand the perfect and what has been made good. Of these one is such as excellence and health, the other as the worthy man and the healthy man; the one as the "of which", of which may be achieved, the other "for which", for which it comes to be and to participate. The result then is clear, that in accordance with the form and not by continuity the perishables are eternal, because they cannot remain the same in number, but are separate from one another' (Simplicius, *In De An* 11.110.31–8).

[7] Ross, *Aristotle's De Anima*, p. 228. In his *Physics* commentary, he gives the following example: 'E.g. in one sense health is the οὗ ἕνεκα of the medical art—it is the εἶδος or φύσις to bring which into being the art is practised; in another sense the patient is the οὗ ἕνεκα– he is that in whose interests it is practised' (p. 509). In his *Metaphysics* commentary, he writes: 'When we speak of the οὗ ἕνεκα of a

[aim]' (οὗ ἕνεκα-οὗ) and 'for the sake of which for which beneficiary' (οὗ ἕνεκα-ᾧ). And this corresponds to common usage of the preposition ἕνεκα with both the genitive object and a dative object of interest (*dative commodi*) in fifth-century prose.[8] In Plato, there is a conscientious, philosophical use of the construction.[9]

Philoponus has an extensive discussion of the distinction in his commentary on the soul.

Since he says it is most natural for an animal to generate another like itself, and this is because of the primary desire everything has for its eternality (and since he has generally called to mind for us the final cause) for this reason he says that 'the for the sake of which'—that is to say the end—is twofold: 'the [aim] of which' and 'the [beneficiary] for whom', as he says in the *Physics* and in the *On Generation [of animals]*. What then do I mean?

The builder has as an end the production of a shelter preventive of rain and heat. This is the end for the sake of which [as aim]. For he makes the house for the sake of shelter. But he also has us as an end. For he make this shelter for us. So we too will be an end of the house in the sense of for which [as beneficiary].

But just as in this case, so also for everything constituted by nature is the end twofold. For example, desire for the divine, the desire in virtue of which each animated thing makes another like itself, is an end in the sense of 'that for the sake of which [as aim]'. For generation is for the sake of this. But since bodies become instruments for the souls, these [souls] are ends in the sense of 'for which [as beneficiary]'. Thus nature is analogous to the builder (who is a craftsman), and the soul to the man giving the command to make shelter, and the house to the body.

But it is not only in the case of animals that the end twofold ('that for the sake of which [as aim]' and 'that for which [as beneficiary]'), but also in the case of plants. Even in their case nature makes the body an instrument that grows upwards for the need of the soul in them. For the parts of plants (root, husk, pit, leaves, and things of this sort) are instrumental.

As has been said, the end is twofold in animate things; but in the rest of things it is impossible to find the twofold end. For minerals, stones and in general the inanimate things (the things that come into being proximately by cooling and heating, but remotely by the whole work of the demiurge) have only one end: for the sake of which [as aim], for

thing we may mean (1) that the thing is good τινί, for some conscious being, or (2) that it is good τινός (ἕνεκα), for the sake of some end' (p. 376). But τινί (ἕνεκα) does not apply only to a 'conscious' being, since, as Aristotle argues in the *De Anima* passage, it applies as well to plants.

[8] Examples, selected more or less at random: 'the leading pirates were powerful men, acting both for the sake of their own advantage and for the support of the weaker among them (τοῦ σφετέρου αὐτῶν ἕνεκα καὶ τοῖς ἀσθενέσι τροφῆς)' (Thucydides, Hist 1.5.1.5–6); 'you and I have done many things for the sake of winning favor for the city (τοῦ ἀρέσκειν ἕνεκα τῇ πόλει)' (Xen. *Hell* 2.3.15.6–16.1); 'if their women joined their campaigns, either in the same ranks or positioned in the rear for the sake of scaring the enemies (φόβων τε ἕνεκα τοῖς ἐχθροῖς) and in case their help should be needed, I know that this would make them quite unbeatable' (Plato, *Rep* 471d5).

[9] Examples: '[a vehicle] is entirely for the sake of some supporting or other, always being a seat for something (διότι πᾶν ἕνεκά τινος ἐφέδρας ἐστί, θᾶκος ἀεί τινι γιγνόμενον)' (Plato, *Polit* 288a3–6); 'all such concern is expended not for things that are provided for the sake of something else, but for that something else for whose sake all other things are provided (πᾶσα ἡ τοιαύτη σπουδὴ οὐκ ἐπὶ τούτοις ἐστὶν ἐσπουδασμένη, ἐπὶ τοῖς ἕνεκά του παρασκευαζομένοις, ἀλλ᾽ ἐπ᾽ ἐκείνῳ οὗ ἕνεκα πάντα τὰ τοιαῦτα παρασκευάζεται)' (Plato, *Lys* 219e7–a1).

they are for the sake of the ordered creation (κοσμοποτὰς), but in them the end is not already for which [as beneficiary]. For they are not instruments of certain things and are not prepared for the use of certain souls either.

Be we must consider this twofold end generally. And the aiming at the good is generally the end in the sense of 'of which' of all things, natural and artificial (for both nature and art do all things for the sake of the good); but the 'for which' is for the sake of the matter that is ordered. For the form of the board and of the animal, taken by itself, is also an end, which is that for which the matter has been ordered, and the aiming at the good [is also an end] because of which these things come to be, being either a need (as it were), or an imitation of the divine.

But it has been pointed out that Aristotle says the target is an end (for the target is that which is aimed at) and because of this he says the end is twofold. But more he says that desire [is the end] more generally. For, in all truth, desire only exists for something capable of perception, as he said above, but the plants do not have desire, since they do not have perception. So by desire he means natural constitution for this, just as we carelessly say that fire aims at the upward region and in this way goes to it. So all things that have this natural constitution and desire aim at this eternality of the first order. And since things that are perishable, he says, are not able to remain the same in number, they instead pursue the eternal by succession, by making another similar to themselves in kind. (Philoponus, *In De An*, 269.26–270.32).

Philoponus refers to other discussions in the corpus of the distinction between senses of 'that for the sake of which': one from the *Physics*,[10] which we will discuss in due course, and another from *Generation of Animals*, which is actually a different distinction not directly relevant to the issue at hand.[11] Philoponus gives as an example the case of a building, being for the sake of protection, but also for the sake of the inhabitants. He applies this to the case of the soul in the following way. The desire to reproduce is a desire for the divine, which involves the nutritive soul in reproduction for this end—imitating the divine. So the soul and the man are that for the sake of which the body exists in the sense of the beneficiaries of its instrumental operations. Philoponus stresses that this applies even to plants, which have their own instrumental body parts, of which the plant souls are the beneficiaries. But, he argues, inanimate beings like stones and metals do not without qualification have a cause for the sake of which in the sense of beneficiary.

For metals, stones and in general the inanimate things (the things that continuously come into being by the agency of cold and heat, but are removed [from the earth] entirely by the skilled workers) have only one end: for the sake *of which*, for they are for the sake of the ordered creation, but in them the end is not already a benefit *for which*. For they are not instruments of certain things and are not prepared for the use of certain souls either.

[10] The reference must be to *Physics* (i.e., ii 2, 194ª35–6), and not '*Poetics*'—as the manuscript mistakenly reads.

[11] *GA* ii 6. The distinction there is between 'the [end] for the sake of which' and 'that which is for the sake of this [end]'. (To put it simply: between means and ends.) This distinction will be discussed in Ch. 6.

Applying this to Aristotle's argument about the nutritive soul, the point would seem to be that the nutritive soul is for the aim of reproducing, and thereby participating in the form of life, which is eternal. The beneficiary of this, the equivalent of the healthy man and the conscientious man, would be the living thing that so participates. Themistius agrees with this when he says 'that *for which* it exists must be said to be what is divine and eternal, and that *for whom* is an animal, and coming into existence. For nature wants to achieve for the latter a likeness of divinity and eternity insofar as it can.' According to this too the nutritive soul is for the aim of (οὗ ἕνεκα-οὗ) participating in the divine and eternal, which is in turn for the benefit of (οὗ ἕνεκα-ᾧ) the living animal.[12]

When Aristotle says τὸ δ' οὗ ἕνεκα διττόν, τὸ μὲν οὗ, τὸ δὲ ᾧ, what exactly does he mean by διττόν? Ross takes it that he means 'ambiguous', and suggests that Aristotle is here specifying that, 'eternity and divinity are οὗ ἕνεκα in the sense of being that at which all things aim'.[13] But there is no forced choice here; on the contrary, both senses of οὗ ἕνεκα should be simultaneously operative, following common usage and the analysis of Themistius, Simplicius, and Philoponus: eternity and divinity are that for the sake of which as aim, but the individual living thing is that for the sake of which as beneficiary of the aim.

Unlike *On the Soul* 415^{b}2–3, where Aristotle seems to hold that the two senses of 'for the sake of which' are simultaneously operative, in two other passages Aristotle discusses a special case in which one of the senses of οὗ ἕνεκα does not apply. The first of these is from *Metaphysics* xii.

> That 'that for the sake of which' exists among the unchangeable things the distinction makes clear: for that for the sake of which is for something, which is the one [the changeable], but not the other [the unchangeable]. (ὅτι δ' ἔστι τὸ οὗ ἕνεκα ἐν τοῖς ἀκινήτοις, ἡ διαίρεσις δηλοῖ· ἔστι γάρ τινὶ τὸ οὗ ἕνεκα, ὧν τὸ μὲν ἔστι τὸ δ' οὐκ ἔστι.) Indeed, it [the unchangeable] causes change by being loved, but the other things cause change while being changed[14] themselves. Thus if something changes, it is possible for it to be otherwise, so that if the actuality of the first heaven is motion, then it is possible for that which is being changed to be otherwise, in this way [i.e. in respect to place], even if not in substance. But since there is something that causes this change while being unchanged, being in actuality, this is in no way able to be otherwise. (*Meta* xii 7, 1072^{b}1–8: Bekker, E, J)

Aristotle has just concluded that: (1) there must be something which is eternally moved or changed (i.e. the heaven with its unceasing rotary motion); (2) there must be something that causes the motion or change of (1) that is not itself moved or changed, the essence of which is actuality; and (3) a possible mode of causing

[12] Ps.-Alexander says: 'things coming to be and acting for the sake of something both come to be and act for the sake of *someone*. For the things coming to be and acting for happiness happen for someone, e.g. for Socrates (τὰ γὰρ γινόμενα καὶ πραττόμενα ἕνεκά τινός τινι καὶ γίνεται καὶ πράττεται· τὰ γὰρ γινόμενα καὶ πραττόμενα ἕνεκα τῆς εὐδαιμονίας τινὶ πράττεται, οἷον τῷ Σωκράτει)' (Ps.-Alexander, *In Meta* [ad 1072^{a}32], 695.28–30).

[13] Ross, *Aristotle's Metaphysics,* vol. 2, p. 228.

[14] Reading κινούμενα with Ross.

motion without being moved or changed is to be an object of desire or of thought. Aristotle needs to show that something that is not itself movable or changeable can possibly be a cause of motion. How can something that does not move or change possibly be 'that for the sake of which' other things unceasingly move? Prima facie it seems that nothing causes motion unless it is moved by something else or causes itself to move or change.[15] But Aristotle now argues, by making a distinction, that there is something that causes motion without being moved itself: 'that for the sake of which' exists among the unchangeable things in the sense of 'aim of something' (οὗ ἕνεκα τινός), not 'benefit for someone' (οὗ ἕνεκα τινὶ).

There are variant readings of the key sentence.

ἔστι γὰρ τινὶ τὸ οὗ ἕνεκα, ὧν τὸ μὲν ἔστι, τὸ δ' οὐκ ἔστι. (*Meta* xii 7, $1072^{B}2$–3: E J Bekker)

Another manuscript has the reading:

ἔστι γὰρ τινὶ τὸ οὗ ἕνεκα *τινός*, ὧν τὸ μὲν ἔστι τὸ δ᾽ οὐκ ἔστι. (*Meta* xii 7, $1072^{b}2$–3: Ab)

This has prompted the following conjectures and additions:

ἔστι γὰρ *διττὸν* τὸ οὗ ἕνεκα, ὧν τὸ μὲν ἔστι τὸ δ᾽ οὐκ ἔστι. (*Meta* xii 7, $1072^{b}2$–3: conjecture of Schwegler)

ἔστι γὰρ τινὶ τὸ οὗ ἕνεκα <*καὶ*> τινός, ὧν τὸ μὲν ἔστι τὸ δ᾽ οὐκ ἔστι. (*Meta* xii 7, $1072^{b}2$–3: addition of Christ, Ross, Tredennick, Jaeger)

The availability of textual alternatives, however, does not substantially affect the interpretative alternatives. The 'division' that Aristotle refers to is the distinction that he repeatedly invokes two senses of that for the sake of which. The division is probably not connected with the table of opposites to which Aristotle refers in the immediately preceding text. That the division should be so understood was proposed by Pseudo-Alexander,[16] and has recently been discussed by Sylvia Fazzo (2002). Pseudo-Alexander is under the impression that the division is made in Aristotle's book *On the Good*, and he connects the distinction with Aristotle's attempted reduction there of all opposites to the one and the many. But this quasi-logical

[15] In particular, Plato does not consider (or rejects) the idea that something causing motion might not be moved (Menn 2002, pp. 93–4).

[16] 'He [Aristotle] discusses these things saying of those we were discussing "*that there is among the unchangeables the for the sake of which as well, the division makes clear"* meaning the division in which he produces the reduction of the contraries to plurality and the one; this [division] is produced in the book entitled *On the Good*. In this discourse *"the for the sake of which is for something"*, for one must out of necessity select a certain sense in order that *"the for the sake of which is for something"*. For things coming to be and acting for the sake of something also come to be and act for the sake of someone. For those coming to be and acting for the sake of happiness act for the sake of someone, e.g., for Socrates. By *"of these one exists and the other does not exist [as an]'of which' [among the unchangeables]"* would be meant those things for the sake of which the action is, but *"the other [that] does not exist [among the unchangeables]"* is the action. And one should say the following: the for the sake of which, which exists [among the unchangeables], is this; but the for the sake of which for something does not exist as such [among the unchangeables]. For the thing changing for the sake of the good is not the good; but the good, which it is for the sake of, is good. It is changed by love for that which it takes as good' (Pseudo-Alexander, *In Meta* xii, 695.23–36).

apparatus is unnecessary to grasp the main point, which Pseudo-Alexander himself goes on to make: the unmoved mover, as that 'of which', is distinct from the things 'for which' that aim at it and benefit from their emulation.[17] It is true that the beneficiaries of imitative action can be plural, while what is aimed at is one, but the two senses of 'that for the sake of which' cannot correlate to these if they are construed as opposites. For, as we have seen, οὗ ἕνεκα-οὗ and οὗ ἕνεκα-ᾧ can be predicated at the same time of the same substance (such as a plant or animal). Now it is clear from the *Metaphysics* xii passage that they need not be, however. It is possible to have a substance, specifically an immovable one, of which is predicated only 'for the sake of which as aim' and not the 'for the sake of which as beneficiary'. Alexander made both of these points, according to a comment preserved in Averroes' commentary on *Metaphysics* xii 7.[18] He points out that I may exercise both for the sake of health, and for my own sake, in which case movement 'for the sake of which' has both an aim and is a beneficiary. He distinguishes this from a case of slaves or subjects imitating the king or master. Being like the master or king is that for the sake of which slaves and subjects act, but the despot is not moved by their emulation. (Although, one could object, it is easy to see him as a beneficiary of their actions.)

The reason why an unchangeable thing cannot be a beneficiary of something is simple: benefiting it would change it. An animal is benefited by the activities of its nutritive soul, for example, because the use of food provides nutrients to its body,

[17] Aquinas misconstrues the distinction as one between intentional and non-intentional pursuit of goals: 'But since what is appetible and what is good have the character of an end or goal, and there does not seem to be an end in the realm of immovable things, as has been explained in the dialectical discussions in Book III (192:C 374–75), he [Aristotle] therefore removes this difficulty. He says that the division in which the various senses of end or goal are distinguished shows that a final cause can be found in a way in the realm of immovable things. Now one thing can be the goal of another in two ways: first, as something having prior existence, as the center of the world is said to be a goal which is prior to the motion of heavenly bodies; and nothing prevents a goal of this kind from existing in the realm of immovable things. For a thing can tend by its motion to participate in some degree in something immovable; and the first mover can be a goal in this way. Second, one thing is said to be the goal of another, not as something that exists actually, but only as existing in the intention of the agent by whose activity it is produced, as health is the goal of the activity of the medical art. An end or goal of this kind does not exist in the realm of immovable things' (Thomas Aquinas, *In Meta* xii 7: para 2528, trans. Rowan).

[18] '"*The fact that there is a final cause in the unchangeable is shown by division*". Alexander says that these words were inserted lest it be thought that he meant by this the perfection which is an accident of that which acquires perfection; some of the perfections for the sake of which the thing acquiring these perfections moves are qualities which the moving thing acquires as perfections, for instance moving for the sake of health, and others are substances external to the thing moving towards them by making itself similar to them, for instance all the actions of the slaves imitate the master and his aim, and the people of the same kingdom strive in accordance with the goal of the king; it is said that the slaves exist only for the sake of the master; the same applies to the people of a kingdom with regard to their king, and to all beings with regard to this first principle, I mean that which the universe desires. [=Alexander, frag. 30F] *"Because the final cause is for something and for this thing"*. He [Aristotle] means: the final cause which is not subsisting by itself exists in something such as happiness in the soul and health in the body. But in the case of that which is subsisting by itself, there exists for this individual thing another individual thing, subsisting by itself' (Averroes, *In Meta*, pp. 1605–6, trans. Genequand).

strengthening it and making it grow. But if something is ontologically precluded from being changed, then it cannot be a beneficiary like that. In the case of the most divine things, it is axiologically impossible for them to be changed, since that change would be either for the better (impossible, since there is nothing better) or the worse (impossible, since the divine will not become worse). As Aristotle says in *On the Heavens*:

> popular philosophy often propounds the view that whatever is divine, whatever is primary and supreme, is necessarily unchangeable. This fact confirms what we have said. For there is nothing else stronger than it to move it—since that would be more divine—and it has no defect and lacks none of its proper excellences. Its unceasing movement, then, is also reasonable, since everything ceases to move when it comes to its proper place, but the body whose path is the circle has one and the same place for starting point and end. (*Cael* i 10, $279^{A}30$–$^{B}3$, ROT)

The outermost stars constantly move in perfect orbits, and are benefited by this (the way in which this is so we will examine in due course). Otherwise they are unchanged, because any further change would be for the worse for them. They are already as perfect as a physical object can be. Simplicius, commenting on this passage, reports the following from Aristotle's *On Philosophy* (the work in which, Aristotle himself tells us, he explained that οὗ ἕνεκα is twofold):

> Aristotle speaks of this in the work *On Philosophy*. In general, where there is a better, there is a best. Since, then, among existing things, one is better than another, there is also something that is best, which will be the divine. Now that which changes is changed either by something else or by itself, and if by something else, either by something better or something worse, and if by itself, either to something worse or through desire for something better; but the divine has nothing better than itself by which it may be changed (for that other would then have been more divine), nor on the other hand is it lawful for the better to be affected by the worse; besides, if it were changed by something worse, it would have admitted some evil into itself, but nothing in it is evil. On the other hand, it does not change itself through desire for something better, since it lacks none of its own excellences; nor again does it change itself for the worse, since even a man does not willingly make himself worse, nor has it anything evil such that it would have acquired from a change to the worse. (Simplicius, *In Cael*, 289 = Aristotle, *On Philosophy*, frag. 16, OT)

A passage from the EE puts the point about the divine not being a beneficiary, very bluntly—the third passage invoking the distinction between two senses of οὗ ἕνεκα.

> But since man is constituted by nature out of an ordering part and an ordered part, each of us should live with respect to the ordering part of ourselves. But this [ordering] is twofold. For medicine is ordering in one sense, and health is in another. And this [medicine] exists for the sake of that [health]. So it is with respect to the theoretical. For the divine is not an ordering ruler, but rather is that for the sake of which prudence gives orders (and 'that for the sake of which' is twofold, but this has been determined in another work), since he is in need of nothing (οὐ γὰρ ἐπιτακτικῶς ἄρχων ὁ θεός, ἀλλ᾽ οὗ ἕνεκα ἡ φρόνησις ἐπιτάττει (διττὸν δὲ τὸ οὗ ἕνεκα· διώρισται δ᾽ ἐν ἄλλοις), ἐπεὶ κεῖνός γε οὐθενὸς δεῖται). (*EE* vii 15, $1249^{b}9$–16)

There is a sense in which the art of medicine gives orders—imperatives—to the doctor, for the sake of the health of the patient. In this analogy, god is not like the art of medicine, much less like the doctor, but rather like health. Health is the unmoved mover and that for the sake of which the doctor moves the patient. The patient is benefited, but health is not. Similarly, the activity of the divine is that for the sake of which natural agents act, but the agent or patient is benefited by so doing—not god.

Individual things that move (on the basis of desire in the case of non-rational animals, and on the basis of both desire and thought in rational ones) do so for the sake of the good and the fine, predicates that are ultimately exemplified by god. But that does not mean that everything moves or changes for the sake of god in the sense of acting for god's good, god's plan, god's order, 'something outside of nature', 'nature as a whole', and so forth. For god (and 'nature as a whole', whatever that means) do not need any benefit from these things and god or nature does not order things for the sake of that. God does not order things at all. To the extent that 'global', 'overall', 'vertical', and 'cosmic' teleology depends on such notions, they are not Aristotelian in orientation.[19] The sense in which god is and is not 'for the sake of which', and the warrant 'for god is in need of nothing', simply extends the reasoning that we saw applied in the previous passages. God does not change because he does not need anything, but change either implies becoming worse (which the divine does not do), or becoming better (but this implies need, which the divine does not have).

But what is Aristotle's point about god not being an 'ordering ruler'? We may get some help here by reading a passage in Sextus Empiricus that has also been attributed to Aristotle's *On Philosophy*.

Some men, when they saw the unswerving and well-ordered movement of the heavenly bodies, say that in this the thought of gods had its origin; for just as if one had sat on the Trojan Mount Ida and seen the array of the Greeks approaching the plains in good order

[19] For example, when Kahn asserts that the prime mover is 'the οὗ ἕνεκα of nature as a whole' (1985, p. 196), he is not precise enough. He does not discuss Aristotle's distinction about the sense in which this is true and the sense in which it is not. Kahn's concern is how far the 'teleological influence of the PM [Prime Mover] extends into the natural world' (p. 183). Kahn describes a narrower and a broader view of the role of the prime mover in nature (he also considers, only to immediately reject, an assimilation of the prime mover to the 'God of biblical religion' which was attempted by some medieval and some nineteenth-century interpreters). The narrower view limits the teleological action of the prime mover to the heaven, while the broader view assigns to it 'direct teleological causality within the sublunary world' (p. 184). After contrasting 'immanent teleology' (p. 186) with 'cosmic teleology' (p. 187), Kahn advocates both by careful inspection of crucial passages that we will examine in due course. The result is a 'broad teleological view' (p. 202), which is motivated by a consideration of the 'universal causality of the PM' (p. 186). Kahn says, 'The Prime Mover is Aristotle's scientific substitute for the mythical Demiurge, both as immediate cause of the supreme celestial rotation and as ultimate cause of the entire system—the οὗ ἕνεκα of nature as a whole' (p. 197). Again, what needs to be filled in here is what it means to be the οὗ ἕνεκα of nature as a whole. We will revisit this issue at the end of Ch. 9, and at that point will be in a position to evaluate Kahn's claim that the οὗ ἕνεκα of the prime mover supports a cosmic teleology.

and arrangement, 'horsemen first with horses and chariots, and footmen behind', one would certainly have come to think that there was someone ordering such an order (τις ὁ διατάσσων τήν τοιαύτην τάξιν) and commanding the soldiers ranged under him, Nestor or some other hero who knew 'how to order horses and bucklered warriors'. And as one familiar with ships, as soon as he sees from afar a ship running before the wind with all its sails well set, knows that there is something directing it and steering it to its appointed harbors, so those who first looked up to heaven and saw the sun running its race from its rising to its setting, and the orderly dances of the stars, looked for the craftsman of this lovely design, and surmised that it came about not by chance but by the agency of some mightier and imperishable nature, which was god. (Sextus, *Math*. 9.26–7 = Aristotle, *On Philosophy*, frag. 12[b], OT, modified)

However much of this passage can be safely attributed to Aristotle, the conception it describes makes perfect sense of Aristotle's denial that god is an 'ordering ruler'. Aristotle accounts for the widespread view that there is an ordering god by noting that people have inferred that from the order of nature, but his own view denies that this order was set up by god because, as we will see, he thinks that the order is intrinsic to nature, and that god has an entirely different nature. The passage also casts some light on Aristotle's question, posed at the beginning of *Metaphysics* xii 10, about the way in which the cosmos is ordered. There too, Aristotle wonders to what extent the order (τάξις) is like that in an army, an organization in which the principle of order is in both the general and the troops. That aporia will be discussed at length in due course. For now we point out that Aristotle's denial that god is a 'an ordering ruler' is an integral part of his conception of god as something unchanging that causes change as 'that for the aim of which' but not as 'that for the benefit of whom'.

The stars are changeable with respect to place, and so somehow beneficiaries of this motion, but otherwise do not change. Thus both οὗ ἕνεκα-οὗ and οὗ ἕνεκα-ᾧ apply to them: they have an aim (circular motion) and are beneficiaries of their everlasting movements. Plants, animals, and humans are similar insofar as they both have aims and thus change and move, and are beneficiaries of their motions and changes. As we learned from the passage from *On the Soul*, the animal reproduces both for the aim of participating in the divine and eternal form, and for its own benefit: it is benefited by this attenuated form of eternality and divinity, and it is for the sake of this benefit that living things desire to reproduce. Furthermore, the process of reproduction directly benefits the animal insofar as it is just this process that has brought it into being and life.[20] Unmoved movers, gods, and the unchangeable forms of plants and animals, on the other hand, can only be οὗ ἕνεκα-οὗ, an aim for others, since they neither need any benefit, nor can they suffer any change whatsoever (even orbital motion).

[20] According to *GA* i 23, 731[a]24–[b]8, both mere existence and even the lowest forms of life are intrinsically good and beneficial for the beings that exist or live. And it is better to exist than not, as pointed out in GC ii 10 336[B]27–34.

We now turn to a continuation of the *On the Soul* passage with which we began our analysis of οὗ ἕνεκα, to a passage that is more specific about the way in which the individual organism is that for the sake of which.

> And the soul is cause and starting point of the living thing. But these are said in many ways (πολλαχῶς λέγεται) and the soul is a cause in the three senses [of cause] that we have distinguished. For the soul is cause of the animate bodies 'whence the motion', and 'that for the sake of which', and as substance. That it is [a cause] as substance is clear. For the substance is the cause of existence for everything. And animation is existence for animals, but the cause and starting point of this is the soul. Again, the thing in a complete state constitutes the account of what exists in potentiality (ἔτι τοῦ δυνάμει ὄντος λόγος ἡ ἐντελέχεια). And it is apparent that the soul is cause as an end and for the sake of which. For, just as reason creates for the sake of something, in the same way so does nature, and this is its end. And the soul is by nature this kind of thing [i.e. an end] in living things. For all the natural bodies are instruments of the soul; just as the natural bodies of animals, so those of plants, since these things are for the sake of the soul. But 'that for the sake of which' is twofold, both the 'of which' and the 'for which' (διττῶς δὲ τὸ οὗ ἕνεκα, τό τε οὗ καὶ τὸ ᾧ). (*Anima* ii 4, 415^{B}7–21)

Here we have an argument for why the soul should be thought to be a cause of the living thing in three different ways: substance or existence, source of change, and that for the sake of which. The soul is a cause 'for the sake of which' because nature, like reason or art, creates things for the sake of something. And nature has generated or created the physical bodies of plants and animals. But physical bodies are instruments of souls, and so exist for the sake of them. But then that for the sake of which is 'in two ways'.[21] The body exists for the aim of the soul's functioning, and the soul's functions exist for the benefit of the individual organism that lives through the soul and with the body. To be more specific, the various bodily organs exist for the aim of (οὗ ἕνεκα-οὗ) the various functions of the soul (roots for nutrition, feet for locomotion, eyes for perception), but for the sake of the organism (οὗ ἕνεκα-ᾧ) which has them as beneficiary (plants or animals or people).[22]

Philoponus' comments[23] on this passage seem to reaffirm the way in which both senses of 'for the sake of which' are predicated of individual living things: the

[21] The adverbial expression διττῶς in 415^{b}20 can be made sense of by supplying λέγεται from 415^{b}9, where Aristotle said that 'cause' is 'said in many ways' (πολλαχῶς λέγεται). Just as multiple senses of cause apply to the soul, so here multiple senses of οὗ ἕνεκα apply.

[22] As Menn explains clearly: 'the body is for the sake of "[participating in] the eternal and divine" as τὸ οὗ, the to-attain-which (by securing the eternity of the species), as a thing is for the sake of its function; whereas the body is for the sake of the soul as τὸ ᾧ, the to-benefit-whom, as an ὄργανον is for the sake of the art or the artisan' (2002, p. 113).

[23] '"That for the sake of which" is spoken of in two ways: both the [aim] of which, and the [beneficiary] for which. For the soul, he says, is an end as [aim] of which, but the animal is [an end] as [beneficiary] for which. For nature makes the instrumental body for the sake of the soul, in order that the soul can use it, being an end in the sense of [aim] of which, but the animate thing [is an end] in the sense of [beneficiary] for which. For nature makes all things so that the activities of the animal are not impeded. Accordingly, it is either as was just stated—the [aim] of which and the [beneficiary] for which are like this—or it [sc. the soul] is [as aim] for the sake of the ordered creation and the eternal

activities of the soul are that at which the body aims, and the same souls are beneficiaries of the instrumentality of their bodies. Simplicius[24] points out that the soul is a cause for the body in the sense of that 'for which', since souls are beneficiaries, but he also points out that souls themselves have a further for the sake 'of which', in that they aim not only at life, but at the perfect life (i.e. the divine life). But only individual souls, not souls taken generically as kinds or forms, can be beneficiaries. This is for the same reason that the other divine, eternal, and unchangeable things cannot be beneficiaries: they do not and cannot change (but being a beneficiary would imply being changed by being benefited), and they do not need anything.

The materials and products of art can be instruments for our sake in a way similar to how organs function and benefit us. This is explained in the final passage in which Aristotle mentions two senses of οὗ ἕνεκα.

> It belongs to the study of nature to know both kinds of nature [viz. matter and form]. As well [it belongs to] the same study [to know] that for the sake of which and the end, and whatever is for the sake of this. For nature is an end and for the sake of which. For if there is some end of a motion which is continuous, this final thing is that for the sake of which. That is why the poet was carried away when he comically said: 'he has reached the end [death], for which he was born.' For not every final thing is considered the end, but the best. Since the arts make the matter—some absolutely, others so that it is beneficial (εὐεργόν)—we use everything that exists as for the sake of us (χρώμεθα ὡς ἡμῶν ἕνεκα πάντων ὑπαρχόντων). For we will be in a way an end as well (ἐσμὲν γάρ πως καὶ ἡμεῖς τέλος). For 'that for the sake of which' is twofold, but we discussed that in the work *On Philosophy* (διχῶς γὰρ τὸ οὗ ἕνεκα· εἴρηται δ' ἐν τοῖς περὶ φιλοσοφίας). And two arts control and know the matter: the art that uses, and the art that controls the making. (*Phys* ii 2, 194[a]26–[b]2)

The issue in this part of *Physics* ii has been whether and to what extent it is necessary for the student of nature to know the causes—matter and form. The answer is that the natural scientist must know both. Since, as we just saw in the passage from *On the Soul*, the soul is a cause both as substance and as that for the sake of which, it makes sense that natural scientists, at least insofar as they are concerned with living things, will have to know the form. Aristotle makes a comparison between natural science and art: in art as well the artist must know both the matter and form in order to create something for the sake of something. The comparison is apt: both the natural scientist and the artist must know matter and form in combination.

But it must be remembered that nature and art have already been contrasted in strong terms in Aristotle's initial discussion of what—or rather where—nature is

(for all things aim at this), and it [sc. The body] for it the soul [as beneficiary]. For it [sc. nature] provides the instrument [sc. the body] for it [sc. the soul]. Wherefore the latter position is rather truer' (Philoponus, *In De An*, 274. 15–23).

[24] 'He again reminded us of this in order that we may put the soul down as cause, but not as the best end among the accomplishments. For this is an end in the sense of "for which", but the soul is [a cause for the sake of which] as "of which", since the soul is for animals cause not only of life but even of the perfect life' (Simplicius, *In De An*, 111.31–112.2).

(*Phys* ii 1, 192^{b}13–23). As Aristotle puts the distinction elsewhere, with maximum brevity: 'art is a principle and form of what is generated, but in another; but natural change is located in the thing itself' (*GA* ii 1, 735^{A}2–3). So what the natural scientist knows is the form and concomitant 'for the sake of which' that is internal to the natural thing itself, as well as the matter out of which the thing that contains the form is composed. By contrast, the artist knows 'that for the sake of which' something is to be done, and the form necessary to make that possible, and also knows how to make that form functional in material that is suitable to receive the form, but which does not have it naturally. Aristotle points out that one kind of skilled person knows how to make the artifact, while another kind knows how to benefit from it or make use of it (εὐεργόν). Aristotle gives the example of the pilot: he knows what a rudder is, and he orders the carpenter to make it. The carpenter knows how to shape the wood into a rudder. The carpenter does not know how to use the rudder to steer the boat (unless incidentally) any more than the pilot knows how to fashion wood into a rudder.

Just as the arts of generating (i.e. producing) artifacts and the art of using them are different, so too is the knowledge of how natural entities are generated and exist, and of how to use them. Knowledge of how natural entities are generated and exist is the purview of theoretical science—the kind of knowledge which grasps the intrinsic causes of things—as opposed to practical knowledge which, like art, knows how to use things and is concerned not with internal and intrinsic forms but with 'a form and principle in another'. This distinction,[25] as we read above, is very important to Aristotle. The knowledge of how to use things must not be confused with the identification of the natural ends of things.

When we use natural things (like earth and stone, or wood) in accordance with art, we ourselves become the end of the creation. For example, if we fashion wood into a rudder, we are an end in that it is we who are piloted by the boat using the rudder. We can see how the two senses of οὗ ἕνεκα apply: they distinguish the objects of the two kinds of art—that which produces something (by imposing an external form on matter), and that which uses the thing (by using the thing produced for the sake of some human objective, like transportation). This is why Themistius says[26] that when we are beneficiaries we not only *know* the things that benefit us, but we also *use* them. One kind of end applies to knowing them (the 'aim of which' that is a cause of them), and another kind applies to using them (the 'for benefit whose' that is not a cause of them but is a cause in us—our ends). Philoponus and Simplicius both follow Themistius here. Philoponus says that just as the maker of a door knows both what a door is for and the kind of resistant materials necessary to make such a thing, so the student of nature must know both

[25] *EE* i 5, 1216^{B}10–19.

[26] 'But even we are ends, for many things are created in order to benefit us; but [in that case] we not only know they are for the sake of us, but we also use them. But that the end is twofold, and how we are [an end] is an issue discussed in the *Ethics*' (Themistius, *In Phys* 43.7–9). Themistius thinks that Aristotle's reference to *On Philosophy* is a reference to our *Ethics*. Simplicius made the same error; see below.

the ends (i.e. functions) of natural things, and the matter that is necessary for these to be realized.[27]

Simplicius stresses[28] that it is only in the mode of art that humans are ends of other natural things as beneficiaries.

For being an end in this way we not only know the things that benefit us, but we also use them. But when Aristotle says that everything is there for our sake, he does not mean everything that exists, but all those things that are for our protection, which are those things finished by the arts. For we use those things. And we will be an end of those things that come about through the arts, since they are there for us, conditioned with reference to us, and they are yoked to our ends. And not only do we know these, but we use them, which is something more.

In that case, we use other natures like matter, reshaping it in accordance with our own ends, as the artist reshapes the matter in accordance with the end of the artifact she intends to create.

[27] He says: 'the end is twofold—the "of which" and the "for which", for example the form of the door is an end "of which". For the artist aims at this, and this they call the target. But the "for which": the door comes about not on account of this itself, in order for there to come about this kind of form, but in order to satisfy the needs of a human, so that the human is somehow an end for which the door comes to be, in order that it protect the house. So the one who knows the end in the sense of "of which", that is, the form of the door, immediately knows also that which is for the sake of it, and this is the matter; and he also knows the end in the sense of 'for which' (for example the human who knows it has come to be for his own use; for this—the human use—is the most final end of the door). For he who knows that one must keep one's household possessions safe knows that to achieve this one needs a solid and resistant body to hinder those who wish to threaten them. So that even if the end is spoken of in two ways, he knows the end, among which is the matter. Therefore it belongs to the natural philosopher, too, to recognize not only forms but also matter' (Philoponus, *In Phys* 230.5–19; cf. 237.20 f.).

[28] 'That the end and the things which are for the end are intertwined, he demonstrates from the fact that we are an end when taking up each thing we do use for our own sake. And it is clear that what he has said about the arts and ends demonstrates this proposal by extension. For doing and using are more than mere knowing. But how are we an end, and how do we use everything? Answer: the end is twofold: (1) the end as the "of which"—the intention (what people recently term the "target", e.g. health, which the doctor aims at); (2) the thing in which this exists and for which it comes about, e.g. the person who becomes healthy. This is the end as the "for which" that even we will be. For the human being is end of the doctor not as the aim "of which" like health, but in the sense as that "for which" the doctor intends to produce health. The distinction is made by Aristotle in the *Nicomachean Ethics*, which he calls *On Philosophy* because the study of the whole of ethics is most distinctly philosophy. Since the term end is spoken of in two ways, both the "of which" and the "for which", he shows that the knowledge of the matter is intertwined with knowing the end, and he now shows that this is how it is for this other end "for which". For being an end in this way we not only know the things that benefit us, but we also use them. But when he says that everything is there for our sake, he does not mean everything that exists, but all those things that are for our protection, which are those things finished by the arts. For we use those things. And we will be an end of those things that come about through the arts, since they are there for us, conditioned with reference to us, and they are yoked to our ends. And not only do we know these, but we use them, which is something more. And in general, the one who knows the end also knows the things for the sake of the end. So if a physicist knows the form as end, the same physicist would also know that which is for the sake of the form, viz., the matter. For if "the matter is relative to the form", as Aristotle says, and the one who knows something knows at the same time what is relative to it, then it is clear that whoever knows the one will know the other' (Simplicius, *In Phys*, 303.25–304.18).

So human beings 'in a way become ends': namely, through the arts that make artifacts and use them for human ends. Both of these kinds of arts are practical knowledge, and this is not natural science; on the contrary it is a kind of knowledge with a completely different purpose. Nevertheless, the passage from *Physics* ii just considered has been read as implying that human beings are the natural end of all natural things, not just their end in accordance with human technology. This reading has been invoked in support of a broad interpretation of Aristotle's teleology.[29]

Thomas Aquinas is an early and articulate representative of this kind of interpretation. Commenting on the first passage from *On the Soul* we examined, he says, 'that for the sake of which a thing is done is (i) perpetual existence itself; (ii) the thing having such existence, which natural entities aim to be made like through generation, in which there is [a kind of] perpetuity; or even (iii) the very generation with which they achieve that perpetuity'.[30] Thus Aquinas seems to conceive of several different possible beneficiaries of natural generation.

But, as we have seen, Aristotle's distinction is not between different beneficiaries, but between aims 'for the sake of which', and beneficiaries 'for whose sake'. Further, the 'perpetual existence' cannot be benefited, precisely because it is eternal. This would imply need and change for it, but it needs nothing and does not change. Thus we must, at least as a matter of Aristotelian interpretation, reject Aquinas' insinuation that the eternal can somehow be a beneficiary of natural generation. We must, for the same reason, reject any notion that the form of the animal (anachronistically, its 'species') might be a beneficiary of its reproduction. For the form, as itself eternal and divine, cannot change and therefore cannot be a beneficiary—the form of a plant or animal or human needs nothing and cannot be benefited, and so can only exist as an aim to be achieved.

Aquinas says in the course of his comment on the second passage from *On the Soul* that we examined:

> just as intellect functions for an end, so too does nature, as *Physics* ii proves. But in the case of things done through art, intellect directs and arranges matter on account of form. Therefore nature does so as well. So since soul is the form of a living body, it follows that it is its end. And, moreover, soul is the end not only of living bodies but also of all natural bodies among those lower entities. He proves this as follows: we see that all natural bodies are the instruments, as it were, of soul. This is so not only in animals but even in plants. For we see that human beings, for their own benefit, use animals, plants, and things without souls (insofar, that is, as they take in food and sustenance from them). But anything that happens in the natural world is naturally disposed (*natum*) to happen that way. Thus it seems that all bodies without souls are the instruments of beings with souls and exist for them, whereas less complete beings with souls exist for more complete beings' souls. And accordingly Aristotle distinguishes that for the sake of which it is, just as he did earlier. (Aquinas, *In De An* II.7.188–213, trans. Pasnau, modified)

[29] See, e.g., Sedley 1991, pp. 189–90. For a concise and forceful response to the anthropocentric interpretation (though without specific reference to Sedley) see Berti 1989/90.

[30] Aquinas, *In De An* II.7.124–41 (trans. Pasnau).

Aquinas again assumes that the distinction between kinds of οὗ ἕνεκα is a distinction between kinds of beneficiaries. He interprets Aristotle as saying that humans turn out to be the ultimate beneficiaries of all natural processes (on the basis of a reference to the *Physics* ii passage, although he is here commenting on a passage from *On the Soul* which says nothing whatsoever about humans specifically). But once it is made clear that Aristotle's distinction is not between kinds of beneficiary but between aims and beneficiaries, it is clear that this interpretation of the *Physics* ii passage is wrong. Parts of a living thing are instruments for the sake of functions which are for the sake of the individual organism which possesses them. Things that are neither alive nor part of things that are alive may be used for the sake of something in accordance with art, but are not prepared for the benefit of any other beings, humans included, as Philoponus and Simplicius argued. The same point applies a fortiori to plants and animals themselves. They exist for their own benefit, not something else, including 'more complete' beings, 'beings higher on the food chain', and even human beings. That is, they do not exist for the benefit of humans naturally and intrinsically, but only in accordance with some art and incidentally.

We can see further evidence for this interpretation by looking at Aristotle's analysis of other teleological terms and notions.

3.2 NOTHING IN VAIN

Aristotle strongly contrasts 'that for the sake of which' (τὸ οὗ ἕνεκα) with 'in vain' μάτην.

> Nature does nothing in vain, for everything by nature is for the sake of something (μηθὲν μάτην ποιεῖ ἡ φύσις. ἕνεκά του γὰρ πάντα ὑπάρχει τὰ φύσει). (*Anima* iii 12, 434^{a}31–2)

Aristotle defines and explains this term in connection with τὸ οὗ ἕνεκα:

> The term 'in vain' (τὸ μάτην) is used when something for the sake of something else does not come to be for it (ὅταν μὴ γένηται τὸ ἕνεκα ἄλλου ἐκείνου ἕνεκα). For example, walking for the sake of voiding the bowels: if the voiding does not come about, we say you walked in vain, and the walking was in vain. We say it because this is 'in vain': the thing which is naturally for the sake of something else (τὸ πεφυκὸς ἄλλου ἕνεκα), but does not achieve that which it is for and which it naturally becomes. That is why it would be ridiculous for someone to say that to wash is in vain because the sun is not eclipsed; for this is not what washing is for the sake of (ἐκείνου ἕνεκα). (*Phys* ii 6, 197^{b}22–9)

In other similar expressions, Aristotle uses as synonyms for μάτην terms like random, irrational, superfluous, and incomplete (ἔτυχε, *Cael* 290^{a}31; ἀλόγως, 291^{b}13; περίεργον, *GA* 744^{a}36; ἀτελὲς, *Pol* 1256^{b}21). These typically appear in Aristotle's use of scientific principles such as the following:

> we hypothesize, and hypothesize on the basis of what we see, that nature never fails nor makes anything in vain so far as is possible with respect to each thing (ἐπεὶ δὲ τὴν φύσιν

ὑποτιθέμεθα, ἐξ ὧν ὁρῶμεν ὑποτιθέμενοι, οὔτ᾽ ἐλλείπουσαν οὔτε μάταιον οὐθὲν ποιοῦσαν τῶν ἐνδεχομένων περὶ ἕκαστον). (*GA* v 8, 788^{b}20–2)

Aristotle is unusually candid here about his scientific methodology in using this principle,[31] making explicit a fundamental supposition of his kind of scientific explanation. This is clearly not just some popular animistic slogan that Aristotle uses to avoid giving real explanations. But because Aristotle, in one[32] or two[33] such uses of the principle, appears to identify nature and god, some interpreters have seen the use of such expressions as evidence of a decidedly Platonic way of thinking,[34] of support for providential design.[35] Although Aristotle's choice of words here seems to encourage such a reading,[36] his expressed principle that art imitates nature in fact discourages it. Consider the following statement: 'generally art either completes that which nature is unable to make work, or imitates it (ὅλως τε ἡ τέχνη τὰ μέν ἐπιτελεῖ ἃ ἡ φύσις ἀδυνατεῖ ἀπεργσάσθαι, τὰ δὲ μιμεῖται) (*Phys* 199^{A}15–17; cf. 194A21–22, *Meteor* 381^{B}6, *Mund* 396^{B}11–12, *Protr* 84.19–20, 80.7–9, 80.18–19). Thus we should not think of nature as a god-like craftsman (i.e. a demiurge) using art to construct nature not in vain: the fact that art imitates nature requires that nature be prior to the work of any artisan. And since we have no further direct discussion of the linkage between god and nature in this way, and no further use of it in practice, it would be incautious to interpret Aristotle's teleology on the basis of those remarks. And Aristotle is just as capable of asserting the principle without mentioning god, or even connoting agency, as in the following:

> The works of nature are not haphazard but for the sake of something to the highest degree. And that for the sake of which they are constituted or have come to be occupies the place [i.e. plays the role of] the fine (τὸ γὰρ μὴ τυχόντως ἀλλ᾽ ἕνεκά τινος ἐν τοῖς τῆς φύσεως ἔργοις ἐστὶ καὶ μάλιστα· οὗ δ᾽ ἕνεκα συνέστηκεν ἢ γέγονε τέλους, τὴν τοῦ καλοῦ χώραν εἴληφεν). (*PA* i 5, 645^{a}23–6)
>
> Nature is for the sake of the better and the end (ἕνεκα δὲ τοῦ βελτίονος καὶ τοῦ τέλους ἡ φύσις). (*GA* ii 4, 738^{a}37–^{b}1)
>
> Things according to nature are as fine as can be (τὰ κατὰ φύσιν, ὡς οἷόν τε κάλλιστα ἔχειν) (*NE* i 10, 1099^{b}21–2)

For our purposes, the real significance of the phrase μηθὲν μάτην is the insight it gives into the meaning of Aristotle's most important teleological phrase, τὸ οὗ

[31] For a thorough examination of the principle, see Lennox 2001^{a}, ch. 9.

[32] 'The god and nature make nothing in vain' (ὁ δὲ θεὸς καὶ ἡ φύσις οὐδὲν μάτην ποιοῦσιν) (Cael 271a33).

[33] 'And this [philosophy] is that for the sake of which nature and the god have brought us into being' (*Protrep* 81.12). Notice that this is not a case of the 'nothing in vain' principle.

[34] Rist 1989. [35] Huby 1991.

[36] In the following version of the principle, Aristotle's diction borrows from the image of the artist of the *Timaeus*: 'The explanation is that nature never manufactures anything in vain, but rather the best possible' (αἴτιον δ᾽ ὅτι ἡ φύσις οὐδὲν δημιουργεῖ μάτην, ὥσπερ εἴρηται πρότερον, ἀλλὰ πάντα πρὸς τὸ βέλτιστον ἐκ τῶν ἐνδεχομένων) (*IA* 711^{A}17–19).

ἕνεκα. What we have seen is that μηθὲν μάτην is used to articulate the fact that natural things are not incomplete, failed, aborted, mutilated, worthless, or useless (we will deal with the exceptional cases of congenital defects and spontaneously generated organisms in due course). What the contrast with μηθὲν μάτην shows is that things that are ἕνεκά τινος are complete and functional entities, rationally explicable, non-random, and which somehow manifest axiological predicates, like 'better' (βελτίονος) and 'finest' (κάλλιστα).

3.3 END, LIMIT, AND THE COMPLETE

We have already seen 'the [cause] for the sake of which' (τὸ οὗ ἕνεκα) mentioned several times in connection with 'the end', as in the names of the causes, and the analogy between nature and craft (τὸ τέλος, in 194^{a}27–8). Further, we saw the use of related terms in the description of developed organisms (τέλεια, 415^{a}27; ἡ ἐντελέχεια, 415^{b}15). In the following passage, Aristotle describes more fully the relationship between τὸ οὗ ἕνεκα and τέλος.

> That for the sake of which is an end (τὸ οὗ ἕνεκα τέλος) such that it is not for the sake of something else, but that for whose sake everything else is; so that if there is to be some such final term (τοιοῦτόν τι ἐσχατον), it will not be unlimited, but if there is no such term, then there will be no for the sake of which (οὐκ ἔσται τὸ οὗ ἕνεκα). But those who endorse an unlimited series, forgetting this, destroy the nature of the good. Yet no one would try to do anything if they were not going to come to a limit. Nor would there be any reason [i.e. rational order] in reality. For whatever has reason always acts for the sake of something, and this is a limit. For the end is a limit (τὸ γὰρ τέλος πέρας ἐστίν). (*Meta* ii 2, 994^{b}9–16)

This passage states that the cause for the sake of which is an end in the sense of a limit, without which intentional activity, and the good in general, would be unthinkable. The τέλος as an end blocks infinite regresses that would otherwise render demonstration, motion, and activity, incomplete, vain, and ineffectual. This point is made in extremely diverse contexts. For example, it appears in the following logical, biological, cosmological, and ethical contexts.

> For the last term is an end and a limit (τέλος γὰρ καὶ πέρας τὸ ἐσχατον). (*Post* i 24, 85^{b}29–30; cf. 85^{b}27–6^{a}3)

> Nature flees from the infinite; for the infinite is imperfect, but nature always seeks an end (ἡ δὲ φύσις φεύγει τὸ ἄπειρον· τὸ μὲν γὰρ ἄπειρον ἀτελές, ἡ δὲ φύσις ἀεὶ ζητεῖ τέλος). (*GA* i 1, 715^{B}14–16)

> Since there cannot be an infinite regress, there is an end (ἐπειδὴ οὐχ οἷόν τε εἰς ἄπειρον, τέλος ἔσται). (*Meta* xii 8, 1074^{a}29–30)

> There is an end . . . for otherwise there is an infinite regress, in which case our desire would be empty and in vain (τέλος ἐστὶ …γὰρ οὕτω ἢ εἰς ἄπειρον, ὥσι εἶναι κενὴν καὶ ματαίαν τὴν ὄρεξιν). (*NE* i 1, 1094^{a}18–21)

The clearest case is intentional activity: if the chain of reasons for our actions did not end somewhere but was infinite (eating for the sake of walking, walking for the sake of health, health for the sake of longevity, longevity for the sake of happiness, happiness for the sake of . . .), there would be no end of the deliberative process, and so no principle on which to begin the action. Action cannot get off the ground if there is no determinate and ultimate end for the sake of which it is undertaken. The argument also applies to demonstration (where the notion of infinite regress is perhaps most at home), and to natural motion (which is why we need a first mover). So there must be an end or τέλος, since there necessarily is demonstration, motion, and activity. The idea of reaching a τέλος or being complete (τέλειον) applies to things as diverse as syllogisms (τέλειον…συλλογισμὸν, Prior $24^{b}22$–3), particular animal species (τὸ δ᾽ἰδιόν ἐστι τὸ ἑκαστου τῆς γενέσεως τέλος, *GA* $736^{b}4$-5), the reproductive soul (τέλος…ἡ πρώτη ψυχὴ, *Anima* ii 4, $416^{B}24$–25), cities (τέλειος πόλις, *Pol* $1252^{b}28$), and poetry (τραγῳδία…τελείας, *Poet* 6, $1449^{b}24$–5). That Aristotle avails himself of teleological terminology in all these diverse domains confirms that we are dealing with a general and flexible mode of explanation.

It is important to realize that the explanation or cause 'for the sake of which' is an end in this specific sense—that of providing a limit which makes things comprehensible and achievable. If I can ascertain that for the sake of which something is produced or exists, then I can begin to understand its structure, constituents, history, development, and so forth. But the cause for the sake of which is clearly not an end in every sense. In particular, it is not the end as the terminal point or final stage. If I am walking to the store and I turn back halfway, halfway was the final or terminal point of my journey, and in a sense an end, but not the end in the sense of that for the sake of which I set out. Similarly, death is the final stage of our existence, and an end to be sure, but not the end in the sense of that for the sake of which: the end of life might be death, but that is not its purpose. That is why Aristotle said that the completed being (ἡ ἐντελέχεια) is determined by powers or capacities ($415^{b}14$–15). These are ends, but not as terminal points or final stages. This is the chief problem with the locution 'the final cause'—because, as often as not, the end for the sake of which is not the end in the sense of finality. This was first mentioned in connection with τὸ οὗ ἕνεκα (at $194^{A}27$–35), and is also mentioned in the definition of τέλειον. The term τέλειον is the adjectival form of the noun τέλος. Here Aristotle's enumeration of uses of the term makes explicit the relationship between ends, finality, and the cause for the sake of which.[37]

'Complete' (τέλειον) means:

(1) that which not a single thing, not even a single part, is taken to be outside; for example, the complete time is that outside of which there is no time to take which is part of that time;

[37] With this should be compared the discussion of the 'complete' or 'perfect' at *Phys* vii 3, $246^{a}10$–$^{b}3$. There he says: 'excellence is a perfection (ἡ μὲν ἀρετὴ τελείωσίς τις), for when anything acquires its proper excellence we call it perfect, since it is then really in its natural state' ($246^{a}13$–15, ROT). See also the commentary by Wardy 1990, pp. 209–13.

(2) that which according to its excellence and good has no superior with respect to its kind (πρὸς τὸ γένος); for example there is a complete doctor and a complete flautist according to the kind of excellence native to them (κατὰ τὸ εἶδος τῆς οἰκείας ἀρετῆς) when nothing is lacking. So by transference of meaning we call evil people 'complete sycophant' or 'complete thief', indeed we even call them good, like a 'good thief' and a 'good sycophant'. And excellence is something complete. For each thing is something complete, and every entity is something complete (οὐσία πᾶσα τότε τελεία) when according to the kind of excellence native to it (κατὰ τὸ εἶδος τῆς οἰκείας ἀρετῆς) no part of its natural dimensions are lacking.

Now, that to which is present the end (τὸ τέλος), when it is important, is among the things said to be complete, for they are complete because they possess the end (τὸ τέλος). Thus since the end (τὸ τέλος) is something final, and the meaning is transferred to worthless things, we say 'completely destroyed' and 'completely rotten' when its destruction and badness lack nothing, but are finalized. That is why the terminal (ἡ τελευτὴ), by transference of meaning, is called an end (τέλος), since both are final (ἔσχατον). And an end is final in the sense of the for the sake of which (τέλος δὲ καὶ τὸ οὗ ἕνεκα ἔσχατον).

There are this many proper meanings of the term complete: (1) according to the good, lacking nothing, having nothing superior nor taken to be outside, and (2) others in general having no superior in their specific kind (ἐν ἑκάστῳ γένει), nor anything existing outside.

The other things are so in accordance with these, either by making something so, or having, or adapting something like this, and from somehow being said to be complete in relation to these primary ways. (*Meta* v 16, 1021^{b}12–1022^{a}3)

A most important feature of this definition is the notion that the complete (or 'perfect', as the term is often translated) is complete relative to 'the kind of excellence native to it' (or 'proper' to it: κατὰ τὸ εἶδος τῆς οἰκείας ἀρετῆς). Complete means having reached an end that constitutes an excellent condition of a specific kind of thing.[38] Thus it is clear from the definition of 'complete' that Aristotle understands the relevant kind of ends in connection with limits, not finalities (like final stages, terminal points, or death). This becomes even clearer when, in the very next entry in the 'metaphysical lexicon', Aristotle gives as one of the senses of limit (πέρας): 'the end of each thing is that "towards which" change and action [tend]—not that "from which"—although sometimes [the end is] both [that] "from which" and "towards which" [change and action tend], i.e. that for the sake of which' (*Meta* v 17, 1022^{a}6–8).

[38] See *Phys* vii 3 on this point (and the previous note). In vii 3 Aristotle discusses 'completion' in the context of alteration. He argues that bodily and psychic conditions or states are not alterations, because they are excellences or defects, but an excellence is a completion, and a defect is the opposite, a perishing or departure from completion. Example: we do not call the completion of a house an 'alteration'—otherwise we would have to call all the alterations that lead up to the completion (tiling, plumbing, etc.) 'completions'. I mention it here because Aristotle stresses that 'completions' are always understood with respect to specific affections. Thus an excellence or defect 'puts that which possesses it in a good or bad condition with regard to its native affections (τὰ οἰκεῖα πάθη), where by "native affections" I mean those by which the thing is naturally produced or destroyed' (246^{b}8–10). Later he repeats the point: 'excellence puts its possessor in good condition, while defect puts its possessor in a bad condition, with regard to its native affections' (247^{a}3–4).

This means that the cause for the sake of which is sometimes identical with the starting point, from which, in addition to the final point, towards which. For example, in intentional action, I both begin the process of building, and am the end for the sake of which the house was built. Similarly, in reproduction, that which begins the process, the form, and the end are all identical: the plant or animal. So the locution 'the final cause' is somewhat misleading, primarily on the grounds that it leans towards a notion of end in the sense of the final stage or terminal point, rather than in the sense of a limit and that for the sake of which. The closest Aristotle ever comes to the 'the X cause' formula with respect to this kind of explanation is where he uses terms that have no connotation of finality whatsoever, but rather stress the axiological aspect of the cause by referring to it as a cause of the 'good' or 'better' (τὸ αἴτιον τοῦ καλῶς καὶ ὀρθῶς, *Anima* i 2, 404^{b}2; διὰ τὸ βέλτιον καὶ τὴν αἰτίαν τὴν ἕνεκά τινος, *GA* ii 1, 731^{B}22–23; τὴν τοῦ εὖ καὶ τοῦ κακῶς αἰτίαν, *Meta* i 3, 988^{a}14).

In the definition of τέλειον, Aristotle also said that the end is determined 'with reference to the kind of excellence native to it' (κατὰ τὸ εἶδος τῆς οἰκείας ἀρετῆς, 1021^{b}16–7, 22), and in the specific kind (ἐν ἑκάστῳ γένει, 1021^{b}33). We see the same notion is at work in his use of the related verbal term, τελειοῦσθαι.

> For things different in kind we hold that they are completed differently. So this appears to be the case for both natural things and artificial things, like animals, trees, a painting, a sculpture, a house, and an implement. And the same goes for activities that differ in kind, since they are completed by things differing in kind. (τὰ γὰρ ἕτερα τῷ εἴδει ὑφ' ἑτέρων οἰόμεθα τελειοῦσθαι. οὕτω γὰρ φαίνεται καὶ τὰ φυσικὰ καὶ τὰ ὑπὸ τέχνης, οἷον ζῷα καὶ δένδρα καὶ γραφὴ καὶ ἄγαλμα καὶ οἰκία καὶ σκεῦος· ὁμοίως δὲ καὶ τὰς ἐνεργείας τὰς διαφερούσας τῷ εἴδει ὑπὸ διαφερόντων εἴδει τελειοῦσθαι). (*NE* x 5, 1175^{a}22–6)

This point will become increasingly important as we explore how Aristotle restricts teleological explanations to specific entities or individual kinds, and also how he looks to the unique excellence for various natural kinds in order to determine their own proper goods. For now we note simply that the significance of these literally teleological terms (words that begin with the root ΤΕΛΕ-) is to place limits on things such that their demonstration, motion, and action is possible. This will become even clearer in the next section, where we examine a neologism of Aristotle's that is a nominalization of these verbal and adjectival notions of limitation and completion.

3.4 FUNCTION, ACTIVITY, AND THE THING IN A STATE OF COMPLETION

The terms hitherto discussed, although they take on technical significance in philosophical contexts, are commonplace in the parlance of Aristotle's time. Another term containing the same radical –ΤΕΛΕ, ἐντελέχεια, was coined by Aristotle.[39]

[39] Porphyry uses this as an example of Aristotle's ability to neologize (*Isagoge* 55; see Menn 1994, p. 100 n. 37).

Aristotle also made up the term ἐνέργεια, which he connected with ἐντελέχεια. The former term contains the radical ἔργον, a term which already had technical philosophical significance by the time of Plato. It is well known that each of these terms has great significance for Aristotle's teleology, and so a somewhat detailed discussion of them is justified here.

The term ἐντελέχεια has been translated as 'actuality' because Aristotle often uses it synonymously with the term ἐνέργεια, which means 'activity'. In this sense, both terms are opposed to δύναμις (capacity, power, potentiality).[40] But it would be a mistake to equate the terms. What we have are two different neologisms. It seems unlikely that Aristotle would make up two different terms, yet have only one concept in mind. One attempt to show that he did leads to a lengthy story involving a complex of developmental hypotheses, speculation about Aristotle's train of thought, and the assumption that there are lost books.[41]

But clarity on the issue can be had from a consideration of Aristotle's own account of the meaning of the terms: 'The ἔργον (function) is the τέλος (end), and the ἐνέργεια (activity) is the ἔργον (function). For this reason the word ἐνέργεια (activity) is said in the sense of the ἔργον (function) and extended to the ἐντελέχειαν (state of completion)' (*Meta* ix 8, 1050^{a}21–3; cf. 1055^{A}10–19).

The term τέλος (end) and ἐνέργεια (activity) are identified with the term ἔργον (function). The term ἔργον (function) is central to Aristotle's science; he uses it in diverse teleological contexts to describe, among other things, the motions of the elements, the functions of animal parts, the purpose of human existence, and the job of politicians. ἔργον in its most common sense means simply work or job, as in the making of good shoes for a cobbler and the promotion of health for a physician.[42]

Already Plato had used ἔργον in a philosophically rich sense, as in the *Republic*, where the following definition is offered: 'the function (ἔργον) of each thing would be that which it produces (ἀπεργάζηται) either alone or better than any others' (*Rep* i, 353^{a}10–11). Aristotle conceives of function similarly: 'everything is defined in respect of its function (τῷ ἔργῳ); for when something is able to perform its function (τὸ αὐτῶν ἔργον), it is truly that thing; an eye for example, when it is able to see' (*Meteor* iv 12, 390^{a}10–12).[43] In the course of one of his attempts to ascertain the function of human beings as a natural kind (i.e. the unique and definitive activity of a human being as a human being), Aristotle explains the term 'function' (ἔργον) in terms of a thing's end and the activity of its proper excellence.

> The function of each thing is its end (τέλος ἑκάστου τὸ ἔργον). It is obvious, then, that the function is better than the state. For the end, as end, is the best. For it was assumed that the best and the final is the end for the sake of which all the other things exist. That the function is better than the state and the condition, then, is plain.

[40] Cf. Menn 1994, pp. 83 f. Menn shows how the contrast between δύναμις and ἕξις is a crucial feature of the neologism.

[41] Blair 1967 (esp. pp. 116–17).

[42] For more elevated examples of this idea, applied to the moral virtues, see *Protrep* 70.1–8.

[43] Also: 'but everything is defined with respect to its function and its power (πάντα δὲ τῷ ἔργῳ ὥρισται καὶ τῇ δυνάμει)' (*Pol* i 2, 1253^{a}23).

But the term 'function' is said in two ways. For some things have a function beyond mere usage, as [the art of] building has a house and not just [the activity of] building, and medicine has health and not just curing and treating. But for other things the use is the function, for example seeing for vision, and mathematical knowledge for theoretical activity. Hence it is necessary that in those cases where the use is the function, the use is better than the state.

Having made these distinctions, we say that the function of the actions is also the function of the excellence, but not in the same way. For example, shoes are the function of both the art of shoemaking and the activity of making shoes. If, then, the art of shoemaking and the shoemaker have an excellence, their job [i.e. function] is a good shoe, and similarly with everything else. (*EE* ii 1, 1219^{a}8–23)

Thus the function is to be identified with an excellent outcome of the end, whether the function is an activity itself or the product of the activity. This is why, as we have already seen, Aristotle contrasts the function as an activity with the capacity, potentiality, or power for an activity. In a parenthetical remark that craftsmen reveal who they really are in their handiwork, he says, 'and this is how it is in nature: what a thing is potentially, its function (τὸ ἔργον) reveals in activity (ἐνεργείᾳ)' (*NE* ix 7, 1168A8–9). In another passage wherein Aristotle comments on the terminology of activity, he expands on his earlier statement that the notion of activity (and hence function) is also applied to the term ἐντελεχεία.

The word ἐνέργεια which is applied to ἐντελέχειαν, was extended from strictly moving things to other things. For it is thought that ἐνέργεια is motion, and that is why motion is not applied to the non-existent, though other predicates are, for example the non-existent is 'thought' or 'desired', but not moved, and this is because, while not being ἐνέργειᾳ they would be ἐνέργειᾳ [if they were moved, but this is impossible since they are non-existent[44]]. For of the things that are, some potentially exist. But they do not exist, because they are not ἐντελεχειᾳ. (*Meta* ix 3, 1047^{a}30–^{b}2)

These remarks immediately suggest that Aristotle's view did not develop from the exclusive use of one term (ἐνέργεια) to the exclusive use of the other (ἐντελεχεία), as has been maintained.[45] For he clearly states that the two terms, while related, designate different things. This also makes it implausible that the two words should have identical meanings, as some translations would lead one to believe, and as has been expressly argued.[46]

Aristotle asserts that ἐνέργεια means activity, because it is connected with action and motion—the word ἔργον indicating 'work' or 'job' but essentially 'active functioning' (whether the function is in fact a product of action, like shoes, or the

[44] Thanks to Stephen Menn for helping me get straight on the translation and interpretation.

[45] Against Blair 1967, p. 116.

[46] Blair 1967, p. 110. Blair's thesis is essentially inconsistent, since he wants to maintain both that the terms are extensionally equivalent, and that Aristotle's thought developed from the exclusive use of one to the other. The story he tells about this is fundamentally Jaegerian: 'Aristotle must have realized that every possession of an end is an activity', and that he later, having outgrown his Platonism, unashamedly emphasized this activity, and so dropped using the term *entelecheia* since it has Platonic connotations of stasis and eternality.

action itself, like shoemaking). The term ἐνέργεια thus literally means something like 'being in action' i.e. 'doing work' or 'exercise'.[47] Aristotle typically uses it in a somewhat enriched sense, meaning 'internally functioning' (i.e. of an organism), and this is the reason for the prefix 'in' (ἐν-). We will discuss this enriched sense in due course.

What then does the term ἐντελέχεια mean? Etymologically, four alternatives have been defended. The suggestion of Hirzel, which has Aristotle creating ἐντελέχεια on the model of ἐνδελέχεια, has been refuted by Diels.[48] Diels himself defended the derivation of the term from the adjective ἐντελής and the verb ἔχειν. ἐντελής is a common word, meaning, for example, 'full-grown' of men,[49] 'perfect, unblemished' of cows,[50] and 'effective'[51] of troops and horses.[52] A similar suggestion, perhaps more plausible, derives the term from the adverb ἐντελῶς plus ἔχειν.[53] The problem with these accounts is that Aristotle only once uses the adjective ἐντελής, and never the adverb. Von Fritz's interesting derivation of the term from ἐν (ἑαυτῷ) τέλος ἔχειν, 'having an end in itself', does not suffer from this problem.[54] Neither does Ross' and others' derivation from ἐν τέλει ἔχειν 'being in a state (or condition) of completion (or fulfillment, or finality)'.[55]

Perhaps a more promising way to understand the word than through its etymology is to look at its use. Aristotle uses the neologism ἐντελεχείᾳ over 100 times, throughout the core scientific works (*Physics*, *On the Heavens*, *Generation and Destruction*, *On the Soul*, *Generation of Animals*, and *Metaphysics*). One of the most common uses is in the distinction between actual and potential infinity, which is applied both to extension (e.g. *Phys* iii 6, 206A14–15, b13, 22, 25, 207^{a}22) and to division (e.g. *Phys* viii 8, 263A29, B5). This is a perfectly sensible use of such a term: something that is infinitely extended or divided, Aristotle thinks, can never reach a state of completion.

[47] For 'exercise' see Menn 1994, p. 80. [48] Diels 1916. [49] Aesch. *Cho*. 250.
[50] Soph. *Tr*. 760. [51] Thuc. 6.45.
[52] Menn argues that there is no reason to suppose that ἐντελέχεια depends on ἐντελής, since the latter is 'not an Aristotelian word' (1994, p. 101 n. 38). He argues that since ἐν + X is a common compound form meaning 'containing X', that this is what Aristotle had in mind. In that case we should stress that that means not just 'having a τέλος' but 'having a τέλος within one' (ibid.).
[53] Graham 1989, p. 798. [54] Von Fritz 1938, p. 66.
[55] For the etymology see: Ross, *Aristotle's Metaphysics*, comment at 1047^{a}30; LSJ, s.v.; Oates 1963, p. 82. With respect to the translation, no one to my knowledge uses it in published versions. This could not be justified by the argument that the translation is inelegant, since the neologism itself could be called that. And the secondary literature on the term frequently speaks in terms of 'states' and 'completion'. Examples: 'τὸ δυνάμει καὶ ἐντελέχεια is that which passes from a state of potentiality to one of actuality in any of these respects' (Ross, *Aristotle Physics*, comment at 200^{b}26, p. 535); 'he invented ἐντελέχεια to be the (static, eternal, unchanging) correlative of matter as δύναμις' (Blair 1967, p. 116); 'the state of completion (*en-telecheia*)' (Peters 1967, s.v. *entelecheia*); 'there is little question that in Aristotle's use, this term signifies a state of having arrived at completeness or perfection' (Kosman 1969, pp. 34–5); 'in its ["actuality"] pregnant sense of ἐντελέχεια it connotes a product not a process' (Graham 1988, p. 54); 'the actuality is a particular state of an appropriate object.' (Gill 1991/94, p. 18); 'when Aristotle says in *De Anima* ii 1 that the soul is the ἐντελέχεια of the body having δυνάμει (i.e., of seed), he means that the state of possessing the soul is the state of having been generated from the appropriate active and passive powers' (Menn 1994, p. 105); 'the final *entelecheia* state' (Bechler 1995, p. 8).

Aristotle also uses ἐντελεχείᾳ to differentiate and order cognitive states, such as knowledge and perception. Consider three kinds of knowing. All humans potentially know Greek, insofar as they can learn it; of these, some have actually learned Greek, and so can potentially use it to read Greek philosophy; of these some are actively using their knowledge of Greek to read Empedocles. The last case is knowledge 'in a state of completion', since it is actively being used (*Anima* ii 5, 417^{a}29). Perception is said to be 'in a state of completion' when a real object of perception is apparent to an appropriate faculty such as vision (*Anima* ii 8, 431^{b}25–6).

A more problematic use of the term, in Aristotle's definition of motion, will be discussed at length in Chapter 5.

Aristotle uses ἐντελέχεια in another important definition, when he says that 'the soul is *a state of completion—the first* of a natural body that is potentially alive' (ἐντελέχεια ἡ πρώτη, *Anima* ii 1, 412^{a}27–8). We can relate this definition to the use of ἐντελέχεια to designate the fully developed adult specimen, capable of reproduction. We have already seen a case of such usage where we were told that the account of the powers or capacities of the soul depends on comprehending the completed state of the organism (ἡ ἐντελέχεια, 415^{b}15).

In connection with this, Aristotle uses the term to designate the most completely developed kind of substance. A thing is more truly what it is when it is ἐντελεχείᾳ than when it is only potentially so (*Phys* 193^{b}7–8). For example, a seedling is potentially a tree, and a seed is potentially a seedling; now a seedling is more a tree than a seed, and a sapling even more so, and a mature oak completely so. This stipulation indicates how parts, qualities, and in general capacities and powers are to be understood: with reference to a specific living thing in a state of completion. The generation and growth of animal parts cannot be understood apart from the mature organism, because the parts cannot be generated and grown except on the way to the completion of the whole animal (*GA* ii 1, 734^{a}30, ^{b}35). In fact, Aristotle takes it as a general proposition that 'all things that come into being come from what is in a state of completion' (*Anima* iii 7, 431^{a}3). Only something in a complete state can generate a substance (*Meta* vii 9, 1034^{b}17); no substance can consist of other substances that are in a complete state (*Meta* vii 13); and each substance is in a complete state and is a definite nature (ἐντελέχεια καὶ φύσις τις ἑκάστη, *Meta* viii 3, 1044^{a}9). Our interest here is not in the analysis of these complex metaphysical doctrines, but merely the fact that the term is of central importance to Aristotle, and is a neologism that deliberately conveys teleological notions crucial to his philosophy. We can drive the point home by considering a lengthy passage in which Aristotle argues that ἐνέργεια (activity or functioning) is prior to δύναμις (power or capacity) with respect to substance. Notice how he builds up to the description of ἐντελέχεια as that state towards which the function is directed.

> But it [activity or functioning, ἐνέργεια] is also prior to that [power, δύναμις] in substance (οὐσίᾳ). [**a**] First, because the things posterior in generation are prior with respect to their form and substance, for example man is prior to boy, and human to sperm. For one has the form, the other does not. [**b**] Second, because everything generated proceeds to a

principle [lit. 'beginning'], i.e. an end. For the [cause] for the sake of which is a principle (ἀρχὴ γὰρ τὸ οὗ ἕνεκα), and that which is generated is for the sake of the end (τοῦ τέλους δὲ ἕνεκα ἡ γένεσις). And the internal functioning is an end (τέλος δ ἡ ἐνέργεια), and it is for its benefit that the capacity is acquired. For it is not in order to have eyes that we see; rather animals have eyes in order to see. Similarly, people acquire the skill of construction in order that they may build, and theory in order that they might theorize. But we do not theorize in order to have the capacity to contemplate, unless we are practicing. But those who are practicing are not contemplating except in this [special] sense, otherwise they have no *need* to contemplate.[56] [c] Third, the matter is a capacity because it could come *into* the form (εἰς τὸ εἶδος), and when it is *in*ternally-functioning (ἐνεργείᾳ), then it is *in* the form (τότε ἐν τῷ εἴδει ἐστίν). And similarly for the other cases, even when the end is motion. Because, just as teachers think that their end is indicated by pointing to the students in active functioning (ἐνεργοῦντα), so nature is like that. For if it was not, then there will be something like Pauson's *Hermes*. For it will then be unclear whether knowledge is *internal* or external (ἔσω ἢ ἔξω), as it is with the condition of the artwork.[57] For the function is the end, and the *internal function* is said in the sense of the function, and that is why the term *internal function* is derived from the function and extended to the thing *in a state of completion*. (τὸ γὰρ ἔργον τέλος, ἡ δὲ ἐνέργεια τὸ ἔργον, διὸ καὶ τοὔνομα ἐνέργεια λέγεται κατὰ τὸ ἔργον καὶ συντείνει πρὸς τὴν ἐντελέχειαν). (*Meta* ix 8, 1050ª4–23)

The passage makes it clear that Aristotle intends each of the pieces of the compound term ἐντελέχεια to be significant. Both functioning and the completion have to be understood as internal—in this passage Aristotle obsessively uses the term 'in' or 'into' (ἐν, εἰς, ἔσω) and 'in' in compounds (ἐνέργεια, ἐνεργοῦντα, ἐντελέχειαν). This is something the translations 'actuality' and 'activity' fail to convey.[58] But functioning has to be understood as a process towards or transition to a complete state, an end (another thing that the standard translations fail to convey). What we need to discuss further is how the internal functioning relates to the complete state of the specific organism or substance. But that is a question irresolvable on terminological grounds, and so we delay its discussion until Part II.

3.5 AXIOLOGICAL TERMINOLOGY: THE GOOD, FINE, ETC.

We have already seen notions like 'the good' (τἀγαθόν) in the names of the causes, and 'the best' (τὸ βέλτιστον) in an elaboration of them (e.g. 194ª33). The phrase 'the native excellence' (τῆς οἰκείας ἀρετῆς) was used in a definition of 'complete' (τέλειον), in connection with core teleological notions like 'end' (τέλος), and 'the for the sake of which' (τὸ οὗ ἕνεκα). It might seem strange that Aristotle should utilize

[56] In the interpretation of this line I have read ἢ οὐδὲν δέονται θεωρεῖν for ἢ ὅτι οὐδὲν δέονται θεωρεῖν (dropping ὅτι as an intrusion from the following line), following Ross' first of three suggestions (*Aristotle's Metaphysics*, vol. 2, pp. 262–3).

[57] Probably a trick painting, but possibly a statue. See Ross, *Aristotle's Metaphysics*, vol. 2, pp. 263–4.

[58] Menn 1994, p. 101 n. 38.

such axiological terms, which are at home in ethics and perhaps politics, but seem out of place in domains like physics and biology. Alan Gotthelf has argued, in fact, that Aristotle's use of such terms, in his biology at least, is merely 'heuristic', and that Aristotle is just using more accessible terms for technical ones like 'capacity' and 'actuality'.[59] The problem with this view is that it ignores the fact that the cause for the sake of which means not just aim (i.e. the function or activity to be achieved), but also beneficiary. When we understand that the objects of teleological explanation must be understood as beneficiaries, it becomes clear that we must understand the axiological terms used to gloss teleological terms literally; that which benefits something is good for it. Consider yet another formulation of the teleological scientific principle.

> Nature makes everything for the sake of something, and this is something good (τὴν φύσιν ἕνεκά του ποιεῖν, τοῦτο δὲ ἀγαθόν τι) (*Somn* 455B17–18)

Aristotle in similar expressions of the scientific principle often uses different terms in lieu of 'good' (ἀγαθόν), such as 'fine' (καλόν). He also uses comparative and superlative terms, such as 'better', 'best', and 'finest' (βέλτιον, *GA* 717ª16; βέλτιστον, *PA* 687ª16; ἄριστον, IA 704B17; κάλλιστον, *Juv* 469ª29). In the following passage, Aristotle discusses the comparative and superlative terms. He has just enumerated the three other causes, and completes his account by saying that the terms are to be used with reference to a specific thing:

> And [there are also those causes] as the end and the good of each thing, because that for the sake of which tends to be the best and the end of each thing. And do not take as different [in this context] the good itself from the apparent good (τὰ δ' ὡς τὸ τέλος καὶ τἀγαθὸν τῶν ἄλλων· τὸ γὰρ οὗ ἕνεκα βέλτιστον καιˊ τέλος τῶν ἄλλων ἐθέλει εἶναι· διαφερέτω δὲ μηδὲν εἰπεῖν αὐτὸ ἀγαθὸν ἢ φαινόμενον ἀγαθόν). (*Phys* ii 3, 195ª23–6)

Aristotle says that the apparent good and the good are not to be distinguished here because the point that he is making is simply that something may be caused to act for what it mistakenly thinks is good, even if that thing is not really so. For example, I may perceive my dinner as nutritious when in reality it has been poisoned.[60] Otherwise, the teleological explanation is understood to apply to what is in fact

[59] Gotthelf 1988.

[60] The background here is Plato's distinction between the real and the apparent good (see, e.g., *Meno* 77d and f., *Rep* 505de, *Phil* 20d, and esp. *Grg* 467c and f.). Plato denies that the apparent good can possibly produce action. Aristotle's point is simply that, as far as explanation is concerned, both that which appears good (but really is not) and that which really is good are equally efficacious in producing action. A button might exist for the sake of launching a nuclear weapon; I might buy a car and then die in it in an accident; and a cat might try to escape the veterinarian's surgical knife. The button, my purchase, and the cat's escape attempt can be explained 'teleologically', as if these things exist or happen for the sake of something good (a pre-emptive attack, transportation to work, avoidance of pain), even if the outcome in reality is bad, like death, disease, and the end of the world. The outcomes in the examples are only apparent goods, not real goods. But they count as goods in explanations all the same (to questions like: why was there a button put there? why did you buy a car? why did the cat attempt to avoid surgery?). On the good and the apparent good, see *Top* 146ᵇ36–7ª11, *Anima* 433ª27, *Motu* 700ᵇ28–9, *Meta* 1072A27–8, *NE* 1113ª16, *EE* 1227A20–31, *Rhet* 1369ª2–4,B19.

better for the thing in question. There is a very important passage in which Aristotle makes this clear while qualifying the sense in which the normative term better (βέλτιον) is to be used in teleological explanation.

> Since, then, nature is for the sake of something (ἡ φύσις ἕνεκά του), this cause too should be known, and one must demonstrate in every way the reason why, for example that [**a**] as a result of this, that is necessary, either absolutely, or for the most part (ὅτι ἐκ τοῦδε ἀνάγκη τόδε οἷον τὸ δὲ ἐκ τοῦδε ἢ ἁπλῶς ἢ ὡς ἐπὶ τὸ πολύ); and [**b**] if this is going to be then that will be present (just as from the premises the conclusion); and [**c**] that this is what it is to be something (ὅτι τοῦτ᾽ ἦν τὸ τί ἦν εἶναι); and [**d**] because better thus—not absolutely, but in relation to the reality of the thing concerned (διότι βέλτιον οὕτως, οὐχ ἁπλῶς, ἀλλὰ τὸ πρὸς τὴν ἑκάστου οὐσίαν). (*Phys* ii 7,198^{b}4–9)

The exact import of the crucial gloss that Aristotle put on the teleological cause in [**d**] is the subject of much debate, but our review of teleological language in general throughout the corpus has put us in an excellent position to understand what it means. Consider the first part: 'Because better in this way' (διότι βέλτιον οὕτως). We have seen how the cause for the sake of which is connected with axiological terms like 'good', 'fine', and their comparatives and superlatives. We have also seen axiological language used in the context of the notion of completion (τέλειον), as in the stipulation that completion be determined in accordance with the kind of excellence native to a thing (κατὰ τὸ εἶδος τῆς οἰκείας ἀρετῆς). Now Aristotle places a similar constraint on the use of normative terms in this kind of explanation with the qualification 'not without qualification, but with respect to the substance of each thing' (οὐχ ἁπλῶς, ἀλλὰ τὸ πρὸς τὴν ἑκάστου οὐσίαν). No examples are given here, but we have already seen the soul of a living thing called 'that for the sake of which and a substance' (415B10–12). In fact, we have seen throughout this chapter how teleological notions like 'the for the sake of which', 'the end', 'completion', 'the developed being', and 'the good', are always applied to some specific kind of thing.[61] The stipulation is also explicitly attached to Aristotle's teleological scientific principle in *On the Progression of Animals*: 'Nature makes nothing in vain, but always as far as possible the best *with respect to each kind of living thing* (περὶ ἕκαστον γένος ζῴου). That is why if there's a better way, this is how it is in accordance with nature' (*IA* 704B15–18).

In the same work, Aristotle reiterates the principle, but with respect to the individual entity. 'Nature makes nothing in vain, but always regards what is the best possible for each thing, preserving the individual substance and that which it is in itself (ἑκάστῳ <ἐκ> τῶν ἐνδεχομένων, διασώζουσαν ἑκάστου τὴν ἰδίαν οὐσίαν καὶ τὸ τί ἦν αὐτῷ εἶναι)' (*IA* 708^{a}9–12).

[61] Here is a summary of the kind of specifications we have seen throughout this chapter: one in kind [or 'species'] (εἴδει δ᾽ ἕν); of the possibilities concerning each (τῶν ἐνδεχομένων περὶ ἕκαστον); with respect to its kind [or 'genus'] (πρὸς τὸ γένος); according to the kind of excellence intrinsic to them (κατὰ τὸ εἶδος τῆς οἰκείας ἀρετῆς); in their specific kind [or 'genus'] (ἐν ἑκάστῳ γένει); the things different in kind are completed by different things, we think, for this is apparent even in natural things (τὰ γὰρ ἕτερα τῷ εἴδει ὑφ᾽ ἑτέρων οἰόμεθα τελειοῦσθαι. οὕτω γὰρ φαίνεται καὶ τὰ φυσικά).

The proviso that teleological explanation (i.e., using the cause for the sake of which to account for natural things) must be applied not absolutely, but with respect to either an individual entity or a specific kind will become even clearer in the next chapter when we discuss Aristotle's conception of nature as an *internal* principle, and his critique of Plato's position on the existence of a universal, univocal form of the good.[62] Further, we will see in Part II the importance of the doctrine with respect to the different kinds of entities that make up Aristotle's cosmos: stars, elements, plants, animals, humans, households, cities, and so forth. In the case of biological entities—organisms—we will see that there is a point to applying such terminology both to the specific kind (ἕκαστον γένος ζῴου) and to the individual entity (ἑκάστου τὴν ἰδίαν οὐσίαν). Such a specification is crucial to Aristotle's account of reproduction. For now, we note that Aristotle emphasizes specificity in the application of teleological explanations, and expects that they indicate why an organ or behavior or arrangement is better for the sake of the animal (either individually or as a kind) that has it, and not simply in general. Even when he says, speaking loosely, that 'perhaps even in inferior creatures there is some natural good stronger than themselves which aims at their native good (ἴσως δὲ καὶ ἐν τοῖς φαύλοις ἔστι τι φυσικὸν ἀγαθὸν κρεῖττον ἢ καθ' αὑτά, ὃ ἐφίεται τοῦ οἰκείου ἀγαθοῦ)' (*NE* x 2, 1173^{a}4–5), notice that the phrase 'which aims at their native good' shows that even this 'stronger' good would apply to the creature itself, no matter how lowly (recalling the language of τῆς οἰκείας ἀρετῆς in 1021B17, 22).[63] The restriction on teleological explanation, that it be applied to natural kinds, is crucial because it shows that the use of normative terminology is not meant to imply an 'external value judgment' or even necessarily an absolute axiology.[64] Nonetheless, it shows how normative terminology can be applied in a specific and yet non-relativistic way, and in a way that is not merely heuristic.[65]

[62] Charleton uses this point to compare Aristotle's teleology with Plato's in a way that is quite instructive. He says that Aristotle 'develops a teleology which is not Platonic. The action of organisms by which certain changes are brought about is to be explained as action for the benefit to the organism of these changes' (1985, p. 149).

[63] The point is missed by Owens (1968, p. 168), who takes the passage to support a broadening of teleology beyond the individual.

[64] As Balme puts it: 'Aristotle too expresses the distinction between the causes as between necessity and "the better" or "the good", although he makes it clearer than Plato does that "good" is not an extrinsic value-judgment but means the useful or advantageous from the animal's viewpoint' (Balme 1987b, p. 277). See also Lennox 1992.

[65] Cf. *Protr* 80.20–2 where Aristotle distinguishes between coming to be, coming to be correctly, and coming to be nobly or as something fine (καλῶς), and then identifies the latter two. This invocation of normative terminology might be responding to the view of Plato, *Tim* 90e f., which maintains that animals come to be through reincarnation of corrupt and bad humans. Aristotle needs to contradict the negative axiological implications of the *Timaeus*' anti-teleological theory of devolution. And so he shows how natural things and their parts come to be for the sake of something good and noble. Even under Plato's theory, the generation of animals and their parts could be correct, but it is for the sake of punishing and harming wicked humans, not for the sake of the what's better for the animal itself. I discuss further Plato's account in Ch. 4.

4

Teleological Dialectic

Aristotle repeatedly states that, 'we think we know when we know the explanation or cause.'[1] One might reasonably ask[2] why he says, 'we *think* we know . . . ' instead of just 'we know . . . '. After all, he states clearly that all knowledge is knowledge of causes or explanations.

The key to the hesitation seems to me to be the number of the term 'the cause' (τὴν αἰτίαν, τὸ διὰ τι, τὴν πρώτην αἰτίαν); it is singular. Aristotle's full view is that knowledge involves a plurality of causes, if possible all four kinds of cause. In *Posterior Analytics*, Aristotle says that all the causes (πᾶσαι αὗται) are 'demonstrated through the middle term' (διὰ τοῦ μέσου δείκνυνται, ii 11, 94^{a}23–4). In *Physics* he repeats the point; 'since all knowledge of nature concerns the four causes, it is naturally necessary to demonstrate the reason in *all* these ways' (ii 7, 198^{a}21–4).

The way that he establishes the position that a full account refers to multiple causes is dialectically—through a conversation with his predecessors. They think that we know by knowing the cause, and Aristotle moves from this common ground (he too holds that knowledge has to do with knowing the cause) to show that in order to really know, one must know all the relevant causes. When they describe the cause of the whole universe, or the primary cause of anything at all, they 'think they know'. Their mistake, he thinks, is that they all latched on to one or, at the most, two causes. Thus at best they manage a sketchy picture, not a realistic representation. Aristotle's analysis of the kinds of cause, and his dialectical estimation of his predecessors, aims to establish all the causes that must be determined in order to explain something completely.

We earlier emphasized that what are called 'the four causes' are more properly understood as 'the four kinds or modes of cause'. In this chapter we will discuss various causes and how they fit under the headings of Aristotle's scheme of causes. The discussion will follow Aristotle's procedure of examining causes in connection with an exemplary exponent of the cause whose philosophy can be encapsulated,

[1] 'We think we know when we know the cause' (ἐπίστασθαι οἰόμεθα ὅταν εἰδῶμεν τὴν αἰτίαν) (*Post* ii 11, 94^{a}20; cf. i 2, 71^{b}10–13); 'We think we know each thing not before we grasp the reason for each thing' (εἰδέναι δὲ οὐ πρότερον οἰόμεθα ἕκαστον πρὶν ἂν λάβωμεν τὸ διὰ τί περὶ ἕκαστον) (*Phys* ii 3, 194^{B}18–20); 'We claim to know each thing when we think we understand the primary cause' (εἰδέναι φαμὲν ἕκαστον, ὅταν τὴν πρώτην αἰτίαν οἰώμεθα γνωρίζειν) (*Meta* i 3, 983^{a}25–6).

[2] James Lennox asked this question in a colloquium at the University of Toronto in 2000.

for dialectical purposes, with reference to that cause: luck (Empedocles), necessity and spontaneity (Democritus), intelligence (Anaxagoras, Diogenes of Apollonia), god (Xenophon's Socrates), and form (Plato).[3] The examination results in an Aristotelian critique of competing attempts to explain how functional things come to be as a benefit to those who have them. Aristotle assumes that everyone is trying to explain the same phenomena (such as the suitability of teeth for grinding or cutting food), but that they offer different causes to account for its explanation. Empedocles, for example, is said to refer the cause of this to luck. The central issue should thus be understood, as far as Aristotle is concerned at least, as a dispute about what is the best candidate for the cause of things that are for the sake of something.

In line with this view, it is important to notice that Aristotle never outright rejects the views of his predecessors. Rather he, much more effectively, co-opts them by an *a fortiori* argument. He shows how if the cause that they have identified is operative, then nature is all the more so a cause. For example, he argues that if luck is reckoned a cause, then nature and intelligence are all the more causes, since nature and intelligence are intrinsic causes of that which luck is incidentally a cause.

4.1 LUCK (EMPEDOCLES)

Aristotle recognizes luck (or chance) and the spontaneous (or automatic) as causes (ἡ τύχη καὶ τὸ αὐτόματον τῶν αἰτίων, *Phys* 195^{b}31, cf. 196^{a}11–16), but wonders what kind of causes they are, that is, which heading of the four they fall under (πῶς εἰς τὰ διωρισμένα αἴτια ἐμπίπτουσιν, 196^{b}8–9).

The first determination of luck and the spontaneous is a negative one: luck does not come about always or for the most part. Among things that come into being, some do always (i.e. necessary things), others for the most part (i.e. natural things), and others neither always nor for the most part. Things that come to be by luck and spontaneity are of this last kind (196^{b}23–31).[4]

The spontaneous is the more general—it includes luck. Spontaneous things can happen either as if they were for the sake of something, or in vain. Aristotle stipulates that spontaneity applies to inanimate objects and living things incapable of intention. Now if a stone were loosened as a trap so that as I walked under an arch it would fall and crush me, then we would be in the realm of deliberate

[3] Note that the purpose of this examination is to comprehend Aristotle's procedure and use of his predecessors, not to reconstruct the ideas of his predecessors or even assess the historical veracity of his account.

[4] Judson calls the condition of not happening always or for the most part, happening 'rarely' (as opposed to 'regularly'). He has a good analysis of the relationship between luck and things that happen rarely (Judson 1991, esp. sec. II). For the stipulation that lucky events happen rarely, see also *Post* i 30, 87^{b}19–27; *Cael* i 12, 283^{a}32–^{b}1, *GC* ii 6, 333^{b}4–7; *EE* vii 14, 1247^{a}31–3; *Rhet* i 10, 1369^{a}32–^{b}5 (Judson 1991, p. 76 n. 7).

(non-accidental) action for the sake of something (killing me). It is only accidental and spontaneous if its cause was non-intentional (even though the effect appears intentional). We will examine spontaneity as a cause more closely in connection with Democritus.

When something comes about through the action of something capable of intention, but the result was not intended, it is said by Aristotle to come about by luck. Thus both thought and luck pertain to things that have choice and are for the sake of something. As Aristotle says, 'intention and luck are concerned with the same thing, for choice involves intention (περὶ τὸ αὐτὸ διάνοια καὶ τύχη· ἡ γὰρ προαίρεσις οὐκ ἄνευ διανοίας)' (*Phys* 197ª6–8). Aristotle's example is someone going to the market to collect subscriptions for a festival, who happens to run into someone owing him money (for a debt unrelated to the subscriptions), and who just so happened to pass through the market on the way to the theater. Assuming his debtor doesn't frequent the market (say he's from out of town), the creditor just luckily ran into him: 'the recovery is the end, not among the causes in him, but among choices and intentions' (ἔστι δὲ τὸ τέλος, ἡ κομιδή, οὐ τῶν ἐν αὐτῷ αἰτίων, ἀλλὰ τῶν προαιρετῶν καὶ ἀπὸ διανοίας, *Phys* ii 5, 197ª1–2). Luck, for Aristotle, is the cause to which we refer in describing spontaneous occurrences—motions or changes—when they are in the realm of choice, and thus for the sake of something.[5] Only they occur incidentally (κατὰ συμβεβηκός), and thus they are indeterminate:

> Of the things that come about, some come about for the sake of something, and others do not (τῶν δὲ γιγνομένων τὰ μὲν ἕνεκά του γίγνεται τὰ δ' οὔ). Of these, some are in accordance with intention, and others are not in accordance with intention, though both are for the sake of something (ἄμφω δ' ἐν τοῖς ἕνεκά του). Thus it is clear that besides the necessary, and that which comes about for the most part, there are other things for which it is possible to be for the sake of something. Whatever things that are due to intentional activity and due to nature are for the sake of something (ἔστι δ' ἕνεκά του ὅσα τε ἀπὸ διανοίας ἂν πραχθείη καὶ ὅσα ἀπὸ φύσεως). But when these things come about incidentally (κατὰ συμβεβηκὸς), we say they are by luck (ἀπὸ τύχης). For just as a thing exists, so it is possibly a cause, either intrinsically or incidentally (τὸ μὲν καθ' αὑτό, τὸ δὲ κατὰ συμβεβηκός). For the house-builder is intrinsically the cause of a house, incidentally a pale man or a musician. The intrinsic

[5] There is a debate in the literature about whether luck is an incidental efficient cause or an incidental final cause. Aristotle clearly says that, 'as for the ways in which they [luck and spontaneity] are causes, both are sources from which the change originates' (198ª2–3). Thus luck is a cause as mover or source of change. But that's not the end of the story, for luck also, 'clearly . . . is an incidental cause in connection with those things chosen for the sake of something' (197ª5–6). And so luck is a cause, incidentally, in both senses. To use the standard example, the incidental collection of the debt: 'the recovery is the end, not among the causes in him, but among choices and intentions' (197A1–2). There are plenty of movements that are totally unconnected: all the people you happen to walk by on your way to work in a new city. But the fact that you pass by these people is not, for Aristotle, a matter of luck, since none of these passages occur in the realm of choice or thought. What is crucial to something being by luck is that it is both a source of motion or change, and that it is an incidental cause for the sake of something. Judson maintains that luck is an 'efficient cause' only (1991, pp. 79–80), against Lennox 1982, p. 233 (cf. Lennox 1984).

cause is definite, and the accidental indefinite. For the number of incidents for one thing is unlimited (τὸ μὲν οὖν καθ' αὑτὸ αἴτιον ὡρισμένον, τὸ δὲ κατὰ συμβεβηκὸς ἀόριστον· ἄπειρα γὰρ ἂν τῷ ἑνὶ συμβαίη). (*Phys* ii 5, 196^{b}17–29)

We saw at the end of Chapter 2 that incidental causes must be excluded from a scientific account of why something happens or happened. The fact that a sculptor happens to be sunburned or a guitar player is incidental to the making of a statue: it is wrong to say, without qualification, that a sunburned person or guitar player is a cause of the statue. There are an indefinite number of incidentals for a cause like this: thus the maker of a statue might be wearing a hat or not, have three brothers or none, and like or hate chocolate ice cream. But such incidentals, whether lucky, unlucky, or irrelevant, cannot be integrated into an account, because they are indefinite: there are an infinite number of things in an indefinite relation to what is being explained: 'it is right to say that luck is something incalculable (παράλογον). For an account applies to what is always or for the most part, but luck comes about in cases besides these. So since the causes like this are indefinite, so too luck is indefinite' (*Phys* ii 5, 197^{a}18–21). According to Aristotle, then, it is impossible to formulate an account of lucky events, because they happen irregularly. Science can only account for what happens regularly. And because there are an infinite number of incidental causes for every single thing, you could not determine the lucky thing or event coherently.[6] As he says elsewhere, plainly, 'There will be no knowledge of it because it lacks a limit' (ἐπιστήμη δ' οὐκ ἔσται αὐτοῦ διὰ ἀπειρίαν, *EE* vii 14, 1247B12–14). There is no provision here for determining the incidents statistically or through correlations. This kind of luck is wholly untamed; it is indefinite (ἀόριστον; *Phys* ii 4, 196^{b}28, 197^{a}9, 20, 21; cf. *Protrep* 80.4), because the number of incidental things is infinite (ἄπειρα, 196^{b}28; ἀπείρων καὶ ἀορίστων, *EE* vii 14, 1247B12) and thus it has been well-said that luck is 'inscrutable to humans' (ἄδηλος ἀνθρωπίνῃ, 196^{b}6; cf. αἰτίαν ἄλογον ἀνθρωπίνῳ λογισμῷ, *EE* vii 14, 1247B7–8). In this way, luck is in opposition to that which happens 'always or for the most part'.

Thus events that are caused by luck cannot be explained: luck is a cause, but not an explanatory cause.[7] If this sounds contradictory, it must be recalled that Aristotle is trying to show both that (1) luck is a cause[8] that can and should be accounted for—it is a kind of cause for the sake of which in the ways described, and (2) that luck is not actually a cause of anything at all. 'Things do, in a way,

[6] As Judson aptly puts it (though I object to imputing the notion of 'laws of nature' to Aristotle): 'there is no finite specification of the possible incidental causes which a given type of event might have, and there is equally no finite specification of the possible incidental "effects" which a given type of event might have. For this reason, any putative "laws" that connect types of events under incidental causation would simply be constituted by infinitely long disjunctions, and these could not, in Aristotle's view be objects of knowledge' (1991, p. 79).

[7] Lennox 1984. Cf. Annas, who says that Aristotle 'does not envisage that a statement might truly pick out a causal relation, but in a quite unexplanatory way' (1982, p. 320).

[8] τύχη . . . ἀνάγκη καὶ εἶναι καὶ αἰτίαν εἶναι (*EE* vii 14, 1247^{b}2–3).

occur by luck, for they occur incidentally and luck is an incidental cause. But strictly speaking it is not the cause of anything' (*Phys* 197ª12–14).

Aristotle does not think that any of his predecessors has given any account of luck, although many have made use of it. He says that Empedocles, for example, refers to luck in describing the motion of the air element, and the formation of animal parts.

> Certainly the early physicists found no place for luck among the causes that they recognized: love, strife, intelligence, fire, or the like. This is strange, whether they supposed that there is no such thing as luck or whether they thought there is but omitted to mention it—and that too when they sometimes used it, as Empedocles does when he says that the air is not always separated into the highest region, but 'as luck has it'. At any rate he says in his cosmogony that 'it happened to run that way at that time, but it often ran otherwise'. He tells us also that most of the parts of animals came to be by luck. (*Phys* ii 4, 196ª17–24)

Aristotle says that Empedocles, in his cosmogony, did not assign definite natural motions to the elements, or did not consistently do so.[9] His moving causes, love and strife, move in opposite ways, the one causing combination, the other separation. Since these cause the elements to move in opposite directions (so ether moves sometimes up, sometimes down, depending on whether love or strife is active), the elements can have no intrinsic nature that determines how they will move. The result is that the elements like ether move 'as luck has it'. A similar complaint is leveled against Empedocles' account of the formation of animal parts.

> What, then, is to stop parts in nature too from being like this—the front teeth of necessity growing sharp and suitable for biting, and the back teeth broad and serviceable for chewing the food, not coming to be for this, but incidentally? And similarly with the other parts in which the for the sake of which seems to be present. So when all turned out just as if they had come to be for something, then the things, suitably constituted as a spontaneous outcome, survived; when not, they died and die, as Empedocles says of the human-headed calves. (*Phys* ii 8, 198B23–32, Clar)

Susan Meyer has pointed out that Aristotle is opposing the idea that morphogenesis happens incidentally, as opposed to by nature. The issue here is not one of reductionism,[10] but of eliminativism. For Aristotle takes the implication of what Empedocles is saying as not that an animal's nature is reducible to the elements, but that the animal has no nature and is only an incidental collocation of elements.[11] Thus Empedocles does not reduce the nature of animal, he eliminates it.

[9] In *GC* he says, 'though strife separated, it was not by strife that the ether was borne upwards. On the contrary, sometimes he attributes the movement to something like τύχη ('for thus, as it ran, it happened to meet them then, though often otherwise'), while at other times he says it is the nature of fire to be borne upwards, but the 'ether' (to quote his words) 'sank down upon the earth with long roots' (*GC* 334A1–5, ROT).

[10] S. S. Meyer 1992, pp. 90, 108–12. Against: Cooper 1982, pp. 205–8, Gotthelf 1986, p. 222, Nussbaum 1978, pp. 67–8, and Charles 1988, pp. 1–5.

[11] He makes the point quite aggressively: 'it is much more difficult [for him] to account for generation in accordance with nature. For the things which are generated by natural processes all do so either

His elements are the only intrinsically real things, according to Aristotle; everything else is an accident of their combination. But if we combine Aristotle's criticism of the cosmogony with that of the zoogony, then animal natures are eliminated in favor of the natures of the elements (whose motions incidentally combine to form animals), but the nature of the elements themselves were shown to be incidental themselves, 'as luck has it'. The result is that Empedocles, according to Aristotle's criticism, has no theory of nature, but has embraced incidental causes and luck without even offering an explicit account of how luck works as a cause.

Aristotle instances the development of the backbone to show why referring to incidental causes is explanatorily inadequate.

> Empedocles, then, was in error when he said that many of the characters presented by animals were incidental (διὰ τὸ συμβῆναι) during their development; for instance, that the backbone was divided as it is into vertebrae, because it happened to be broken owing to the contorted position of the fetus in the womb. In so saying he overlooked the fact that propagation implies a creative seed endowed with certain formative properties. Secondly, he neglected another fact, namely, that the parent animal pre-exists, not only in form, but actually in time. For man is generated from man; and thus it is the possession of certain characters by the parent that determines the development of like characters in the child. (*PA* i 1, 640ª19–26)

Empedocles' account of formation of the backbone as an incidental result of the contorted position of the fetus in the womb fails to explain how it is that this result regularly happens. Aristotle's genetic explanation, about which we will have much to say in Chapter 5, accounts for the regular formation of animal parts, because they are hereditarily transmitted as part of a genetic program in the semen. Empedocles, he says, cannot account for nature, and fails to comprehend it as a cause. And this failure Aristotle takes to have very serious repercussions. For depending on luck, and without a coherent notion of how nature acts as a cause for the sake of which, natural science is impossible.

> it would be necessary for the seeds to come about as luck would have it. Generally, however, the man who says that abolishes natural things and even nature (ὅλως δ' ἀναιρεῖ ὁ οὕτως λέγων τὰ φύσει τε καὶ φύσιν). For by nature are whatever things that arrive at some end by changing continually from some principle in them. But each thing does not come to the same thing in each case or as luck has it, but rather it comes to the same thing, always or for the most part, if there is no impediment. But that for the sake of which, and that which it is for the sake of (τὸ δὲ οὗ ἕνεκα, καὶ ὃ τούτου ἕνεκα) could come to be by luck. For example, we say that by luck the stranger came, paid ransom, and left, when the act of coming was as if for the sake of this (ὥσπερ ἕνεκα τούτου), even though he didn't come for the sake of it.

> always or for the most part in a given way . . . what is the cause determining that man is generated from man, that wheat (instead of an olive) is generated from wheat, either always or for the most part? . . . the cause in question is the substance of each thing—not merely (to quote his words) "a combining and a divorce of what has been combined" . . . The cause, therefore, of the things which exist by nature is that they are in such and such a condition; and it is this which constitutes the nature of each thing—a nature about which he says nothing. What he says, therefore, tells us nothing about nature' (*GC* 333B4–18).

And this is incidental. For luck is among the incidental causes (ἡ γὰρ τύχη τῶν κατὰ συμβεβηκὸς αἰτίων), according to what we said before. But when something comes about always or for the most part, it is neither incidental nor by luck. In the case of that which is natural, it comes about this way always, if there is no impediment. (*Phys* ii 8, 199^{b}13–26; cf. *Anima* ii 4, 416^{b}23–5 and *GA* i 18, 722B17–24)

To summarize, Aristotle's critique of Empedocles aims to show that luck, and incidental causes generally, are insufficient to account for both the regularity and the functionality that are the hallmark of nature, whether on the level of animals, or of the elements. Thus Aristotle strongly contrasts luck and spontaneity as causes with nature.

The furthest removed from the things by luck are those things that come about by nature. For when something comes about contrary to nature (παρὰ φύσιν), we say that this comes about spontaneously, not luckily. But even this is different: for spontaneity is an external cause, while nature is an internal cause (τοῦ μὲν γὰρ ἔξω τὸ αἴτιον, τοῦ δ᾽ ἐντός). (*Phys* ii 6, 197^{B}32–37)

There is an emphasis on the point that the principle is internal: 'nature is a principle and cause of being moved and made to rest *in* that to which it belongs primarily—intrinsically—and not incidentally' (οὔσης τῆς φύσεως ἀρχῆς τινὸς καὶ αἰτίας τοῦ κινεῖσθαι καὶ ἠρεμεῖν ἐν ᾧ ὑπάρχει πρώτως καθ᾽ αὑτὸ καὶ μὴ κατὰ συμβεβηκός, *Phys* ii 1, 192^{b}21–3); 'each natural thing "has *in* itself a principle of motion and rest"' (ἐν ἑαυτῷ ἀρχὴν ἔχει κινήσεως καὶ στάσεως, *Phys* ii 1, 192^{b}13–14); 'nature is always *in* a subject' (καὶ ἐν ὑποκειμένῳ ἐστὶν ἡ φύσις ἀεί, *Phys* ii 1, 192^{b}34). As we saw in examining *Metaphysics* ix 8, 1050^{a}4–23, the prefix ἐν- in the terms ἐνέργεια and ἐντελεχεία is anything but incidental.

The importance of the distinction between internal and external principle (or origin or source) cannot be overstated.[12] Some interpretations are called into question simply by not sufficiently attending to this fact.[13] For example, when Owens says, 'the whole teleology of nature is found to be directed towards something outside nature' (1968, p. 170), the position is prima facie implausible, given that it makes the location of nature as a principle ambiguous, while Aristotle himself could not be more clear.[14] So intense is Aristotle's emphasis on the

[12] Even contemporary discussions of teleology, including those that make no mention of Aristotle, use such a notion. See, for example, Wright, who speaks of 'inherent natural tendencies' (1976, p. 65), which are contrasted with what is 'accidental' (p. 67; cf. pp. 92, 98). And Wright is building on Taylor, who speaks of 'natural or inherent tendencies' (1964, p. 20).

[13] Nussbaum incautiously adopts the term 'internalist essentialist' to describe her use of 'Aristotelian essentialism'—restricting the essentialist analysis to human beings, and not more generally to non-human reality as well. This is an unfortunate choice of words, because when Aristotle uses the notion of internal in his definition of nature, he means internal to the natural substance itself (the star, element, plant, animal, human, etc.). With Nussbaum's use, internalism is restricted to humans, since it takes its stand within human experience. See Nussbaum 1992, p. 208. For a critique of Nussbaum's reading of Aristotle as an 'internalist realist' see Cooper 1988, pp. 554 f. I make another kind of criticism against the view in Ch. 8.

[14] Owens sees in Aristotle an overall 'teleology of nature' which is 'towards something above and outside itself' (1968, p. 167). Contrasted with the 'internal teleology' of the parts of the organism is

internality of goods and ends, that the phrases 'in it as good' and 'in it as end' are listed by Aristotle among the major senses of the term 'in'; this is, he adds, 'that for the sake of which' (ἔτι ὡς ἐν τῷ ἀγαθῷ καὶ ὅλως ἐν τῷ τέλει· τοῦτο δ' ἐστὶ τὸ οὗ ἕνεκα, *Phys* iv 3, 210ª22–3).[15] And recall that Aristotle said that if we are not clear that nature relates to internal functioning then we will have a situation like Pauson's *Hermes*, where we are unable to tell where the principle is located—inside or outside—and the result will be that we are led into illusion (*Meta* i 8, 1050ª4–23). Indeed, broad interpretations of Aristotelian teleology (such as the anthropocentric and holistic interpretations) suffer from this problem: they make it impossible to tell just where the end is located—in the substance itself, in some other substance, or in the relation to something else (like the human race or god or the cosmos as a whole).

It is on this point that natural things are contrasted with products of skill or art, like a bed or a coat: 'insofar as they are products of art, have no tendency of change which is innate' (ἔμφυτον, *Phys* ii 1, 192ᵇ18–19), except incidentally.[16] Incidentally, insofar as they are made of something that has such an innate tendency, principle, or cause of motion, they too have such a principle. For example, if a table is made of wood, then a table has a tendency to burn when lit on fire, but this is incidental to its being a table (although it is intrinsic to wood). A table as a table does not have the property of being flammable (it could be made of iron, or ice, or marble, or covered with fireproofing protection). But the principle of change is external to artifacts, for their principle is in the thing that makes or uses them. In Aristotle's words:

> I say not incidentally (τὸ μὴ κατὰ συμβεβηκός) because someone who happens to be a doctor might be a cause of health for himself. But in this way it is not as someone being healed that he has the medical art, but it is incidental that he is both a doctor and being healed. That is why the roles [doctor and patient] are separate. So it is with each of the things that are made. For none of them has the principle in itself of its making, but these are in something else and external (ἀλλὰ τὰ μὲν ἐν ἄλλοις καὶ ἔξωθεν). For example, for a house, and each other manufactured thing, the principles are in something else and not intrinsic (τὰ δ' ἐν αὑτοῖς μὲν ἀλλ' οὐ καθ' αὑτά), and so for everything whose causes bring them about incidentally (κατὰ συμβεβηκός). (*Phys* ii 1, 192ᵇ23–32)

the 'teleology that extends outside the individual agent, and destines the individual to be sacrificed for a higher good' (p. 170). But there is no evidence, so far as I can see, that nature can operate as an external principle. Similarly, I find no support in Aristotle for the claim that 'the whole teleology of nature is found to be directed towards something *outside* nature, towards intellection' (Owens 1968, p. 170, emphasis added).

[15] See also Morrison 2002, p. 75.

[16] As Aristotle argues, artifacts have no inherent natural tendencies, except insofar as they are composed materially of something that does have such a tendency. But their own principle of motion and end is external. Thus all functions of artifacts are ultimately incidental. That is why it is possible to construct for any artifact incidental functions that have an equivalent explanatory status to any purported 'essential' function they might have. For example, a chair can be used to prop open the door, or a pencil to scratch my ear. This is a deficiency of Wright's account, since he thinks that the notion of 'why it is there' can serve to determine an artifact's essential function (1976, p. 79). But I might make a pencil just to scratch my ear, or a chair just to prop open a door.

Because what is intrinsic is prior to what is incidental, and because luck and spontaneity are incidental causes of that of which nature and intelligence are intrinsic causes (namely, that for the sake of which), it follows that luck and the spontaneous are posterior to nature and intelligence.

what the spontaneous and what luck are has been stated, as has how they differ from one another. Concerning the ways in which they are a cause, each is a source from which motion originates (ὅθεν ἡ ἀρχὴ τῆς κινήσεως). For that of which they are causes—either of things by nature or things from thought—are an unlimited multitude. But since the spontaneous and luck are causes of that which intelligence or nature could bring about, when the cause of these things coming about is incidental, and since nothing incidental is prior to the intrinsic, it is clear that neither is an incidental cause prior to an intrinsic cause. Therefore, spontaneity and luck are posterior to reason and nature (ὕστερον ἄρα τὸ αὐτόματον καὶ ἡ τύχη καὶ νοῦ καὶ φύσεως). Thus the more that the spontaneous is a cause of the heavens, it is necessary that intelligence and nature be a cause prior, both of the entire universe, and of everything else. (*Phys* ii 6, 198[a]1–13)

This argument, which comes at the end of the account of luck and the spontaneous, shows Aristotle's real motivation for explicating these notions. First, by determining that luck and spontaneity are causes for the sake of which, he has shown that they are causes which fit into his fourfold scheme.[17] This is important because it shows that for Aristotle there are both intrinsic and incidental occurrences for the sake of something, which will indicate a difference between explanatory and non-explanatory references to ends as causes. Second, he has shown that those who emphasize luck and the spontaneous in their accounts of nature (cosmogonies, zoogonies, and so forth) are forced to admit that intelligence and nature are *a fortiori* causes. This is so not only because the luck and spontaneity are posterior to intelligence and nature (they presuppose the possibility of non-incidental causes for the sake of something), but also because it is impossible to generate a definite account of what luck causes.

A similar argument applies to art.[18] Because art either completes or resembles nature, it follows that if art is for the sake of something, then nature is so too.

[17] Cf. *Protr* 79.9–80.4, and *EE* vii 14, 1247[b]1 f.

[18] Aristotle has been accused of failing in *Phys* ii to distinguish 'properly between the Agency and Functional model' of teleological causation (Charles 1991, p. 127). Charles leaves it as an open question whether Aristotle adequately distinguishes these anywhere else in the corpus, such as *PA* (pp. 102, 127). Later we will see that he does do so, when we consider his criticisms of art as a model for explaining organisms. For now, we point out that Aristotle need not sharply distinguish between the two kind of teleological causation here, since his point is merely to establish (against the predecessors, i.e. Empedocles, Anaxagoras, and Democritus) that the cause for the sake of which and the end have a bona fide role to play in scientific explanation. Thus his notions of nature and natural processes are not 'in certain important respects, left ill-defined' (Charles 1991, p. 127). Nature as a cause is suitably defined as an internal and intrinsic cause for the sake of something. This definition is illuminated, for the purposes of filling in where the predecessors fail (i.e. dialectical purposes), by the contrast with luck, spontaneity, and necessity, and the comparison with reason and art. As Charles himself points out, Aristotle is concerned to evince the general structure of teleological explanation (of which the Agency and Functional models are species), and it cannot be said in doing so that he has

Whatever things have an end, the prior and successive things happen for the sake of it, and as things naturally become, so each happens, if there is not some impediment. And it is done for the sake of something. Therefore, even if it becomes naturally it is for the sake of something. For example, if a house came to be by nature, it would come to be as houses do now by art. And if the natural things came to be not only by nature but also by art, similarly they would come to be as happens naturally. Therefore the one is for the sake of the other (ἕνεκα ἄρα θατέρου θάτερον). And generally art either completes that which nature is unable to make work, or imitates it (ὅλως δὲ ἡ τέχνη τὰ μὲν ἐπιτελεῖ ἃ ἡ φύσις ἀδυνατεῖ ἀπεργάσασθαι, τὰ δὲ μιμεῖται). So if that which is in accordance with art is for the sake of something, it is clear that so too are things in accordance with nature (εἰ οὖν τὰ κατὰ τέχνην ἕνεκά του, δῆλον ὅτι καὶ τὰ κατὰ φύσιν). For the relation of prior to posterior is the same in the things according both to nature and to art. (*Phys* ii 8, 199ª8–20)

Empedocles sometimes compares the functioning of organs to the working of artifacts, for example seeing to lanterns,[19] and breathing to the clepsydra.[20] In the Aristotelian framework, the acknowledgement that artifacts are for the sake of something forces one to acknowledge that nature is a cause, since art in general imitates nature. Aristotle considers it ridiculous to hold that elements or other parts (homogeneous or heterogeneous parts) incidentally came together and function like artifacts.

What Aristotle has tried to do with his analysis of luck, spontaneity, and art is to show how, if they are causes, and causes for the sake of something, then nature must be a cause for the sake of which all the more so.[21] Luck, spontaneity, and art are external causes: to the extent that they exist for the sake of something at all, that something is external to them. Natures, on the other hand, exist for the sake of something internal to them. Products of art (or skill or craft) are for the sake of whoever makes or uses them, and the closest thing they have to a nature is what they are composed of, and in many cases the relationship between what they are and what they are composed of is incidental (as in the case of the table, which can be made of wood or ice). Of course there are limitations—hypothetical necessities, really—which govern how materials relate to artifacts (there are no saws made of wool, for example, and a house of cards is not for the sake of shelter). But these necessities should not be confused with natures, which artifacts as such lack. And so with products of spontaneity and even luck: they have no nature. Ice, lava, waves, and rainwater might cause subterranean openings, but the fact that I can live in a cave does not make the nature of a cave out to be a house. In summary: luck

unconsciously conflated the two notions (pp. 114–15). On the contrary, the contrast between art as an external cause of that of which nature is an internal cause goes to the heart of Aristotle's position. (On this issue see also Broadie 1987, 1990.) Further, we can see even here the beginning of the distinction of the agency and function models, insofar as art (agency) is said to be posterior to and imitative of nature (function). We will see that Aristotle considers appeals to the agency model (by specifying reason, or the demiurge, or a designer god as a cause of natural things) to be inadequate to account for natural things. This is the shortcoming with Anaxagorean and Platonic models of explanation, which assume that the specification of an agent is sufficient to account for natural functions.

[19] DK 31B84. [20] DK 31B100. [21] Cf. *Protr* 80.5–22.

and spontaneity are incidental causes of that of which art and nature are intrinsic causes—that for the sake of which. Further, art is an external cause of that of which nature is an internal cause—for the sake of something. Thus if you posit luck, spontaneity, or art as causes, you are committed to positing nature as a cause, since it is intrinsically and internally a cause of that of which luck, spontaneity, and art are incidental and extrinsic causes.

4.2 NECESSITY AND SPONTANEITY (DEMOCRITUS)

Aristotle considered Democritus to be his most formidable predecessor and interlocutor in the field of natural science.[22] Indeed, it can be shown that Aristotle adopts many of the Abderite's insights.[23] But he also criticizes Democritus, in no uncertain terms, for attempting to account for nature with reference to both the 'spontaneous' and 'necessity'.

This combination of causes seems prima facie contradictory. That is because interpreters have often seen the spontaneous as a kind of luck or equivalent to luck, and thought that it ought to be opposed to necessity. But, as we have seen, Aristotle considers luck, on the contrary, to be a kind of spontaneity, a kind that has an incidental outcome that could have been caused by intentional agency. The spontaneous is, on the other hand, a cause of quasi-intentional outcomes in things that are not capable of intentionality, including many natural entities. There are precedents for this in early Greek literature. Hesiod speaks of the spontaneous in natural contexts: diseases spontaneously (αὐτόματοι) come upon humans;[24] 'the fruitful earth of itself (αὐτομάτη) bare fruit abundantly'.[25] Thus the basic idea is not that these things happen 'as luck would have it' but, on the contrary, of things happening of their own accord, without external causes or cultivation. Although it is difficult to find mention of it in the secondary literature on causes and explanation in early and classical Greek science, the spontaneous shows up quite frequently, from Democritus' predecessors (poets, historians, medical writers) and peers (Anaxagoras, Plato, Xenophon), to his successors (Aristotle, Theophrastus). It has many and diverse applications in the areas of meteorology and geology and ecology,[26]

[22] 'In general, no one except Democritus has applied himself to any of these matters in more than a superficial way' (*GC* i 2, 315A34–35; Cf. *Phys* viii 1, 252A34–B1; *PA* i 1, 642A26–27; *Meta* xiii 4, 1078^{b}20). Aristotle wrote a book on Democritus, which is quoted by Simplicius (*In Cael*, 294.23–295.26).

[23] Aristotle has even been accused of '*in flagrante delicto* using Democritean atoms' in his 'chemical treatise [*Meteor* iv]' (Leijenhorst et al. 2002, p. 9).

[24] Hes. *Op* 103.

[25] Hes. *Op* 117–18.

[26] Thucydides describes 'forest fires on the mountains which have broken out spontaneously through the branches of trees being rubbed together by the wind' (2.77.4.4). Notice that the idea is not that the fires were uncaused or random (for Thucydides gives the cause); they were automatic because they happened due to the collision of the trees themselves, not external agency. Herodotus says that the Egyptians 'simply wait for the river of its own accord (αὐτόματος) to flood their fields' (2.14.13–14). The flooding is a regular and natural, not random, occurrence. Herodotus also uses the

medicine,[27] botany, and biology.[28] It is safe to assume that Democritus used the term, much like his predecessors and successors, in his many books on the causes of things on the earth, in the water, sky, and heavens, of plants and animals.[29]

term to refer to salt which is formed by 'natural processes' (αὐτόματοι) at the mouth of the river (4.53.11–12). For Aristotle too, springs and rivers flow αὐτόματα (*Meteor* ii 1, 353^{b}28).

[27] Plato has Socrates refer to death by natural processes: 'If you had waited a little while this would have happened from natural causes (ἀπὸ τοῦ αὐτομάτου). You see my age, that I am already advanced in years and close to death' (*Apo* 38c5–6; cf. Herodotus, *Hist* 2.66.15–6). Theophrastus also describes the death of plants by natural causes as automatic: 'withering from old age and weakness is natural, when ἐκ τῶν αὐτόματων the tree dissipates its fluid and lets its heat die down, whereas death coming from the outside is unnatural' (*CP* V.11.1.3–5). The term appears over a hundred times in the Hippocratic corpus. 'What need is there for further assistance when nature neutralizes the effect of such an agent spontaneously (ἀπὸ ταυτομάτου)?' (*prisc med* 16.37, trans. Chadwick and Mann). The doctor's intervention is unnecessary when natural processes cure the ailment. (But compare: 'no patient who recovers without a physician can logically attribute the recovery to τὸ αὐτοματον. Indeed, under a close examination τὸ αὐτοματον disappears; for everything that occurs will be found to do so through something, and this 'through something' shows that τὸ αὐτοματον is a mere name, and has no reality' (*arte* 6.10–12; cf. *artic* 46.27–49).) The regularity with which automatic processes can work is clear from the following: 'people of the constitution mentioned above, that is athletic people who have got soft, generally recover of their own accord (αὐτόματοι) within forty-five days of the wasting beginning. If such a period be exceeded, natural recovery (αὐτόματοι ὑγιέες) takes a year' (*de nat hom* 12.33–5, trans. Chadwick and Mann). Frequently, the spontaneous refers to a cause which has not yet been discovered: 'spontaneous (αὐτόματοι) weariness indicates disease' (*aph* 2.5; cf. 1.2.1; 4.2.2.; 4.21.1; 4.78.1; 6.15.1.).

[28] Herodotus mentions several plants that grow not by cultivation but 'wild' (αὐτόματα) (2.94.5; cf. 3.100.5; 4.74.3; 8.138.11). Plato uses spontaneity in the same way (αὐτομάτης, *Polit* 272^{a}2–5), but also to refer to natural processes, in particular those of plants and brute animals. He asks, 'does nature generate them [e.g. animals and plants] by some spontaneous cause (ἀπὸ τινος αἰτίας αὐτομάτης) and grow them without thought, or are they generated by a god following reason and divine knowledge?' (*Soph* 265^{c}7–9). Aristotle, for whom plants and animals are generated naturally, holds that some plants and animals are generated not from seed but spontaneously, to wit: τὰ αὐτόματα (*HA* v 1). Among animals, the testacea are generated this way, but this does not mean at random or without cause. On the contrary, 'all things formed in this way, whether in earth or water, manifestly come into being in connection with putrefaction and an admixture of rain water . . . animals and plants come to be in earth and liquid because there is water in earth, and air in water, and in all air is vital heat, so that in a sense all things are full of soul. Therefore living things form quickly whenever this air and vital heat are enclosed in anything' (*GA* 762^{a}9–23). By the time of Theophrastus, the spontaneous is coordinate with the natural in the study of plants, as opposed to the cultivated and artificial: 'these constitute two divisions of the subject, the one as it were natural and αὐτόματον, the other belonging to art and preparation, which intends the good. But the account is not the same for both, the first is what we might call an account from nature, the other from inventiveness, nature doing nothing in vain, and intellect proposing to help nature' (*CP* II.1.1.6–11). Also: 'The study of plants pursues two different investigations in two different fields. The first investigation deals with plants that grow αὐτομάτοις, and here the starting point belongs to their nature; whereas the other starting point is that which proceeds from human ingenuity and contrivance, which we assert helps their nature to achieve its goal' (*CP* III.1.1.1–5; Cf. *IP* II.1.1.1–10). Theophrastus is even willing to state that the spontaneous is equivalent to the natural principle, in contrast to art: 'the nature contains the starting points in itself, and we speak here of the natural, and what we see in plants that grow ἐκ τῶν αὐτόματων is of this description' (*CP* I.16.10.8–10). Changes in qualities are also said to arise spontaneously: 'changes also occur in odor; they mostly arise αὐτομάτως because of the air and the country' (*CP* II.16.1.1–2); 'savors are found in things mixed by some procedure of art, or else in things that alter αὐτομάτως, sometimes for the better, sometimes, as in decomposition, for the worse' (*CP* VI.3.3.3–5).

[29] See, under the titles given by Thrasyllus, 'the unarranged treatises' 1–9 (D.L. IX.47).

But the idea that Democritus chalked everything up to luck was a misinterpretation already current in antiquity.[30] Several modern commentators assert, confusingly, that Democritus identified necessity and luck (or 'chance').[31] We do have direct evidence that Democritus held the spontaneous and necessity as causes, in the following quotation in which Epicurus criticizes Leucippus and Democritus: 'the first men to give a satisfactory account of causes, men not only much greater than their predecessors but also, many times over, than their successors, turned a blind eye to themselves (although in many matters they had alleviated great ills) in order to hold necessity and the automatic as the cause of everything (τὸ τὴν ἀνάγκην καὶ ταὐτόματον πάντα αἰτιᾶσθαι)' (*On Nature* 25, text and trans. Sedley 1983, p. 19–23). But we will now have to show that this cannot mean that Democritus identifies necessity and luck (or 'chance'), or that he makes luck the cause of everything. Only then will we be in a position to understand Aristotle's criticisms of Democritus' position.

Aristotle begins his treatment of luck and the spontaneous by pointing out that some people deny the existence of luck altogether:

> Some people . . . say that nothing comes to be as an outcome of luck, but that there is a definite cause of everything which we say comes to be as a spontaneous outcome or as an outcome of luck. Thus when we say that a man as an outcome of luck came into the market-place, and found there someone he wished but did not expect to find, they claim that the cause was wishing to go and attend the market. And similarly with other things which are said to be the outcome of luck. (*Phys* ii 4, 195^{b}36–6^{a}11, Clar)

Aristotle does not give any proper names here. Simplicius, comments that 'even if the natural scientists say nothing about them [luck and the spontaneous], they do treat them and name them as if they did exist' (*In Phys* ii, 327.15–16, trans. Fleet). This in itself is an odd statement. They both say nothing about them, and they treat them and name them. Simplicius is unsure in his attribution of cause to both Democritus and Anaxagoras:

> When Democritus too says 'the vortex was separated off from the whole, of all sorts of shapes' (how and by what cause he does not say) he *seems* to be generating it from the spontaneous and luck (ἔοικεν ἀπὸ ταὐτομάτου καὶ τύχης γεννᾶνα). And although Anaxagoras grants the existence of intelligence, according to Eudemus, he thinks that most things result from luck. (*In Phys* 327.24–7, trans. Fleet).

[30] I will show the emergence of the confusion in Simplicius and Philoponus below, but the claim is made already by Themistius. 'They [Democritus and others] assign the greatest effects to it [chance] but have handed down to men not the slightest account of it, though they assign the innumerable worlds and the vortex and the all-embracing order to no other cause, but merely mention chance and randomness' (Themistius, in *Phys* 49.13–16). See also: D.L. IX.33; Hippolytus, *Refutation*, I.12; Eusebius, *Praepar*. evang. XIV.23.2 and XIV.26.4–5).

[31] Guthrie says, 'for the course which their movement takes (on which depends all that happens in this world) both necessity and chance are alleged as causes'. The note to this sentence reads: 'ἀνάγκη and τύχη or αὐτόματον' (Guthrie, v.2, p. 414 n. 3). For others, see: Huby 1967, p. 361; Edmunds 1972, pp. 349–50; 'reason, necessity, and also chance were interchangeable terms for the atomists' (Konstan 2000, p. 132).

It is clear that Simplicius is foisting luck upon both Democritus and Anaxagoras here, since, as he himself says, Democritus mentions no cause, and Anaxagoras mentions intelligence, not luck. That Democritus at least did not explicitly make luck a cause is clear also from Simplicius' own commentary on Aristotle's reference to 'the old argument which does away with luck [according to which] everything which comes to be can be lead back to some cause' (*Phys* ii 4, 196ª11–16).

> The words 'as the old argument goes, which does away with luck' *seems* to refer to Democritus, for even if he *seems* to have used luck in his cosmogony (ἐκεῖνος γὰρ κἂν ἐν τῇ κοσμοποιίᾳ ἐδόκει τῇ τύχῃ κεχρῆσθαι), in particular instances he *denies* that luck is the cause of anything, leading things back to other causes (ἀλλ' ἐν τοῖς μερικωτέροις οὐδενός φησιν εἶναι τὴν τύχην αἰτίαν ἀναφέρων εἰς ἄλλας αἰτίας); for example, he says that the cause of finding treasure is digging or olive planting, or that the cause of the bald man's fractured skull is the fact that the eagle dropped a tortoise so that the shell should smash. That is Eudemus' account. (Simplicius, *In Phys* 330.14–20, trans. Fleet)[32]

It is clear then that, far from making luck the cause of everything, Democritus leads back to necessary and definite causes even accidents. This fits well with his and Leucippus' views on universal necessitation. Leucippus said: 'nothing happens in vain, but everything from intelligence and out of necessity' (DK 67B2). Lucky (or unlucky) events occur only when two sets of necessary causes intersect: a person having buried treasure, and my planting an olive tree as the cause of discovering treasure; Aeschylus' taking a stroll in the park and an eagle needing to crack open the shell of a turtle as the cause of the skull being fatally fractured.

But Simplicius still wants to saddle Democritus with luck as a cosmogonical cause. To see why he insists on this we must consider yet another passage of Aristotle.

> [**a**] There are others who make the spontaneous the cause of the heaven and the cosmic systems. For they say that spontaneously the vortex come to be and the motion which separated out and established everything in the present order (ἀπὸ ταὐτομάτου γὰρ γενέσθαι τὴν δίνην καὶ τὴν κίνησιν τὴν διακρίνασαν καὶ καταστήσασαν εἰς ταύτην τὴν τάξιν τὸ πᾶν).
>
> [**b**] And this is itself really incredible. For they also say that the animals and the plants neither come to be nor exist by luck, but rather nature or intelligence or something like that is their cause (φύσιν ἢ νοῦν ἤ τι τοιοῦτον ἕτερον εἶναι τὸ αἴτιον). For it is not just as luck has it that each of these comes to be out of a seed, but out of this one an olive and out of that one a human.
>
> [**c**] But the heaven and the most divine things that we see they say to have come about spontaneously, without the sort of cause of the animals and the plants. Indeed, if things are this way, this would itself be worth knowing, and it would have been good to say something about it.

[32] See also: 'Even though Democritus usually takes a different standpoint, he seems to concur with general conceptions of luck. For he says that he did not find the treasure as a result of luck, but because he was digging in order to plant, to find water or some such thing, in the course of which he would have found it. Each of these activities would be and become the cause in the same way' (Simplicius, *In Phys* 338.3–7, trans. Fleet); cf. 328.1–5.

[**d**] In other respects what they say is absurd, yet it is even more absurd to say these things when nothing we observe in the heavens comes about spontaneously, and many things that do not come about by luck, they say incidentally do come about by luck. Indeed the opposite of this should be the case. (*Phys* ii 4, 196[a]24–[b]5)

We cannot, on the basis of these arguments in Aristotle, attribute to Democritus the view that luck is the cause of anything, much less of everything, as so many interpreters of the passage have.[33] In [**a**] we have the statement that the spontaneous (not luck) was made the cause of the vortex and the worlds. In [**b**] it is pointed out that 'they' deny that animals and plants are generated by luck, attributing the cause instead to nature or intelligence. Prima facie this applies to Anaxagoras, who argues that intelligence separated out and ordered the natures. But even if it applies to Democritus and Leucippus (perhaps on the basis of an extrapolation from Leucippus' assertion that everything happens from intelligence and out of necessity), it is important to keep in mind that the statement *denies* luck a causal role in the formation of plants and animals. In [**c**], we have the further remark that 'they' made the heavens the outcome of the spontaneous (not luck), and that they said nothing further about this cause. In [**d**] we have Aristotle's assertion that the heavens do not come about spontaneously, with the addition that the same things do not come about by luck either. When Aristotle adds that 'many things . . . they say incidentally do come about by luck', he is arguing by means of his own technical terms, not attributing the view to Democritus or anyone else, which is clear since he has just said that 'they' (Anaxagoras and Democritus) say nothing further about these causes beyond naming the spontaneous. Now consider Simplicius' commentary.

[**a**] The followers of Democritus (οἱ δὲ περὶ Δημόκριτον) appear to be guilty of a double absurdity. First, although they say that it is the cause of this world, they fail to tell us just what the spontaneous is (οὐ λέγουσι τί ποτέ ἐστι τὸ αὐτόματον). Why do I say 'this world', since according to them it is the cause of many or even an infinite number of universes? They say that 'the vortex and the movement which separated out and established the cosmos in its present state are the result of the spontaneous' (ἀπὸ ταὐτομάτου γάρ φασι τὴν δίνην καὶ τὴν κίνησιν τὴν διὰ κρίνασαν καὶ καταστήσασαν εἰς τήνδε τὴν τάξιν τὸ πᾶν). [**b**] Second, it is the cause of some surprise how it is that they maintain that animals and plants neither exist nor come to be as the result of luck, but are caused by nature or intelligence or something like that—a cause which is determined and neither irregular nor irrational . . . —while in the case of the greatest and most divine of natural phenomena, viz. the heavens and the dance of stars, in which there is nothing irregular and irrational, they trace the cause back to luck and the spontaneous, claiming that in this case there is no such cause as the one they posit for animals and plants, where it is determined and operates rationally and with regularity. [**c**] Even so, they say nothing about luck and the spontaneous (καὶ ὅμως οὐδὲν περὶ τύχης ἢ αὐτομάτου λέγουσι). (Simplicius, *In Phys* ii, 331.16–332.1, trans. Fleet, modified)

[33] The two most important English commentators on the *Physics* have advanced this view: Ross, *Aristotle Physics*, ad loc., and Charlton, *Aristotle's Physics*, ad loc. Both refer to Bailey 1928 for support.

Here Simplicius is careful, at least initially in [**a**], not to say luck but to attribute to Democritus the view that *the spontaneous* is the cause of the cosmoi, the vortex, and our world. He even seems to be quoting Democritus to this effect. He further reports that Democritus would *deny* that luck is a cause of animals or plants, although he is sketchy on this, claiming that such philosophers mention 'intelligence or nature or something like that'. When he finishes off the argument by comparing their denial of luck as a cause for animals with their use of the spontaneous as a cause for the heavens, he says 'luck and the spontaneous' in [**b**]. But luck has been illegitimately tacked on to the spontaneous. Once again he makes it clear that they actually said nothing about luck in [**c**]. The same process of distortion can be seen in a comment of Philoponus, from which it is nonetheless possible to glean the truth, that Democritus attributed cosmological events to the spontaneous, not luck.[34] Even if our sources, going back to Aristotle, are right to complain that he did not further explain this cause, it is clearly not justified to complain, with Eusebius for example, that Democritus contradicted himself in making luck the pre-eminent cause and yet banishing it from human life. He clearly sought to banish luck by referring to necessary and spontaneous causes.

Let us consider further the fact that Democritus attributed cosmological processes to spontaneity, and that this is not equivalent to luck. Aristotle himself is of course very careful to distinguish luck and the spontaneous.[35] They differ, again, in that the spontaneous is broader than luck. Luck applies only to that which can engage in rational activity. The spontaneous, on the other hand, extends to non-rational animals, plants, and inanimate objects. Aristotle's examples include a horse that goes away from the camp to drink water when a camp is raided—the horse is spontaneously saved; a tripod falls from a roof, but lands straight up suitable for sitting on—the tripod spontaneously fell straight up.[36] This is of course Aristotle's distinction, not Democritus'. But we can assume that Aristotle was correct in saying that Democritus assigned the *spontaneous* as a cause in cosmological contexts (such as the formation of worlds by vortices), which are by their nature devoid of choice. In cases involving choice or objects of choice (like finding a buried treasure; having a tortoise dropped on your head), he seems to have viewed luck as an eliminable cause, which could be traced back to necessary causes that are incidentally related.

[34] '[Aristotle] blames Democritus [for this] too, that among particulars he says that nothing arises by luck (for not just any luck thing arises from anything), and in giving particular [causes], such as what distinguishes hot things or white things, or why honey is sweet, he ascribes [these things to] the position and order and shape of the atoms, but of the generation itself of the star-systems he says the cause is the spontaneous (αὐτῆς δὲ τῆς τῶν ὅλων γενέσεως τὸ αὐτόματον αἴτιον εἶναί φησι)' (Philoponus, *In Phys* ii 262.16–20, trans. Lacey, modified).

[35] Aristotle often speaks more casually, grouping luck and the spontaneous; it is this tendency that has encouraged those dependent on him to equate the automatic with luck (see, e.g., *Post* 95A3–6, *Cael* 283A31–B1, 287^{b}25, *Meta* 1065^{b}3; *Pol* 1323^{b}28).

[36] 'So it is clear that in the case of things which generally come to be for the sake of something, if something comes to be, having an external cause, not for what benefits incidentally, this we say to be by a spontaneous outcome; and if such an outcome is for something capable of choosing and an object of choice, we call it a lucky outcome' (*Phys* 197^{b}18–22).

Democritus in fact refers the creation of the worlds to the spontaneous, that is, to the necessary 'impact and blow' of matter. He also refers the formation of natural things, like plants, animals, and humans, to natural and spontaneous causes. He refers apparently lucky events in the human sphere to necessity.[37] He even, in an acute and widely influential anthropology, attributed the invention of the arts to necessity. This is not an unreasonable position, and to contemporary determinists this all sounds downright plausible. Even Aristotle's pupil and successor Theophrastus considered it plausible that the spontaneous is a cosmic cause of natural forms: 'the account that it is by spontaneity (τῷ αὐτομάτῳ) and through the rotation of the whole that these things acquire certain forms or differences from one another seems to have some plausibility' (*Metaphysics* $10^{b}26$–$11^{a}1$).

It thus would not have been at all extraordinary or unreasonable for Democritus to call the spontaneous a cause, whether of cosmic entities, plants and animals, or even human activities. In so doing, he would not be claiming, despite the polemics of his later critics, that these things were caused by luck. On the contrary, he would be saying that they were caused by their own natural powers or agency, without external influence or motivation.

If it is not the case that Democritus, like Empedocles, is forced to attribute all natural things to luck, then what is Aristotle's problem with Democritus' account of nature? Aristotle argued that incidental causes, like luck, were insufficient to account for natural things because they cannot account for nature's regularity. So it would seem a promising solution to go to the opposite extreme, and to chalk up the causes of nature to necessity, making everything is completely regular. This is indeed how Aristotle characterizes Democritus' position.

> it is a wrong assumption to suppose universally that we have an adequate first principle in virtue of the fact that something always is so or always happens so. Thus Democritus refers the causes that explain nature (Δημόκριτος ἀνάγει τὰς περὶ φύσεως αἰτίας) to the fact that things happened in the past in the same way as they happen now; but he does not think fit to seek for a principle to explain this 'always': so, while his theory is right insofar as it is applied to individual cases, he is wrong in making it a universal application. (*Phys* viii 1, 252A32–B2)

The problem with the Democritean position is that although it accounts for regularities, it cannot account for the fact that the things regularly generated by nature are *for the sake of something*. As Aristotle says: 'Democritus, however, *neglecting the for the sake of which*, refers all the operations of nature to necessity (Δημόκριτος δὲ τὸ οὗ ἕνεκεν ἀφεὶς λέγειν πάντα ἀνάγει εἰς ἀνάγκην οἷς χρῆται ἡ φύσις)' (*GA* v 8, 789B2–4). But notice that the problem is not that Democritus has involved necessity into his account. As we will discuss at length in due course, Aristotle himself incorporates natural necessity into his own teleological explanations.

[37] This does not mean that there is no such thing as luck. Democritus held that the invention of words was not by nature but by luck, i.e. what other parties to this dispute would call 'convention' (DK 68B26). He even says, 'the blows of luck (or fortune) are suffered by all' (DK 68B293).

The problem for Democritus, according to Aristotle, is that he does not connect necessity to the cause for the sake of which, but only with 'the full and the empty' (i.e. atoms and void), and their shapes, positions, and configurations (*Meta* i 4, 985^{b}4–22). But, Aristotle argues, functions cannot be accounted for by referring to shapes and their differences, since two things can have the exact same shape, while one is functional and the other is not.

> Does, then, configuration and color constitute the essence of the various animals and of their several parts? For if so, what Democritus says will be strictly correct. For such appears to have been his notion. At any rate he says that it is evident to everyone what form it is that makes the man, seeing that he is recognizable by his shape and color. And yet a dead body has exactly the same configuration as a living one; but for all that is not a man. So also no hand of bronze or wood, or constituted in any but the appropriate way, can possibly be a hand in more than name. For like a physician in a painting, or a flute in a sculpture, in spite of its name it will be unable to do the function that its name implies. Precisely in the same way no part of a dead body, such I mean as its eye or its hand, is really an eye or a hand. To say, then, that shape and color constitute the animal is an inadequate statement, and is much the same as if a woodcarver were to insist that the hand he had cut out was really a hand. (*PA* i 1, 640B29–1A6, ROT)

Thus although atomists discuss the form, or shape, or arrangement of something, they fail to do so in a way that is explicative of that which they are trying to describe. Something can have the shape or arrangement of something else, but not really be that something else, if it is not so as to function in accordance with its nature. A cardboard cutout of a saw has the shape of a saw, but cuts nothing itself and so is not a saw; and a wooden duck is a decoy, not a duck, even though it is carved in a very convincing shape.

Aristotle does not completely reject Democritean necessity. He does not consider necessity to be an alternative to teleological explanation. On the contrary, he thinks that necessity is a part of teleological explanation (although in a different way for each of the various kinds of science, as we will see). We have already seen how Aristotle connects the notions of matter and necessity, for example by describing the cause 'out of which' in terms of necessity in *Posterior Analytics* ii 11. This is quite consistent with his relatively positive evaluation of Democritus in dialectical contexts in general, and with the fact that Aristotle holds that necessity and the cause for the sake of which are perfectly compatible causes, especially in the case of things generated by nature, as we saw above.[38]

But how does Democritus fit into Aristotle's overall dialectical strategy? We have seen how that strategy involves the association of a predecessor with a certain causal factor, and then deploying an *a fortiori* argument to the effect that the efficacy of this cause requires that nature be even more so a cause. In broad outlines, the same remains true for Aristotle's treatment of Democritus.

[38] Aristotle explicitly says that the cause for the sake of which and necessity are compatible, among other places, at *PA* 642^{a}31–2 and *GA* 743^{b}16–18.

Aristotle has already identified Democritus with the causal factor of necessity (and in its guise as spontaneity). And in the closing words of *Physics* ii (from which we got the dialectical *a fortiori* arguments about luck, spontaneity, and art), he says of necessity:

> It is clear that necessity in natural things is that which we call the matter and the motion for these things (τὸ ἀναγκαῖον ἐν τοῖς φυσικοῖς τὸ ὡς ὕλη λεγόμενον καὶ αἱ κινήσεις αἱ ταύτης). And both explanations must be given, but more the cause for the sake of something (μᾶλλον δὲ ἡ τίνος ἕνεκα). For this is the cause of the matter, but the matter is not the cause of the end, and the principle comes from the definition and the account, just as in products of art. Since a house is this kind of thing, these other things must come to be and constitute it, out of necessity (ἐξ ἀνάγκης). And since health is this, these other things must come to be and constitute it, out of necessity. And similarly with a human: if this, then that. (*Phys* ii 9, 200^{a}30–^{b}4)

In due course we will examine different kinds of necessity, and how they correspond to different kinds of matter and sources of motion. These distinctions play a crucial role in how teleological explanations are used and understood in the various sciences. But we do not need the details of this account to see Aristotle's overall strategy against Democritus. Aristotle associates Democritean causality with necessity in order to show that in the case of natural things the cause for the sake of which is *a fortiori* a cause (μᾶλλον δὲ ἡ τίνος ἕνεκα). The effectiveness of this strategy assumes, of course, that Democritus doesn't have some other means of accounting for the cause for the sake of which. Clearly Aristotle does not think he does: that is why he says that the atomist cannot account for functions.

4.3 INTELLIGENCE (ANAXAGORAS AND DIOGENES OF APOLLONIA)

Aristotle says that Anaxagoras made a quantum leap beyond his predecessors by identifying intelligence (νοῦς) as a cause:

> for neither fire nor earth nor another of that kind of thing could be thought by them to be the likely cause (εἰκὸς αἴτιον) for the generation of those things which have goodness and beauty. Nor again to spontaneity or luck could such things be referred well. So when someone mentioned that intelligence (νοῦν) exists and is, as in the animals so in nature, the cause of the cosmos and order of everything (τὸν αἴτιον τοῦ κόσμου καὶ τῆς τάξεως πάσης), he seemed serious, relative to the casual talk of his predecessors. And we know for sure that Anaxagoras touched on these kinds of accounts, although Hermotimus of Clazomenae[39]

[39] Legend holds that he was able to separate his intelligence from body and so teleport, and then narrate events he had witnessed at a remove from his body. So the reason he is mentioned here is that Anaxagoras is supposed to hold that intelligence is separate from all bodies (Ross, *Aristotle's Metaphysics*, vol. 1, ad loc).

has credit (αἰτίαν) for mentioning them earlier. Those, then, who understood things in this way posited the explanatory principle (τὴν αἰτίαν ἀρχὴν) of beings and at the same time of their goodness, and of from where they get motion. (*Meta* i 3, 984^{b}11–22)

But Aristotle soon withdraws the attribution, arguing that both Anaxagoras and Empedocles 'make no use of their causes except to a small extent' (985A17–18). Even the 'small extent' of Anaxagoras is denied to have any real explanatory purchase: 'Anaxagoras uses intelligence as a *deus ex machina* for the making of the world, and when he is at a loss to tell for what cause something necessarily is, then he drags intelligence in, but in all other cases he ascribes events to anything rather than to intelligence' (*Meta* i 4, 985^{a}18–21).

According to this statement, Anaxagoras brings in intelligence at two points in his account of nature, at first in his cosmogony, and then when he cannot explain according to other factors. In the cosmogony, intelligence is said to pervade the universe and set it moving with a vortical motion, which rotation separates and arranges all things.[40] As Stephen Menn has pointed out, this means not that some divine intelligence has actively separated things out and ordered them, but that intelligence as such dominates the cosmic mixture and thereby imposes order on it.[41] Intelligence is also said to pervade all things, from the cosmic stones to plants, animals, and, of course, humans. This does not mean that the planets or plants themselves possess intelligence conducive to prudence or wisdom, but rather that the existence of intelligence in all these things controls them through being present in their bodies; intelligence is supposed to be on an ontological par with gold and hot and bone and white.[42] Anaxagoras would have 'explained' apparently purposeful arrangements (of celestial bodies, of parts of animals, and of animal and human behavior) as due to the physical presence of intelligence in these entities. But, the criticism goes, Anaxagoras' 'intelligence' is then not explanatory; it is just a label that is attached to things that cannot be explained by the more mundane causes. In order for intelligence to be explanatory, it will have to be integrated into an account that makes reference to necessity and any other relevant kind of cause.

To point to something and simply assert that it was designed by intelligence is no more to give an account of it than to say that it is a product of luck, or necessity, even if you assert that intelligence—as opposed to luck or necessity—is what is ultimately responsible for the arrangement of things. Unless you indicate why and how intelligence caused something, you have provided no explanation.[43] This is not, of course, to say that intelligence is not a cause. Aristotle most certainly acknowledges that it is. Only he holds that it is not enough to call it the cause of natural things and leave it at that.

[40] DK 59B12. [41] Menn 1995, pp. 27–8. [42] Menn 1995, pp. 26–9.

[43] For another, related case in which Aristotle accuses Anaxagoras of failing to provide an explanation for motion in general, see *Phys* viii 1, 252A10 f. and *Meta* xii 6, 1072^{a}5 f.

The same argument goes for Diogenes of Apollonia (hereafter, Diogenes). Diogenes has often been mentioned in connection with Anaxagoras and the influences on Aristotelian teleology. It might seem strange that Aristotle does not mention him in connection with the kind of explanation we are looking for—the teleological kind—since some contemporary scholars have seen teleology in his work, and held it to be influential on subsequent teleological doctrines.[44] And the writings of Diogenes were certainly not unknown to Aristotle. In fact, Aristotle directly quotes Diogenes' account of the veins as if it is authoritative, as far as a physiological description goes (*HA* 511B30–12B11). But he never mentions a passage like the following, preserved for us by Simplicius: 'Without intelligence it is inconceivable that matters would be disposed in such a way as to contain measures of everything—of winter and summer, night and day, rain and warmth, wind and sunshine. And anyone who cares to think about it will find that everything else too is in the best possible condition. (Simplicius, *In Phys* 152.12–16=DK $64^{b}3$, trans. Waterfield, modified). Despite the promising diction of such remarks, Aristotle considers Diogenes a natural philosopher championing the cause of air (*GC* 322B13–14, *Anima* $405^{a}21$, *Meta* $984^{a}5$). Aristotle cites with approval Diogenes' remarks in favor of a uniform substratum (*GC* 322B13–14), here again reducing Diogenes' contribution to a theory about matter. In this connection, consider another fragment of Diogenes:

> The possessor of intelligence is what men call air, and everything is steered and controlled by air. I say this because it is my opinion that air is a god, and pervades everything, manages everything, and is present in everything. There is nothing that does not partake of air. However, there is nothing that partakes of air in the same way as anything else; there are many modes not only of air itself, but also of intelligence. For the modes of air are diverse: it may be warmer or cooler, drier or wetter, more or less mobile, and it contains many, infinitely many, modifications in terms of taste and color . . . In so far, then, as modification is diverse, living creatures are diverse too, and there is a plurality of them, with the diversity of modifications responsible for their dissimilar characteristics, ways of life, and kinds of intelligence. Nevertheless, it is by means of the same one thing that all living creatures live and see and hear, and the rest of their intelligence stems from the same one thing. (Simplicius, *In Phys* 152.22–3.13=DK $64^{b}5$, trans. Waterfield F5, modified)

Scholars have seen a 'rudimentary doctrine of finality' in the fragments of Diogenes, chiefly because of his frequent use of terms like νοῦς, νοήσις, κρατεῖν, διακοσμεῖν. The same terms are used by Anaxagoras, a widely acknowledged influence on Diogenes.[45] But, whereas Anaxagoras had made intelligence itself a

[44] Theiler 1925, pp. 6–35; 'Diogenes is today regarded as the first proponent of a consistent teleological scheme' (Solmsen 1960, p. 16); 'a clearly defined sense of purpose in the operations of the *kosmos* does not appear in Greek speculative thought until Diogenes of Apollonia' (Peters 1967, s.v. *telos*); 'les rudiments d'une doctrine finaliste' (Lerner 1969, pp. 16–17).

[45] The earliest doxagraphies made the connection. 'Diogenes . . . wrote in an eclectic fashion, following Anaxagoras in some things and Leucippus in others' (Theophrastus, *apud* Simplicius, *In Phys*, 25.1=DK $64^{a}5$).

substance whose distribution in things was held responsible for their arrangement, Diogenes discovers that intelligence is actually identical with the element air.[46] It is the presence of air in all things—cosmic stones, the earth's atmosphere, plants, animals, and humans—that is responsible for the nature and arrangement and behavior of things. But this can hardly be more satisfactory to Aristotle than Anaxagoras' own account. Aristotle does not consider it enough simply to mention the existence of intelligence, or to describe something as 'controlling', or even 'for the best'. Diogenes, like Anaxagoras, does not actually make use of these notions causally, to wit in explanations. Rather, Diogenes' explanations rely on reference to modifications of a material element (as above), or are simply physiological descriptions (as in his account of the veins). Aristotle undoubtedly holds roughly the same evaluation of Diogenes' intelligence as he did of Anaxagoras'.

The case of Diogenes is important, however, because it gives us insight into how Aristotle prosecutes his dialectic of causal explanation. Aristotle acknowledges promising turns of phrase, and avenues for development, but he begrudges anyone credit for discovering a cause unless they actually used it to explain something according to his standards for explanation. We will see the same dialectical technique in effect in Aristotle's treatment of Socrates and, more controversially, Plato. Keeping this dialectical procedure in mind will allow us to address the mystery surrounding Aristotle's failure to acknowledge Plato's use of moving and 'for the sake of which' causes.

4.4 GOD (XENOPHON, SOCRATES)

The only explicit mention that Aristotle makes of Socrates in connection with scientific explanations is when he says that in the time of Socrates a nearer approach was made to the method of providing the account of 'what it is to be something' as a definition. Alas, people then turned away from the investigation of nature and turned to politics and ethics (*PA* 642^{a}29–31). This is curious because Aristotle's source for information on Socrates, Plato, has Socrates make an objection to Anaxagoras' use of intelligence, in the *Phaedo* (a dialogue which Aristotle knows well). The objection is substantially similar to Aristotle's own (quoted above), and may be its source.

> I never thought that Anaxagoras, who said that those things were directed by intelligence, would bring in any other cause for them than that it was best for them to be as they are. Once he had given the best for each as the cause for each and the general cause of all, I thought he would go on to explain the common good for all, and I would not have exchanged my hopes for a fortune. I eagerly acquired his books and read them as quickly as I could in order to know the best and worst as soon as possible. This wonderful hope was dashed as I went on reading and saw that the man made no use of intelligence, nor gave it any responsibility for the management of things, but mentioned as causes air and ether and water and many other strange things. (*Phd* 98^{a}7–^{c}2, trans. Grube)

[46] Menn 1995, pp. 30–1.

It would perhaps be possible to attribute Aristotle's neglect of Socrates' argument here to the (very plausible) suggestion that Aristotle assumed that the real argumentation is due to Plato, not Socrates. Two facts make this a somewhat awkward excuse, however. The first is that Aristotle refuses to recognize Plato as an advocate of the cause for the sake of which, as we will see. The second is that we have independent evidence of Socrates' views on teleological explanation: Xenophon's *Memoirs of Socrates*.

There are two major sections of Xenophon in which Socrates engages in discussions of divine providence, creationism, design, and, perhaps, teleology. The context of the first passage (1.4) is a discussion about 'religion' (δαιμονίου, X. *Mem* 1.4.2). Socrates is conversing with Aristodemus, a man whose irreligion goes so far as to scoff at those who pray or use divination. Socrates asks him first if he admires products of art, to which he says yes, and second whether he admires more products that are alive, or those that are inanimate.

— The one who creates live things, by far, provided that they are products not of luck but of art.

— Some things are not for the sake of anything (ὅτου ἕνεκα) so far as we can tell, and others are obviously useful (ὠφελεία).

— Which class do you assign to luck, and which to design?

— Those which are useful should be products of art. (X. *Mem* 1.4.4–5, trans. Waterfield, modified)

Socrates adduces several examples of things which must be caused not by luck, but by art, on the grounds that they are useful to humans (ἀνθρώπους ἐπ᾽ ὠφελεία, 1.4.5): eyes, ears, noses, tongues, and then eyelashes and teeth. Also, the positioning of the eyes and nose, at a sufficient remove from the organs of excretion. Neither Socrates nor his interlocutor is in any real doubt 'whether such provident arrangements are the result of luck or of design'. Aristodemus then admits that such products seem to be 'the products of some wise and benevolent artist' (σοφοῦ τινος δημιουργοῦ καὶ φιλοζῴου τεχνήμασι, 1.4.7). Shortly thereafter, Socrates endeavors to show that the gods, who are responsible for these artistic products, do take an interest in the affairs of humans. His arguments specify all the bodily advantages that humans have over other creatures: walking erect, hands, language and, most importantly, the capacity to have sex year round throughout their lives. Next come the mental advantages: intelligence, foresight, religion, and memory. The conclusion: 'compared with other creatures, men live like gods, naturally supreme in both body and intelligence' (X. *Mem* 1.4.13, trans. Waterfield).

The context of *Memoirs* 4.3 is also religion. This time the focus is on how carefully the gods have provided for human needs. We need to see, so they give us the sun for light; we need to rest, so they make the sun set at night; we need to tell time, so they give us the stars and the moon. Also 'There is the fact that we

need food, and the gods produce this from the earth, providing for the purpose appropriate seasons, which supply us not only with all kinds of things we need but also those things in which we find enjoyment' (X. *Mem* 4.3.5, trans. Waterfield).

Additionally, there are the obvious uses and benefits of water and fire, as well as the gradual motions of the sun towards and away from the earth. This preponderance of evidence makes Euthydemus, Socrates' interlocutor this time, wonder

> whether the gods have any function other than looking after men. My only difficulty is that the animals share these benefits as well.
>
> Naturally, said Socrates, because it's obvious, isn't it, that animals too are born and reared for the benefit of mankind (ἀνθρώπων ἕνεκα)? (X. *Mem* 4.3.9–10, trans. Waterfield)

Socrates goes through a list of all the animals 'for the sake of humans': goats, sheep, cattle, horses, etc. Not to mention, he adds, plants.

Now there are good reasons to believe that Aristotle had access to these texts, for he directly takes over many of these arguments, and it is unreasonable to think that he was unconsciously reinventing the wheel. For example: the contrast between art and luck, the functional account of body parts, the notion of correct positioning of the sense organs at a remove from the excretory organs, the requirement that a certain kind of soul can only work with a certain kind of body, the notion that hands are possessed by a being with intelligence (and are not the cause of intelligence), and the idea that the motion of the sun towards and away from the earth are responsible for generation and destruction. All these are core Aristotelian distinctions and positions. On the other hand, it is true that some of these arguments are obvious, and others could stem from a source common to both Aristotle and Xenophon.

But even if Aristotle were totally unaware of Xenophon's work, it seems unlikely that he would be unaware of the strong association of Socrates' insistence on purposive explanations of body parts and other aspects of nature. The reason he disclaims Socrates' use of this kind of explanation is that, as with the use of 'intelligence' as a cause by Anaxagoras, Aristotle does not think it explanatory to refer simply to a purposive agent putting things together; that is not a sufficiently naturalistic interpretation. Aristotle attributes these things to the intrinsic finality of nature itself, and integrates other kinds of cause, such as necessity, into his explanations of them. The 'explanations' before us simply assert that humans are beneficiaries of the natural functioning of nature. They provide no account of how the functions came about, or how they serve the intrinsic ends of the kinds of things that have them naturally. Thus Aristotle's position on the kind of arguments attributed by Xenophon to Socrates, like his position on Empedocles and Anaxagoras, would clearly be to deny that these sorts of speculations are scientific explanations, since they do not actually explain anything; they merely assert beneficiaries.

4.5 FORM (PLATO)

Aristotle says that Plato used as causes only 'the what it is to be something' and matter:

> Plato, then, declared himself thus on the points in question; it is evident from what has been said that he has used only two causes, that of 'the what it is to be something' and the material cause (for the forms are the causes of the what it is to be of all other things, and the one is the cause of the what it is to be of the forms); and it is evident what the underlying matter is, of which the forms are predicated in the case of sensible things, and the one in the case of forms, viz. that this is a dyad, the great and the small. Further, he has assigned the cause of good and of evil to the elements, one to each of the two, as we say some of his predecessors sought to do, e.g. Empedocles and Anaxagoras. (*Meta* i 6, 988^{a}7–17)

Aristotle seems to ignore Plato's discussion of other kinds of cause. This is strange, since discussions of necessity, intelligence, art, luck, and so forth are not hard to find in the dialogues. The passage where Plato has Socrates complain about Anaxagoras' not providing 'the best for each as the cause for each' (quoted above) comes immediately to mind. Can we not say here, with little or no anachronism, that Plato is discussing teleological causes? Plato has Socrates complain that Anaxagoras 'makes no use of intelligence, nor does he refer to any causes in [his discussion of] the ordering of things, but rather he cites airs and ethers and waters and many other irrelevant things as causes' (98b8–c1). This is a demand that an explanation make reference to more than just material factors. And then there are several other relevant texts pointing in the same direction. That Aristotle appears to neglect these was noticed already in antiquity. Alexander, for example, asks:

> One might ask how it is that, although Plato speaks of the efficient cause in the passage where he says, 'It is then our task to discover and to make known the maker and father of the universe' [*Tim* 23c], and also of that for the sake of which and the end by what he again says, 'All things are with reference to the king of all, and everything is for his sake' [*Ep* ii, 312e], Aristotle makes no mention of either cause in [reporting] the doctrine of Plato. [The reason is] either because Plato did not mention either of these in what he said about the causes, as Aristotle has shown in his treatise *On the Good*; or because he did not make them causes of the things [involved] in generation and destruction, and did not even formulate any complete theory about them. (Alexander, *In Meta*, 59.28–60.2, trans. Dooley)

Because we do not possess the treatise *On the Good*, we can only guess what Aristotle's argument there may have been to the effect that Plato did not mention the cause for the sake of which in his discussion of causes. Simplicius quotes Alexander as saying that 'according to Plato the first principles of things, and of the forms themselves, are the one and the indefinite dyad, which he used to call great and small, as Aristotle relates in his work *On the Good*' (*In Phys* 151.6–8).

This returns us to the quote from the *Metaphysics*, where Aristotle complains that Plato did not mention the cause for the sake of which, but only mentioned as causes the 'what it is to be something' and the matter, and made these elements the cause of the good and the bad respectively. It is immediately clear, then, that Plato did not use the good as a cause in the explanation of natural things, but rather offered an explanation of the good itself, by referring to the cause 'what it is to be something' in the form of the one and the limit. Thus Plato did not use 'that for the sake of which' as an explanatory cause. Plato neither makes use of it in explaining generation and destruction, nor develops any general theory about them at all, just as Alexander suggested.

With respect to the *Phaedo* at least, Aristotle's complaint is justified. Just after Plato has Socrates complain that Anaxagoras makes no use of 'the best for each as the cause for each' in his explanations, Socrates admits that he could 'neither discover it myself nor learn it from another' and so 'as a second best, I busied myself with the search for the cause' (*Phd* 99d). The ensuing discussion itself makes no use of what Aristotle calls the cause for the sake of which. Rather Plato has Socrates say:

> I no longer understand or recognize those other sophisticated causes, and if someone tells me that a thing is beautiful because it has a bright color or shape or any such thing, I ignore these other reasons—for all these confuse me—but I simply, naively and perhaps foolishly cling to this, that nothing else makes it beautiful other than the presence of, or the sharing in, or however you may describe its relationship to that beautiful we mentioned, for I will not insist on the precise nature of the relationship, but that all beautiful things are beautiful by the beautiful. That, I think, is the safest answer I can give myself or anyone else. And if I stick to this I think I shall never fall into error. This is the safe answer for me or anyone else to give, namely, that it is through Beauty that beautiful things are made beautiful. (*Phd* 100de, trans. Grube)

The result is that Plato will radically develop the idea that 'like causes like' into a theory of forms that discovers the cause of something in its homonymous form. Now there is room here for a kind of teleology, insofar as intelligence, an intrinsically good thing, will be considered a cause of all good things. As Sedley acutely observes, 'Platonic teleology, then, can be read as fully adhering to the strict Platonic notion of a cause. Teleological causation is from start to finish a matter of the good bringing about the good. It is, in short, a special application of the formal causation to which Socrates turns' (1998, pp.126–7). But Socrates in the *Phaedo,* of course, works out no such plan, and we will have to wait for other dialogues, and in fact other characters, to present something like this, and develop it into a cosmology, zoology, and so forth. In the *Phaedo* itself, we simply have no theory of a cause for the sake of which. The method as presented will not even satisfy Socrates' original demand: that there be an explanation that refers to intelligence and gives the causes of why things are arranged how they are. For even if the forms can explain how several things are some one thing (in linguistic terms,

how several things share the same predicate), they cannot explain why a certain thing is what it is and not some other thing; that is, it cannot explain why things have been so arranged that this form, not that form, is present here.[47] Thus the appeal to forms is inadequate in the same way that the materialist theories are: the materialist theories might explain how this thing is what it is, but it cannot explain why it is that thing and not something else; neither the materialist or formalist theories on their own can explain arrangement or order. At any rate, it is clear that that the theory of cause Plato has Socrates articulate in *Phaedo* mentions neither nature, nor the cause for the sake of which, nor in general anything teleologically explanatory at all.[48]

There are, however, several other passages in the Platonic corpus that unambiguously make reference to the cause for the sake of which.[49] Certainly Plato refers to the cause for the sake of which (and represents Socrates as being aware of it), even in the context of generation, as a conversation in the *Philebus* makes plain.[50]

[**a**] all things are either for the sake of something else or they are that for whose sake the other kind comes to be in each case (λέγει δ' ὅτι τὸ μὲν ἕνεκά του τῶν ὄντων ἔστ' ἀεί, τὸ δ' οὗ χάριν ἑκάστοτε τὸ τινὸς ἕνεκα γιγνόμενον ἀεὶ γίγνεται). (*Phil* 53e)

[**b**] I hold that all ingredients as well as all tools, and quite generally all materials, are always provided for the sake of some process of generation. I further hold that every process of generation in turn always takes place for the sake of some particular being, and that all generation taken together takes place for the sake of being as a whole. (*Phil* 54c, trans. Frede)

After making the distinction in [**a**] between that which is for the sake of something else, and that for whose sake everything else is, Socrates maps this distinction onto being (οὐσία) and becoming (γένεσις), securing Protarchus' agreement that becoming is for the sake of being, and not vice versa. This is broadened in [**b**] to include not just all processes of becoming, but all instruments and 'raw materials' as well. The next stage of the argument is that pleasure is a state of becoming and thus is for the sake of some being. This is the real issue of the dialogue, and the brief discussion of what kinds of things are for the sake of others is applied to this purpose. We do not have any space or reason to pursue the argument, but notice that it does not proceed in the direction of an account of the cause for the sake of which as an explanation. The being for the sake of which (the product) explains why the instruments, processes, and materials are used and arranged as they are.

There is an elaborate discussion of causes earlier in the dialogue, where Plato has Socrates distinguish 'four kinds' (τετάρτου γένους, 23d5; τὰ τέτταρα ἐκεῖνα,

[47] As Menn remarks, 'the problem with explanation through forms is ultimately the same as the problem with the explanation through matter: it does not explain the *order* of the universe' (1995, pp. 3–4, emphasis in original).

[48] Cf. Annas 1982, pp. 324 f.

[49] Alexander's example is from the second *Letter*: 'Upon the king of all do all things turn; everything is for the sake of him, and he is the cause of all good things (περὶ τὸν πάντων βασιλέα πάντ' ἐστὶ καὶ ἐκείνου ἕνεκα πάντα, καὶ ἐκεῖνο αἴτιον ἁπάντων τῶν καλῶν)' (*Ep ii*, 312e, trans. Morrow).

[50] Cf. *Grg* 467d.

30[a]9–10; τῶν τεττάρων, 30[e]1–2): limit, unlimited, their mixture, and the 'cause' of their mixture. This is the closest we get in Plato's dialogues to the position on causes described by Aristotle in both the *Metaphysics* passage considered above, and in *On the Good* (at least as far as we can tell from the reports of Alexander and Simplicius).

We had better affirm, as we have said often, that there is plenty of the unlimited in the universe, as well as sufficient limit, and that there is, above them, a certain cause (αἰτία) of no small significance, that orders and coordinates (κοσμοῦσά τε καὶ συντάττουσα) the years, seasons, and months, and which has every right to the title of wisdom and intelligence. (*Phil* 30c, trans. Frede)

Of this fourth kind, it is said that 'there is no difference between the nature of what makes and the cause, except in name, so that the maker and the cause (τὸ ποιοῦν καὶ τὸ αἴτιον) would rightly be called one' (26[e]6–8). Immediately we can see that the conception of cause would fall into the kind of cause that Aristotle calls the moving cause (and sometimes the 'making' cause). This is affirmed when Socrates declares that, 'the artist who produces all these must be the fourth kind, the cause' (27[b]1–2). Later we are presented with a forced choice between the view that 'the universe and cosmos are ruled by disproportion and irregularity, as luck would have it, or … governed by intelligence and prudence of some wonderful intelligence' (νοῦν καὶ φρόνησίν, 28[d]7–8).[51] Protarchus concedes that ' the only account that can do justice to the wonderful spectacle presented by the cosmic order of the sun, moon, and stars and the revolution of the whole heaven is that intelligence orders everything' (νοῦν πάντα διακοσμεῖν, 28[e]2–6; cf. 30bc). And in several other dialogues, Plato introduces a divine artist to show how intelligence gives order to the phenomena.[52]

Take animals and everything mortal, including plants and everything on the earth that grows from seeds and roots, and also all lifeless bodies made up inside the earth, whether fusible or not. Are we going to say that anything besides the artistry of a god makes them come to be after previously not being? … Are we going to say that nature produces them by some spontaneous cause that generates them without any thought, or by a cause that works by intelligence and divine knowledge derived from a god? (*Sph* 265[c], trans. White)

the artist of the heavens arranged them and all that's in them in the finest way possible for such things (κάλλιστα τὰ τοιαῦτα ἔργα συστήσασθαι, οὕτω συνεστάναι τῷ τοῦ οὐρανοῦ δημιουργῷ αὐτόν τε καὶ τὰ ἐν αὐτῷ). (*Rep* 530a5–7, trans. Grube rev. Reeve)

Of all the things that have come to be, our universe is most beautiful, and the most excellent of causes (ὁ δ' ἄριστος τῶν αἰτίων) is the artist. This then is how it has come to be: it is a work of art. (*Tim* 29a, trans. Zeyl)

[51] Cf. *Grg* 448c.

[52] That the demiurge should be understood as *nous* is persuasively argued by Menn: 'the demiurge of the *Timaeus* and *Statesman* is, as he seems to be, a single substantial unity, identical with the *nous* of the *Philebus* (and *Phaedo* and *Laws*)' (1995, p. 7 and *passim*).

In *Laws* X, Plato attempts to prove the existence of this craftsman and the operation of intelligence as an ordering cause. The passages in which he does so will be very instructive to examine. *Laws* X contains an extended polemic against atheism, a proof for the existence of god, and a discussion of the appropriate punishments for various acts of impiety. It is a more sophisticated and advanced version of the argument in favor of piety presented by Xenophon discussed above (X. *Mem* 1.4 and 4.3). In the course of prosecuting his case, Plato has the Athenian describe the natural philosophy of his infidel predecessors.

> Some people, I believe, account for all things which have come to exist, all things which are coming into existence now, and all things which will do so in the future, by attributing them either to nature, art or luck (τὰ μὲν φύσει, τὰ δὲ τέχνῃ, τὰ δὲ διὰ τύχην) . . . the facts show—so they claim—that the greatest and finest things in this world are the products of nature and luck (φύσιν καὶ τύχην), the creations of art being relatively trivial. The works of nature, they say, are grand and primary, and constitute a ready-made source for all the minor works constructed and fashioned by art—*art*efacts, as they're generally called . . . they maintain that fire, water, earth, and air owe their existence to nature and luck, and in no case to art (φύσει πάντα εἶναι καὶ τύχῃ φασίν, τέχνῃ δὲ οὐδὲν τούτων), and that it is by means of these entirely inanimate substances that the secondary physical substances—the earth, sun, moon, and stars—have been produced. These substances moved at random, each impelled by virtues of its own inherent properties, which depend on various suitable amalgamations of hot and cold, dry and wet, soft and hard, and all the other haphazard combinations that inevitably resulted (κατὰ τύχην ἐξ ἀνάγκης) when the opposites were mixed. This is the process to which all the heavens and everything in them owe their birth, and the consequent establishment of the four seasons led to the appearance of all plants and living creatures. The cause of all this, they say, was neither intelligent planning, nor a deity, nor art, but—as we've explained—nature and luck (οὐ δὲ διὰ νοῦν, φασίν, οὐδὲ διά τινα θεὸν οὐδὲ διὰ τέχνην ἀλλά, ὃ λέγομεν, φύσει καὶ τύχῃ). (*Leg* X, 888e–9c6, trans. Saunders)

The diction and procedure of this argument in part prefigure Aristotle's own dialectical treatment of his predecessors. First, there is the discrimination of causal factors. Second, there is the leveling and assimilation of what is in fact an extremely diverse set of positions into one or two causal factors. Third, there is the suggestion that the predecessors apply this causal factor as an explanation of both the heavens and the animal kingdom. As important as these parallels are to Aristotle's own dialectical procedure, the devil is in the details. Plato associates the predecessors with 'nature and luck' as opposed to art or intelligence. Aristotle associates the likes of Empedocles and Anaxagoras with luck as well, but as opposed to nature. In fact, Aristotle takes the chief lesson of the dialectic with these philosophers to be the establishment of his own position, that if luck is a cause, then nature is *a fortiori* a cause. Plato, on the other hand, identifies nature and luck, opposing these to intelligence and art. He expands on the opposition between the two groups of concepts by associating intelligence and art with soul and asserting the priority of its and all associated causal factors to nature.

The first cause of the birth and destruction of all things . . . the soul . . . is one of the first creations, born long before all physical things, and is the chief cause of all their alterations and transformations . . . Opinion, diligence, intelligence, art, and law, precisely because they come in the category 'primary', will be attributable to art. Natural things, and nature herself—to use the mistaken terminology of our opponents—will be secondary products from art and intelligence. (*Leg* X, 892[a]–b8, trans. Saunders)

The real difference between the Platonic notion of a cause for the sake of which, and the Aristotelian one, can be discerned from an analysis of this prioritization. While Plato thinks that nature and natural causes are secondary to intelligence and art,[53] Aristotle holds that the existence of art as a cause for the sake of which confirms that nature is *a fortiori* a cause. This is because art imitates nature, or fills in where nature leaves off. Aristotle, in effect, deploys the same dialectical tactic on Plato as he did on Empedocles and Anaxagoras. He associates Plato with the causal factor of intelligence or art, and then goes on to argue that art is posterior to nature.

To further substantiate these claims—that Aristotle believes Plato's doctrine to be reducible to the causal factor of art, and that this is a conceivable interpretation of Plato's published works—consider a later passage from the same book.

The supervisor of the universe has arranged everything with an eye to its preservation and its excellence, and its individual parts play appropriate active or passive roles according to their various capacities. These parts, down to the smallest details of their active and passive functions, have each been put under the control of ruling powers that have achieved the ultimate end of its divisions. Now then, you perverse fellow—a mere speck that nevertheless contributes to the good of the whole—one part is you, you who have forgotten that everything is created for the sake of creating this, that the entire universe exists in a life of prosperity; and you forgot that creation is not for your sake, rather you exist for the sake of the universe. Every doctor, you see, and every skilled artist always works for the sake of some end product as a whole (ἕνεκα πάντα ἐργάζεται); he handles his materials so that they will give the best results in general, and makes the parts contribute to the good of the whole, not vice versa (τὸ κοινῇ συντεῖνον βέλτιστον μέρος μὴν ἕνεκα ὅλου καὶ οὐχ ὅλον μέρους ἕνεκα ἀπεργάζεται). But you're grumbling because you don't appreciate that your position is best not only for the universe but for you too, thanks to your common origin. (*Leg* X, 903[b]4–d3, trans. Saunders)

The artist makes everything for the sake of the whole, and on the scale of the universe this means that every thing in the cosmos exists for the whole world; the individual or 'part' has its good only in relation to that whole. These subservient parts include not only individual organisms, such as the human who is the target of the polemic, but every body, power, and function in the universe. All of these things are for the sake of the good of the whole universe.

What would Aristotle make of such claims? First, this seems to be just the sort of use of the cause for the sake of which that he discourages by requiring that

[53] This point is brought out well in Lennox's aptly titled essay: 'Plato's unnatural teleology' (1985a).

the better be specified with reference to an individual being, and not just asserted 'universally'. Aristotle specifies nature as an internal principle and an end because he does not think that the good of individual things should be transferred to things external to it, or assimilated to some greater being. He is concerned with the natural good, survival, preservation, and flourishing of 'each kind of living thing' and 'the individual entity and that which it is itself'. Aristotle thinks that objects of art have their principle of change, and thus value or use, only in relationship to something external to them, and inside the one who makes or uses them. If there is no nature, but only technology, then the value of everything exists only in the creator or user of the technology. But the divine artist is not that for the sake of which, in the sense of a beneficiary of the products of his creation. What else is there to be the beneficiary? Certainly not god. Aristotle argues that god should not be considered a beneficiary of the good of other things, and that is the reason he denies that god is a creator or an ordering ruler.

The discussion of the artist of the universe and its contents is elaborated in the *Timaeus*, a dialogue in which the issue of cause is central. Plato there asserts that everything that is generated comes to be as a result of some cause (28ac). The dialogue is structured around the distinction between two kinds of cause that Plato repeatedly insists must be involved in the pursuit of knowledge (e.g. 46de, 68e–9a). These two key causes—intelligence and necessity (48a)—are discussed separately in Plato's dialogue. The necessary causes—the elements (earth, air, water, and fire), their constituents (various atomic triangles), their corresponding bodies (the perfect solids), their movements, properties, orientations, and sensory effects—are discussed in detail from about 53c to 68e. These causes are then used to discuss the parts of the human being, including the parts of soul (rational, spirited, and appetitive), and the parts of the body (lungs, liver, pancreas, brain, flesh and bones, mouth and teeth, etc.). The explanations follow a pattern of describing the use or function (e.g. lungs facilitate the cooling of the heart through respiration, 70cd), and then describing how the necessitating causes were utilized in the design of the organ for that function. Some of the functions are quite bizarre; the liver for example, ultimately exists as a 'center of divination' (71e), and that is why it is dense with a smooth texture and bright complexion, so that it may bear imprints well. Most bizarre, however, is the function Plato mentions in connection with nails, claws, and hoofs:

> [Sinew, skin and bone] were mere auxiliary causes in its [nails'] formation—the pre-eminent cause of its production is the purpose that took account of future generations (τῇ δὲ αἰτιωτάτῃ διανοίᾳ τῶν ἔπειτα ἐσομένων ἕνεκα εἰργασμένον): our creators understood that one day women and the whole realm of wild beasts would come to be from men, and in particular they knew that many of these offspring would need the use of nails and claws or hoofs for many purposes. This is why they took care to include nails formed in a rudimentary way in their design for humankind. (*Tim* 76de, trans. Zeyl)

The only mention of living things besides humans is as follows. First, plants exist for the sake of humans (77ac). There are four other kinds of living things, which

are distinguished by their environment: gods, things that have wings and travel in the air (birds), things that live and swim in the water (fish), and things that live on the land (39^{e}–40^{a}). Humans are in the last class. Among humans, males are superior to women (42a). The male human is what the explanations according to the two causes were about. Women and all the other kinds of animals come into being in order to serve as fitting reincarnations of degenerate men, in a sort of reverse theory of descent, or theory of devolution (*Tim* 90^{e}–92^{c}). Future generations of humans would be reborn as women and other animals, and nails, claws, hoofs, and so forth would be useful for protection. The entire description of non-human animals, which are clearly held in contempt, is contained in less than two pages[54] But the point is obviously not to describe their physiology or the functioning of their organs in their own right, but rather to describe the appropriate kinds of human moral failings that would result in a reincarnation into one of these kinds of beasts.[55]

The point in mentioning these passages and positions is to show on the one hand the causal discriminations that Plato makes, and on the other, the uses to which he puts them. This will help determine why it is that Aristotle refuses to recognize in these the cause for the sake of which. The *Timaeus* is long on examples of applications of what Plato took to be causes, but short on general or theoretical descriptions of how these causes are supposed to work. The artist model does not constitute a theoretical discussion of causality, for it merely gives an image for

[54] Johansen in his recent study of the *Timaeus* states that the dialogue is 'anthropocentric only to limited extent because the primary task of cosmology is to demonstrate the goodness and beauty of the whole cosmos, of which man is just a part' (2004, p.3). What cosmology is about is irrelevant to the charge of anthropocentism–what matters is what the cosmos itself is for. As Johansen goes on to say: 'we see a kind of anthropocentricity, for example, in the view that the sun illuminates the heavens so that by observing the planets "those animals to which it was appropriate" can learn the mathematical regularities that govern their motions and thereby become better persons . . . the foresight that lies behind the universe takes into account in a special way the ethical requirements of living beings such as us. Thus there is a sense in which the cosmos also fulfils *its* purpose when we use cosmology to become better persons' (p.3, emphasis in original). If setting up the sun and planets for the sake of human improvement (not living beings 'such as us'–but specifically us, or rather the males among us) does not count as full blown anthropocentrism, then it is hard to see what would. And Johansen has less to say in his study about other animals or plants than even Plato–they simply do not in themselves figure into 'Plato's natural philosophy'.

[55] Likewise, Plato has Socrates in *Phaedo* describe plants and animals in this part of the 'corroded and polluted' cosmos, as suffering from 'ugliness and disease' (*Phd* 110^{e}2–6). Sedley has shown how Plato envisions a purposeful structure of the cosmos ordered 'with a view to the self-improvement of souls' (1989, p. 379). The different layers, from Hades inside the earth to the outer celestial spheres, are a ladder on which souls can ascend depending on their moral righteousness. This accounts for the fact that this world as a whole is an ideally good one and exhibits an overall teleological structure, despite the fact that things in our cosmos are corrupt. As a primer to Aristotle's response should be read *Protr* 81.7–9, where Aristotle remarks that it makes no difference to his account if it is maintained that animals are brought into being through 'some corruption or wickedness'. Aristotle holds that all animals are brought into being for the sake of something, and this something is their own good. That is why parts of animals are good for the animal even if it is 'corrupt', as even Plato allows. For Aristotle this is due to the fact that there is something good worth preserving in its own right, and not simply as a scheme to punish or reward souls.

visualizing how intelligence could work in conjunction with necessitating factors in order to produce good and beautiful beings. Saying that things are ordered by art is but a small step from the Anaxagorean position that things are ordered by intelligence: it does not produce an explanation but merely a heuristic for thinking about causality[56] Furthermore, there is no reason to prefer this way of putting things to saying that nature itself is a cause of order and an end. This will be argued for at length over the next several chapters, but it is worth pointing out here that natural teleology captures everything an artificial one does, but with a simpler principle.[57]

Aristotle himself uses the art model. It will become clear that Aristotle does not intend it to explain anything, but merely to give us a notion of how causality itself works on the basis of the facts most readily available to ourselves (i.e. how intentional agency and the crafts can produce definite results). Recall as well that art is posterior to nature as a cause, and thus for Aristotle cannot be the primary cause of the universe, as Plato asserts. Understanding how Plato's artist works tells us no more (and no less) about how Plato conceives of a cause 'for the sake of which' than Aristotle's use of the art analogy tells us how he thinks nature operates as a cause.[58] Plato's description of the divine artist is given not in order to see how a literal demigod works, but rather to see how an ordering and organizing cause, like intelligence, might work; the activity of the artist merely exemplifies that. That is why Lennox's way of referring to what Plato is doing is so apt: 'Plato's artificial teleology.[59] Furthermore, the overall Platonic conception of the generation

[56] Lennox argues that in the middle and latter periods Plato develops the artist model in an effort to form a 'more integrated theory of scientific explanation' (1985a, pp. 281 f.). I agree with this. Certainly there is more sophistication in the account of the *Timaeus*, in this regard, than in the *Phaedo*. But in no case does Plato offer an account of scientific explanation that could satisfy Aristotle's notions of explanation. I am rather inclined to agree with Sedley that the point of Plato's use of teleology in both *Phaedo* and *Timaeus* is to support a moral story about the fate of human souls. While in the *Phaedo* myth the device for this is the description of the cosmos as segregated according to degrees of perfection and beauty, in the *Timaeus* the device is the description of the devolution of kinds of animals. Thus the issue of how 'scientific' the *Phaedo* myth really is turns out to be beside the point (Sedley 1989, p. 383; cf. Sedley 1997, p. 337).

[57] This is acknowledged in Johansen's recent study of the *Timaeus*: 'the problem with the craftsmanship hypothesis is that any increase in order makes the alternative to design, natural teleology, equally more likely. But the natural teleology thesis is more probable than the craftsmanship hypothesis, because it is simpler. There is therefore no increase in the degree of order that would ever be enough to make the design hypothesis more probable than that of natural teleology' (Johansen 2004, pp. 78–9). Aristotle might or might not use the argument from parsimony here, but he does use the *a fortiori* reasoning described in this chapter to make a substantially similar point.

[58] Charles has persuasively argued that the chief significance of the artist for Aristotle is as a model for knowledge acquisition (2000, p. 358 and *passim*). Plato, on the other hand, uses the artist as a direct causal agent with influence over nature.

[59] Lennox 1985a. As Johansen says: 'Aristotle's natural teleology is normally taken as an example of the . . . unintentional sort. In contrast, Plato's cosmology in the *Timaeus* is, with good reason, taken as an example of the intentional sort of teleology, or "unnatural teleology" as James Lennox has called it . . . The aim of this chapter is to examine the role of the demiurge in the creation of the cosmos in the light of this contrast between natural and unnatural teleology' (2004, p. 69). This is done well in

of animals, however impressive as a piece of moralizing, has no explanatory value from a scientific standpoint.

We are now in a position to summarize why it is that Aristotle denies that Plato distinguished or used the cause for the sake of which, even though we have seen it both theoretically discussed (in *Philebus* and *Laws* X), and employed in something resembling explanations (in *Timaeus*). It is because Plato's prioritization of art over nature, and his specification of the cause for the sake of which with reference to the whole universe, and not with reference to its individuals or natural kinds, means that he did not employ the notion of the for the sake of which as a cause—i.e. in a causal explanation. He specifies no end for the technology, nor indicates a real beneficiary. He cannot locate the intrinsic cause of change, or determine that for the sake of which, using a theory of forms in conjunction with a model of an artist, as he attempts to do in the *Timaeus*. Aristotle says:

> In general, though philosophy seeks the cause of perceptible things, we have given this up (for we say nothing of the cause from which change takes its start), but while we fancy we are stating the substance of perceptible things, we assert the existence of a second class of substances, while our account of the way in which they are the substances of perceptible things is empty talk; for 'sharing', as we said before, means nothing. Nor have the Forms any connection with what we see to be the cause, in the case of the sciences that for whose sake both all intelligence and the whole of nature are operative—with this cause which we assert to be one of the first principles (οὐδὲ δὴ ὅπερ ταῖς ἐπιστήμαις ὀρῶμεν ὂν αἴτιον, δι' ὃ καὶ πᾶς νοῦς καὶ πᾶσα φύσις ποιεῖ, οὐδὲ ταύτης τῆς αἰτίας, ἣν φαμεν εἶναι μίαν τῶν ἀρχῶν, οὐθὲν ἅπτεται τὰ εἴδη). (*Meta* i 9, 992A24–32, ROT)

So the overarching criticism of Plato's use of quasi-teleological causes is comparable to Aristotle's criticism of Empedocles and Anaxagoras (and of criticisms he could have made of Socrates as well). Each of these philosophers uses notions like intelligence and art, but not as a cause in complete explanations of specific things that yield what Aristotle considers scientific knowledge.[60]

Johansen's chapter 4 on 'Teleology and craftsmanship'. But it makes one wonder why the title of his book is *Plato's Natural Philosophy*. Does Plato have a 'natural philosophy'?

[60] For a related case in which Aristotle criticizes Plato for failing to provide a cause of motion in general see *Meta* xii 6, 1071^{b}33–4.

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PART II

TELEOLOGICAL EXPLANATIONS IN NATURAL SCIENCE

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5

Teleology and Elements

Having examined the interpretations, terms, and logical and dialectical procedures of Aristotle's teleology in general, we are now in a position to examine the teleological explanations that he specifically offers. There is a dispute about which sciences Aristotle actually countenanced and provided teleological explanations for. A case in point is the elements—simple bodies like earth, air, water, and fire. Are they teleologically explicable?

One might think that on an issue this fundamental there would be consensus. But although all are agreed that it is an issue with far-reaching implications, scholars are divided on the point. Rist (1965, p. 342) and Owens (1968, p. 167), for example, both consider the 'purposiveness' and even 'desire' of the elements to be key evidence of an 'overall' teleology in Aristotle. Balme agreed that teleological explanations apply to the motions of the elements, but did not hold that this was part of an 'over-all' teleology (1965, p. 6).[1] Ayala on the other hand, faults Aristotle on this score: 'his error was not that he used teleological explanations in biology, but that he extended the concept of teleology to the nonliving world' (1970, p. 48). Lang has gone so far as to argue that the teleological account of the elements is the essence of his teleology. 'In short, the order of nature is nothing other than the orientation of each element toward that place that is its form and actuality—natural places within the cosmos that are defined by place as the limit of the first containing body—and this relation *is* Aristotle's teleology of nature' (1998, pp. 274–5, emphasis in original). Nussbaum, rejecting such conceptions, makes Aristotle say in an imaginary dialogue that teleological explanations apply neither to the motions of the elements, nor to meteorological events: 'the idea that I think natural phenomena—eclipses, rainstorms, the downward motion of earth, the upward motion of fire—are best explained teleologically, is a misconception that I frequently try to avoid' (1978, pp. 93–4).[2] Despite the explicitness of

[1] 'Finality, in [Aristotle's] view, goes through and through nature from the elements upwards' (Balme 1965, p. 6; cf. 1987b, p. 277). Still, Balme rejects 'a unified overall teleology in nature' (1972, p. 94).

[2] This is part of her argument against a universal teleology. 'Aristotle neither applies teleology to nonliving natural bodies, nor gives any evidence for believing in a universal teleology' (Nussbaum 1978, p. 60). Others that are committed to the position that the elements do not have ends include Wieland (1962/1975, p. 150), Gotthelf (1987[a], pp. 210 f.) and Byrne (2002, pp. 19 f.). Gotthelf

Nussbaum's Aristotle, Kahn holds that 'the cosmic teleology reaching down from the outer heavens is thought of as including both inanimate nature and the biological world, where it will coincide with the patterns of immanent teleology' (1985, p. 193). And several others have argued that teleological explanations pertain to meteorological phenomena like those referred to by Nussbaum's Aristotle. Clearly the status of teleological explanations of elemental motion needs sorting out.

This is what we undertake to do in the present chapter. Section 1 discusses Aristotle's general conception of natural change and motion. Natural motion is the motion of substantial bodies that are moved for the sake of something. Section 2 examines a relatively uncontroversial case, that of celestial bodies (natural substances composed of the element ether). They are considered by Aristotle to be living, intelligent beings, and so he holds that they move for the sake of something, namely, the completion of perfectly circular paths. In the case of the motions of the planets this gives rise to a perplexity, the examination of which reveals a lot about Aristotle's methodology of teleological explanations. Section 3 describes how the terrestrial elements (fire, air, water, and earth), although they are inanimate, also move naturally to what Aristotle calls their appropriate place. Section 4 considers another kind of elemental change or motion for the sake of something: the reciprocal transmutations of the elements, wherein they are said to resemble the perfect celestial motions. Section 5 discusses how the elements can also be involved in motions incidental to their own intrinsic nature, for example meteorological phenomena, such as rainfall, which are not for the sake of anything but occur out of natural necessity. Thus some but not every motion in which elements are involved (or can be made to be involved by art) is that for the sake of which the element exists.

5.1 NATURAL CHANGE AND MOTION

'The science of nature is almost exclusively concerned with bodies, most clearly with their magnitudes, their affections, and their motions, and also with their principles, all that are of that kind of substance. For, of the things constituted by nature, some are bodies and magnitudes, others have body and magnitude, and others are principles of the things having these' (*Cael* i 1, 268^{a}1–6). This admirably concise account of the contents of natural science is an extension of the notion that nature is an internal principle of motion. Nature is always in a body, a body that moves, and a body that moves in accordance with a principle. Thus Aristotle's

asks, 'can one account for a particular living process in terms of the element-potentials involved in the process, making no mention of the overall end or goal of the process?' He thus assumes that elemental motion is to be contrasted with an end-oriented process. (Although he remarks elsewhere, oddly, that, 'omitted as irrelevant to our immediate purpose [is] the role of the efficient cause of locomotion to natural place' (p. 210 n. 13).)

natural science is fundamentally a set of principles for different kinds of bodies and their motions.

If that seems either too broad or too vague, it should be noticed that this formulation actually has far-reaching consequences. It excludes, for example the following: things that are not bodies, except insofar as they are related to substantial bodies (properties, relations, events, negations, etc.); things that are bodies, but that do not have an internal principle of motion (artifacts, spontaneously generated organisms, accidental compounds, etc.); and things that do not move (numbers, words, abstractions, the primary unmoved mover, etc.).

What, then does it include? Aristotle lists the following as considered 'by everyone' to be natural bodies and substances: simple bodies, both celestial (stars, sun, and moon) and terrestrial (air, water, air, fire), and compound bodies that are alive and have parts (plants and animals).[3] These are the things of which the natural-physical universe is composed.

In our region of the universe, there also exist artifacts, quasi-substances[4] created by humans out of natural materials for the sake of some human purpose. But these are derivative from and resemble natural substances (they 'imitate' or 'fill in' nature). Their nature, to the limited extent that they can be said to have one, is the natural material out of which they are made (*Phys* ii 1, 193^{a}9–29). Thus artifacts can only be explained, according to Aristotle, on the basis of their relationship to natural things.[5] This basis can be either the natural materials out of which they are constructed, or the purposes of the natural organism (i.e. humans) that created them. The former kind of explanation refers to their matter, the latter to their form (and hence end). Thus I can explain a bed on the basis of the properties it has by being made out of wood, or on the basis of its uses for a human being—a platform for resting, or whatever. But without reference to these other natural things, which do have their own internal principles, there is no explanation of a bed or any other artifact.

This implies that it is impossible to explain natural things on the basis of their resemblance to artifacts, simply because artifacts do not have internal principles of motion or change with reference to which they can be understood independently of the humans (or other animals or gods) who are responsible for their production. On the other hand, all natural things have an internal principle of motion and change, on the basis of which they can be explained. Since nature is a cause for

[3] For the list of substantial natural entitles about which 'everyone agrees', see also *Cael* iii 1, 298A29–32; *Meta* v 8, 1017^{b}10–14; vii 2, 1028^{b}8–13; viii 1, 1042^{a}6–12; xii 1, 1069^{a}30–3.

[4] Aristotle says that these things, and all things that are not generated naturally, are 'probably' (ἴσως) not substances (*Meta* 1043B21–23; cf. 999^{b}4–20, 1060^{b}23–8, 1070^{a}13–20). See also Katayama 1999.

[5] This is a crucial point in the determination of the role and importance of the craft analogy in Aristotelian teleology, and hence in the determination of the extent to which Aristotle's teleology is illegitimately anthropomorphic. Aristotle does not assimilate the explanation of natural things to the sphere of human craft production; although the model of craft shows how it is that we identify the natural kinds about which we later develop deeper kinds of knowledge (as Charles 2000 rightly observes).

the sake of something, it follows that such natural substances are explained, in the first place, on the basis of what their motions are for the sake of, that is, teleologically.

Since mobile and mutable substance is the object of natural science, the natural scientist will have to know about motion and change. Aristotle initially defines change (κίνησις) as follows.

> Having distinguished with respect to each kind (καθ' ἕκαστον γένος) what is in a state of completion and what is potentially (τοῦ μὲν ἐντελεχείᾳ τοῦ δὲ δυνάμει), the state of completion of that which is potential, as such, is change (ἡ τοῦ δυνάμει ὄντος ἐντελέχεια, ᾗ τοιοῦτον, κίνησίς ἐστιν). For example, of the alterable, as alterable, it is alteration. And of the increasable and its opposite reducible (for there is no name common to both), it is increase and reduction. Of that which is generable and destructible, it is generation and destruction. Of what is mobile, it is motion. (*Phys* iii 1, 201ª9–15)

In our survey of terminology, we saw that the term ἐντελέχεια is at root a teleological term. Is the implication that Aristotle considers all change to be teleologically explicable?

Before directly answering this question, we have to get a better idea of just what Aristotle aims to define here. It is *natural* change. Natural change happens in the case of things that have a state of completion and, concomitantly, the capacity to change into it. Natural things can both be affected and affect other things (ποιητικὸν καὶ παθητικόν). For example a rock can be completely cold, as when near the peak of a mountain, and yet potentially hot, if the mountain was a volcano and its lava heats the rock. The rock could be affected by the lava, and in turn affect a tree that it is hurled towards, lighting it on fire. Natural bodies are like that: 'so is that which changes when the change is natural (τὸ κινοῦν φυσικῶς κινητόν); for everything that is like that changes other things and is changed itself (κινεῖ κινούμενον καὶ αὐτό)' (*Phys* iii 1, 201ª23–5). Something that could cause change without itself being changed, or affect others without being affected, would no longer be natural (οὐκέτι φυσικῆς, 198ª28, cf. 198A35–B3).

There are four basic kinds of natural change: (1) locomotion, change with respect to place; (2) generation and destruction, change with respect to substance; (3) growth and diminution, change with respect to quantity; and (4) alteration, change with respect to quality (for example from pale to tan, or sickness to health). Every kind of change is either one of these four (*Phys* iii 1, 201ª4–9), or it is not natural.

Animals undergo every kind of change just mentioned, and it is not surprising that animals are paradigms of natural substances with natural motions for Aristotle. We can easily see them being born, growing, moving from place to place, ageing, changing colors and even shapes, and eventually dying. Most obviously, we see this happening with humans. Although the specifics of animal motion and change are difficult to determine and explain, the overt nature of the phenomena is not hard to recognize.

On the other hand, the idea that the elements—simple, inanimate natural bodies—have proper motions and changes is not so obvious. Even if we consider the existence of such bodies to be obvious, the fact of their having natural motions intrinsic to themselves is not. When you think about the motions and distributions of elements in the universe, it is not apparent whether they can be said to be moving themselves, or whether they are being moved by other things, or even whether they have natural motions at all. This obscurity affects the interpretation of Aristotle: as we have seen, scholars are divided on the proper explanation of the motions of the elements, and this, perhaps more than any other issue, has been a source of confusion and misinformation about Aristotelian teleology. Why do the elements move and change as they do, and what is the best way to explain their motion? Aristotle himself considers this a difficulty (ἀπορία). Here's why.

> For these things, when they are moved to an opposite place, their motion is forced (βία), but when moved into their appropriate place (εἰς δὲ τοὺς οἰκείους), e.g. the light up and the heavy down, their motion is natural (φύσει). But when they are moved by something other than force it is no longer apparent [what is the source of their motion], as it is when they move contrary to nature (παρὰ φύσιν). For it is impossible to say that they are moved by themselves. For this is characteristic of a living thing and is particular to animate things; and in that case they would be able to stop moving themselves. (*Phys* viii 4, 255A2–7; cf. *Meta* i 1, 981^{b}4)

Before moving on to examine Aristotle's treatment of the problem, we pause to note that this passage shows how false is the notion that Aristotle believed all the elements to be living or even intelligent agents. There has been confusion about the possibility of animism in Aristotle. Even a careful historian of philosophy like Gomperz is none too clear on the issue. He remarks that, 'deanimation of nature, this view of it as merely passive and receptive, is greatly predominant with Aristotle' (1909, p. 115), and then later complains of Aristotle's 'extreme teleological view of nature and the, so to speak, atavistic tendency to assume the animation of all nature' (1909, p. 171). The notion of animism has been used to criticize or even ridicule Aristotle, although sympathetic commentators have also advanced it.[6] But, for all that, it is clearly impossible: Aristotle is very careful to distinguish animate and inanimate bodies.[7] The problem with the motion of the terrestrial elements, as with several other cases in teleology, is just to explain how

[6] Rist says, 'There is some kind of desire inherent in matter' (Rist 1965, p. 342; cf. 1989, pp. 130 f.). Rist's 1965 article addresses Ross' concern about the incoherence of an 'unconscious teleology' manifest in 'unconscious purpose in nature' (Rist 1965, pp. 337 f.). Such purposes pose no problem for Aristotle, argued Rist, since Aristotle considered all matter to be in a sense alive. Later, Rist argued that if 'the world is in some sense alive, then it may have some sort of overall purpose as such: a purpose distinct from, though instantiated in, the purposes of its individual living entities' (Rist 1989, p. 127). Balme is less clear than usual on this point when he says, 'nature is alive—not, of course, as a single personalized entity, but as a collection of separate living beings, not excluding the soulless elements' (1965, p. 24).

[7] For further argumentation that the elements are not alive, see *Anima* 411A14 f.

they can be understood to have natural motions despite the fact that they are not alive or volitional. We can get a better idea of Aristotle's position on this by examining and comparing inanimate elemental motion to the following case in which the element is alive.

5.2 CELESTIAL ELEMENTAL LOCOMOTION

It was stated above that what Aristotle calls the science of nature is concerned with bodies, their magnitudes, properties, and movements. Bodies, again, are either complex or simple. Simple bodies are elements. Aristotle recognizes five elements: ether, whose nature it is to move eternally in a circle, and earth, water, air, and fire, whose nature it is to move rectilinearly, the former two towards the center of the cosmos, the latter two away from it (*Cael* i 2, 268^{b}14–9^{a}9). Ether has been called the fifth element, but Aristotle says that its motion is the 'first motion' because it is the most simple and complete: the circular rotation of the stars.

Aristotle is not very concerned with astronomical details for their own sake. As G. E. R. Lloyd has observed, 'he needs astronomy primarily . . . for his teleology, especially to establish the orderliness of the heavens' (1996, p. 161). In support of this is the fact that Aristotle stresses that the rotary motion of the ethereal heavenly bodies is for the sake of something. But for what? It is for the sake of the celestial bodies themselves, which are carried by the motion. Aristotle conceives of the celestial bodies as alive and divine, on account of their perfection and eternality.

> Each thing that has a function, exists for the sake of its function (ἕκαστόν ἐστιν, ὧν ἐστιν ἔργον, ἕνεκα τοῦ ἔργου). The activity of god is immortality, i.e. eternal life, and so it is necessary for the movement of the divine to be eternal. But the heaven is this kind of thing, for it is a divine body, and for that reason it is given the circular body whose nature is to move always in a circle. (*Cael* ii 3, 286^{a}8–12)

In another context, we already saw Aristotle argue that the circular motions of the heavenly bodies provide the clearest example of nature acting for the sake of something.[8] In those passages, Aristotle claims that we never observe disorder or randomness in the heavens, and that activity for the sake of an end is more obvious in the heavens than in animals. This was part of the *a fortiori* argument for nature as a cause for the sake of something against those who hold spontaneity and luck to be sufficient causes. It is worth examining yet another passage where Aristotle expands the argument.

> Nature makes everything for the sake of something (ἡ φύσις ἕνεκά του ποιεῖ πάντα). For it is evident that, just as art is in the case of artifacts, so in things themselves there is a similar principle and a cause (ἀρχὴ καιʹ αἰτία) which we ascertain from the universe just as we do

[8] *Phys* ii 4, 196^{a}24–^{b}7; ii 6, 198^{a}1–13.

the hot and the cold.[9] That is why it is more likely (μᾶλλον εἰκὸς) that the heavens came to be by this kind of cause, if it came to be, and exists more because of this kind of cause than the mortal things—i.e. animals. In fact the ordered and the definite is much more evident (πολὺ μᾶλλον φαίνεται) in the heavens than in us—there is more variation and luck for mortal things. But some people say that while the animals are born and exist by nature, the heavens subsist by luck and the spontaneous—heavens in which no luck or disorder is evident whatsoever. But we say in every case that something is for the sake of something (πανταχοῦ δὲ λέγομεν τόδε τοῦδε ἕνεκα), when some end (τέλος) is evident towards which change proceeds if nothing impedes it. (*PA* i 1, 641B12–25)

The fact that we see the stars moving in definite circular patterns is taken by Aristotle to be observational evidence that they are moving for the sake of something, since all things that move like that, i.e. not haphazardly, do so for the sake of some end. We see other things, closer to home, also moving and changing in definite and apparently purposeful ways, though with greater variation and usually more impediments. Since almost all are agreed that at least some such things move for the sake of something, everyone ought to acknowledge that the movements of the stars in heaven are likewise (or rather, *a fortiori*) for the sake of something. So goes Aristotle's argument. Just why we are entitled to infer from the effect of regularity to the cause for the sake of which is not mentioned here. The dialectical framework of the argument assumes that an interlocutor concedes (or in their own theory holds) that animal motion is regular and for the sake of something, and so will be compelled to admit that stellar motion, being much more regular, is *a fortiori* for the sake of something.

In fact, the rotary motion of the celestial bodies seems to Aristotle so regular, complete, and perfect, that he hypothesizes the existence of a unique material out of which they are composed—ether—in order to account for their impressive regularity. He also invokes tradition to support his conviction that the motions of the heavenly bodies are eternal, divine, and perfect.

It is right to be convinced of the truth of our ancient and truly venerable accounts, that there is something deathless and divine having movement, and having it in a way that has no limit itself, but rather is the limit for the other things. For the term 'limit' (τό τε γὰρ πέρας) also applies to what contains; and this motion, being complete (τέλειος οὖσα), contains the incomplete motions having limits and cessation (τὰς ἀτελεῖς καὶ τὰς ἐχούσας πέρας καὶ παῦλαν), itself having neither beginning nor end, but unceasingly existing for an unlimited amount of time, of some the cause of their beginning, of others of their being made to stop. (*Cael* ii 1, 284ª2–11)

The celestial bodies rotate themselves eternally, and their movements describe the limits of the universe. Thus although unlimited in one sense (being in continual

[9] The sentence is obscure, but its meaning is probably something like the following. Just as we grasp the properties of hot and cold from natural things themselves, i.e. we sense them, so we grasp the principles of the motion of celestial bodies from direct observation. We see them going around in a circle, continuously. We conclude that their principle is motion in a circle.

rotary motion), in a more profound sense they are the physical and axiological limit for all motion in the universe. Continuous and regular rotary movement is perfection, thus it is called divine. The seemingly unlimited numbers of halting and zigzagged movements typical in our region of the universe are just more or less imperfect imitations of that motion, and they are ultimately bounded by it.

Aristotle infers from the perfection of their movements, relative to those of terrestrial bodies, that the bodies further away from the terrestrial sphere have a more 'honorable' nature (τιμιωτέραν ἔχον τὴν φύσιν) (*Cael* i 2, 269^{b}16), and the further the better. This picture, of a linear increase in order and value as one moves away from the center and towards the extreme closest to the unmoved principle of all motion, gives rise to a set of perplexities (ἀπορίαι), the examination of which has much to teach us not only about Aristotle's teleology, but about his general scientific method as well.

The exact problem is why the greatest variety of movements exist among the bodies in the middle celestial spheres, instead of a successively greater variety of motions with increased distance from the primary body (the highest heavens). For it seems reasonable (εὔλογον), that there would be least variation for the primary bodies (the fixed stars), more variation for the intermediate bodies (the planets), and the most variation for the rest of the bodies (the sun and moon). But observation shows that this is not the case, for there is more variation among the movements of some of the planets than among the moon and the stars, even though the planets are farther from the center and thus nearer to the primary bodies. The appearance of insolubility of the problem is due to an assumption whose removal makes possible theoretical considerations that can account for the observed facts.

> We have become accustomed to thinking that these are mere bodies, and that they are points having order but are entirely lifeless. But it is necessary that we conceive of them as embracing action and life. For then none of the facts will seem to be irrational. Because it makes sense for the best conditioned to attain the good without activity, for the things nearest to attain it through a single activity or a few, and for the things farther removed to attain it through more activity. (*Cael* ii 12, 292^{a}18–24)

Aristotle gives two analogies to support the point. The first concerns the condition of the human body. Some people have great bodies without doing anything at all; others have to walk to keep in shape; still others have to exercise all the time, running, wrestling, martial arts, etc.; finally, some people can never get in shape and have a good body despite all their activities and exercises. The second example is dice throwing: rolling snake eyes once is not hard to do, but rolling it a thousand times is very difficult. In general, the more motions or activities required to accomplish something, the more difficult the thing is, and the less likely it is that the goal will be achieved. So it is with the cosmic bodies: the best doesn't have to move at all in order to attain the good; the next best needs only one motion, the following need more motions; the lowest never attain the good at all, and so do not even attempt as many motions. These considerations have a direct counterpart

in the realm of terrestrial living things, which supports Aristotle's overall claim that we ought to conceive of the stars themselves as living things.

That is why we must think of the activity of the stars as similar to that of animals and plants. For even here humans have the most activity. For since there are many things that they happen to be capable of, so there are many actions for the sake of various things (ἄλλων ἕνεκα). But that which is in the best condition has no need of action, since it is itself that for the sake of which (αὐτὸ τὸ οὗ ἕνεκα), while action always has two factors: (1) something for the sake of which [i.e. the end], and (2) the thing for the sake of this [i.e. the means] (καὶ οὗ ἕνεκα ἢ καὶ τὸ τούτου ἕνεκα).[10] Among the lower animals there is less activity, and among plants very few and perhaps only one. For either plants happen to have only one 'of which' (just like humans), or all the many they have is oriented towards the best. So, if the end is health, while one thing is in the condition of, and participates in, the best, another approaches it through a few actions, another through many, but another doesn't even try, but considers it sufficient to come near the final (τοῦ ἐσχάτου). (*Cael* ii 12, 292^{b}1–13)

The four aspects of this complex analogy are as follows. (1) The uppermost part of the cosmos, the sphere of fixed stars, being nearest to the good, has simple, rotary movement. (2) The middle part of the cosmos, the planets, has the greatest variety of movements, because they reach the good through diverse activities and routes. This is analogous to the situation with humans who, among living things, have the greatest variety of actions because they have several different ways and means of achieving their good. (3) The lower part of the cosmos (sun, moon, and earth) has simple movement, or (in the case of the earth) no motion at all. This is because, like animals and plants, these cannot achieve the highest good, and so have to be content with reaching the goods nearest to them (or not moving at all, as with plants). Getting the analogy straight helps us understand the summary of the following response to the initial problem.

On the one hand, to attain the best of each thing is for everything the end (τοῦ τέλους). But if not this, it is always better the nearer it is to the best. And that is why, generally the earth does not move at all, and the things nearest to it move a little. For it doesn't reach the final point (ἀφικνεῖται πρὸς τὸ ἔσχατον), but only reaches so far as it is able to share in the divine principle. But the first heaven immediately attains it through one motion. But the things between the first and the final reach it, but only reach it through several motions. (*Cael* ii 12, 292^{b}17–25)

For the purposes of the present investigation, the point is that the motion of the heavens is purposeful activity. The motion of the first heaven in its simplicity and consistency is the most obvious case of this. The somewhat irregular motion of the planets makes the fact less apparent, or even problematic, although the difficulty is resolved when we recognize that their complex motions are necessary for them

[10] Notice that this is a slightly different distinction between two senses of 'the for the sake of which' than that discussed in Ch. 3. The distinction here is between means and ends. But this is conformable to the distinction between aims and beneficiaries. For aims can be characterized as the means by which beneficiaries, as ends, are benefited.

to approximate the best (just as humans need to engage in many actions in order to be the best). The relatively regular motion of the sun and moon, and the absence of motion for the earth, is due to the fact that these cannot finally achieve the best, and so they settle for less, and are less active. Thus the hierarchy of purposes and perfection is maintained, despite the observational difficulty of non-linear decrement of activity. The result is that the rotary motion of the ethereal bodies in the first heavens makes them paradigms of bodies that are for the sake of something. Motion in a circle is the paradigm of natural motion. As Aristotle says, 'human affairs form a circle, and there is a circle in all other things that have a natural motion and generation and destruction' (*Phys* iv 14, 223B24–6). The heavenly bodies achieve that circle perfectly, through rotary motion, and the terrestrial bodies and organisms try to achieve it so far as they are able. And, as we will soon see, Aristotle holds that the terrestrial natural bodies—the sublunary elements (earth, air, water, and fire), plants, and animals (including humans)—also have a kind of circular motion and so too exist for the sake of something.

5.3 TERRESTRIAL ELEMENTAL LOCOMOTION

In a way, the confusion over whether Aristotle considers the motions of the elements to be teleologically explicable is itself puzzling, given the fact that the motion of the ethereal element is clearly teleologically explained, and that this motion (the 'first motion') is treated by Aristotle as the paradigmatic case of elemental motion. Nevertheless, there is considerable disagreement about whether or not Aristotle considers the motions of the sublunary bodies to be teleologically explicable; this is related to the dispute about whether or not meteorological events can be said to be teleologically explicable.

Whatever one's position is on the teleological explicability of elemental motion, the possibility of the terrestrial elements being purely active sources of self-motion, like the celestial element, can definitely be ruled out. We have already seen that Aristotle thinks that that kind of motion applies exclusively to living things.[11] Animals and stars are examples of living things, and to some extent they are self-moved. Stars, at any rate, are living things, and so it is clear to Aristotle that their motion is teleologically explicable. The terrestrial elements, on the other hand, are not alive, and are always moved by something else. Unlike animals, who are also moved at least in part by external things, the elements do not additionally have the capacity for self-motion, or for bringing themselves to rest. At this point it seems reasonable to ask in what sense they are natural then, since nature was defined as an internal principle of motion and rest. For it is clear that Aristotle still wants to insist that their motion is natural.

[11] *Phys* viii 4, 255^{a}1–7.

Fire and Earth are moved by something forcibly when they are moved contrary to nature, but they are moved naturally when they are moved towards the actuality which they potentially are. (*Phys* viii 4, 255^{a}28–30)

Why ever are the heavy and light moved into their own place? The explanation is that they naturally grow[12] to be somewhere (πέφυκέν ποι), and the light and heavy just are this, the former determining what it is to be up, and the latter down. (*Phys* viii 4, 255^{b}14–17)

How can the elements move naturally if they cannot initiate motion? The answer is that they have an internal principle of change that constitutes a tendency or inclination (ῥοπή) for them to move in a certain direction. They have an internal principle of both moving and resting, and when they move they are influenced by something to move in accordance with this principle and hence naturally. Aristotle deliberately uses middle–passive voice constructions in his definition of nature,[13] as we saw he did in his original formulation (αἰτίας τοῦ κινεῖσθαι καὶ ἠρεμεῖν, *Phys* ii 1, 192^{b}22). In the case of the elements, the reason for this is that they do not move themselves but rather are caused to move in accordance with their internal principle of change.

It is clear that none of these things moves itself. But it has within itself a principle of motion: not of setting in motion or affecting, but of being affected. Everything that is moved is moved either naturally or contrary to nature and forcibly. Everything moved forcibly and contrary to nature is moved by something else. And again everything moved naturally is moved by something else—both those moved by themselves, and those not moved by themselves (e.g. the light things and the heavy things; for they are moved either by that which generated them and made them light or heavy, or by that which removed what was blocking them, causing release). If this is true, then everything that is in motion would be moved by something else. (*Phys* viii 4, 255^{b}29–6^{a}3; cf. 255^{a}24–9)

Thus the natural motion of the terrestrial elements should not be conceived of as a principle of simple active motion, as with the ethereal element. Many natural things cannot actively move themselves: the terrestrial elements, inanimate compounds, and plants, for example, do not move themselves at all, rather they are moved in accordance with a natural principle. In fact, were the elements not moved by anything else, they would go to their natural place in the cosmos and remain segregated into concentric orbs, the lower region into orbs corresponding to each of the four elements.[14] Even animals, which can actively move themselves locally, are nonetheless moved by external or environmental forces as well, and most of their natural functions (like respiration, circulation, and nutrition) are not movements they themselves initiate (*Phys* viii 2, 253A11–20; viii 6, 259^{b}6–16). Nonetheless, elements are no exception to the rule that all natural bodies have an

[12] The verb πέφυκέν 'grow' is etymologically connected by Aristotle to φύσις 'nature' (*Meta* v 4, 1014^{b}16), but he is capable of using it to mean something like 'properly', as in: 'it is coincidental that a builder restores to health, because it is not a builder but a doctor who properly does (πέφυκε) this' (*Meta* vi 2, 1026B37–7A2).

[13] For an extended discussion of this, see Lang (1998, pp. 40 f.).

[14] *Cael* ii 14 and iii 12.

Table 5.1 Intrinsic and incidental causes of an element (water)

Causes	Intrinsic causes	Incidental causes
Matter	water	rainwater, contents of a pitcher
Mover, source of change	inclination, heaviness	irrigation channel, person pouring
Form	wet, cold	drop, pool, shape of a cup
End	resting at proper place in the cosmos; transmutation	irrigating crops, flooding crops, quenching thirst

internal and intrinsic principle of motion or rest, and it is with reference to this principle that their natural motions are determined.

As Physics viii 4 indicates, there are other motions in which the elements can be involved. Change or motion is incidental to the element when contrary to nature, 'forced' or 'unnatural'. It is possible for air or fire to be forced downwards, as when I blow down into a straw, or smoke a cigarette while lying on my back. Similarly, it is possible for earth to be forced upwards, as when I use a lever to lift a stone, or when columns hold up a heavy stone ceiling.[15] Were I to remove the columns, the stone would immediately resume its natural motion downwards, since nothing would then be inhibiting it. We can in fact easily conceive of incidental causes that correspond to all of the intrinsic causes of an element, as in Table 5.1.

Aristotle holds that the natural motions of the sublunary elements are orderly or regular (*Cael* iii 8, 307A6–13). And now we can see why. It is because there are limited numbers of intrinsic causes of the elements and their motions, and these can be distinguished from the non-natural and incidental causes that could be ascribed to them. For Aristotle, the elements are natural substances, and hence they are subject to the four kinds of cause and explanation that apply to all natural things. This is why whenever Aristotle offers a list of natural bodies or substances, he names not only the stars, plants, animals, and their parts, but the elements (earth, air, water, and fire) as well.

Hence the terrestrial elements, although not alive, are, for Aristotle at least, teleologically explicable. Further confirmation of the fact is available, since Aristotle is even willing to use a manifestly teleological term like 'function' to describe the principle of elementary motion. Above, it was established as a general proposition that that which has a function exists for the sake of its function (ἕνεκα τοῦ ἔργου, *Cael* 286^{a}8–9). And Aristotle is committed to the fact that all natural bodies have functions.

[15] The opening of the pseudo-Aristotelian treatise *Mechanics* introduces the subject of mechanics as a technique for doing things 'contrary to nature' and quotes Antiphon: 'Mastered by nature, we overcome by art' ([Arist.], *Mech* 847A20–1, ROT).

That the differences between the elements do not depend on their shapes is clear from the foregoing. But since the most important differences of bodies are their affections, functions (τὰ ἔργα), and capacities (for we say that each of them by nature has functions (ἔργα), affections, and capacities), first we must speak about these, so that, having grasped these, we can explain the differences between each of them. (*Cael* iii 8, 307^{b}18–24)

Aristotle has already indicated what he means by functions: 'By affections and functions I mean the movements of each of these things [natural bodies] and the others, as many as have the power in themselves to cause this, as well as their alterations and transformations into each other' (*Cael* iii 1, 298^{a}32–^{b}1). Thus it is clear that Aristotle intends there to be functional, teleological explanations of all the elements. Helen Lang, who recently made an extended study of this, makes the doctrine of elements out to be the foundation of Aristotle's teleology:

inclination constitutes the very nature of each element and is a principle of an element's being moved, which is oriented toward the respective proper place of each. Thus the cosmos is constituted by these two principles, which are intrinsically and causally related. Consequently, I shall conclude that Aristotle's view of the cosmos as determinate and orderly in this sense may constitute one of the deepest marks of his teleology. (1998, p. 39)

We can agree with this as far as it goes, but not all the way to the remark, quoted above, that: 'this relation *is* Aristotle's teleology of nature' (1998, pp. 274–5, emphasis in original; cf. Lang 1994). Briefly, we may object as follows.

Aristotle's teleology as applied to living substances is of central importance to his philosophy, and the inclination of elements to their natural places has little direct import for teleological explanations in this context. In the final chapter of *Meteorology*, wherein Aristotle offers a transition between the treatment of the elemental substances (in *Cael*, *GC*, and *Meteor* itself), and the treatment of living substances (in *HA*, *PA*, etc.), he even says that there is a kind of scale of teleology, with the elements on one end and complex body parts on the other.

For the [cause] for the sake of which (τὸ γὰρ οὗ ἕνεκα) is least clear there, where matter is most. For, just as if we also take the extremes: on the one hand, matter is nothing but matter itself; on the other hand the substance is nothing other than a formula (ἡ δ' οὐσία οὐδὲν ἄλλο ἢ λόγος), and the things intermediate are related proportionally by their proximity to each extreme. For each of these are for the sake of something (ἐπεὶ καὶ τούτων ὁτιοῦν ἐστιν ἕνεκά του), and is not absolutely water or fire, just as flesh is not, nor are the viscera, and the same is true *a fortiori* for the face and hand. (*Meteor* iv 12, 390^{a}3–9)

The same is true, *a fortiori*, for Aristotle's use of teleological reasoning in ethical and political contexts: I can see no direct relevance of the teleology of the elements for the teleological explanation of the purpose of human existence, or the best organization of the city. (On the other hand, the part–whole teleology of organisms is of direct significance in the explanation of human life and the city, which is conceived of as an organism.)

In fact, it seems that the teleological explanation of the locomotion of the elements does not prima facie cohere with the teleological explanation of living

things. Consider that a living thing (an animal, say) is composed of elements. Why does the animal not disintegrate into the elements out of which it is constituted, and they discharge towards their proper places?[16] The proper functioning of living natural kinds seems to require that the elements be constrained against their inclinations, and so prevented from reaching their proper places and thereby actualizing their intrinsic capacities as elements. The existence of living things would seem to, in this sense, be contrary to nature. But of course living things are, as we will see, in accordance with nature to the highest degree. They have their own internal principles of motion and intrinsic ends. In fact, how their ends are intrinsic is much clearer than with the elements, since ends of living things (nutrition, pleasure, reason, etc.) do not require reference to something external to them, while the elements have their 'intrinsic orientations . . . towards their proper place, the periphery or the middle' (Lang 1998, p. 223 and *passim*; cf. the oxymoronic phrase 'intrinsic relations', p. 171).

Furthermore, if all the elements actually did reach their ends, the result would be stratification of the cosmos and the impossibility of generation of any complex substances (such as living things and cities). In that case, it seems to me that a 'mechanistic' explanation would do just fine: we could focus on 'how' the universe is ordered like it is, and would have no further need to explain 'why' it is that way (in Aristotle's or Theophrastus' terms, to explain why it is better that it is that way, and why change would be for the worse).

The solution to these difficulties is undoubtedly that the elements are completely transformed into a new substance (οὐσία), with a new formula (λόγος), when they are combined so as to form homogeneous bodies, whether inanimate (like silver and bronze), or animate (like flesh and blood). The homogeneous bodies are in turn completely transformed when they compose heterogeneous bodies, like faces and hands. The new formula indicates a new end and cause for the sake of which, and so the end of a hand is to grasp and not to move to the center of the cosmos, despite the fact that it could be analyzed in part into earth. Aristotle makes this clear in the continuation of the last quoted passage.

> Everything is defined by its function (ἅπαντα δ' ἐστὶν ὡρισμένα τῷ ἔργῳ). For the function of each thing is truly what each thing is able to do, for example an eye, if it can see, but if it is not able to, then [it is an eye] only equivocally, like a dead eye or one made out of stone. For neither is a saw made out of wood [a saw], but only a likeness of a saw. So this is the way it is with flesh, except that its function is less clear than that of the tongue. And similarly for fire: still less is [its function] obvious, perhaps, through natural inquiry, than the function of flesh. The parts of plants and inanimate bodies like copper and silver are the same. They are what they are in virtue of a certain capacity for affecting or being affected—just like flesh and sinew. But we cannot state their definitions accurately, and so it is not easy to tell when they are really there and when they are not unless the body is thoroughly decomposed and only its shape remains. (*Meteor* iv 12, 390ª10–21)

[16] Lang 1998, p. 167 n. 5, puts this question aside.

But the fact that the elements are transformed into something with a different end does not in any way conflict with the fact that the elements, when taken as elements, have their own ends, and thus are teleologically explicable. So we can agree with Lang that the teleological explicability of the elements serves to underscore the fact that every complex substance that is composed of the elements is from the bottom-up teleologically explicable: the fact that literally every element of an organism, for example, has its own inclination towards an end proves that the cosmos is entirely made up of end-oriented substances. This is important because it shows (against some interpreters whose views will be criticized in due course) that Aristotle does not reject mechanistic or reductionist explanations simply because they did not seem adequate at the time to explain the functioning of organisms. Rather he rejects them *tout court* or in principle, because he doesn't think that such accounts are really explanations. Even at the simplest and most 'mechanical' level of the locomotion of the elements, Aristotle provides a teleological explanation.

We have been discussing the natural local movements of the elements (earth towards the center of the cosmic sphere, and fire towards the extremes, and so forth), and how these are considered the functions of these elements. We just argued that the elements are completely transformed when they compose more complex substances, like the homogeneous and heterogeneous organs. There is actually a more basic level on which the elements are transformed into substances with different ends, namely other elements. Thus it remains to describe the other aspect of elemental functionality mentioned by Aristotle, their reciprocal transformation. This is where their teleological aspect in fact becomes most evident, and it will allow a more complete answer to the question of why it would not be better for all the elements to move to their proper place in the cosmos and remain there at rest.

5.4 ELEMENTAL TRANSMUTATION

Aristotle holds that generation and destruction of natural things and compounds happen continuously (*GC* i 3). What are the principles and causes of this fact in general, independent of the explanation of the generation and destruction of specific kinds of things? When Aristotle confronts this question, he begins by representing the results of his dialectical critique of the causes discriminated by his predecessors (*GC* ii 9), and repeats the claim that none of his predecessors mentioned the relevant causes of generation and destruction, and thus none of them could explain it adequately. None has definitely stated 'the [cause] for the sake of which in the sense of the shape and the form, which is the formula of the being of each thing (τὸ οὗ ἕνεκα ἡ μορφὴ καὶ τὸ εἶδος· τοῦτο δ᾽ ἐστὶν ὁ λόγος ὁ τῆς ἑκάστου οὐσίας)' ($335^{b}6$–7).

Aristotle claims to have proved that motion is eternal, and he thinks that the fact that generation is eternal is a consequence of the eternality of motion ($336^{A}15$–16).

Furthermore, the cause of generation is motion (336[A]25–6). But what then is the cause of destruction? It could not be the same eternal motion, because the same cause will always by nature produce the same effect (τὸ γὰρ αὐτὸ καὶ ὡσαύτως ἔχον ἀεὶ τὸ αὐτὸ πέφυκε ποιεῖν, 336[a]27–8). So the continual motion, exemplified most clearly in the movements of the celestial bodies, will be the cause of either continual generation or continual destruction, but not both. There must then be some other moving cause that is responsible for constant generation and destruction.

Aristotle believes this cause to be 'the motion along the inclined circle'—the motion of the sun—because it is both continuous and variable, with its duality of movements (rotary, and approaching towards and retreating from the earth). This cause can account for not only the continuity of change itself, but also the alternating cycles of generation and destruction. For when the sun approaches, there is generation, and when it retreats there is destruction. There is ample observational evidence available to support this thesis; for example, the fact that generation and destruction occupy roughly the same periods of time, to wit spring–summer and autumn–winter.

We have just described the moving cause of generation and destruction, and we digressed to do so because this account will become important when we discuss the causes of meteorological regularities, such as the fact that there is commonly more rain in winter than in summer. But what is the cause for the sake of which continuous generation and destruction in general takes place?

> Generation and destruction will, as we have said, always be continuous, and will never stop because of the cause (αἰτίαν) we stated. And this continuity has a good reason. For in all things, as we affirm, nature always strives after the better. Now it is better to be than not to be (βέλτιον δὲ τὸ εἶναι ἢ τὸ μὴ εἶναι) (and we have explained elsewhere the exact variety of meanings we recognize in this term); but not all things can be, since they are too far removed from the source (τῆς ἀρχῆς). In the only remaining way, god filled up the universe (συνεπλήρωσε τὸ ὅλον ὁ θεός) by making generation continual: for the greatest possible coherence is in this way assured for being, because generation generating itself perpetually is the closest approximation to substance (οὐσίας). The cause of this continual generation, as we say, is circular motion: for that is the only motion that is continuous. That is also why all the other things, the things, I mean, which are reciprocally transformed in virtue of their affections and their powers of action—the simple bodies—imitate (μιμεῖται) circular motion. For when water is transformed into air, air into fire, and fire back into water, we say the generation has completed the circle, because it returns again to the beginning. Hence it is by imitating (μιμουμένη) circular motion that rectilinear motion too is continuous. (*GC* ii 10, 336[b]25–7[a]7)

Thus the teleological explanation of the elements—the specification of their function—indicates that their reciprocal transformation is an imitation (μίμησις) of the cyclical movement of the celestial bodies. The movements of the heavenly bodies have already been shown to be paradigmatically for the sake of something, and so teleologically explicable. Thus that which resembles their motion should accordingly be for the sake of something, and so teleologically explicable. In this

case, it amounts to an extremely attenuated benefit: a kind of immortality sufficient for the axiological maxim, that it is better to exist than not. Later we will see that plant and animal reproduction also resembles the same circular motion through reproduction, which is thus their function and that for the sake of which they exist, an idea we were already introduced to in the description of the reproductive soul.[17]

There is, understandably, interpretative controversy over how exactly we are to understand the 'imitation' of the celestial circles by the terrestrial elements.[18] Aristotle elsewhere says: 'imperishable things are imitated (μιμεῖται) by those that are involved in change, e.g. earth and fire. For these also are ever-active; for they have their movement of themselves and in themselves' (*Meta* vii 8, 1050^{b}28–30). With reference to this passage, Ross says, 'it is doubtful whether this refers to the natural movement of fire upwards, and of earth downwards, or to the constant tendency of the elements to change into one another, by virtue of which Aristotle says (*GC* 337^{a}1–7) they imitate the circular movement of the heavenly bodies' (*Aristotle Metaphysics*, vol. 2, pp. 265–6). Kahn argues, on the other hand, that the *Metaphysics* passage refers only to locomotion, since the elemental transmutation is not a change that belongs to the elements '*per se* and in themselves'. 'By contrast, the movement of the simple bodies to their places is an eternal fact just because it is an expression of their essential natures. In following their own natures, then, the elements imitate their ontological superiors' (Kahn 1985, p. 189). Here I think we are treading on dangerous ground. The elements appear under such a description to be actively and intentionally moving, along the lines of B. F. Skinner's ignorant remark that 'Aristotle argued that a falling body accelerated because it grew more jubilant as it found itself nearer home'.[19] For we are entitled to ask of an account like Kahn's just how it is that the elements could 'follow their own natures' and 'imitate their ontological superiors'. The interpretation is a personification.[20]

But no personification is necessary. Imitation here could have a non-metaphysical sense of resemblance. In fact, this is a common Aristotelian use of the term: he uses it this way throughout the *Poetics*.[21] The productive arts create things (sculptures,

[17] *Anima* ii 4, 415^{a}23–^{b}21; cf. *GA* ii 1, 731^{b}20–2^{a}1.

[18] A recent discussion of Aristotle's metaphysics of imitation is Richardson Lear 2004, pp. 82 f., but although her account recognizes the importance of the issue, she does address the issue of how something without a mind and even inanimate, like the elements, can be understood to imitate (or 'strive for' or 'approximate') the eternal. She seems to imply that Aristotle simply adapted Plato's account of imitation. 'Aristotle rejected Plato's theory of Forms as an account of how sensible things are related to their own natures . . . But he did not reject the imitation or approximation at the heart of the theory as a possible model of final causation' (2004, p. 83).

[19] Skinner 1971, p. 6.

[20] The same goes for Sedley's remark: 'the circular motions of the stars, the reproductive drive of animals, and the cyclical inter-transformation of the elements . . . are all in a fairly transparent way bids for a share of divine immortality' (1997, p. 336). It is not transparent, to me at least, how it is that an element can bid for a share of divine immortality.

[21] *Poet* 1447A18–8B24, 1450^{a}16, 1451^{A}31, 1453B12, 1454^{a}27, 1459^{a}15, 1461^{b}26–2^{b}15. Cf. *MM* 1190^{a}31. As Halliwell points out, this is the 'primary sense of the mimesis family in Aristotle' (1990, p. 315).

paintings, dances, poems, etc.) that imitate or resemble their subjects. No one worries about a possible metaphysical sense of μίμησις when Aristotle talks about poets or painters creating imitations or resemblances of animals or people.[22] It is in connection with such usage that we should think about how the 'cycles' described by the reciprocal transmutation of the elements resembles the 'circles' described by the celestial bodies turning in the night sky. The notion is explicitly visual.

This interpretation is confirmed by examining other contexts, besides the creative arts, where the term is used in just the same way. In *Meteorology*, Aristotle says with the cycle of evaporation and condensation 'there comes about a circle resembling the circle of the sun' (γίγνεται δὲ κύκλος οὗτος μιμούμενος τὸν τοῦ ἡλίου κύκλον, 346^{b}35–6). According to *History of Animals*, the palm of an ape's hand 'is unusually hard and in a rough obscure kind of way resembles (μιμούμενον) a heel' (*HA* 502^{b}9, ROT; cf. 597^{b}23–6). In *Nicomachean Ethics*, although a case of intentional resemblance, Aristotle says that, 'as the brave man is with regard to what is terrible, so the rash man wishes to appear (φαίνεσθαι), and thus he imitates (μιμεῖται) him in situations where he can' (*NE* 1115^{b}32). All of these uses of the term are quite straightforward and unproblematic, and ought to guide us in interpreting the *Generation and Destruction* and *Metaphysics* passages. A more direct guide is Aristotle's use of the term in a key teleological notion: that art 'imitates' nature (ἡ τέχνη μιμεῖται τὴν φύσιν, *Phys* ii 2, 194^{a}21–2).[23] This too means that art resembles natural things: Aristotle explains the notion by saying that if a house or a ship came to be by nature, it would come to be exactly as it does now by art, and if the things that now come to be by nature came to be by art, they would also come to be in the same way.[24] So neither does understanding this notion require a mysterious metaphysical sense of 'imitation'. In fact, Aristotle explicitly says that a more technical or metaphysical notion of mimesis, such as that used by the Pythagoreans and Plato, is unclear to him: 'as to what participation or imitation (μίμησις) of the forms may be they left an open question' (987B13–14).[25] We are permitted, on the basis of this remark, and the availability of other meanings of the term, to interpret imitation here as resemblance.

So the circle or cycle of elemental transmutation resembles the circles or cycles of stars in their orbits. But it is a fair question to ask what we are supposed to infer from this similarity. Evidently, we are supposed to infer that the cycle of generation and destruction will be continuous and eternal, just as the circular movement of the celestial bodies is continuous and eternal. But the fact that both can be

[22] This is not to say that there are no interpretative problems with the notion of mimesis in the context of creative arts. It's just that those problems have nothing do with a Platonic metaphysical sense of mimesis (Halliwell 1990, p. 315; cf. Halliwell 1986, ch. 4).

[23] See also *Phys* 199A15–17, *Meteor* 381^{b}6, *Mund* 396B11–12.

[24] *Phys* ii 8, 199A8–20, B28–30.

[25] This rules out the interpretation of Owen, who says with reference to the *Meta* passage, 'μιμεῖται in the properly Platonic sense that they are and are not ἄφθαρτα (immortal by constantly changing into one another–*GC* 337^{a}1–7), not as an explanation of their behavior, which stems from their own nature' (apud Burnyeat et al. 1984, p. 145).

described as 'circles' does not seem to be an adequate warrant for the inference. Helen Lang has argued that the way in which the elements imitate the heavens is by being 'ever active' in that they are always moving towards their natural place (or are 'actively' resting at that place). Even in transmutation, the elements are oriented towards the natural place that corresponds to the element into which they are mutating. Because the elements are always active in this sense, even when they are potentially another element, they resemble the heavens, which are always active in their locomotion, without qualification (Lang 1998, pp. 11, 248–51, 269; cf. Lang 1994, pp. 331–3). The problem I see with this position is that locomotion is precisely the sense in which the terrestrial elements do not resemble or imitate the celestial element: Aristotle draws the strongest possible contrast between the movement in a circle proper to the stars, and the rectilinear movement proper to everything in the sublunar cosmos. This is what bifurcates his cosmos into two realms, one of perfection, and the other of generation and corruption.

Rather, the way that the terrestrial elements resemble the celestial element is that they are eternal and always active in the sense of being in a continual process or cycle of transmutation, which accounts for the eternal and ongoing process of generation and destruction in our sphere of the universe. This is fundamentally similar to how the celestial element is in a continual locomotive circle, and in both cases the 'circle' is indicative of eternality. This interpretation is supported by the fact that Aristotle makes nearly the same argument with regard to plant and animal reproduction, which we will discuss in due course.[26] Briefly, Aristotle says that the cycle of reproduction resembles the activity of the stars because it gives the things involved in the circle a kind of attenuated immortality, not literally like the stars which are eternally identical, but resembling the stars by ensuring an eternal existence of the living thing in kind. This argument, about the reproductive cycle resembling the celestial circles, has nothing whatsoever to do with locomotion on the part of the animals, but rather relates to their generation and destruction. So I think that we would be better off interpreting the passage about the terrestrial elements from *Generation and Destruction* along similar lines.

5.5 METEOROLOGY

We have now dealt with elementary bodies and their motions in the upper and lower cosmos. Now we move to discuss events in the region between these, meteorological events. Meteorology is regarded as a part of the science of nature. After the description of where these things fit into his overall plan for the study of nature in *Meteorology* i 1, Aristotle begins to lay down the general principles of meteorology in i 2. He summarizes the theory of elements, distinguishing between the four terrestrial elements and the ethereal celestial element. He announces that

[26] *GA* ii 1, 731B20–2A1; cf. *Anima* ii 4, 415^{a}23–^{b}21.

the present treatise is concerned with the conditions and affections of the terrestrial bodies, which are regulated by the motions of the heavens (339ª21–4). Thus the operative causes for the present treatise are described as twofold: (1) air, water, fire, and earth as 'the cause of the events of this kind in the matter' (ἐν ὕλης εἴδει τῶν γιγνομένων αἴτια, 339ª28–9); and (2) the eternally moving bodies as 'the cause whence the motion begins' (τὸ δ' οὕτως αἴτιον ὅθεν ἡ τῆς κινήσεως ἀρχή, 339ª30–1). Two causes: matter and the source of motion. None others are mentioned. The next chapter, i 3, expands on the description of the elements and the various degrees to which they occupy the space between the earth and the celestial sphere. Chapters i 4 and following are attempts at explanation of the various 'meteorological phenomena' with reference to the aforementioned causes.

There does not seem to be a role for teleological explanations here, and so how is this pertinent to the present study? It is so because there is a much disputed and key passage bearing on Aristotelian teleology (In *Phys* ii 8) that uses a meteorological phenomenon, rainfall, as an example. The controversy is over whether rainfall is supposed to be an example of a teleological event or not. Here is the passage.

[**a**] There is a difficulty (ἀπορίαν): What prevents nature creating neither for the sake of something, nor the better (τὴν φύσιν μὴ ἕνεκά του ποιεῖν μηδ᾽ ὅτι βέλτιον), but as Zeus rains, not in order to make the crops grow, but out of necessity? [**b**] For what rises up must be cooled, and what is cool becomes water to fall down. The crop growth results (συμβαίνει) when this happens. [**c**] Similarly, if the crop is destroyed on the surface where the grain is separated, it rained not for the sake of this destruction, though this resulted (συμβέβηκεν).

[**d**] What then prevents the parts being like this in what is natural (ἐν τῇ φύσει)? For example, the teeth out of necessity coming up sharp in the front suitable for dividing, but the molars broad and so useful for chewing the food. Suppose it didn't happen for the sake of this, but coincidentally (ἐπεὶ οὐ τούτου ἕνεκα γενέσθαι, ἀλλὰ συμπεσεῖν). And similarly even with the other parts, whenever they seem to exist for the sake of something. Wherever they resulted as if happening for the sake of something, these things survived because they were spontaneously structured and adapted (ἀπὸ τοῦ αὐτομάτου συστάντα ἐπιτηδείως). But wherever they were not so adapted they perished and are perishing, just as Empedocles says the 'cow progeny with human faces' were. So this argument, and others like it if there are any, may present difficulties (ἀπορήσειεν).

[**e**] But it is impossible for this to be the way it is. For these and every natural thing come about either always or usually, but that which is by luck and by spontaneity does not. [**f**] For it does not seem to be by luck or spontaneity that it rains a lot in the winter, but only if it does in the summer. Nor does a heat wave in summer, but only in winter.

[**g**] So if it seems to be either by spontaneity or for the sake of something, and if they cannot be by coincidence or spontaneity, then they are for the sake of something. But that all these things are by nature, even those saying such things would agree. Therefore there is the [cause] for the sake of which in that which by nature is born and exists (ἐν τοῖς φύσει γιγνομένοις καὶ οὖσιν). (*Phys* ii 8, 198ᵇ16–99ª8)

The disjunction in [**ef**] shows the dialectical structure of the whole passage. Either: things come to be for the sake of something naturally, or they do so spontaneously.

Both parties to the debate agree on this, and so the truth of the disjunction is not independently argued for.[27] Notice that accepting either disjunct is compatible with holding that rain is not spontaneous, and yet not for the sake of something. Aristotle does not here, or anywhere else, commit himself to the crazy idea that everything that comes about non-spontaneously comes about for the sake of something. For some things come about from absolute necessity, or as a concomitant to hypothetical necessity, but are not for the sake of anything. An example of this was already mentioned: it is necessary that an eye has a certain color, but having blue or grey eyes is not for the sake of anything.[28] Further confirmation of this is the fact that Aristotle holds that many spontaneous things are for the sake of something, although incidentally.

What is in dispute about this passage is whether Aristotle is advocating the position that rainfall is teleologically explicable—that the rain falls for the sake of making crops grow. Some recent interpreters have rethought the standard interpretation, which holds that the explanation of rainfall according to necessity is meant to be contrasted with the teleological explanation of animal parts (teeth for the sake of biting and chewing). They hold that the claim about rainfall happening not spontaneously, but 'always or usually' according to the seasons, shows that Aristotle considers rainfall to be a natural phenomenon, which thus exists for the sake of something.[29] And at least one of these interpreters has held that that for the sake of which it exists is in order to make the crops grow for human benefit.[30] If true, this would support an anthropocentric interpretation of Aristotle's teleology.

The position that rainfall (or other meteorological phenomena, for that matter) happen for the sake of anything, including human beings, will be refuted in the first place by an alternative interpretation of the passage in question, and in the second place by reference to other texts, which show that this cannot be Aristotle's general position.

It is clear that Aristotle holds the explanation of animal parts to be for the sake of something. The point of the present argument is to refute the view that these

[27] Charles 1991, p. 13; Code 1995, p. 129, esp. n. 2, and p. 132. [28] *GA* v 1, 778^{a}29–^{b}19.

[29] Cooper (1982, pp. 217–18) and Furley (1985, and 1996, p. 76) hold that meteorological events like rainfall are teleological for Aristotle, on the basis of this passage. For Furley the implications of this are profound, because they affect which of two kinds of interpretation of Aristotle's teleology one might have: 'the first interpretation would allow us to claim that Aristotle uses teleological explanations only in accounting for the presence, growth, and functioning of the parts of organisms and the motions of animals (with the rather awkward addition, since the evidence is too explicit to hide or explain away, of the movements of the heavenly bodies). The second, at first sight at least, seems to imply a much wider application of teleology—perhaps embracing all the workings of the whole natural world' (Furley 1985, p. 177). It was actually in a much earlier and less well-known article that Furley first associated Aristotle with a broad teleology. In an article on Lucretius and the Stoics, Furley alleged that Lucretius directed his anti-teleological remarks not against the Stoics, as most scholars believe, but rather against a thoroughgoing teleology expressed by Aristotle in the dialogue *On Philosophy*, which Lucretius is supposed to have taken as the authority on Platonic-Aristotelian cosmology (1966, pp. 27 f.). For a response to this argument, see Kullmann 1998, p. 275.

[30] Sedley 1991, pp. 181–7.

parts came about incidentally (against Empedocles). It is possible for things that are useful to come about luckily or spontaneously, but it is not possible for useful things to come about spontaneously always or for the most part.

Notice that the dispute is not about whether parts exist for the sake of something. No one, not Empedocles or anyone else, would quarrel with the claim that the sharp front teeth are both suitable for and used by animals for biting, and that the broad molars are useful for grinding food. The question is whether such conveniences come about spontaneously or not. Aristotle thinks that they come about regularly, and so by nature, not spontaneously. The point of the rainfall example is to show how there can be a coincidental result that is beneficial (or, for that matter, detrimental). Rain falls for necessary reasons, having to do with the circulation of elemental bodies in the atmosphere, and so is regular, depending on the seasons and other meteorological conditions. But the fact that rain can make crops grow is just as incidental to the cause of rainfall as is the fact that rain can spoil crops if they have been threshed and are sitting outside when a storm comes [c], or if rainfall is so intense that it floods the fields, as was more or less a common problem for Greek farmers.[31] If rain existed for the sake of making corn grow, then it would make corn grow always or for the most part. But it is just as plausible for crops to be destroyed by rainfall as it is for them to be irrigated.

The reason why rain regularly helps farmers grow crops, then, is neither luck, nor nature, but art, to wit, the art of agriculture. Whether the rain, which necessarily falls, ends up helping or hurting the crops depends on the skill of the farmer: Did he plant at the right time? Did he fertilize properly? Did he remove the crops from the threshing floor before winter? This interpretation is supported by a remark in Aristotle's *Protrepticus*.

> Therefore everything that is done artfully comes into being for the sake of something, and this purpose of it is the best thing. But surely that which comes into being by luck does not come into being for the sake of anything, since something good might occur even by luck as well and yet it is not good in respect of the luck or insofar as it results from luck, for that which comes into being by luck is always indeterminate. And yet that which comes into being according to nature does so for the sake of something, and is always constituted for the sake of something better than the product of art; for nature does not imitate art, but art nature, and art exists to help nature and to complete what nature leaves undone. For some things nature seems capable of completing by itself without requiring any help, but others it completes with difficulty or cannot do at all; for an obvious example take what happens with reproduction—some seeds obviously germinate without protection, whatever kind of land they fall into, others need the art of farming as well, and, in a similar way, some animals also attain their full nature by themselves, but human beings need many arts for

[31] 'The climate of Greece is what meteorologists call "Mediterranean," meaning intermittent heavy rain during a few winter months and hot, dry summers. . . . Winters could be cold and blustery . . . Since the amount of annual precipitation was highly variable, farming was a precarious business of boom and bust, with drought and flood both to be feared' (T. R. Martin, *An Overview of Classical Greek History from Homer to Alexander* (www.perseus.org), sec. 2.5.ii).

their survival, both first when they are born and later as they are brought up. If, then, art imitates nature, on the basis of nature it turns out to be true for the arts as well that every process comes about for the sake of something. For we might take the position that everything that comes into being correctly comes into being for the sake of something. (*Protr* 79.25–80.20)

According to Sedley (1991, pp. 188–9), this argument supports the anthropocentric reading of *Physics* ii 8, since it seems to show that some seeds exist for the sake of human nutrition, namely those that need the aid of human agricultural technology in order to reproduce. But what both passages actually show, as I have argued, is that the use of rain and seeds for the production of nutritious food is a matter of human art or technology (i.e. agriculture). In the *Protrepticus* passage, Aristotle argues that humans need to employ technology not only in order to obtain food from plants, but also for defense and protection (clothing, weapons, etc.). The analogy is thus that just as humans need technology in order to survive and reproduce (since they are not provided with food, weapons, and clothes at birth), so some plants are in need of technology in order to survive and reproduce. It does not follow that plants exist for the sake of being eaten by humans, except in the limited sense that humans can in fact use them for that purpose. Neither do trees exist just so that humans can make spears or huts out of their branches, nor do cows exist in order to provide leather for boots, nor horses for riding on, nor rocks so that we can build a wall around the city. Of course, we can plant and grow trees for just such purposes, and we can husband cows and horses, and chip rocks for such purposes as well. But it is a fallacy to infer from the fact that we can use these things, and that we need to use these things, that they are here in the world just for that reason. The fact that we cannot make such an inference is clear from the fact that our needs do not stand in any straightforward explanatory relation to the generation or existence of these things, except in the case of human skill. Trees exist and we use them, but they don't exist because we need to use them, unless we plant trees in order to use them, in which case we are not talking about natural teleology but rather about the products of human skill and technology.[32] To return to the main point, the rain does not exist in order that we can grow food. And a sign of this is the fact that we do not explain rainfall with reference to our need to grow food, but rather with reference to the elements and their motions.

The forced choice here is not between explaining rainfall teleologically or according to necessity. The real issue is whether rainfall is absolutely necessary, or whether it is merely hypothetically necessary. Rainfall could only be for the sake of humans in a strong sense (i.e. not just incidentally beneficial) if it fell just

[32] This is so even if, as Charles argues, craft knowledge grounds our knowledge about natural kinds. Craft knowledge (the knowledge possessed by the so-called 'master craftsman') may very well be indispensable for an identification of natural kinds, but it clearly is dispensable for the further scientific exploration of the natural kind (what Charles calls the 'metaphysician's deeper understanding' as opposed to the 'type of practical knowledge possessed by the master craftsman' (2000, p. 359)).

because it was necessary for human survival. If it falls for the sake of something else, or due to absolutely necessary factors, then its benefit to humans is incidental to its real causes and hence to its explanation.[33] In *Meteorology*, the treatise in which rainfall is properly explained, Aristotle never mentions human needs. Here is how the chapter devoted to the subject of rainfall begins.

> Let us now speak of the region second after the celestial and first around the earth. For this is the region common to water and air, and of the occurrences resulting in the generation of water above the earth. Of course, we must grasp the principles and the causes of these and all similar things (λεπτέον δὲ καί τούτων τὰς ἀρχὰς καὶ τὰς αἰτίας πάντων ὁμοίως). The controlling, moving, and first of the principles is the circle (ἡ μὲν οὖν ὡς κινοῦσα καί κυρία καί πρώτη τῶν ἀρχῶν ὁ κύκλος ἐστίν), in which the sun obviously moves, approaching and retreating, producing composition and dissolution, and thus being cause of generation and destruction. The earth is at rest, and the water around it is carried up by the sun's rays and the other heat from above. But when the heat which made it rise departs, some being scattered in the upper region, some extinguished by rising so far into the air above the earth, the vapor is cooled and condensed again by the departure of the heat and the height, and water comes to be out of air. Having become water, it is carried back to earth. (*Meteor* i 9, 346B16–31)

What we have here is an extended version of the brief explanation of rainfall given in *Physics* ii 8. And it is explicitly stated that the ('controlling, moving, and primary') cause of rainfall is to be found in the moving cause of the sun's revolutions. Notice that this explanation accounts for the seasonal regularity of rainfall. Aristotle gives the same account in *On Sleep* 3 (457B31–8A1) and *Parts of Animals* ii 7 (653A2–8). He also gives an abbreviated version of it as an example of absolute necessity in *Posterior Analytics* ii 12 (96A2–7).[34] In *Metaphysics* vi 2, he

[33] Although Cooper has argued for a teleological interpretation of the rainfall passage of *Phys* ii 8 (1982, p. 217, and n. 12), in his article on hypothetical necessity he makes two notes which militate against this interpretation, and support the one just offered. He says, 'Aristotle does not speak of hypothetical necessity except where the outcome is also a goal: it may be true enough that my window would not have broken when it did if there had not been a heavy wind blowing, but the wind did not blow by (hypothetical) necessity. That is because the window's breaking was no natural (or other) goal: where something is being pursued as a goal there is some reason to think it will come about, and this gives point to saying about the conditions necessary for the outcome in these cases, but not the others, that they come about by necessity. Aristotelian hypothetical necessity is not simply the necessity of conditions necessary for some outcome, for something to happen' (1985, n. 2). Also: 'even the simple physical elements have a formal as well as a material nature, and . . . the formal nature is to be defined in terms of some natural function, some end the stuff in question naturally achieves . . . But this just refers, e.g., to fire's tendency to heat things, and offers no ground for saying that fire has the nature it does (including the natural tendency to warm things up) for the sake of anything further' (1985, n. 2). These two notes can serve as a convenient way of summarizing my argument against the teleological reading of rainfall in *Phys* ii 8. First, just because water falling to the earth has the benefit that it does, does not imply that the rain fell for that purpose, any more than the wind blew in order to break my window. Second, water has its own form and function, a wet and heavy body, which falls downwards. This is why it falls, and not for the sake of anything further, any more than fire has a tendency to heat things up so that my soup is served hot instead of cold.

[34] Sedley acknowledges as much. He says, 'I think it has to be admitted that the actual mechanics of the elemental change described [In *Phys* ii 8] are Aristotelian . . . That, however, can at most show

gives regular rainfall as an example of natural necessity, and describes rain during the dog-days as a case of the incidental (1026^{b}27–35). He also mentions rainfall in connection with a discussion of absolute necessity in *Generation and Destruction*. This latter passage is worth examining in detail, because it makes perfectly clear that Aristotle is committed to the 'of necessity' alternative (as opposed to the 'for the sake of something' alternative) given in *Physics* ii 8, and because it also raises an aporia which suggests a disanalogy between the generation of rainfall and of living things.

> In cyclical motion and generation the absolutely necessary therefore exists. And if something is cyclical, then each thing necessarily is generated and has been generated, and if it is necessary, then its generation is cyclical. And these things are reasonable, since the cyclical motion—the one of the heavens—is held to be eternal for other reasons, because these things out of necessity both generate and will generate those motions which are it and are due to it. For if the cyclical motion is always moving something else, it is necessary even for the other things moved to be moved in a cycle. For example, since the upper movement is cyclical, the sun also moves this way, and since it does, the seasons go through cycles, i.e. return back, and in turn so do the things generated by the seasons. Why then do some things appear this way, but not others? For example water and air are generated cyclically, and if there is a cloud, it necessarily rains, and if it rains, then there necessarily is a cloud. But humans and animals do not return back into themselves so that they are generated again the same. For it is not necessary that if your father is born, you be born, but if you, then he. The generation seems rather to be rectilinear [and not cyclical]. But we must begin our investigation again with this: whether all things return the same way, or not, but rather some do in number, but others only in kind (τὰ δὲ μόνον εἴδει). Since as many things whose substance it is to be moved are imperishable, it is obvious that the imperishables will be numerically the same. For the motion follows that which moves. But for those things whose substance is destructible, it is necessary for them to be the same in kind, since in number they cannot return again. That is why water out of air, and air out of water is the same in kind, not numerically. And even if [I am wrong and] these are the same numerically, still this is not the case with respect to the substance for which it is possible to be or not to be. (*GC* ii 11, 338^{a}14–^{b}19)

The passage fully accounts for the regularity of seasonal rainfall with reference to absolute necessity. It makes no mention whatsoever of a cause for the sake of which, whether human or otherwise. Furthermore, it contrasts the generation of rainfall with the generation of animals such as humans, which is not necessitated in the same way (if there is Philip, there is not necessarily Alexander). The

that we must not assume the entire *aporia* to be simply quoted verbatim from an anonymous opponent. It may still be his attempt to capture, in language familiar to his own audience, the spirit of Presocratic material explanations. And that in turn leaves open the possibility that, while Aristotle broadly concurs with the mechanists on the material analysis of rainfall, he differs from them in not considering it to be the whole truth' (1991, p. 182). Indeed, this is not the whole truth, and there is a possible teleological explanation of the phenomenon available, although it is in no way anthropocentric.

generation of rainfall it describes as an absolutely necessary process (if there is evaporation and condensation, there is necessarily rain). Thus there is no reason to think that the rainfall described in *Physics* ii 8 has to be for the sake of something (like the growth of crops), just because it happens regularly (more in winter, less in summer). The necessity of rainfall happens to be beneficial for humans (as it also is for fish,[35] although no one has come forth to defend an ichthyocentric teleology, as far as I know). But rainfall cannot be *explained* by its benefit to crops or humans or fish. To put it another way, crops and humans (or fish) are not the cause of rainfall.

It should come as no surprise that meteorological events are explained according to some causes and not others. We saw that it was Aristotle's explicit policy in *Meteorology* i 2 to explain these events according to matter and the source of motion. Consider a passage from another text, wherein Aristotle describes another event that cannot be explained according to the cause for the sake of which.

> [T]hings which exist by nature but are not substances have no matter; their substrate is their substance. For example, what is the explanation of an eclipse? What is its matter? It has none; it is the moon which is affected. What is the moving cause that destroys the light? The earth. But there is probably no cause for the sake of which (τὸ οὗ ἕνεκα ἴσως οὐκ ἔστιν). (*Meta* viii 4, 1044B8–12)

The reason why eclipses are not explained according to the cause for the sake of which, is that they are not substances. There is nothing in the natural phenomenon of an eclipse, however regular it might be (and it is far more regular than rainfall), that corresponds to a thing in a state of completion (ἐντελέχεια). The moon being screened by the earth is not a state of completion of the moon, the earth, or the sun. It was established in Chapter 3 that teleological explanations have to be made with reference to specific substances,[36] and substances that do achieve such states of completion, and so can be identified as beneficiaries of the end. Since an eclipse is not a substance, it is not explained that way. Similarly, rainfall is not a substance. Water is a substance, and so it can be teleologically explained. But it would be bad science to explain the existence of water or the phenomenon of rainfall with reference to how it relates to animals or other beings. To Aristotle's credit, he does not explain it that way. The teleological explanation of water discusses its properties and principles—what Aristotle calls the functions of water, principles intrinsic to water. In the final analysis that is the imitation of the celestial rotation through its cyclical transformation into and out of other elements. Admittedly, this is an extremely attenuated 'benefit' for the elements involved—a kind of analogical immortality. But the elements are nonetheless the only direct (causal and explanatory) beneficiaries of their elemental transmutations, of which rainfall is an instance.

[35] *HA* 601B9–28.

[36] See such passages as: *Phys* ii 7, 198^{b}4–9; *IA* 704B15–18, 708^{a}9–12; *Meta* v 16, 1021^{b}12–22^{a}3; *NE* x 2, 1173^{a}4–5.

So rainfall might have a role to play in the teleological explanation of water (a natural body and substance with natural movement), in its generation out of air, but that does not mean that rainfall itself is teleologically explicable, in the strict sense of being 'for the sake of something' or having an end. There is no 'being in a state of completion' (ἐντελέχεια) for rainfall as rainfall: that is why it is just as possible that the rainfall causes a flood or destruction of crops as that it irrigates. Water does not always or for the most part end up as irrigation if nothing else prohibits it. But rain that falls over the ocean or in unoccupied lands is not in vain just because it is not useful to humans.

Hence it is absurd to build a case for the teleology of meteorological phenomena like rainfall, much less a case for anthropocentric teleology, based on the single passage at *Phys* ii 8. Aristotle is prone to make teleological explanations wherever it is at all reasonable or plausible to do so, and he never tires of faulting his predecessors for failing to do so where they should have. But this is a case where Aristotle neither faults his predecessors for failing to give teleological explanations of meteorological phenomena, nor advances one of his own. As we will see, it is not the only case.

As for the disputes mentioned earlier about the appropriateness of teleological explanation with respect to the elements—simple bodies whether celestial or terrestrial—we have this to say by way of summary. We described two extreme positions, one that denied outright that elemental motion was considered by Aristotle to be teleologically explicable, and another that claimed that the teleological explicability of elemental motion shows that Aristotle held a universal or even anthropocentric teleology. It can now be seen that neither of these views are correct. The key is to determine the limitations of teleological reasoning as it functions in explanations in natural science. Thus the idea of the element being alive and for the sake of something applies to one of the elements (ether), but not the others.

With respect to the terrestrial elements, the natural scientist looks neither at every lucky or unlucky thing that happens with an element, nor at any way that an element can be used intentionally in accordance with an art. The elements are indeed moved for the sake of something, but not for the sake of every process in which they can be involved. They are for the sake of their functions, which are their motions, and for being in states of completion with respect to their capacities for those motions, and for being so eternally. The fact that they might also be involved in irrigation of human farms, or help fishes flourish, or cause floods, is as incidental to their own proper motions, teleologically described, as the fact that the moon is eclipsed to the proper motions of the sun.

But if rainwater is used for irrigation, by a human who possesses the craft of agriculture, then there is nothing wrong with saying that the farmer uses water for the sake of making corn grow. This would be a case of intentional use in accordance with an art. Similarly, if a doctor prescribes consumption of water for a headache, then I can drink water for the sake of curing my headache. But water itself does not exist for the sake of making corn grow, or treating headaches. Again,

if there is a deposit of iron in the ground, I can mine it, refine it, and, assuming I have the relevant skills, make a knife out of it. But the explanation of why the iron is in the ground has to do with factors like compression, heat, and so forth, and not with the fact that I can cut my steak with a knife, or fashion a statue out of iron. Theoretically, we can use everything, or nearly everything, for our own technological purposes; that is why Aristotle, as we saw, said that,

> we use everything that exists as for the sake of us. For we will be in a way an end as well. For 'that for the sake of which' is twofold, but we discussed that in the work *On Philosophy*. And two arts control and know the matter: the art that uses, and the art that controls the making. (*Phys* ii 2, 194A34–B2)

So, to the extent that the elements are utilized in accordance with art or skill, they can of course be described as being for the sake of something. But that is beside the point: according to nature, which is the object of the science we are wondering about, the elements are for the sake of their circular motion, which is the manifestation of their eternal existence, either in number or in kind. Thus the teleological explanation of elemental motion directly offered by Aristotle does not support an 'overall' or universal teleology. On the contrary, it is a strictly limited teleological explanation: it applies only to the good of elemental bodies themselves.

Besides their own proper motions, the elements (i.e. earth, water, air, and fire) can be involved in two other kinds of teleological explanations: (1) when they are constitutive of organic bodies; and (2) when they are used intentionally by an agent in accordance with a craft. In the next two chapters we will consider the first case, and in Chapter 8 the second case.

6

Teleology and Organisms i: General Principles

In the last chapter we examined the teleological explanations Aristotle offers for simple substances—celestial and terrestrial elements. There we saw that the explanations describe the elements themselves as the beneficiaries of their motions. In this chapter we continue our survey of Aristotle's teleological explanations, examining how they are applied to complex substances, natural living organisms. Here too we will show that Aristotle describes the substances for which the explanations are offered as the beneficiaries of their parts and motions. For plants and animals, that benefit is primarily their own survival and reproduction. The orientation of teleological explanations towards the individual, and by extension its kind, is thus consistent with the substance-specific orientation of teleological explanations as described in the last chapter.

Aristotle's use of ends and the cause for the sake of which to explain the parts and movements of animals is the most successful and most influential aspect of his teleology. It is also the most complex and controversial. Among the disputed issues are: the problem of backwards causation, the extent to which ends can be reduced to materialist or mechanistic causes, and whether teleological explanations ought to be regarded as merely heuristic.

The first section of this chapter is a brief overview of the place of the study of living things within Aristotle's science of nature. In the explanation of living things there is a reversal of explanatory and genetic (or temporal) order, which Aristotle is concerned to justify. His account will be discussed in section 2. Section 3 includes a general discussion of the basis of all teleological explanation of organisms: the nutrition, growth, and reproduction of kinds of plants and animals. It turns out that necessary causes (such as material and moving factors) are completely inadequate on their own to deal with the simplest level of biological explanation, according to Aristotle. An important implication of this is discussed in section 4, that there is no possibility of a 'reduction' to material and moving factors. Further, there is no clear way to contrast, in the context of Aristotle's work, teleological with 'mechanistic' explanations; mechanism is, if anything, an aspect of, but not a coherent independent alternative to, the teleological explanatory scheme within Aristotle's philosophy. Accordingly, the notion that teleological explanations are merely a 'heuristic' for discussing what are really mechanistic factors is a misguided way of interpreting Aristotle's position, as is argued in section 5.

6.1 REASONING FROM PHENOMENAL EFFECTS TO EXPLANATORY CAUSES

In the *History of Animals*, Aristotle's procedure is to speak generally about each subject, and then get more specific, where necessary making reference to each kind (περὶ ἕκαστον γένος, *HA* i 1, 487[a]13). He elsewhere states that this is the best way to present scientific results, beginning with what is general and proceeding to what is more specific, in order to avoid both over-generalization and redundancy (*PA* i 4, 644B1–7; cf. i 5, 645B10–13 and i 1, 639A15–B5).

The purpose of the *History of Animals* has long been thought to be either an encyclopedic 'natural history', or an attempt at a zoological taxonomy. It has been shown, by a convergence of scholarship, to be neither of these.[1] Instead, *History of Animals* can be understood as a collection of data that is to be digested and worked into explanations later, as it is in the *Parts* and *Generation of Animals*. Aristotle himself describes its purpose that way.

[**a**] After this, we must try to discover the causes of these (μετὰ δὲ τοῦτο τὰς αἰτίας τούτων πειρατέον εὑρεῖν). For to do this, after having provided the research concerning each, is the natural method (Οὕτω γὰρ κατὰ φύσιν ἐστὶ ποιεῖσθαι τὴν μέθοδον, ὑπαρχούσης τῆς ἱστορίας τῆς περὶ ἕκαστον). (*HA* i 6, 491A10–13)

[**b**] Out of what and how many each of the parts of animals are composed, has been elaborated in detail in the researches (ἐν ταῖς ἱστορίαις) concerning them. We must now know through what causes (αἰτίας) each is in the state that it is, a separate issue unto itself from that which we discussed in the researches (χωρίσαντας καθ' αὑτὰ τῶν ἐν ταῖς ἱστορίαις εἰρημένων). (*PA* ii 1, 646[a]8–12)

[**c**] Regarding all of them, and as many others as are like them, we must study the causes (τὰς αἰτίας). That these things happen in this way is clear from our natural researches (ἐκ τῆς ἱστορίας τῆς φυσικῆς), but now we investigate the reason why (διότι). (*IA* 1, 704[b]8–11)

This procedure also fits Aristotle's general methodology, as put down in *Parts of Animals* i 1. Aristotle asks whether one should first survey the appearances (τὰ φαινόμενα, facts, observations) with respect to each species of animal and their parts (τὰ ζῷα . . . καὶ τὰ μέρη τὰ περὶ ἕκαστον), before stating their reason and cause (τὸ διὰ τί καὶ τὰς αἰτίας) (639[b]7–10). He answers that one should survey the appearances first, because knowing the facts is a precondition to knowing their cause (*PA* i 1, 640[a]14; cf. *Post* ii 2, 90[a]14–23 and *NE* vii 1, 1145B2–7). The chain of inference proceeds from facts or effects to causes, not vice versa. For example, one can infer from the fact that something moves locally that its feet exist for creeping,

[1] Not a classification or taxonomy: Pellegrin 1986, pp. 1–12; Balme 1987b, pp. 80–5; Depew 1995, pp. 162–4. Not a natural history: Balme 1987a, p. 9 and 1987b, pp. 85–8. There is an admirably concise summary of the current consensus in Lennox 1991, p. 40. Cf. Whewell 1837, pp. 287–92.

but one cannot infer from the fact that all animals need move locally that they all have feet. For some have wings or fins for that purpose.

The *History of Animals*, then, is a compendium of observations and facts about various traits of animal existence, which Aristotle works into explanations in other biological works.[2] The traits include parts (μόρια), ways of life (βίους), activities (πράξεις), and habits (ἤθη) (*HA* i 1, 487ª11–14). By 'parts' Aristotle means any constituent of an organism that contributes to its survival, reproduction, or flourishing. By 'ways of life', 'activities', and 'habits', Aristotle means the behaviors, adaptations, and generally the ethology of the various kinds of animals.

The first book of *Parts of Animals* contains an extended discussion of scientific explanation as it applies to the life sciences. It presupposes that the auditor of a biological explanation is an educated person, familiar with the general procedures and terminology of scientific demonstration, though not necessarily a specialist. Aristotle's aim is to indicate how explanations and demonstrations should proceed and be evaluated in the life sciences, which show some important differences from other theoretical sciences such as mathematics. That is, *Parts of Animals* i adapts the general procedures of demonstration, those laid down in the *Analytics*, to the specific case of living things, especially animals.[3]

To this end, Aristotle states that with respect to the inquiry into nature (τῆς περὶ φύσιν ἱστορίας, 639ª12) it is clear that there are 'certain norms (or limits)[4] with reference to which one appraises the manner of exposition' (ὅρους τοιούτους οὓς ἀναφέρων ἀποδέξεται τὸν τρόπον τῶν δεικνυμένων, 639ª13–14).[5] According to Aristotle, the manner of exposition can be judged on the basis of its adherence to these norms, independently of whether the content of the exposition is true or false (639A14–15). The rest of *Parts of Animals* i 1 is an elaboration of the norms, as they apply to the biological sciences, and the term διορίζειν is used in connection with this (διορίζειν, 639A16; διώρισται, 639B6; διοριστέον, 639B11–19).

We have already touched on the issue of the role of necessity in explanation when we discussed Aristotle's terminology and methodology of explanation in *Posterior Analytics* ii 11. There, one of the kinds of cause—the one that is later said to include matter—was labeled 'the things which, when they are, this must be'. Aristotle asserted the compatibility of explanations according to both necessity and the for the sake of which,[6] and asserted that in nature there are many things of that kind. After saying that, Aristotle distinguished between two senses of necessity: (1) according to natural impulse, and (2) by force and contrary to

[2] Cf. Balme, *Aristotle History of Animals Books VII–X* (Loeb), pp. 21–6, and 1987*a*, p. 13; Lennox 1996*a*.

[3] Recent important discussions of this compatibility, which I build on here, include Pellegrin 1986, Lennox 2001*a*, 2001*b*, and 2001*c*, and Charles 2000.

[4] Other translations: 'principles' (Balme, Clar); 'canons' (Ogle, Loeb); 'standards' (Lennox, Clar).

[5] See generally Lennox 2001*b*, pp. 119–21. As we saw in Ch. 1, the term limits (ὅροι) is similarly used by Theophrastus, when he calls for the determination of 'norms' or 'limits' on the application of teleological principles in scientific explanation.

[6] *Post* ii 11, 94B27–37.

natural impulse (ἡ δ' ἀνάγκη διττή, 94[b]37; cf. *Meta* vi 2, 1026B28–29). We also saw that he applied this distinction to the motions of the terrestrial elements. By natural impulse, earth moves to the center of the universe, by force it is flung up into the air.[7]

In the entry on 'necessity' in a metaphysical lexicon of *Metaphysics* v, both of these sense of necessity—absolute, natural necessity, and compelled, unnatural necessity, are duly listed. But even before discussing them, Aristotle names another kind of necessity.

> Necessity means: [1] that without which it is not possible to live, as a contributing cause, for example breathing and food are necessary for the animal, since it is impossible [for the animal] to exist without them. And those things without which the good either cannot exist or come to be, or without which something bad cannot be gotten rid of or removed, for example, drinking the medication is necessary in order not to be sick, and sailing to Aegina is necessary in order to collect the money. Also: [2] the forced and compulsion. . . . Also: [3] the thing which cannot be otherwise we say to be in this condition [i.e. necessary]. (*Meta* v 5, 1015[a]20–35)

The order is not particularly important. Later in the *Metaphysics*, Aristotle says, 'the necessary has this many meanings: that done by constraint that is contrary to desire; that without which the good is not; and that which cannot be otherwise but is absolutely [necessary]' (xii 7, 1072[b]11–13). In *Parts of Animals* i 1, Aristotle describes the kind of necessity without which the good does not obtain 'the hypothetically necessary' (τὸ ἐξ ὑποθέσεως, 639[b]21). It is irrelevant to the present investigation whether the delineation of another kind of necessity indicates a 'development' in Aristotle's thought, or just reflects the fact that the distinction is drawn here because this is where it becomes necessary to draw it.[8] What matters is that Aristotle thinks that the concept of necessity must be adapted to fit this subject matter. He says that the hypothetically necessary is present in everything that is generated: both artifacts and natural things. For example, if there is to be a house, there will have to be bricks or beams, and they will have to be moved and arranged in a certain way. A house made out of paper is not really a house but rather a card trick. And if there is to be a saw, metal will have to be molded in a certain way. A saw cannot be made of wool or intestine if it is to perform the function of a saw, and so be a saw. Thus it is necessary, if there is to be a saw, that certain materials are arranged in a certain way. The same applies to a dandelion, rat, worm, and human: if it will come to be, certain materials will have to be developed in a certain way.

Thus the exact role and kind of necessity that is appropriate in scientific explanation differs across various fields of knowledge. Even within the broad field of life science, necessity is present in different ways. (We will examine the different

[7] *Phys* viii 4, 255[a]28–30, B13–17, and [b]29–6[a]3.

[8] On the issue, see: Lennox 1996*b*, pp. 139f; 2001*b*, pp. xiv–xv; and 2001*c*, pp. 134–7.

kinds in the next chapter.) For now, we are concentrating on the difference between the role of necessity in different kinds of science.

> The mode of the demonstration and of the necessity is other in the natural and the theoretical sciences (ὁ τρόπος τῆς ἀποδείξεως καὶ τῆς ἀνάγκης ἕτερος ἐπί τε τῆς φυσικῆς καὶ τῶν θεωρητικῶν ἐπιστημῶν). These have been discussed elsewhere. For the latter [the theoretical sciences that are not natural] the starting point is what is, but for the former [the theoretical sciences that are natural] it is what will be. For 'since such is health or a man, it is necessary for this to be or to come to be'; but not 'since this is or has come to be, that necessarily is or will come to be'. Nor is the necessity strung together in this kind of demonstration forever, so that one says, 'since this is, so that is'. But these things have been determined elsewhere, both where it is present, where reciprocal, and through what cause. (*PA* i 1, 639^{b}30–40A9)

I have followed G. E. R. Lloyd's translation of the first sentence, in order to preserve an ambiguity in the Greek. Lloyd has described three alternate interpretations of this line, none of which he finds adequate, for the reasons provided here in parentheses (Lloyd 1996, p. 29): (1) The contrast is between physics on the one hand, and theoretical sciences on the other. (But in *Meta* vi 1, Aristotle states that physics is a theoretical science, as over against practical and productive sciences.) (2) The contrast is between physics and the other theoretical sciences on the one hand, and art or craft (*technē*) on the other. (But Aristotle's examples are of health and a man, and it is impossible that a man is a product of *technē*.) (3) The contrast is between physics and the theoretical sciences on the one hand, and the products of *technē* and the things that come to be by nature on the other. (But there is no mode of explanation of natural things that is independent of physics.)

Another alternative is to see the distinction, as David Charles (1988) does,[9] as one between an absolute necessity that applies to the eternal cycles of the heavenly bodies and of meteorological processes like rain showers on the one hand, and on the other hand a conditional necessity that applies to other physical (including) biological processes. But there seem to be the following problems with this proposal. First, the interpretation does no justice to the, admittedly difficult, distinction drawn by Aristotle here between 'natural science' and 'theoretical sciences' (as Charles translates, p. 7). For the sciences that deal with the heavenly bodies and meteorological processes like rainfall are both natural and theoretical, just like those that deal with plants and animals. Second, the idea that absolute necessity applies only to the cycles of the stars and meteorological processes (as Charles argues, p. 12) is not quite right. For there is a sense in which plant and animal generation constitutes an absolutely necessary cycle, given the eternality of their species, as we will see. In the passage from *GC* ii 11 partially referenced by Charles, Aristotle asks why some necessary processes seem to be eternal, like the

[9] See also the similar interpretation of Düring 1961, pp. 214 f. Boylan also holds that absolute necessity 'is limited to the superlunary realm' (1984, pp. 114–15).

rotations of the heavenly bodies, but others do not. The cycle of water and air in the meteorological process of rain is necessary in the sense that if there is a certain kind of cloud, it rains, but the cycle of reproduction of humans and animals is not like that (it is not necessary that you were born just because your father was). Aristotle asks whether biological generation, rather than being cyclical, does not 'seem (ἔοικεν) to be rectilinear' (338^{b}11). But in what immediately follows (quoted above, p. 155, and not discussed by Charles), Aristotle states that we must begin the inquiry again (ἀρχὴ δὲ τῆς σκέψεως πάλιν, 338^{b}11–12) into this question with the idea that the generation of perishable substances is different in that what is involved in the cycle does not remain numerically the same, but only the same in kind. What he goes on to say does not argue that there is no eternal or necessary cycle in the biological case (for elsewhere he clearly states that there is, just as there is in meteorology, and both of these cases are said to imitate or resemble the eternal celestial cycles), but only that the kind of permanence in each case is different.[10] So the categorical distinction between biological and celestial cycles is not a distinction between kinds of necessity, but between kinds of immortality (in number or in kind). Both cycles are absolutely necessary; in fact in the final analysis all three are: the celestial, meteorological, and the biological cycles are all equally absolutely necessary. Thus Aristotle in the *Parts of Animals* passage is probably not referring to a kinds of necessity that apply differentially to celestial or biological phenomena.

There is another way to interpret the distinction between kinds of necessity 'in the natural and the theoretical sciences' mentioned in *PA* i 1. I have interpolated this interpretation into my translation of the passage. The contrast could be between the theoretical sciences that are natural (i.e. those that involve things that both are changed and cause change), and those that are not (i.e. those that involve things that are not changed at all, such as numbers). Making this interpretation palpable will require a brief digression into the discussion of necessity in *Physics* ii 9. There Aristotle says:

> Necessity pertains to the mathematical things and to the things that come about by nature in a kind of parallel fashion. 'Since the straight is what it is, necessarily the triangle has angles equal to two rights'; NOT, 'since the triangle has angles equaling two rights, straight is what it is'. But if this is not the case, then straight doesn't exist. In the things that come to be for the sake of something, the case is reversed (ἐν δὲ τοῖς γιγνομένοις ἕνεκά του ἀνάπαλιν): if the end will be or is, then that which precedes it will be or is. But if not, then just as there [in mathematics], if the conclusion is not present, then there will not be the starting point, so here [in physics] there will not be the end and the for the sake of which. (*Phys* ii 9, 200^{a}15–22)

[10] In fact, Aristotle distinguishes the meteorological cycle from the celestial one on this score, and puts it into the same class as the biological cycles, because the water and air elements, although they eternally exist, do not remain numerically the same, but rather transmute into and out of each other. Similarly, in reproduction, biological entities do not remain numerically the same, but rather reproduce descendents the same only in kind as their ancestors.

This passage, and the examples that follow it, make it clear that the difference Aristotle is getting at is not between physics and theoretical science, but between two different modes of demonstration within theoretical science. We might reiterate his claim thus: The mode of demonstration and of necessity is other in the theoretical sciences *that are natural*. In the theoretical science of mathematics, one proceeds from the principles ('starting points' or 'beginnings') to the necessary conclusion (in this case about the angles of a triangle). In the theoretical science of physics, on the other hand, one proceeds from the cause for the sake of which ('ends') to what must come before. So the difference is between whether what is assumed is the 'beginning' or the 'end'. This is an issue that Plato is said to have mentioned often, possibly at the outset of any discussion: 'Is the way from, or to, the first principles?' (*NE* i 2, 1095A32–33).

This is why Aristotle, in both passages just quoted, puts the distinction in terms of tense: in one case it is a matter of what *is*, in the other of what *will be*. 'If there is a straight line, then the angles of a triangle are equal to 2R', but not 'if there is some metal then there is a saw'; rather 'if there *will be* a saw, then there *will be* metal in such and such a configuration'. Other familiar examples can make this even clearer. If there is to be a house or a saw, then someone will have to fell logs and arrange them, or mine iron and cast it. These steps precede in time the end or goal (the house or saw is produced after the logs are gathered or the iron mined). In the mathematical example, what is assumed comes before the conclusion drawn about the angularity of three-sided figures but, strictly speaking, the straightness of lines is perfectly simultaneous with it. Notice that the contrast with the procedures in mathematics applies both to the products of art and to those of nature. And, as we will see in the next section, the emphasis on tense here reflects a concern about the relationship between explanatory and genetic (or temporal-historical) order.

6.2 GENETIC ORDER AND EXPLANATORY ORDER

In *Posterior Analytics* ii 11, we also had an example of mathematical necessity contrasted with two other kinds of explanation, both of which were tensed. The mathematical example, by contrast, involved equation of the components of the premises: right angle = ½2R = angle in a semi-circle. There is no time element here: a right angle *is* the angle in a semicircle. But in the case of the explanation according to the source of motion, there was a definite time element (e.g. Athenians launch an attack, there is retaliation, the Persian war starts). This was compared with the teleological explanation, which also involves a time element (e.g. walking after dinner, digesting food, health). But in the teleological case the middle term of the explanation (health) is temporally posterior to what brings it about, although it is explanatorily primary. In the explanation of the source of motion, the explanatorily primary aspect is at the same time temporally prior (the Athenians' attack was the cause of the Persian war).

Given the examples, this reversal of historical and explanatory priority presents no problem at all for teleological explanation. For the examples (walking for health and house-building for security) involved intentional action. And the intention (to facilitate digestion, to become healthy, etc.) is temporally prior to actions deliberately taken in order to secure the goal. But in biological explanation, the case is not so simple. Neither the parts of animals nor the behavior of the vast majority of them (all but a subset of human action) are intentional. Thus critics of teleology routinely voice an objection. Teleological explanations of the formation of animal parts, or even the whole organism, seem to put effects before causes, requiring a backwards causation, with some state in the future exerting influence on events in the past. For example, if we use the end state of a mature oak tree as a cause of the developmental processes going on in a seed, or in a sapling, then we seem to be saying that the future state of a tree is somehow influencing its past.

In fact, what is going on is that in teleological explanation, the order of generation and the order of explication are reversed: the starting point of the explanation is what you end up with in the process of generation. It is only once the 'effect' or end (the aim or the beneficiary) is established, that it is possible to discuss the processes that lead up to this development and are thus prior in time to it. Take the case of seeds. The most important explanatory component is what it is a seed of—what will grow out of it if it is planted and fertilized. Next comes the description of the processes that lead to the germination of the plant, the seedling, the sapling, and finally the full-grown oak. The full-grown oak, the complete organism, is thus prior, explanatorily, to the processes that lead up to it, which are prior genetically.

> We say that 'this exists for the sake of that' every time some end is evident, towards which the motion proceeds if nothing impedes it. Thus it is obvious that there is such a thing, and it is in fact that which we call a nature (ὅ δὴ καὶ καλοῦμεν φύσιν). For in fact it is not 'whatever happens to come out of a seed', but rather this from that, nor 'any lucky thing comes out of a chance body'. Therefore a seed is a starting point and a making of something out of something. For these things are by nature, at least they grow naturally (Φύσει γὰρ ταῦτα· φύεται γοῦν ἐκ τούτου). Yet still prior to these is that of which they are the seed. For the seed *becomes*, but the end *really exists* (γένεσις μὲν γὰρ τὸ σπέρμα, οὐσία δὲ τὸ τέλος). Prior, however, to both is the organism from which the seed was derived. For we speak of seeds in two ways, mentioning that from which it comes and that to which it gives rise: it is both the seed of that from which it came, of the horse for instance, and the seed of the organism that will eventually arise from it, the mule, for example—the seed of both, though in different ways, as here set forth. Further, the seed is potentially something. It is potential insofar as it is in a state oriented towards a state of completion, we said (δύναμις δ' ὡς ἔχει πρὸς ἐντελέχειαν). (*PA* i 1, 641^{b}23–2^{a}1; cf. 640^{a}19–26; *Meta* xii 7, 1072^{b}35–73^{a}1)

Aristotle thinks that the inversion of genetic and explanatory order is a general rule: 'that which is posterior in generation is prior in the order of nature, and that which is genetically last is first in nature' (*PA* ii 1, 646A25–27; cf. *GA* ii 1,

734A16–32; ii 6, *passim*; cf. *Protr* 81.20–82.2). In *Parts of Animals* i 1, the craft analogy is invoked for illustration: the complete house is the last thing to be developed, but it is the first in importance. The finished house does not exist for the sake of the process of building, or for its foundation, walls, plumbing, painting, and so forth. Although all those happen before the house is complete, they come after it in importance. The same is the case with animals and their parts and processes. Their homogeneous parts develop before the heterogeneous ones, and the whole adult after various phases of immaturity. But the hand and eye do not exist for the sake of flesh and bones, and still less does the complete organism exist for the sake of hands and eyes, or flesh and bones.[11]

The doctrine that genetic and explanatory priority are opposite does not 'reverse cause and effect', require 'backwards causation', or even 'conflict with causation' as has been argued.[12] For Aristotle, the 'effect', if there is one, is the phenomenon to be explained—e.g. the existence and regular reproduction of a variety of living things—and the effect is explained by reference to causes. (That is a strong argument in favor of preserving the translation 'explanation' for αἰτία: it avoids the confusion altogether.) As we saw in our examination of *Posterior Analytics* ii 11, Aristotle is firmly committed to the conventional concept of causes preceding effects, and there is an explanation according to the 'origin of motion' in principle compatible with every teleological explanation.

Aristotle maintains this position in his extended discussion of the causal sequence in the development of organisms in *Generation of Animals*. Chapter ii 6 is worth examining in a little detail, since it not only explains this in detail, but also contains a neglected discussion of distinct senses of οὗ ἕνεκα. Besides being of intrinsic interest, an analysis of the passage further substantiates the claim that Aristotle conceives of the individual organism (as opposed to the species, the cosmos, or god) to be the beneficiary of teleologically explicable processes. Aristotle is discussing the principles according to which we must explain the order in which the various parts of a living (animal) body are formed. The immediate issue is which parts are prior to the others. We then read:

> But the term 'prior' is already ambiguous. For there is a difference between both (a) 'that for the sake of which' and (b) 'that which is for the sake of this' (τό τε γὰρ οὗ ἕνεκα καὶ τὸ τούτου ἕνεκα), and the latter (b) is prior with respect to generation, but the former (a) is prior with respect to substance. (*GA* ii 6, 742^{a}19–22)

[11] *PA* ii 1, 646^{b}5–12; cf. *Meteor* iv 12, 390^{b}14–22, where Aristotle says that the heterogeneous parts will be discussed after the homogeneous parts, because the former are made up of the latter.

[12] 'Aristotelian goal-directed causality . . . appeared to put the cart before the horse—explaining a cause before its effects—and thus to require "backwards causation" ' (Buller 1999, p. 5). The confusion is acutely evident in the remark of a prominent biologist: 'the recognition and description of end-directedness does not carry a commitment to Aristotelian teleology as an efficient causal principle' (Pittendrigh 1958, p. 394). For Aristotle, the cause for the sake of which is not an 'efficient cause'. The cause for the sake of which explains *why*, not *how* the process happens. The cause for the sake of which provides the explanation of the end-oriented activity which necessitates 'efficient causal' (moving and material) processes.

The point is clarified with further distinctions and a comparison with art. There is no problem understanding what is meant by 'prior in generation': the parts of an animal, in the embryonic stage for example, are generated before the whole animal. But how is the whole animal 'prior in substance'? In accordance with what Aristotle says elsewhere, this indicates ontological priority: A is prior to B, if A can exist without B, but B cannot exist without A. Somehow the whole animal must be able to exist without the animal parts, which paradoxically develop earlier than the complete organism (and not vice versa—the parts must not be able to exist without the whole organism). But it is difficult to see how this could be, since the whole animal cannot come to be, that is, cannot develop into a whole animal, without the prior development of the parts. Aristotle continues with the following distinction.

Even 'that for the sake of this' has two divisions (δύο δὲ διαφορὰς ἔχει καὶ τὸ τούτου ἕνεκα·): for there is (a) that from which the motion comes and (b) that which is used by that for the sake of which (τὸ μὲν γάρ ἐστιν ὅθεν ἡ κίνησις, τὸ δὲ ᾧ χρῆται τὸ οὗ ἕνεκα). I mean to say both (a) that which generates, and (b) that which is an instrument for what is generated. For of these it is necessary for the one to be prior, namely the producer. For example, the teacher [is prior to] the learner, but the flutes are posterior to the student leaning to play flutes, since it is superfluous for those who do not know how to play flutes to possess them. (*GA* ii 6, 742ª22–8)

In the analogy, the teacher is the generator of a student capable of playing flutes, and flutes are the instruments that are used by the student. The flute player is 'that for the sake of which' (τὸ οὗ ἕνεκα), while flutes and flute teachers are two kinds of 'that which is for the sake of this' (τὸ τούτου ἕνεκα). With maximum brevity: the flute player is that for the sake of which flutes and flute instructors exist or come to be. Now in one sense flutes and flute instructors both exist prior to flute players, since no one plays the flute without a flute to play or without instruction in how to play them. But in another sense, 'in substance', flutes and flute instructors come after flute players, since these have no purpose or reason or reality in the absence of flute players. Aristotle summarizes the distinctions made as a result of this analysis as follows.

[Consider three things:] (1) one is the end which we say is 'that for the sake of which' (ἑνὸς μὲν τοῦ τέλους ὃ λέγομεν εἶναι οὗ ἕνεκα), (2) second is 'that which is for the sake of this', namely the kinetic and genetic starting point (δευτέρου δὲ τῶν τούτου ἕνεκα τῆς ἀρχῆς τῆς κινητικῆς καὶ γεννητικῆς) (for the producer and generator, as such, are relative to that which is produced and generated), (3) third is that which is usable and the end uses (τρίτου δὲ τοῦ χρησίμου καὶ ᾧ χρῆται τὸ τέλος). Of these three things (1) first some part is necessary in which the genetic starting point subsists, since immediately this is the part of the end that is individual and most controlling, (2) next is the whole and the end, and (3) third and finally are the parts which are instruments for these for its uses. (*GA* ii 6, 742ª28–36)

The order of genetic priority is thus:

1. the genetic starting point, which is 'for the sake of this' (τούτου ἕνεκα)
2. the whole organism, which is 'that for the sake of which' (οὗ ἕνεκα)
3. the organs used by the organism, which are 'for the sake of this' (τούτου ἕνεκα)

But in the order of substantial priority, the whole individual organism, the end of the dynamical, kinetic, and genetic processes, is first. Among parts, the first that come to be are those that contain the genetic starting points, and only later and last do the parts come to be that do not contain genetic principles. The individual organism, that for the sake of which both the genetically crucial and merely instrumental parts exist, comes to be as a whole somewhere in the middle. The 'activating' parts thus come to be prior in time to that for the sake of which they come to be, even though they are substantially posterior to the whole organism in a way that is analogous to how merely instrumental parts (unnecessary for generation) are posterior to the organism as a whole. Aristotle admits that this situation makes it difficult to establish the order in embryonic development, since some parts come to be prior to others and even prior to the organism as a whole: 'to distinguish between the activating and instrumental parts is not easy; nonetheless this is the method we must follow in order to discover what is generated after what' ($742^{b}9$–11).

Thus in the context of organisms, there is no confusion in proposing as a cause of organic development an end-oriented 'genetic program' which determines how one stage of an organism naturally develops into another, temporally later stage. Prominent biologists use the notion of a genetic program, and those who understand Aristotelian genetics rightly tend enthusiastically to credit him with articulating the notion.[13] What are in the final analysis causally efficacious in biological contexts are in fact fully developed organisms: the adult parents that are responsible for the reproduction (*PA* i 1, $640^{a}19$–26, $641^{b}23$–$2^{a}1$, and *Meta* xii 7, $1072^{b}35$–$3^{a}1$). Since it is the organism in a complete state of development—the adult parent—that is capable of transmitting the form (i.e. the genetic program) to the offspring, it is this 'being in a state of completion' (ἐντελέχεια) that must be regarded as the 'cause' (construed as a mover, formula, genetic program, and end) of the developing parts and their concomitant capacities. While the parts are developing they are incomplete from a functional standpoint, but they will naturally develop into a complete state if nothing interferes or disturbs the process. But what will develop is not hands, eyes, or a heart, but a complete organism that has these because of the kind of soul that it has. The stages of development, from embryo, to infant, child, adolescent, adult, and so forth, aim at a state of completion where all the parts are capable of performing the functions for which the organism's soul has capacities. The explanation of these parts thus makes reference to the soul, really the 'first complete state of the organism', in which these capacities are functional.

[13] Ernst Mayr, in response to the assumption that 'teleonomic processes are in conflict with causality because future goals cannot direct current events', says: 'this objection, frequently raised by physicalists, is due to their failure to apply the concept of a program' (1992, p. 123). Also: 'The use of so-called teleological language by biologists is legitimate; it neither implies a rejection of physiochemical explanation, nor does it imply noncausal explanation' (1988, p. 59, cf. pp. 55–7 where Mayr discusses his sympathy with the Aristotelian account and decries its frequent misrepresentation). See also Delbrück 1971, pp. 53–5; Balme 1965, p. 5; Boylan 1984, pp. 128–9.

How is each [part] produced? In answer to this, it is necessary to take as a starting point the principle that created things, whether generated by nature or by art, come to be functional (ἐνεργείᾳ) out of a potential for this. So seed is like that, and it has both change and this kind of principle: when the change ceases, each of the parts comes into being and into a soul (ἔμψυχον). For there is no face, nor flesh, not having a soul in it, though when it's dead these things are referred to as such, ambiguously, as they are when produced in stone or wood. So the homogenous parts and the organs ('instruments') come into being simultaneously. And just as one should not say of an axe or any other instrument merely that it was made from fire, neither should we say that a foot or a hand was. The same thing goes for flesh. For of this there is a function (ἔργον). So, while hot and cold could make hardness, softness, adhesiveness, brittleness, and all other such affections underlying the parts that have soul in them (ἐμψύχοις), at the formula for the flesh or bone, we get to a point where they no longer could: rather this is made by the movement from the thing in a complete state that is reproducing (ἀπὸ τοῦ γεννήσαντος τοῦ ἐντελεχείᾳ ὄντος) [i.e. the adult parent], who is that out of which, potentially, something is produced, just as is the case for those things produced in accordance with art. For the hot and cold make the iron soft and hard, but what makes the sword itself is the movement of instruments by someone who possesses the formula of the art. For art is a starting point and form of that which is produced, but in another, while the motion of nature is in that which is produced itself, from another natural being who possesses the form functionally (ἡ δὲ τῆς φύσεως κίνησις ἐν αὐτῷ ἀφ ἑτέρας οὖσα φύσεως τῆς ἐχούσης τὸ εἶδος ἐνεργείᾳ). (*GA* ii 1, 734^{b}19–5^{a}4)

Explaining animal parts means specifying their form, matter, and generation, but especially their ends. Here Aristotle compares generation as it happens in art. In discussing how an artist generates an artifact, one does not merely mention the instruments and materials used by the artist. Rather, one first mentions the purpose of the artifact, and then the motions that must be carried out by the artist in order to produce the artifact. So one does not simply say that a table is made by wood, nails, saw, and hammer. Rather one says something like: a wooden surface is attached to legs at regular intervals, so that there will be a surface suitably elevated for resting certain kinds of objects upon. So too in the discussion of living things, one does not explain them by merely mentioning flesh, blood, and bones. One must describe 'the movement of the instruments by someone who possesses the formula'. In art the formula is not just the outline or shape of the artifact, but even more importantly, the end for which it is to be used; in nature it is the form of the living thing, the soul, which is, taken as a whole, the end for the sake of which it comes to life.[14] Thus, before we begin to explain the parts of the animal,

[14] Whether or not this model necessarily implicates Aristotle in anthropomorphism (or an intentionalistic fallacy) will be discussed in due course. Stephen Menn has emphasized and greatly clarified how Aristotle's teleology involves the model of the relationship between the artist and his instruments to the soul and the body. 'Aristotle is speaking not specifically of the human soul, but of the souls of animals and plants in general. These certainly do not literally possess arts. . . . Aristotle finds the arts useful as a model for how something stable and "perfect" can move and give order to something subordinate to itself. In particular, the art, or the artisan qua artisan, is an unmoved mover, of the ὄργανα and of the bodies that the ὄργανα are applied to, and Aristotle thinks that the soul must be an unmoved mover of the body in order for it to be constantly a source to the body of the same

which serve as instruments of the soul, we have to discuss the soul itself, since it is the 'first complete state' of the organism that possesses the parts.

6.3 SURVIVAL AND REPRODUCTION AS THE BASIS OF EXPLANATION IN THE LIFE SCIENCES

In *Parts of Animals* i 1, Aristotle explicitly states that some account of the soul must be given (641^{a}17–32), either as a whole, or at least in part (641^{a}23–4), with respect to both its substance and attributes (641^{a}24–5). That is because the living thing is natural, and

> nature is spoken of in two ways: being on the one hand as matter, on the other as substance (ὡς οὐσίας). And the latter as both the mover and the end (καὶ ὡς ἡ κινοῦσα καὶ ὡς τὸ τέλος). Thus the soul is this [substance, mover, and end] of the animal, either the whole soul, or some part of it. It follows from this that, for the person investigating nature, it would be more important (μᾶλλον) to speak about the soul than about the matter, insofar as the matter is a nature more (μᾶλλον) on account of this [the soul], than the other way around. (*PA* i 1, 641^{a}25–31)

This passage again shows Aristotle concerned with the completeness, order, and priority of causal factors within explanation. The passage also shows Aristotle grouping together the mover and end (and identifying them substantially with the soul), a procedure we have seen several times before, most notably in *On the Soul* ii 4.

The present passage also shows to what extent and why Aristotle thinks that a study of the soul is relevant to natural science. What follows makes it clear that this serves not simply as an expansion of the scope of natural science, but also requires that a limit be established as to what the science can explain. For if natural science was to include everything about the soul, then philosophy would be nothing but natural science (οὐδεμία λείπεται παρὰ τὴν φυσικὴν ἐπιστήμην φιλοσοφία, 641A35–36). Everything would be an object of natural knowledge (περὶ πάντων ἡ φυσικὴ γνῶσις ἂν εἴη, 641^{a}36–^{b}1). But not every aspect of the soul is an object of natural science. We could establish that limitation, along Aristotelian lines, according to a number of different criteria. For example, natural things are always sources of motion, but 'not all parts of the soul are a source of motion, nor are all its parts' (641^{b}4–5). Thought or intellection is not really 'moved' by a part of the soul. Hence 'not all parts of the soul are to be explained, for not all the soul is natural' (641^{b}9–10). We already met this policy of exclusion of things that are not themselves moved from natural explanation. Discussion of such things as

teleological order. . . . much of the programme of the *De Anima* and the *Parts* and *Generation of Animals* is to work out the picture of the body as ὄργανον of the soul and use it to perform certain vital activities. This is a teleological programme, since the ὄργανον will be explained by showing how they are for the sake of the user' (2002, p. 113).

intelligence, and its objects and subjects, is not about things that have in themselves a principle of being moved and so are 'no longer natural' (οὐκέτι φυσικῆς, 198[a]28; cf. [a]36–[b]3). More pertinent to our investigation would be the fact that abstract objects, like numbers, are not natural because they are not for the sake of anything, but natural substances (the objects of natural science) are always for the sake of something (ἔτι δὲ τῶν ἐξ ἀφαιρέσεως οὐδενὸς οἷόν τ᾽ εἶναι τὴν φυσικὴν θεωρητικήν, ἐπειδὴ ἡ φύσις ἕνεκά του ποιεῖ πάντα, 641B10–12). Thus only those parts and activities of the living thing that are for the sake of something are subject to natural explanation.

> Since every organ is for the sake of something, each of the parts of the body are for the sake of something, and since that for the sake of which they exist is some activity, it is clear that the whole body is constituted for the sake of some manifold activity. For the sawing does not come about for the benefit of the saw, but the saw for the sake of sawing, since the sawing is an activity. Therefore the body as well exists somehow for the sake of the soul, and the parts are for the sake of the functions towards which each of them naturally grows (τὰ μόρια τῶν ἔργων πρὸς ἃ πέφυκεν ἕκαστον). It follows that one must state first the activities that are common to all, and then those that are specific and according to each kind (καὶ τὰς κατὰ γένος καὶ τὰς κατ᾽ εἶδος). (*PA* i 5, 645[b]14–22)

Aristotle goes on to give examples of the kinds of activities that he has in mind (generation, growth, coition, walking, sleep, locomotion, etc.), as well as the kinds of parts (nose, eye, face, limbs, etc.). He says that we have to establish the priority of activities, so that the order of explication for the various activities and parts will be clear. Both activities and parts are in relations of subordination to one another, and some functions or parts are necessarily present simply because other functions and parts are (645[b]28–33). To make up an example, flexion of the knee is subordinate to the striding motion of the leg, and so to the function of walking and, generically, locomotion. The kneecap might be present just to protect this joint. But the function of locomotion must be understood to explain the various actions and parts involved in walking and the leg. Thus, if we are to follow Aristotle's procedures for the complete explanation of all natural living things, we have to establish what activity of the soul is (1) common to all living things, and (2) prior to all other activities of living things. In order to do that we turn to the treatises in which Aristotle discusses the soul and its activities.

Different kinds of living things have different capacities or powers and, corresponding to these, they have different body parts that correspond to these capacities. But the organs and the powers to use them are absolutely co-extensive. As we saw, they come into being together.[15] According to Aristotle, no animal has a capacity for that of which it lacks the part necessary to actively use the capacity (*GA* iv 1, 776A5–30). For example, no animal has sight, but lacks eyes, or the ability to fly, but lacks wings. Similarly, no animal possesses a body part that it

[15] *GA* ii 2, 734[b]19–5[a]4.

does not have a capacity to use. Thus no animal has feet, but lacks the ability to walk, or has lungs but no capacity to breath air.[16] Aristotle frequently mentions the co-extension of capacity and part as a manifestation of the principle that 'nature does nothing in vain'.

Now it is possible to gather the powers of the soul (or 'souls', as they are often called) into five groups: (1) nutritive-reproductive, (2) appetitive, (3) perceptive, (4) locomotive, and (5) intellective (*Anima* ii 3, 414^{a}31–2). Plants have the first only. Of animals, some have one, others several, and still others all, of the remaining powers in addition. They are ordered serially, such that the possession of one implies possession of all the others that come before it. Thus every living thing has a nutritive soul, or nutritive powers of its soul. Animals, which have the power of sensation, also have an appetitive soul in addition to their nutritive soul. If an animal is able to move itself with respect to space, it has all of the foregoing. In other words, if a living thing can move itself locally, then it can also reproduce, use food, and perceive.[17] If it has mental powers, as rational animals do, then it possesses all and every power of the soul.

Since our investigation requires that we begin with the capacity that is most common, and prior to all the others, it is clear that we must begin with the nutritive soul.

> First we must discuss nutrition and generation. For the nutritive soul underlies the other souls, and it is the first and most common power of the soul, being that in virtue of which all the living things subsist. It is the function of this to generate (i.e. reproduce) and to use food. For that is the most natural of functions for living things (φυσικώτατον γὰρ τῶν ἔργων τοῖς ζῶσιν), as many as are developed and neither mutilated nor spontaneously generated: to produce another like itself, an animal an animal, a plant a plant, so that they participate in the eternal and divine as far as possible. For everything desires this, and does for the sake of this everything that it does naturally. For 'that for the sake of which' is twofold: that of which [i.e. the aim] and that for which [i.e. the beneficiary] (τὸ δ' οὗ ἕνεκα διττόν, τὸ μὲν οὗ, τὸ δὲ ᾧ). Thus since it is not possible to share in the eternal and divine, because nothing among the perishable things is able to remain the same and one in number, each participates as possible, it shares in this, some more and others less, and remains not the same but like the same, not one in number, but one in form. (*Anima* ii 4, 415^{a}23–^{b}7; cf. 416^{b}20–5)
>
> Since it is right to call things after the ends they realize, and the end of this soul is to generate another being like that in which it is, the first soul ought to be named the reproductive soul (ἡ πρώτη ψυχὴ γεννητικὴ). (*Anima* ii 4, 416^{b}23–5)

Just like the other natural bodies, stars and elements, which perpetuate their existence eternally and thus manifest their divine aspect (either through continuous circular

[16] The only possible exception of which Aristotle is aware is the mole, which is deprived of sight, although it has eyes 'in a kind of way' (*HA* 491^{b}28). The explanation of this is that, 'its nature was stunted in the course of development', and so the would-be eyes are underdeveloped and incapable of sight owing to congenital defect (*HA* 491B30–4).

[17] For an insightful discussion of the serial nature of souls, see Menn 2002, pp. 106–7. Menn also rightly emphasizes the fundamental nature of the nutritive-generative soul on pp. 121–2.

motion, or through imitation of this in continuous reciprocal transmutation), organisms too exist for the sake of—aim of—eternal existence, and so this is the primary source of explanatory information about them. Organisms are unlike stars in that they must reproduce in kind in order to survive eternally, but they are also unlike the terrestrial elements, in that they are alive. Their situation from a teleological standpoint could be described as intermediate: they are alive like the stars, but like the elements can achieve immortality only in kind. From this standpoint the fact that the soul exists primarily both for the sake of living and for the sake of a living organism is not a problem, since the same soul—the nutritive soul—manifests both functions, living and reproducing. This is a key case where the dual sense of the cause for the sake of which—aim and beneficiary—is fully apparent.

The activities of living, growing, and reproducing thus govern the teleological explanation of living things. All teleological explanations of organisms must begin from this (as opposed to, say, the material), and proceed from it. Thus a teleological explanation of a plant or animal part, function, activity, behavior, or movement, must ultimately presuppose the growth, reproduction, or nourishment of that *kind* of animal, and the same goes for plants. This fits excellently with the expectations of our terminological survey, where we established that Aristotle uses teleological terms and formulae with reference to the good of specific kinds.

Now there can of course be further specifications of just what constitutes living for each kind of organism, and the life of a plant, such as a grass or a tree, is rather obviously different than the life of an animal, such as a slug, bee, or human. We mentioned above that these specifications are made with respect to five kinds of soul. Yet from the primary teleological standpoint, these powers are secondary in importance to the nutritive or growth-promoting part of the soul.

Nature manufactures (ἡ φύσις δημιουργεῖ) all these things reasonably. For of the substance of plants there is no other function or activity (ἔργον οὐδὲ πρᾶξις) except the production of seed, so that since this comes about through combination of male and female, nature mixing them, puts them together with one another. That is why in plants male and female are not separate. But plants have been investigated elsewhere. Of animals, however, reproduction is not the only function, for this is common to all living things, but they all also participate in a kind of knowing, some more and others less, others still admittedly quite a small amount. For they have perception, and perception is a kind of knowing. But their value and disvalue is considered very different relative both to wisdom, on the one hand, and to the kind of thing that is lifeless, on the other. For relative to being wise the participation in touch and taste seem to be nothing, but relative to being plants and stones it is wonderful. For to happen upon this knowledge would seem to be cherished, rather than to remain lifeless or non-existent. And the animals are different from the merely animate due to perception. But since it is also necessary to live, if it is a living animal, then when it needs to accomplish the function of the living thing (τὸ τοῦ ζῶντος ἔργον), it unites and mixes and reproduces, just as if it were a plant (ὥσπερ ἂν εἰ φυτόν), as we said. (*GA* i 23, 731^{a}24–^{b}8)

Now it is true that the function of most animals is, you may say, nothing else than to produce young, as the function of a plant is to produce seed and fruit. (*GA* i 4, 717^{a}21–2, ROT; cf. *GA* ii 4, 740B34–1A5; *MM* i 10, 1187^{a}30–5)

Even though some kinds of living thing will have different and perhaps more valuable aspects of their soul that make their living worthwhile, still the most basic function of all organic beings relates to the nutritive-reproductive soul. It follows that the function of this soul is fundamental to Aristotle's teleological explanations of living things. On this level plants and animals are equal, as Aristotle sees it, since they are both in the class of beings that must reproduce in order to continue to exist. Aristotle is radical in attributing souls to plants, while depriving them of sensation and desire. Related to this is an even more radical and fundamental move, the attempt to explain nutrition (and concomitant vegetative functions like growth) as a capacity of the soul.[18]

With respect to organisms, there is no more basic level of explanation than this. Thus we do not keep on asking why plants and animals reproduce, or try to survive, any more than we ask why they use food to grow and sustain their bodies. Here we reach the 'end' of the explanation. Beyond the survival and reproduction of living things, there is only the axiom that it is better to exist than not exist, and to live than not live. This is the same axiom we saw Aristotle invoke in order to explain why there is constant reciprocal transmutation and generation of the elements.[19]

> Why there comes to be and exists the male and the female, as from necessity, and the first mover, and some kind of matter, we must try to give the account as we proceed. But that it is for the better and the cause for the sake of something speaks to a higher principle (ὡς δὲ διὰ τὸ βέλτιον καὶ τὴν αἰτίαν τὴν ἕνεκά τινος ἄνωθεν ἔχει τὴν ἀρχήν). For, among beings, some are eternal and divine, and others are capable of both being and not being. But the noble and the divine, in accordance with its own nature, is always the cause of the better in those things which admit of the better and worse, and those things which are not eternal both exist and change, and so do admit of both better and worse. But soul is better than body, and the animate is better than the inanimate, because being is better than not being, and living is better than not living. For these reasons there is reproduction of animals. For since the nature of this kind of thing cannot exist forever as an individual, the individual exists forever in the way that is possible: in virtue of having reproduced it is eternal. So in number it is impossible, since substantial being is in that which is individual (ἡ γὰρ οὐσία τῶν ὄντων ἐν τῷ καθ' ἕκαστον). Were it that kind of thing it would be eternal, but it is possible only in form. That is why there is always, of humans, animals, and plants, a kind. (*GA* ii 1, 731^{b}20–2^{a}1)

John Cooper has rightly emphasized the importance of the position on the permanent and eternal existence of plant and animal kinds for Aristotle's enthusiasm for teleological explanations.[20] I want here to add to his account by pointing out exactly who is the beneficiary of the perpetual existence of various plant and

[18] Menn points out that some of Aristotle's predecessors had attributed souls to plants, but they had not explained nutrition as a psychic power; Plato attributes souls to plants, but he thinks they also have sensation and desire (*Tim* 77b1–c5); the Stoics and Epicureans did not follow Aristotle in attributing souls to plants (2002, pp. 116–17, esp. n. 47).

[19] *GC* ii 10, 336^{b}25–7^{a}7, *Anima* ii 4, 415A23–B21.

[20] Cooper 1982, p. 205.

animal species. Organic reproduction is for the sake of the life, activity and the good of the individual organisms that are reproduced, and not just for the sake of perpetuation of the plant or animal kinds. Earlier, it was argued that this was so simply because the kinds themselves (i.e. the forms of plants and animals) are eternal and immutable, and thus cannot be beneficiaries, since they need nothing and cannot suffer any change that benefiting them would imply. Here I add that if the continually reproduced form were supposed to be a beneficiary, then there would be no 'end' to the process of reproduction, but rather an infinite series. There would be no point to infinite reproduction and permanent existence unless we could point to some good which this eternal and infinite process aims at.[21] That good, I contend, is the life, survival, activity, and flourishing of the individual living specimen.[22] Only individuals can generate other individuals, and only individuals can benefit from reproduction and any other function of the soul. As Aristotle says in a different context,

> The universal causes, then, of which we spoke do not exist. For the individual is the source of individuals. For while human is the cause of human universally, there is no universal human, but Peleus is the cause of Achilles, and your father of you, and this particular *b* of this particular *ba*, though *b* in general is the cause of *ba* taken without qualification. (*Meta* xii 5, 1071^{a}19–24)

Perpetual existence is regarded by Aristotle as a fact,[23] and the explanation of that fact requires (1) specifying the cause for the sake of which this happens—i.e. why it is good, and (2) the necessitating conditions that make this possible. The first is provided for simply by indicating the good for the individual organism whose kind persists through the process of its reproduction.[24] The account of the

[21] Apparently, this position conflicts with that held by Avicenna, who says: 'We say that individual entities which are infinitely many cannot be essential ends in nature. Rather, essential ends are, for example, that the substance that is man—or horse or palm tree—should exist and that this existence should be a continuous and well-established existence. This [perpetuity] is impossible [in the case of] the aforementioned single individual, because a necessary concomitant of every entity (I mean entities [derived] from corporeal matter) is passing away. And as this [perpetuity] is impossible in the individual, it is maintained through the species. The primary purpose [here] is the maintenance, for example, of human nature, or of something other [than human nature], or of an indeterminate extended individual. This [purpose] is the final cause of the act of universal nature' (*The Cure* 289, 16–290, 5, trans. Wisnovsky 2003a, p. 128). But in his *Marginal Notes on Aristotle's De Anima*, Avicenna offers an interpretation of the distinction between two kinds of 'for the sake of which', which seems to me to prove that the individual must be the beneficiary: '"That for the sake of which" is of two types; one is "that in view of which", such as pleasure, the good, health, and so on; and the second is "that for the benefit of which", it being that which strives for the end, such as that which strives for pleasure or health. Among things which are subject to passing away the end is that they imitate—as much as is possible for them—the eternal, divine things, namely the divine thing which is perpetuity. The end 'for the benefit of which' consists in the things that are subject to change. Since the thing which is subject to passing away cannot persist forever and attain this imitation (this being sought by it as an object of desire and [through] an act of will) as an individual, it strives for it in species' (94, 18–23, trans. Wisnovsky 2003a, pp. 133–4).

[22] There are alternatives, of course. The beneficiaries could be somehow the species itself, or other species, or humans, or the gods, or the environment, or the cosmos.

[23] Cf. Balme 1965, p. 13 and 1980.

[24] Code 1995, p. 132.

reproductive and nutritive soul provides for the second—nutritive souls are the necessitating condition of the perpetuation of living things. These explanations of souls (the nutritive like all others), of course, are provided on the generic level of the form, since there is no science of individuals. But the nutritive soul as a form, and the animal as a kind or species are 'for the sake of' in the sense of 'for the aim of' (οὗ ἕνεκα-οὗ), while the individual specimen is 'for the benefit of' (οὗ ἕνεκα-ᾧ), and the only possible one, since it both needs the functioning of the soul and can change in accordance with the benefit it receives.

There is, again, no further explanation of why an animal moves to reproduce itself, or why motions, changes, and processes happen in embryological development. For reproduction is not something that non-human animals 'choose' to do, any more than a plant chooses to shoot out reproductive spores. Rather, reproduction is a basic function and activity of the nutritive-vegetative soul, not of the soul that deliberates. Animals that do move about for the sake of reproductive activity do so because it causes them pleasure,[25] and so such activity is connected with the higher faculty of perception.[26] But the ultimate reasons why the animal reproduces is the same as the reason it survives, as a kind. That is, on an ultimate teleological level, because it is better to exist than not to exist, and what is necessary (and for some organisms sufficient) for this is the activity of vegetative soul. That is why Aristotle locates the functions of nutrition and reproduction in the same soul, the vegetative soul that is shared in common with plants. And this is also why he differentiates such vegetative motions, processes, and functions from the local motions initiated by a higher faculty of the animal soul.

Whatever interferes with the nutritive soul interferes with and interrupts all other functions of the soul, because it threatens the living thing and life itself. Thus anything directly adverse to this soul cannot be positively involved in a natural teleological explanation of the organism at hand, which always assumes the primacy of this. No part of an animal's life, whether of its soul, or of its body, can be said to exist for the sake of its destruction. Even though there are higher

[25] *HA* viii 1, 588^{b}21–9^{a}9.

[26] The result of this activity is an attenuated version of immortality, but the only capacities with which brute animals can pursue this are perception and locomotion, since these are the only super-vegetative capacities that they possess. But we need not assume that any animal is conscious of reproducing itself in kind. Thus, for Aristotle, there is no possibility of a conflict of interest between the individual and the species in reproduction, as arises in socio-biological considerations of what the advantage of reproduction is for the individual organism. For Aristotle's entire teleological analysis is carried out at the level of the species or kind of animal: its appropriate function, its specific kind of pleasure, locomotion, reproduction, communication, etc. (On this point, see Grene 1972, p. 401.) The final analysis of why the kind has all of these characteristics, as I have argued, is because it is good for the kind and ultimately its individual members to exist, or, said another way, it is better for it to exist and to be what it is than not to exist, and this is the only way for it to exist. This is further substantiated by an analysis of how in Aristotle's account of reproduction an individual transmits the form of its kind to its descendent. On this, see: Cooper 1991; Code 1986, n. 82 and 1987, p. 299 and n. 15. At some level the question of the relation between the individual and form in reproduction adverts to a more basic ontological aporia about whether the individual or species constitutes the primary ousia. On the aporia, see Code 1984.

functions of the soul, as there are for many animals and plants, there cannot be a function which conflicts with the aim of its reproduction and survival. Put another way, an organism cannot exist, i.e. live, for the sake of anything adverse to its own survival or reproduction.[27] On the contrary, the organism lives for the sake of its own survival and, in a way, for its species, to the extent that the qualified immortality made possible through reproduction of the species can be seen as an advantage for the individual specimen.

6.4 THE INSUFFICIENCY OF NECESSITY ALONE TO ACCOUNT FOR LIVING NATURES

Given that all explanation of living natures begins, whether as an assumption or explicitly, with the survival and reproduction of the organism, Aristotle rejects the notion that an explanation could begin, or begin and end, with a discussion of merely necessary factors, such as matter or sources of motion. Hence one of the canons of *Parts of Animals* i 1 is that the account and the cause for the sake of which should be determined before the moving processes (639B11–21, $640^{a}10$–b4). This turns out to be a concomitant of the stipulation that every natural explanation should mention both the cause for the sake of which and the necessary (641B10–2B4), since the kind of necessity required, hypothetical necessity, must be determined with respect to that for the sake of which it is hypothetically necessary as means to an end ($639^{b}21$–$640^{a}9$, 642A2–13).

In *Parts of Animals* i 1, Aristotle encapsulates the dialectical critique of the causal discriminations of his predecessors. Everyone from Thales through Anaxagoras and Empedocles is grouped together and said to mention, and use only in an inadequate way, moving forces (τίνος κινοῦντος), material factors (ὑποκειμένης ὕλης), and necessity (ἐξ ἀνάγκης) ($640^{b}4$–11). He argues that they not only explain the universe this way, but living things as well:

> They speak in the same way about the generation of animals and plants. For example that 'water flowing into the body generated a hollow and so all the receptacles of food and residue' and 'breath moving through the pores forced open the nostrils'. But air and water are matter of bodies. For out of these bodies they compose all nature. But if these are the parts of the human and the animals by nature, then one must speak also of flesh, bone, blood and all the homogeneous parts. And similarly one must speak of the non-homogeneous parts—for example face, hand, foot—what they are and according to what capacity (κατὰ ποίαν δύναμιν). For it is not sufficient to say out of what they are made, fire or earth. (*PA* i 1, $640^{b}11$–23)

[27] Compare Sedley's statement: 'each being serves both its own ends and . . . those of the next link on the food chain' (1991, pp. 190–1). Wardy shows how such a situation would always create a conflict of interests, and thus a problem for teleological explanation, for the species 'lower on the food chain' (1993, pp. 26 f.)

In specifying the materials out of which parts are made, and the motions necessary to make things out of them, the early Greeks thought they were also providing an account of the processes that resulted in the production of organs and organisms. Aristotle argues that this procedure goes nowhere—in fact, it is a non-starter. The craft analogy he appeals to in *Parts of Animals* i 1 to make this argument is not, curiously, the standard house or saw, but a bed.[28] Still the point is very familiar: if you wanted to know about the thing in the hotel room, and I said to you it is wood and cloth, I would have given an inadequate explanation, because incomplete. And if I went on to add that planks of a certain dimension were cut and laid parallel to one another, and then another board was laid across that, and then some cloth was stuffed with feathers and sewn together and placed on top of the board, still I would not have answered your question, or even begun to explain what a bed is. Until I indicate that it is a surface for reclining or resting upon, none of the information about what it is composed out of, or how it was put together actually explain anything. Once I have said that it is for sleeping on, then it makes sense that it is a uniformly elevated surface, and that it is made out of cloth and wood (and not an inclined plane, or made out of paper or intestine). The same goes for the explanation of animal organs: you do not explain the stomach by saying that liquid flowing into it created its hollowness. Yet the earlier attempts to explain animal parts never passed beyond this threshold of explanation.

> Those who account for nature speak about the generation and the explanation of the shape in this way: by what powers it was manufactured (ὑπό τινων γὰρ ἐδημιουργήθησαν δυνάμεων). But in fact, the artist says 'by an axe' or 'by a drill', while they say 'by air' or 'by earth', except what the artist says is better. For it is not sufficient for him to say just this, that when the tool hits, one thing becomes hollow, another flat, but he also provides the reason (διότι) for the blow, and what it is for the sake of (τίνος ἕνεκα): he states the explanation (τὴν αἰτίαν)—in order that it becomes this or that shape. It is clear from this that what they say is not correct, and that one must say that, the animal is this kind of thing—with respect to each kind (περὶ ἐκείνου)—both what it is and what it is like, and one must also say this for each of the parts just as one must with respect to the form of a bed. (*PA* i 1, 641^{a}7–17)

Aristotle himself connects teleological explanations with the specification of what power or capacity (κατὰ ποίαν δύναμιν) is operative in the generation of a certain organ or organism. This is because generation is a kind of motion or change, and we saw that motion and change are in general understood in terms of states of completion with respect to specific powers or capacities.[29] Aristotle's complaint about the predecessors' theories is not that they fail to mention these powers, but

[28] Curious because the bed is used in the craft analogy in *Phys* ii 1 (193A9–17) to illustrate a different point. The point there was that the real nature of a bed, if it has one, is in the wood out of which it is composed, since, as Antiphon says, if you were to plant it, what would grow would be a tree, not a bed. Thus the nature is more like the matter, because it has an *internal* principle of change. Here, on the other hand, the point is that the 'nature' of a bed is its form and purpose, not its matter. The example may have been common in Academic circles; think of Plato's form of the bed in *Rep* X (596b and f.).

[29] *Phys* iii 1, 201A9–16.

rather that they fail to discuss what constitutes the exercise or completion of those powers, and to relate their causes to the powers in an explanatory way. This is what he says about Democritus at any rate; Aristotle argues that although shape and color and such properties, along with necessity, are important, even more important is what they are shapes and colors of, and what necessitates them being that way.[30] For a thing could be in the shape of a person, or a hand, or a flute, but not actually be any of those. But to equate organisms, organs, and tools with their shape or color, or that of whatever they are made out of, is like equating a statue with a real person, or a toy with a musical instrument. Thus for Aristotle, an explanation of a natural kind has to specify not just, and not first, the capacities, but rather the activities and that for the sake of which the capacities exist and become active.

> Since we see multiple causes in natural generation, for example both that for the sake of which (τήν τε οὗ ἕνεκα) and whence the source of motion, one must determine concerning these, which naturally comes first, and which second. But evidently first is that which we call 'for the sake of something' (φαίνεται δὲ πρώτη, ἣν λέγομεν ἕνεκά τινος). For this is an account, and the account is the starting point in the same way both in the things composed in accordance with art, and in the natural things. For it is when (either in thought or perception) the doctor has defined health, or the architect the house, that they retail the accounts and the causes of that which they do, and give the reason why one must do it in this way. But that for the sake of which and the good exist more in nature's works than in the things of art (μᾶλλον δ ἐστὶ τὸ οὗ ἕνεκα καὶ τὸ καλὸν ἐν τοῖς τῆς φύσεως ἔργοις ἢ ἐν τοῖς τῆς τέχνης). (*PA* i 1, 639^{b}11–21; cf. 641^{b}10–642^{a}1)

We will digress to notice that this passage states explicitly how Aristotle intends the craft analogies to be understood, those he so often invokes during the explanation of natural things. Aristotle's use of the craft analogy in discussing animal parts has been considered anthropomorphic, since artifacts are products manufactured by human beings for the sake of some purpose or goal pursued. Hans Meyer argued that human production in art exemplifies 'the science of the purposive cause' (*Die Wissenschaft von der Zweckursache*), and thus Aristotelian physics and metaphysics (including all of the biological writings) are permeated by a deeply anthropomorphic perspective.[31] But the passage shows that, far from conflating art and nature (much less making nature out to be a work of art, as does Plato in the *Timaeus*), Aristotle argues for a specific analogy between them: in the explanation of both artifacts and natures, the function must be established before the necessities or mechanisms may be specified. Aristotle is quite aware that nature

[30] *PA* i 1, 640^{b}29–41^{a}5.

[31] Meyer describes Anaximenes, Empedocles, Anaxagoras, the Pythagoreans, the author of the pseudo-Hippocratic work *On Regimen*, and Plato as forerunners of Aristotelian anthropomorphism, which in turn had a profound influence on the anthropomorphism of Philo, the patristics, and the scholastics. The criticism of Aristotle is also leveled by Joly 1968 (p. 249) and Kirk 1981. It is addressed by Solmsen 1960, pp. 487–95, Balme 1987b, p. 278, Broadie 1987 and 1990, and Atran 1990, p. 116.

does not function just like art—recall that he defines nature in *Physics* ii in contrast to art.[32] And, as he explicitly says, the cause for the sake of which is somehow even more salient in the 'works of nature' than in works of art. Thus Aristotle is not, simply by invoking the craft analogy, unconsciously falling prey to the 'anthropomorphizing inclination of the Greek mind' (Kirk 1981, p. 116). In the next chapter we will see how Aristotle confronts anthropomorphism where it is most threatening: on the level of animal behavior as well. He argues that animals can achieve ends, even though they do not deliberate; but he refuses to explain animal motion with reference to cognitive states distinctive of humans.

We are familiar with the line of reasoning that says that the cause for the sake of which is more salient in products of nature than in products of art because it is an extension of the *a fortiori* argument justifying nature as a cause that we examined in Chapter 4. In the passage just quoted, the argument is pressed into service to show that the cause for the sake of which must be established before the moving cause can be specified. A corollary of this is that the manner of a thing's existence should be stated before the manner of its genesis ($640^{a}10$–$^{b}4$). An artist or craftsman does not begin to chip away at the marble, mold the ceramic, or pour out the medicine, until what it is that is to be made or done or cured has been determined. Aristotle thinks that the same reasoning applies in natural explanation: it would be absurd to begin explaining the processes of natural generation before we have established what it is that is being generated. Thus the formula, which indicates what all the processes are for the sake of, has both explanatory and natural priority. Until we know just what it is, the generation of which we are trying to explain, the 'explanation' of it would be an exercise in futility. Returning to a standard example, given a pile of bricks and beams, I cannot say how they must be arranged. They could be arranged into a house, or a bridge, or a dock, or a wall. I have to know that the process being explained will result in a house if I am to give an explanation of the process of generation of such a structure with these materials. The same reasoning applies in the case of natural things, but even more so. As Aristotle says, 'generation exists for the sake of a substance, a substance does not exist for the sake of generation' ($640^{a}18$–9, cf. Plato, *Phil* 54c).[33] Thus I must know that I am explaining a process that results in a tree or slug or human. Given roots and leaves, or flesh and bones (not to mention mere earth and water), I cannot say a priori how they must be arranged. An attempt to do so would be a catalogue of capacities or powers for the various materials involved, but it would not be an

[32] *Phys* ii 1, 192B16–34. The reason that it will be helpful to refer to the familiar crafts in the explanation of unfamiliar physical things is because it is easier for us to understand what is closer or 'better known by us' than it is to understand things 'better known by nature'. For this general epistemological distinction, see: *Prior* ii 23, $68^{b}35$–7; *Post* i 2, 71B33–2A5; *Top* vi 4; *Phys* i 1; *Meta* vii 4, 1029B3–12; *NE* i 2, 1095B2–4.

[33] Also: 'when we are dealing with definite and ordered products of nature, we must not say that each is of a certain quality because it becomes so, rather that they become so and so because they are so and so, for the process of becoming attends upon being and is for the sake of being and not vice versa' (*GA* v i, 778B2–6).

explanation of something actual in nature. The generative and developmental processes take place for the sake of the organism as a substance. Thus until the functions of the organism have been determined, there is no role for the necessitating factors to play.

6.5 MECHANISM, REDUCTION, AND HEURISTIC

The point about explanatory priority is worth dwelling upon because a correct understanding of it can serve to eliminate a pervasive misconception about Aristotle's teleology, and about teleology in general.

Some hold that teleological explanations are appropriate only where reduction to so-called mechanical forces (material–efficient causes) is impossible. Kant originally formulated this position in the *Critique of Teleological Judgment*. He distinguished and opposed 'mechanism' (efficient causes) and 'teleology' (final causes), and argued that mechanical causes should be determined so far as possible, and that it is only when something remains unexplained (which always and only happens in organic contexts) that it is right to invoke 'final causes'. Final causes are held to be merely regulative concepts of judgment, and are not constitutive of the entities being explained. Mechanistic descriptions employ real causes, which fit with the cause–effect model and do not require backwards causation or the ascription of intentionality to non-human organisms. But since it is a limitation of human knowledge that we cannot explain organisms on the basis of mechanism alone, we are forced to invoke final causes and teleological explanations. But the latter are understood only as a heuristic, since they are, again, not real causes.[34] Hegel, but not Kant himself, pointed out the similarity of what Kant was arguing for and Aristotle's teleology.[35]

An early twentieth-century German interpreter of Aristotle seems to have absorbed these assumptions, or arrived at them independently. Gomperz, like Hegel, discusses Aristotle's teleology with approval, asserting that it is 'certainly just to speak of the heuristic value of the teleological way of looking at nature' (1909, p. 134). The chief disadvantage Gomperz sees with teleology is that it can divert attention away from 'immediate causes' (read: mechanical causes),[36] but Gomperz also praises Aristotle for being aware of the problem and laboring 'with much care, but assuredly not with uniform success, for its obviation' (p. 134). Here he cites the famous rainfall example of *Physics* ii 8, commenting, 'it is surprising to find the mechanical explanation here taking the place of the teleological one' (p. 134). From the example he draws the conclusion that 'the teleological interpretation usually makes its appearance in Aristotle, as elsewhere, when the ordinary means of explaining nature deny their aid' (p. 134).

[34] This is the outcome of the 'dialectic of teleology and mechanism', for which see ch. 1, and Kant 1790, sec. 9 (70) [pp. 387 f.].

[35] See Ch. 1, and Hegel 1830, sec. 204.

[36] Originally Francis Bacon's argument, see Ch. 1, and *Advancement of Learning* iii.4.

The Kantian position was advanced as an interpretation of Aristotle in French by Le Blond in 1939, and later by Wieland in his 1962 book on Aristotle's physics, the relevant part of which was translated into a widely read article entitled 'The Problem of Teleology'. Wieland was concerned to counter 'the usual interpretation, followed (so far as I can see) by all scholars, [that] teleology is the universal and supreme principle of Aristotle's physics' (1962/1975, pp. 256/142). According to Wieland, teleology is not for Aristotle a 'universal cosmic principle', but rather simply 'a concept of reflection'— a matter of 'as if' (*als ob*) reasoning— a reflective not constitutive concept of natural things. Given this description, it comes as little surprise when Wieland concludes that, 'in his [Aristotle's] work teleology has no greater (and to be sure, no smaller) importance than it has in Kant's philosophy' (pp. 276/159).[37]

Allan Gotthelf rejects the 'as if' aspect of this interpretation, because he thinks that Aristotle believes in the reality of ends ('final causes').[38] Yet he argues that, for Aristotle, teleological explanation is dependent on what he calls 'ontological irreducibility', by which he means the thesis that teleological explanations are appropriate only where reduction to materials, motions, and capacities (what he calls, in not quite Aristotelian diction, 'element-potentials') is impossible. Were it possible to explain biological entities with reference to these, there would be no need of teleological explanation, so goes the argument.[39]

> Focusing on development and with our discussion of the Aristotelian approach to explanation of natural motion and change in mind, we may put the reduction question as follows: *Is the development of a living organism the result of a sum of actualizations of element-potentials, or is it primarily the actualization of a single potential for an organism of that form, a potential the actualization of which involves the actualization of element-potentials, but is not reducible to them?* The answer to this question is the key to understanding the precise nature of Aristotle's conception of final causality. (Gotthelf 1997a, p. 212; emphasis in original)

[37] Compare Asma, who contrasts Aristotle's 'causal' position with the 'explanatory' position of Kant (1996, pp. 26 f.).

[38] It is odd that Gotthelf bothers to criticize the heuristic interpretation of Aristotle's use of final causes (1987a), but then argues that Aristotle, who constantly uses normative terminology (like good, better, best, noble, right, etc.) in teleological explanation, does so as a 'heuristic' (1988, p. 134), for talk of potentialities, forms, powers, and so forth.

[39] The 'dependence of teleological explanation on ontological irreducibility' is glossed as follows: 'if some sum of actualization of element-potentials *were* by itself sufficient for the production of some outcome, that outcome would not be the subject of teleological explanation by Aristotle' (1987a, p. 231, emphasis in original). Although Gotthelf believes that teleology is fundamental to Aristotle's philosophy, he says the following: 'There is nothing in the fundamentals of Aristotle's philosophy, and nothing in his philosophical or scientific method, which would prohibit the adoption of a reducibility thesis, should the scientific evidence be judged to warrant it.' (1987a, p. 229). In a response to Gotthelf's position, Bradie and Miller conclude, 'although Aristotle believed that the potential for form was not reducible to the material principles of Pre-Socratic physics, his theory does not rule out a reduction to some other material principles' (1984, p. 83). In what follows, it will be seen that Aristotle's teleology was not formed in response to a reducibility thesis, and that the whole notion of reducibility is inappropriate (and thus both Gotthelf's position and Bradie and Miller's response to it are misguided), since an explanation cannot even begin until the for the sake of which has been established. Further, the elements themselves are subject to teleological explanation. If anything, the materials and motions are reducible to mere concomitants of that for the sake of which.

According to Gotthelf, Aristotle is motivated to stress the final cause in scientific explanation because of the impossibility of explaining organisms according to other causes, namely material and moving ones ('actualizations of element-potentials'). Gotthelf asserts that if Aristotle had been able to reduce the explanation of the generation and development of organisms to lower-level causes, then he would have been happy to do so (p. 229).

As a recent commentator has pointed out, this interpretation removes the ontological controversy about ends to an epistemological sphere wherein the exhibition of the insufficiency of materialist and reductionist explanatory schemes is offered as justification of teleological explanations and hence causes (Quarantotto 2001, p. 355 and *passim*). What these views, the heuristic and the anti-reductionist interpretations, have in common is that they both suppose that Aristotle in fact recognizes a separate and independent level of explanation that involves only matter and motion.

John Cooper to some extent supports this thesis, although the scope of his analysis is much wider than Gotthelf's, since he is not narrowly focused on final causes in the biological realm. But his overall position is similar to Gotthelf, in that he sees final causes as a separate and potentially eliminable aspect of scientific explanation.

> There are then *two distinct and independent levels of facts and correspondingly two levels of principles* that Aristotle holds are responsible for what happens in the course of nature. There are facts about the various kinds of matter there are, and principles of a mechanical sort governing their behavior in given conditions. And there are facts about the natural kinds of living things and principles of a teleological sort governing their development and behavior. Aristotle's predecessors and contemporaries were all agreed, as we would also agree, that there are facts and principles of the first sort. This can be accepted as non-controversial. But what ground does Aristotle have for thinking there is, *in addition to and independent of these, a second level of facts and principles* such as he postulates? (Cooper 1982, p. 202, emphasis added)

I have argued that in Aristotle's account of the procedure and priorities in explanation there is no distinct and independent level of facts and principles in addition to and independent of teleological facts and principles.[40] Aristotle holds that the existence of the cause for the sake of which is far more obvious, apparent, and primary than the existence of 'element-powers' or mechanical principles; this is the basis of his *a fortiori* argument about nature being for the sake of something that we examined in Chapter 4. Because the cause for the sake of which is prior to matter in all relevant senses, it cannot suffer reduction to what is posterior to and existentially dependent on it.

Aristotle does not hold that the motions of the 'element-powers' are 'mechanical', but rather teleological, as was shown with respect to ether, air, water, fire, and

[40] For a different critique of the heuristic interpretation, see Grene 1972, pp. 399–400.

earth in the last chapter. Thus it seems misguided to speak of reducing teleological explanation to 'element-powers', since, in the final analysis, that reduction would itself result in a teleological explanation.[41] As he makes quite clear elsewhere:

> Everything is defined with respect to its function (ἅπαντα δ' ἐστὶν ὡρισμένα τῷ ἔργῳ): the function of each thing—what it is able to do—is what it truly is, for example an eye is really an eye, if it can see, while if a thing is not so able, then it is that only nominally, for example a dead man or a statue of a man [is only nominally a man]. Or consider a wooden saw, which is but a likeness of a saw. So it is even with flesh: the function of this is less clear than it is with the tongue. So again with fire, though its function is even less clear, naturally, than the function of flesh. (*Meteor* iv 12, 390A10–16)

Because the matter itself (earth, air, water, fire) is functional and subject to teleological principles, there is no separate and independent level of mechanistic explanation. There are in fact no separate levels at all: all natural substances lie on a continuum of explanation between extremes of pure matter on one side and pure form on the other—but no natural substance is at either extreme (*Meteor* iv 12, 390^{a}5–10). Thus teleological explanation can be neither potentially reducible to, nor merely a heuristic for, mechanistic or materialist explanation.

Aristotle stipulates that, in the context of living things, explanation cannot even begin until the for the sake of which has been identified. It is indispensable to explanation in natural science: if there is no for the sake of which, then there is no nature to be explained.[42] The cause for the sake of which includes an aim and a

[41] Gotthelf misses this point in part because he considers 'irrelevant to our immediate purpose . . . the role of the efficient cause of locomotion to natural place' (1987a, p. 210 n. 13). Had he included this in his study of final causes, he would have seen that there is no domain explicable by efficient causes alone to which there is the logical possibility of a reduction. A similar point is also made in Balme 1965, p. 21; Matthen 1989, pp. 278–9; and Wardy 1990, pp. 261–2. On the other hand, Byrne has recently argued explicitly for the thesis that there is a separate and independent physical necessity that is not teleological (2002). The main problem with his argument is that he (unlike Gotthelf) admits that there is something teleological about the local motion of the elements, but holds that there is a 'more fundamental' aspect of the elements that is not teleological (pp. 25–6), yet he does not deal with the fundamentally teleological aspect of their reciprocal transmutation (on which see ch. 5). For example, he says, 'Aristotle says that something happens for the sake of an end only if it happens for the sake of some good or other. There is nothing teleological about the way in which the fundamental tactile properties of the sublunary elements operate because none of the effects they produce is, as such, good. At the level of the fundamental properties of the sublunary elements, then, nature does not act for the sake of an end, because nothing happens here for the sake of some good or another' (pp. 25–6). But the properties (hot, cold, wet, dry) are incorporated by Aristotle into an account of the process of transmutation, and the transmutation cycle is said by Aristotle to resemble ('imitate') the cycles of the celestial element, which affords these natural substances a sort of eternal existence (in kind, not number), which Aristotle considers to be good, since it is 'better to exist than not to exist'.

[42] Against Charles: 'there is no reason to accept that Aristotle thought that it was irrational to believe that a complete physical account of the relevant kind could be given: i.e. an account stated in *independent* physical terms of conditions sufficient for the occurrence of an organism of kind K' (1988, p. 5, emphasis in original). But Charles later concludes that: 'teleological explanations both fix what it is to have the relevant potentially and what it is to be man (in terms of a man's successful functioning). It is in virtue of possessing these goals that man has the nature he has . . . So far from teleological causation resting on efficient causation, it is rather the reverse. The presence of goals makes the

beneficiary,[43] and without a beneficiary of the activity or part, there can be no 'explanation' of it, just as there can be no 'element-power' without an activity or completion of the power. If I do not know what health is, or what a healthy patient is, I cannot know what has or does not have the power to create healthy people. If there were no way to know what the thing being explained is or is for, then there would be no way to know what the 'element-powers' it has are: you cannot know a power without knowing what it is a power to do or become. The same goes for a 'mechanism': you cannot know how a mechanism works unless you know that it is a clock or computer or whatever. To put it in ontological terms: were there no for the sake of which, there would be no powers, potentials, or mechanisms.[44]

Notice that this does not mean that every single thing and event in the natural world is teleologically explicable. We have already seen, for example, that the process of rainfall is explicable with reference to material and moving factors alone, and we don't need to mention an aim or beneficiary of rainfall, since rainfall *per se* is merely a concomitant of the transmutation of the air element into water, a motion that is on other grounds teleologically explicable. And in the next chapter we will see that there are parts of animals that are like precipitates in that they are merely outgrowths or residues of teleologically explicable processes, but are not themselves for the sake of anything.[45] Waste, for example, while it is in the body having been created during the concoction of nutriment, is not for the sake of anything, but is merely a by-product of digestion. Digestion is for the sake of something, and causes waste, but is not for the sake of waste. Notice that in both these cases, although explanation by reference to moving and material factors is fully appropriate, the most complete explanation can also trace these processes back to a process or substance that is teleologically explicable, such as the elemental transmutation (in the

organism what it is, and its being that organism explains why it must f in C. If this is correct, teleological causation is not explained in terms of efficient causal necessitation. The one is reducible to the other. Teleological goals are taken as primitives. These later concerns show why Aristotle preferred the *downwards-perspective* [from the teleological factors to the 'independent physical level']. The nature of the kind is basic, and this is fixed by primitive teleological factors. Teleological concerns determine its potentialities as the ones they are' (p. 43). I agree with this conclusion. I cannot see that this leaves open the possibility of an 'independent physical account' account, if 'independent' here means, as it appears to, independent of a teleological account. See also Lewis: 'the material/efficient and final points of view allow for the possibility of different but non-competing explanations of the *same* thing' (1988, p. 55). Lewis' account suffers from an over-emphasis of the groupings 'material/efficient' and 'formal/final', and insufficient attention to the extent to which Aristotle is more interested in grouping or even identifying 'efficient/formal/final' causes in biological explanation (see e.g. Lewis 1988, p. 54 and n. 1–6).

[43] Gotthelf misses this point because he fails to grasp the importance of the distinction between the two senses of the for the sake of which: 'the passages which identify or refer to two ways in which *to hou heneka* is "said", are intended to isolate the sense of "that for the sake of which" which plays a technical role in Aristotle's philosophy from an ordinary use, approximating "beneficiary", and as such are neither intended to nor do shed light on that technical sense' (1987a, p. 210 n. 13).

[44] Even if the explanation of something like an organism were reducible, the reduction still might be anti-explanatory. On this point see Wright 1976, pp. 66, 69.

[45] See also Lloyd 1995, p. 538.

case of rainfall), or digestion and nutrition (in the case of animal's food residue). The key to getting the explanation right is properly demarcating the explananda by fully fleshing out the aim and beneficiary of the cause for the sake of which.

Thus 'the reducibility question' is not 'key to understanding the precise nature of Aristotle's conception of final causality' (Gotthelf 1987a, p. 212), because Aristotle did not ask this question, and the very form of the question expresses priorities quite different from his. The question presupposes the primacy of material and moving factors, and that whatever is not reducible to them must be subject to another kind of explanation. But Aristotle never considered that 'the development of a living organism is the sum of actualizations of element-potentials' (Gotthelf 1987a, p. 212), even as a way of representing his predecessors. After all, the predecessors were not reductionists.[46] Aristotle represents them not as rejecting the purposes and uses of things, but of failing to provide all the causal factors adequate to produce a functional explanation. At any rate, they did not try to show that ends are reducible to matter and motion.

The material and moving factors have a role to play only in the context of a teleological explanation; it is only once what something is for and what it develops into have been established, that we are in a position to describe the elements, parts, and motions involved. Discussion of the matter, motions and, in general, necessary factors, starts where teleology leaves off, not vice versa. Thus making the 'teleological' principles secondary and the 'mechanical' ones primary is misleading as an interpretation of Aristotle.[47]

It follows from this that the heuristic interpretation cannot be right either, since that interpretation assumes that Aristotle in principle recognizes some separate and independent kind of mechanical explanation, for which teleological explanation is only a heuristic. If anything, Aristotle thinks of 'mechanistic' explanations as a heuristic for teleological explanations, since he is willing to invoke the analogy of craft production under very specific circumstances and with many provisos, in the process of a teleological explanation. But he never allows that the teleological explanation of the parts or behavior of natural substance might just be an instructive way of describing 'mechanistic' causes. This point will become even clearer in the next chapter, where we will examine some of the actual explanations that he offers.

[46] Meyer 1992 points out that Aristotle represents his predecessors not as reducing the explanation of natural substances like animals to material and moving factors, but of eliminating animals as natural substances by considering them accidents of elemental bodies in motion. See also Witt 1998a, pp. 268–9.

[47] The attribution of this position to Aristotle perhaps indicates the influence of the Kantian perspective, which assumes the primacy of 'mechanistic' explanations, and a resolution of the antinomy between mechanism and teleology. Cf. Balme, who points out that Aristotle could not have conceived of either his own or his opponents' views as mechanistic (1939, p. 1). Balme further argued that Aristotle could in fact co-opt our kind of 'mechanistic' description (modeling computers and robots) in the service of his kind of teleological explanation (1965, pp. 21–2; cf. 1987b, p. 283). Further argument against the contrast between mechanism and teleology in Aristotle can be found in Boylan 1981 and 1984, and Lloyd 1995, pp. 542, 544.

7

Teleology and Organisms ii: Specific Explanations

Having established that Aristotle's teleology of living natures is not anthropomorphic, not committed to backwards causation, and not a mere heuristic for materialist and mechanist explanations, it remains to evince in the three sections of this chapter what it in fact is. Crucial to Aristotle's teleological explanations of living natures is his distinction of several kinds of necessity in relation to the cause for the sake of which. In section 1, we will look at examples throughout the biological works to illustrate these differences, and assess how far the explanations offered conform to the kind of explanation described as scientific in the *Posterior Analytics*. (That is, whether they conform to demonstrations in which the cause for the sake of which is the middle term of the piece of reasoning.) In section 2, the apparent exceptions to the normal framework of teleological explanation of living natures will be investigated, including spontaneously generated organisms, freaks, and incidental functions. In section 3, we will examine the special and important case of teleological explanation of animal behavior or ethology. This will set the stage for the study of Aristotle's teleology as applied to human affairs in Chapter 8.

7.1 NORMAL CASES

Aristotle's teleological explanations are not just a heuristic for what is actually a mechanical process, as Kant would have it.[1] On the contrary, they are for Aristotle the starting point for the explanation of living natures, and they necessitate a description of the material and moving aspects of an organism. That is why Aristotle holds that necessity is among the two modes of cause (δύο τρόποι τῆς αἰτίας, 642A14) that must be mentioned in an explanation: 'the cause for the sake of which and the necessary' (642A2). In the following passage Aristotle distinguishes and ranks three ways in which the for the sake of which and necessity are to be related in a teleological explanation of an organism.

[1] Ginsburg rightly notes that, despite this difference, Kant in effect agrees with Aristotle about the importance of teleology in holding that it is in principle indispensable given the nature of the human intellect (2004, p. 60).

One should say that [**a**] 'since this is what it is to be a human, that is why he has these things, for it is not possible to be a human without these parts'. If not, then we should get closest to this, and say that [**b**] 'generally it is impossible otherwise', or that [**c**] 'it it is fine (καλῶς) this way', and then, 'these things follow . . .' and 'since he is this kind of thing, his generation happens thus and these things happen necessarily . . . That is why this of the parts comes about first, and then that.' And this is the way one should speak in general about everything that is composed naturally. (*PA* i 1, 640^{a}33–^{b}4)

The passage shows three different ways that a teleological explanation can be made with respect to living natures. The first [**a**] is a case of hypothetical necessity: given the form and definition of, e.g., a human (an animal, a perceptive being), this part or these parts (sense organs, eyes) are necessary. Again, since part of the definition of a human necessitates the ability to use food, a human must have a liver (*PA* iii 7, 670^{a}23–9). The second [**b**] is a case where a part is necessary, but its necessity is not directly connected to the definition of the living thing.[2] For example, the definition of a human necessitates the ability to use food, and the use of nutrients necessitates the generation of waste residua and bile in the stomach and intestine (*PA* iii 7, 670^{a}30–2; iv 2, 677A11–19). It is impossible for a human to live without generating waste, although the generation of waste is not directly necessitated by the definition of a human being. The third [**c**] is a case where a certain part is not necessitated by a definition, but the presence of the part is better for the living thing, and it is 'fine' or 'noble' for it to be that way.[3] Sticking with the example of digestion, the definition of a human necessitates the ability to use food, and this in turn necessitates the generation of waste residua, and so a human has a kidney which assists in the disposal of liquid waste; now the bladder is capable of performing this, but in creatures like humans who generate a lot of waste, the kidney, which assists in this, while not strictly necessary, is for the sake of what is better and 'fine' (*PA* iii 7, 670^{b}22–7).

In the rest of this section, we look in more detail at each of these kinds of explanation.

Hypothetically Necessary Parts

At the end of *Parts of Animals* i, Aristotle gives the following example of how a straightforward teleological explanation with respect to a living nature should be made.

[2] See: Kullmann 1974, pp. 36–7, 325 f.; and 1998, p. 274; Code 1995, p. 140. For a different view, see Balme 1972/1992, p. 87, and Gotthelf 1987b, p. 189.

[3] Bolton argues that Aristotle means by this 'good enough' (see his translation at 1995, p. 107, and the analysis following). He argues, 'the actual material parts of an actual biological entity such as a human being might not be the only possible ones suitable for reaching the goal of some such entity. The actual parts might in fact only be *good enough*' (p. 108). He gives as examples brain and bones. But Aristotle does not use the term καλῶς in explaining these parts. Aristotle seems to me to argue that these parts are straightforwardly hypothetically necessary (the brain for internal temperature maintenance, and the bones for providing a structure for the sensitive fleshy parts). Further, it is difficult to imagine what could replace these as 'good enough'.

One should demonstrate as follows. For example, 'because breathing is for the benefit of this here (ἡ ἀναπνοὴ τουδὶ χάριν), this comes to be because of these other things out of necessity'. But the term 'necessity' signifies, sometimes, that 'if that for the sake of which will exist (εἰ ἐκεῖνο ἔσται τὸ οὗ ἕνεκα), then these things necessarily are in this state'. Other times it signifies that this is their state and natural disposition (ἔχοντα καὶ πεφυκότα). For heat necessarily goes out, and again comes in—when counteracted, the air flows. This is already a necessity. So when the inner heat is counteracted—in this cooling there is the intake of outside air. Thus this is the manner of our investigation, and these and such are that about which it is necessary to grasp the causes. (*PA* i 1, 642^{a}31–^{b}4)

The example is unfortunately cryptic, but can be supplemented by relevant passages from Aristotle's treatise on the subject, *On Respiration*. The first part of the explanation is the specification of that for the sake of which the thing being explained occurs. Aristotle gestures at this, 'breathing is for the sake of this', but does not specify what the 'this' is. Elsewhere we learn that the purpose of respiration is refrigeration—i.e. internal temperature maintenance (*Resp* 16, 478^{a}28–30).[4] Everything else follows from this. This order of explication follows the procedure Aristotle described above. So the next thing to be stated is how other things necessarily work to make this happen. The basic mechanism here is the respiration and expiration of air due to 'counteracting' temperatures. Cool air is drawn in, counteracted by the hot, and then expired, and so forth. Aristotle does not elaborate on the process, because his purpose here is not really to explain respiration but rather to show how 'the for the sake of which' and 'that which is necessitated by this' must both be represented in a natural explanation, and in what order.

Notice that Aristotle is clear here that what should be given is a demonstration. He is not talking about some other kind of explanation that is native to the physical and biological works but alien to the analytical works.[5] Consider the terms of demonstration for this example.

(A) heat being expelled

(B) internal cooling

(C) survival

A inheres in B, and B in C, therefore A inheres in C. Furthermore, B and C are interchangeable, since to some extent an animal's survival is internal temperature maintenance. Natural death can be defined as a kind of failure of internal temperature maintenance.[6] Here we have a teleological explanation that shows the relation

[4] For an in-depth analysis of Aristotle's explanation of respiration, see King 2001, pp. 113–22.

[5] Against McKirahan and Freeland (see Ch. 2). For arguments to the effect that the biological works are compatible with the *Analytics*' model of demonstration, see Lennox 1987a, 1991, 2001a, 2001b, and 2001c, and Charles 2000.

[6] All animals eventually die because internal temperature maintenance cannot be maintained forever (*Juv* 469B9–70B5, *Resp* 472A11–16, 476A16–22, 478A26–30). Internal temperature maintenance and respiratory failure are the cause of 'natural death' according to Aristotle, and this is contrasted with 'violent' death—i.e. death brought about from an external force (478^{b}22–7). Even

of the cause for the sake of which to what is hypothetically necessary for it to happen.[7] We also see how the absolute necessity of the motion of the material constituents (air and heat and cold) is not just compatible with, but is instrumentally required for the process that is being teleologically explained (respiration) to occur.[8]

In the treatise devoted to the subject of respiration, Aristotle frequently points out that his predecessors, especially Empedocles and Democritus, failed to explain the process precisely because they failed to specify the for the sake of which (*Resp* 3, 471^{b}23–9; 4, 472^{a}1–3; 5, 472^{b}24–7; 7, 473^{a}15–16). Notice that his argument in these passages is not that they tried and failed to reduce their explanations to material or moving factors, but that they failed to explain at all, since they failed to take this into account, and so lacked the first element of explanation.

After Aristotle specifies that for the sake of which respiration exists, i.e. internal cooling, he discusses the organs that facilitate this (lungs), and how they function. The last part of his explanation is the description of the necessities involved (*Resp* 21). Nutrition increases the internal temperature, making the lungs expand ('like the bellows in a smithy' he says[9]); the expansion of the lungs causes cool air to flow in, which has a chilling effect; the cooled lungs thus contract, and this contraction forces air back out. The expired air is warm because of its contact with the heat resident in the organs. Gills function similarly, *mutatis mutandis*. This part of the explanation could justifiably be called 'mechanical', as long as we keep in mind that the mechanisms (just like clocks, computers, and bellows) function for the sake of something,[10] and assuming that the cause for the sake of which has been previously specified. For it is not until Aristotle has established that respiration exists for the sake of cooling what is internally heated owing to nutrition, that he

if internal temperature maintenance is just one of several conditions of survival, the two terms are still interchangeable in the way that good digestion and health were said to be convertible in *Post* ii 11.

[7] Cooper (1985, pp. 160–3) argues, rightly, that 'Democritean' or 'material' necessity is compatible with and even explanatory within natural science, alongside teleological explanation. But what needs to be worked out more fully is just how the relationship between the two is supposed to be conceived.

[8] The same scheme applies to the activity of sleep. Sleep is 'for the sake of renewal' (*Somn* 458^{a}32), but is brought on by a necessary process (the seizing up of the heart and the elimination of perceptual activity owing to rising internal heat from digestion). There is a good discussion of sleep and its teleological explanation by Bolton 1995, pp. 103–6. For a discussion of the anti-teleological explanation of dreams (which shows that their 'daemonic' aspect can be likened to the effects of luck), see Gallop 1988.

[9] Notice that the craft analogy is invoked not as an explanation of the phenomenon, but as an illustration of it by reference to a parallel process that happens in craft. In both cases—lungs and bellows—heat causes expansion. The explanation of this fact has to do with the properties of heat. This is a good example of Aristotle's use of the craft analogy in the explanation of a natural phenomenon. And in it we see Aristotle not anthropomorphizing simply by comparing the natural process to what happens in the craft.

[10] McLaughlin also points out that mechanisms like clocks are teleologically explicable because intentionally designed (2001, pp. 21–2).

at last describes the mechanisms or (less anachronistically) necessities that make this possible.

This is the character of the explanations that we should expect Aristotle to give: stating what something is for in terms of how it benefits the survival of the kind, and then describing what necessities follow from this in order to achieve the stated aim. And this is what one does in fact find throughout *Parts of Animals*. This holds for both the homogeneous and heterogeneous parts.

For example, consider Aristotle's account of flesh and bones. Organic parts in general may be either (1) instrumental, or (2) sensitive (641^{a}2). The former exist for the sake of supporting some other part, process, or activity (as brain does for the cooling of the marrow, or blood does for nutrition in general). Flesh is in the latter category. Flesh is the organ that exists for the sake of the most basic function, definitive of animals: sensation by touch (*PA* ii 8, 653^{b}19–30). Because this is the definitive functional faculty of animals insofar as they are animals (and not just living beings), all their other parts exist for the benefit of this (πάντα τἆλλα τούτου χάριν ὄντα, 653B30–1). Bones, sinew, blood, hair, nails, skin and so forth are contrived by nature for the sake of security (φύσις σωτηρίας ἕνεκεν μεμηχάνηται, 653^{b}33–4) of the sensitive parts. Thus it is for the sake of the fleshy parts that are connected to them that bones exist in general (ὧν ἕνεκεν τὸ τῶν ὀστῶν ἐστι γένος, *PA* ii 9, 654B27–9). Similarly, there are several homogeneous animal parts that resemble bones and serve the same function, that is protection, such as nails, hoofs, claws, horns, beaks and so forth.[11] Animals possess these for the benefit of their safety (πάντα δὲ ταῦτα βοηθείας ἔχουσι χάριν τὰ ζῷα, *PA* 655^{b}4–5). Thus it is clear that all of the homogeneous parts of animals exist either directly for their individual benefit (survival, reproduction, sensation), or indirectly, for the support and safety of those parts that directly benefit them. If this seems obvious, compare Plato's account of the same in the *Timaeus*.

Now animals have different ways of life, not only different functions and capacities, but also different environments, ways of rearing young, relating to their kin, and so forth. Aristotle holds that these differences necessitate a variation in the parts, particularly the heterogeneous ones. 'As the external organs are not precisely alike in all the animals, but each creature is provided with such as are suited to its special mode of life and motion, so it is with the internal parts, these also differing in different animals' (*PA* iii 4, 665B2–5).

[11] Compare the foregoing account of brain and bones with Bolton's (1995, pp. 109–10). Bolton argues that bones fit the καλῶς kind of explanation, saying, 'the system of bones is, thus, something sufficient to do the job well enough, not the only thing that could do the job' (p. 110). But this is not Aristotle's way of proceeding. Instead of just indicating the function (i.e. a structure that protects the fleshy parts), Aristotle describes several things related to bones, and shows how they each function in a unique way, specific to the needs (hypothetical necessities) of the organisms involved. Bones are described by Aristotle as the necessary structure for the kinds of animals that have them (think of the importance of being a vertebrate to contemporary zoology), just as horns and beaks are for the animals that possess those kinds of bones.

The explanation of the eye and its associated parts is a case in point. Consider the eyelids. It is rather obvious that eyelids exist in order to protect the eyes; blinking is an involuntary action of the eyelids that aids this protection and makes vision keener by maintaining a fluid condition (*PA* ii 13, 657^{a}31–^{b}2). According to Aristotle, oviparous quadrupeds do not blink in this manner, but birds with talons (i.e. birds of prey) do. The reason for this is as follows: the latter, since they soar in the air and have to spot their food from afar, must blink more often to maintain accuracy of vision; the former do not need to maintain such keen vision, 'since nothing in their mode of life imperatively requires it' (657^{b}29). Similarly, fishes have no eyelids, since the fluid consistency of their eyes is maintained by the medium in which they live (658A6–10).

Eyebrows and eyelashes also exist for the protection of the eyes (658B14–15). Even Socrates is supposed to have made this last point, at least if the account of Xenophon is to be believed.[12] But unlike Socrates who simply asserts that, Aristotle goes further and describes the mechanism whereby this happens:

> the lashes are set at the terminations of the small blood vessels. For the vessels come to an end where the skin itself terminates; and, in all places where these endings occur, the exudation of moisture of a corporeal character actually necessitates the growth of hairs, unless there be some operation of nature which interferes, by diverting the moisture to another purpose. (*PA* ii 15, 658B20–26, ROT)

Notice here again that Aristotle perceives no conflict between the specification of necessary factors and functional explanations, and in fact considers both to be crucial aspects of the complete explanation.

(A) exudation of moisture at the termination of the eyelid

(B) lashes covering the open eye

(C) protection of the eyes

Here again we have a typical teleological explanation, the syllogism for which tells us not only why some creatures have eyelashes, but also how they have them. This is a vast improvement on the Xenophontic Socrates' explanation, which simply states that we have eyelids in order to protect the eyes.

The mouth is another interesting case because the organ and its parts can serve so many different functions. Primarily, it exists for the reduction of food and thus digestion, but some animals also use it for various other purposes, depending on their needs. Thus it can also be an aid to respiration, a defensive weapon, and a speech organ (*PA* iii 1, 662^{a}20–7). This is a case of nature adapting a single organ to several different functions (662A18–20).[13] When teeth are used as defensive

[12] Xenophon, *Mem* 1.4.5.

[13] This is a counterexample to Bolton's claim that Aristotle 'never suggests that the actual set of human organs might perform quite different functions' (1995, p. 121). Bolton makes this assertion in support of his argument that the functions might exist in a number of different material configurations

weapons, they are further adapted according to the specific situation. Thus some animals have tusks, while others have sharp teeth that interlock with the opposing jaw, depending on whether they are better suited to impale or bite. No animal has both tusks and sawed teeth, for that would be in vain (661B17–26). The fact occasions a general remark.

> A general principle must here be noted, which will be found applicable not only in this instance but in many others that will occur later on. Nature allots each weapon, offensive and defensive alike, to those animals that can use it; or, if not to them alone, to them in a more marked degree; and she allots it in its most perfect state to those that can use it best; and this whether it be a sting, or a spur, or horns, or tusks, or what it may be of a like kind. (*PA* iii 1, 661B26–34, ROT)

This principle can be seen as an extension of the doctrine that organs and parts are co-extensive with the capacity to use them, which we discussed in a general form in the last chapter.[14] It is no mystery for what purpose animals have weapons of defense in the first place, for it is obvious, perhaps more here than elsewhere, that they exist for the survival of the animal that has them. And nature ensures that every animal has such means (*PA* iii 2, 662^{b}27–3^{a}18). Cephalopods, for example, eject ink. They do this both out of necessity (for when endangered, fear causes a disturbance of the bowels, producing a discharge of ink), and for their protection and safety; this is a case of a residue existing both out of necessity and for the sake of something (*PA* iv 5, 679^{a}25–30). Consider further the deer's weapon of defense, horns. These show a different relationship between functionality and necessity.

> Deer are the only animals in which the horns are solid throughout, and also are the only animals that cast them. This casting is for the advantage of the deer from the increased lightness it produces, but, seeing how heavy the horns are, it is also a matter of necessity. In all other animals the horns are hollow for a certain distance, and the end alone is solid, this being the part of use in a blow. At the same time, to prevent even the hollow part which grows out of the skin from being weak, the solid part fitted into it comes up from the bones. For this arrangement is not only that which makes the horns of the greatest service in fighting, but that which causes them to be as little of an impediment as possible in the other actions of life. (*PA* iii 2, 663^{b}12–20, ROT)

In either case, solid and cumbersome, or hollow and light, functional and necessary factors conspire to produce the optimal advantage, for the species that possesses the defensive weapon. Consider a demonstration along the following lines.

or parts, but that a given material configuration necessitates just one kind of function, which indicates the teleological explanation of the part and its relation to hypothetical necessity. Contrary to this, Aristotle argues that nature often uses a single organ for several different functions: 'nature, as usual, turns the same part to more than one use' (659A21–22). He says this, for example, with reference to the elephant's trunk, which is both an organ of respiration and of grasping. The leading example is the human mouth (659B30–60A13, 662A18–24) and hands (687A7–23).

[14] See also *GA* ii 1, 734^{b}19–5^{a}4.

(A) excessive growth of horns

(B) casting off by the deer

(C) increased lightness and agility

So with respect to the question—Why does the deer shed its horns?—a complete teleological explanation answers why (to reduce encumbrance), and how (they become heavy and prone to break off).

The lungs show yet another relationship between necessity and functionality. Above, we discussed the lung in connection with the function and structure of respiration. There are still other features of this organ of interest to the present investigation. The lung exists for the sake of respiration, but it derives its motion, according to Aristotle, from the heart (*PA* iii 6, 669^{a}15). This again shows how comfortable Aristotle is with the simultaneous causal efficacy or, in other words, explanatory compatibility of necessity and function. The lung also differs in different animals, that is, animal kinds show various adaptations with respect to the lung, depending on such factors as their size and internal heat conditions (669A24–B2).[15] Numerous other examples could be cited where Aristotle asserts that an organ exists both out of necessity and functionally. Examples are: the epiglottis (*PA* iii 3, 665A6–10), omentum (*PA* iv 3), mesentery (*PA* iv 4), cartilaginous vertebrae in serpents (*PA* iv 11, 692A3–5), hair on human heads (*PA* 658B2–7), tails (*PA* iv 10, 690^{a}1–4), and feet (*PA* iv 12, 694^{b}5–9). The many different forms of feet are attributable not only to certain necessitating factors, but also to the fact that they are adapted to the particular circumstances of the animal that has them. For example, focusing for a minute on a birds, we notice a number of important adaptations. Their beaks are adapted to their various modes of life (διαφορὰν δ' ἔχει καὶ τὰ ῥύγχη κατὰ τοὺς βίους, *PA* 693A10–11). So are their wings adapted to their way of life (διὰ τὸν βίον, 694^{a}2). As for their feet:

> These are formed out of necessity through the sorts of causes discussed. But also because it is better for them to have their particular feet for their way of life (ἐξ ἀνάγκης μὲν οὖν ταῦτα συμβαίνει διὰ ταύτας τὰς αἰτίας· ὡς δὲ διὰ τὸ βέλτιον ἔχουσι τοιούτους τοὺς πόδας τοῦ βίου χάριν). (*PA* iv 12, 694^{b}5–7)

As a final example, consider the case of the human hand. This offers an interesting contrastive case of the competing modes of teleological explanation available in Aristotle's milieu.

> Now it is the opinion of Anaxagoras that the possession of these hands is the cause of man being of all animals the most intelligent. But it is more rational to suppose that his endowment with hands is the consequence rather than the cause of his superior intelligence. For the hands are instruments or organs, and the invariable plan of nature in distributing the organs is to give each to such animals as can make use of it; nature acting in this matter as any prudent man would do. For it is a better plan to take a person who is already a flute-player

[15] On the complexities of this passage and the functional explanation of the lung, see Lennox 2001b, p. 267.

and give him a flute, than to take one who possesses a flute and teach him the art of flute-playing. For nature adds that which is less to that which is greater and more important, and not that which is more valuable and greater to that which is less. Seeing then that such is the better course, and seeing also that of what is possible nature invariably brings about the best, we must conclude that man does not owe his superior intelligence to his hands, but his hands to his superior intelligence. (*PA* iv 10, 687A7–21, ROT)

Aristotle is not the first person to argue that only an intelligent animal could have hands. Xenophon attributes it to Socrates, in an abbreviated form, as we saw above. There it was part of a broad teleology, an anthropocentric and providential arrangement designed by a personified divinity. It should already be clear, to some extent at least, just how different this is from Aristotle's method of teleological explanation of animal parts. But if it is not, the passage on hands can be used as illustration. For, despite the superficial similarity between the account of hands of Aristotle and Xenophon's Socrates, they are in fact very different. Xenophon's Socratic argument is designed to show that the gods care about humans and thus deserve our reverence in return. The gods gave humans both intelligence and hands, in order to make them superior to other animals, something we should be thankful for. Aristotle's argument (which, admittedly, invokes a semi-personified 'nature' in lieu of god) is, in part at least, designed to show that no animals have parts without the capacity to use them, an implication of Aristotle's principle of the simultaneity of part and power. (For example, fishes are said never to have any kind of limbs, because they are adapted to their aquatic environment and so have fins with which to swim, not limbs which would hinder that (*PA* iv 13, 695B17–25). Their power to swim corresponds perfectly with the part.) Thus humans have hands because it is their nature to be intelligent, and being intelligent they are in a superior position to use hands. This is of course quite different than saying that man was given hands and intelligence in order to be superior.

Consider four ancient accounts of the human possession of hands: (1) an Empedoclean account, where hands, along with various other limbs and organs randomly combined, the resulting viable creatures surviving; (2) an Anaxagorean account, where an animal that possesses hands develops intelligence as a result, and so becomes the superior animal; (3) Xenophon's Socratic account, in which hands and intelligence are simultaneously given to humans in order to make them superior to other animals; and (4) the Aristotelian account, wherein hands are understood as a natural adaptation of a certain kind of animal, given its superior capacities. The last appears to be the most reasonable account.[16] For it explains why an animal has a certain part naturally, i.e. both functionally and out of necessity, and how it is a unique advantage to a particular species.

The above examples, I hope, show Aristotle's general procedure of explaining animal parts in terms of their adaptive advantages, and in terms of the parts or

[16] Compare the assertion of a modern anthropologist: 'When the immediate forerunners of man acquired the ability to walk upright habitually, their hands became free to make and manipulate

processes that these necessitate. Let us now consider the second kind of demonstration according to function and necessity that Aristotle mentioned.

Incidentally Necessary Parts

Aristotle also said that some parts are to be explained as hypothetically necessary, but not as directly necessitated by the definition of the organism. The clearest example is eye color, which was discussed in Chapter 2.[17] Although it is hypothetically necessary for humans to have eyes (because the ability to see is intrinsic to their definition), it is not necessary for them to have a certain eye color. And yet some eye color is necessary. Or consider the example of bile.

> It is likely that, as the bile when it is present in any other part of the body is a mere residue or concomitant, when it is present in the region of the liver it is a residue and not for the sake of anything (οὐχ ἕνεκά τινος); just as is the case with the excretions of the stomach and the intestines. For though even the residua are occasionally used by nature for some benefit, yet we must not in all cases expect to find them for the sake of something (οὐ μὴν διὰ τοῦτο δεῖ ζητεῖν πάντα ἕνεκα τίνος); for granted the existence of this or that constituent, with such and such properties, many results must ensue as necessary consequences (ἐξ ἀνάγκης συμβαίνει) of these properties. (*PA* iv 2, 677A11–19)

'Incidental necessities' is a fitting appellation for such parts, since they are not intrinsically related to the ends of the organism given its definition, but are nonetheless necessary in order that other hypothetically necessary parts (which are intrinsically related to the definition of the organism) can function. In the course of his description of animal parts, Aristotle often discusses such a residue or concomitant (περίττωμά ἢ σύντηξις), which exists in addition to the hypothetically necessary or beneficial parts of animals.[18] Aristotle uses such terminology in his description of the spleen: 'The spleen is present, in those that have one, as an incidental necessity (κατὰ συμβεβηκὸς ἐξ ἀνάγκης), as are the residues' (*PA* iii 7, 670A30–1). Thus such parts do not directly have ends of their own. Waste residua and the spleen do not contribute to functions like internal cooling, or even digestion. Rather, they are necessitated by the hypothetical necessity of parts that do have ends, like the stomach, liver, and bladder.

Hypothetically Beneficial Parts

The last kind of teleological explanation of living natures mentioned by Aristotle is that which indicates: 'It is fine (or noble, καλῶς) this way'. This means that the

tools—activities which were in the first place dependent on adequate powers of mental and bodily coordination, but which in turn perhaps increased those powers' (Oakley 1949, pp. 1–2). Note that Aristotle also considers erect posture and walking a condition for hand use: 'In man the forelegs and forefeet are replaced by arms and by what we call hands. For of all animals, man alone stands erect' (*PA* iv 10, 686A25–7).

[17] See *GA* v 1, 778^{a}29–^{b}19. [18] Balme 1939, pp. 131 f.

part serves some direct benefit (unlike the incidental necessities), but is not strictly hypothetically necessitated by the definition of the organism (unlike the hypothetical necessities). A good example here is the kidney.[19]

> The kidneys are present in those that have them not out of necessity (οὐκ ἐξ ἀνάγκης), but for the sake of the good and doing well (τοῦ εὖ καὶ καλῶς ἕνεκεν). That is, they are present, in accordance with their distinctive nature, for the sake of the residue which collects in the bladder in those animals in which a greater amount of excrement comes about, in order that the bladder may perform its function better (ὅπως βέλτιον ἀποδιδῷ ἡ κύστις τὸ αὑτῆς ἔργον). (*PA* iii 7, 670^{b}23–7, Clar)

This kind of explanation is inferior to the other two, because it only shows *why* and not *how* the part exists. It is clear that the part has a benefit, for it helps the process of elimination. But the necessitating factors are not evident, and so it is not clear that this counts as a full-fledged explanation. This is why Aristotle says that we only state things like this if we cannot give a full account of hypothetical necessity and 'if not, then we should get closest to this' (*PA* i 1, 640A35–6) by providing either an account according to incidental necessity and, failing that, of a hypothetical benefit. This last kind of explanation, the least adequate according to Aristotle, is just the kind of explanation provided by popular teleology like that represented by Xenophon, where it is simply stated what benefit a thing provides, without stating the necessary factors (and thus a complete explanation involving every relevant cause).

7.2 ABNORMAL CASES

Having discussed Aristotle's teleological explanations of living natures, and the extent to which they meet the expectations of the *Analytics*, we must now confront several cases that do not appear to fit into this scheme. There are three cases that stand out: (a) freaks; (b) spontaneously generated organisms; and (c) incidental functions. As we discuss each of these, we will see how they are interrelated, and about which of them Aristotle thinks it is still possible to have some kind of explanation (whether teleological or otherwise).

Freaks

In the normal course of development of an organism, whether animal or plant, the ends determined by the formal genetic program conditionally necessitate certain processes that, as we have seen, are associated for the most part with

[19] An example of this kind of explanation in the *GA* is the testes, which, according to Aristotle, are not necessary for generation, but 'somehow better so' (*GA* i 4, 717A12–22).

material and moving factors. In some cases, however, the form is not completed in the normal way, and the result is some kind of freak. Freaks are defined as excesses or deficiencies of certain parts, and thus with regard to the normal specimen. For example, a chicken born with four legs and four wings, or an animal with two sets of sex organs, or animals born without a spleen or kidney when their kind normally has one. The challenge of such cases is that they seem to conflict with the undeniable regularity of the generation of natural things, and with the assumption that in nature the same processes should terminate in the same ends always or for the most part. Aristotle's response to this concern is as follows.

> The freak belongs to the class of things contrary to nature, not any and every kind of nature, but nature in her usual operations; nothing can happen contrary to nature considered as eternal and necessary, but we speak of things being contrary to her in those cases where things generally happen in a certain way but may also happen in another way. In fact, even in the case of freaks, whenever things occur contrary indeed to the established order but still always in a certain way and not at random, the result seems to be less of a freak because even that which is contrary to nature is in a certain sense according to nature, whenever, that is, the formal nature has not mastered the material nature. (*GA* iv 4, 770B9–17, cf. ROT)

Thus freaks, while contrary to the regular order of nature, have their own kind of regularity, and their own identifiable causes. In the case of chickens born with four legs and four wings, 'the cause lies in the material and in the embryo as it is forming' (770A6–7). The chicken produces many young, laying eggs often and copulating year round; it happens that in so doing it produces double eggs, for the embryos grow together, 'as often happens with many fruits' (770^{a}15). In double eggs, either the yolk separates and the result is two normal chicks, or it does not, and the result is a freak.

Thus Aristotle's account of freaks opens up the possibility of teratology, the science of monstrosity. This is because he holds that there are a limited number of definite causes for freaks. It is not a purely accidental situation, but is a birth defect with definite congenital or genetic causes. Notice that both teleological and necessitating factors must be invoked in the explanation of the freak, since it is only with reference to ends, and the normal development of the organism, that the differences in the developmental processes, and how they went wrong, can be understood. This situation should be closely compared with the next case, of spontaneously generated organisms, because with those the situation is reversed: there is a completion of the end, but not through the natural, regular chain of conditionally necessitated processes.

Spontaneously Generated Organisms

Organisms, whether plants or animals, are normally generated through natural processes of reproduction. In the case of plants, this happens through seed, which

has the male and female principle pre-mixed;[20] for animals, sexual reproduction is the norm. But there are also creatures, namely testaceans (i.e. shell-fish), some at least of whom are generated spontaneously.

> Now all things formed in this way, whether in earth or water, manifestly come into being in connection with putrefaction and an admixture of rain-water. For as the sweet is separated off into the matter which is forming, the residue of the mixture takes such a form. Nothing comes into being by putrefying, but by concocting; putrefaction and the thing putrefied are only a residue of that which is concocted. For nothing comes into being out of the whole of anything, any more than in the products of art; if it did, art would have nothing to do, but as it is in the one case art removes the useless material, in the other Nature does so. Animals and plants come into being in earth and in liquid because there is water in earth, and air in water, and in all air is vital heat so that in a sense all things are full of soul. Therefore living things form quickly whenever this air and vital heat are enclosed in anything. When they are so enclosed, the corporeal liquids being heated, there arises as it were a frothy bubble. Whether what is forming is to be more or less honorable in kind depends on the embracing of the psychical principle; this again depends on the medium in which the generation takes place and the material which is included. Now in the sea the earthy matter is present in large quantities, and consequently the testaceous animals are formed from a concretion of this kind, the earthy matter hardening around them and solidifying in the same manner as bones and horns (for these cannot be melted by fire), and the matter (or body) which contains the life being included within it. (*GA* iii 11, 762A9–32, ROT)

The problem occasioned by spontaneously generated organisms is that they have functionality similar to all other organisms,[21] and yet they are not generated for the sake of their functions. That is why their generation is called spontaneous, in conformity with the doctrine of spontaneity developed in *Phys* ii 4–8.[22] Things are generated spontaneously when they result in an end (in this case, a living thing), but did not come to be naturally or deliberately for the sake of this. That is evidently the case with the testacea. Unlike natural plant and animal reproduction, in which the parts and processes exist and come about for the sake of reproducing the form of an adult plant or animal, spontaneously generated organisms come about because certain materials are moved in certain ways that allow the concoction of the vital principle. Thus they come about in a variety of environments (such as lagoons and the sides of boats), but cannot be made to come about by any regular process, such as attempting to breed them (763A25–B14). So, unlike the case of incidentally necessary processes that generate things not for the sake of anything (like waste products), here we have a case of necessary processes incidentally

[20] For details see the fine article by Sprague 1991, esp. pp. 361–2.

[21] In some ways they function like plants, in others ways like animals (761ª14–31). That they have their own good is confirmed also in the passage just quoted, which shows that different spontaneously generated organisms have different degrees of value (τιμιώτερον). On the relation of this to Aristotle's hierarchical gradation of nature, see Lloyd 1996, pp. 122 f.

[22] For a defense of the consistency of the doctrine of spontaneity in *Phys* ii with *GA*, see Lennox 1982. Cf. Balme 1962.

generating something that has an end. Notice that Aristotle's recognition of the possibility of such organisms counts as evidence against the view, most prominently advanced by Gotthelf, that Aristotle was motivated to provide teleological explanations only because he believed that the material parts alone were not capable of coming together to produce a living form. For that is just what happens with spontaneously generated organisms.

These cases of ends being incidentally generated can be compared to yet another case of incidental causation, where an organ or organism exists for the sake of some function, but can also be used for some other function which has an incidental relation to its own good.

Incidental Functions of Organs and Organisms

Genuine teleological explanations of organs, according to the foregoing discussion, involve a specification of ends, and a description of the conditions necessitated by the realization of these ends. For example, if we are explaining an eye, then we name its aim (seeing) and a beneficiary (the organism that sees, such as an owl or an octopus). But it is possible to involve the eye in teleological explanations that are incidental to the intrinsic cause for the sake of which it is present to a given organism. We saw this in Chapter 2, where we discussed Aristotle's aporia about the fact that the eye can be used not only for seeing, but also for skewing seeing (by pressing on it while looking at an object), or for eating, or selling.[23] Consider Table 7.1, which compares intrinsic and incidental causes of the eye.

The aporia arises because there are an unlimited number of possible uses of anything, such as an eye. Although we can specify seeing as one of the functions of the eye, there are many other functions that we could assign to it as well. How do we know if we have the right one? The solution is to apply the criterion of hypothetical necessity.

If the aim is to see, then there are very specific conditions that must obtain in order for that end to be realized. But these conditions are not equivalent to the conditions required if one is to eat or sell something. If the aim is to eat, it is only

Table 7.1 Intrinsic and incidental causes of an organ (eye)

Causes	Intrinsic causes	Incidental causes
Matter	tissues; blood	irritable tear ducts, a scratched cornea
Mover, source of change	the father; embryological-developmental processes	Philip; royalty; Macedonian blood
Form	spherical	blue
End	sight	eat; sell

[23] *EE* vii 13 (viii 1), 1246^{a}26–31.

necessary that there be some nutritional substance produced, not necessarily an eye. And if the aim is to sell, then it is only necessary that there be some commodity, not necessarily body parts. Sure enough, it is possible to harvest animal or human organs for purposes other than that for which they exist naturally in some animal or person. But the possibility of organ harvesting does not constitute an intrinsic cause of the natural production of some organ.

For example, one cannot explain why and how the pancreas develops in the pig on the basis of the fact that it can be used to produce insulin for humans, or a drug that the Eli Lilly Company sells, or a profit for the shareholders of that company. Pig pancreases might be farmed for insulin, but pigs do not have pancreases in order to help the drug companies or diabetics. Now of course we could point to some pigs bred and harvested just for their insulin and say that the reason they have been bred and thus have pancreases is so that the drug company can harvest their insulin and sell it to diabetic patients who need it in order to metabolize carbohydrates. But then we would be explaining why those particular pigs are being raised over there (and so why certain hypothetical necessities are in fact in place) in accordance with human technology, but not why the pigs themselves naturally have, develop, and use pancreases.

It is not possible to construct a syllogism in which the middle term would explain the function of an organ like an eye or a pancreas being for the sake of some other organism, or for any other incidental function for that matter. Organs are generated for the sake of a certain function, or a certain set of functions, and there is hypothetical necessity between the function and its material and generation. There is, however, no hypothetically necessary relation between the material and generation of an organ and the myriad other things it could possibly be used for. We can thus speak of incidental functions of organs—of possible uses of an organ incidental to the ends for the sake of which it was generated—just as we can talk of an incidental formal cause of an eye, the fact that it is blue.

The same analysis applies just as well to whole organisms. There are both intrinsic causes of organisms, on the basis of which a scientific explanation of them can be given, and then there are incidental causes. The capacity for motion is an especially illustrative case. Earlier we quoted Aristotle arguing that just as an animal can be an intrinsic cause of its own motions (e.g. by creeping over to a pond for a drink of water), it can also be moved incidentally (e.g. by a crane or a conveyor belt). A very important aspect of this distinction for the investigation of Aristotelian teleology is the fact that Aristotle goes on to compare intrinsic and incidental animal motions to intrinsic and incidental goods: 'that which is good in itself or by its own nature can only incidentally be good because of, or for the sake of something else (ὥσπερ οὐδὲ τὸ καθ' αὑτὸ ἀγαθὸν ἢ δι' αὑτό, τὸ μὲν δι' ἄλλο εἶναι, τὸ δ' ἑτέρου ἕνεκεν)' (*Anima* i 3, 406B8–10). Keeping with the examples just mentioned, the quenching of the pig's thirst is a natural and intrinsic good for the pig (not only does it help it to survive, but it is also pleasurable for it). But the use of these animals by a human (for insulin, entertainment, labor, food, or whatever),

Table 7.2 Intrinsic and incidental causes of an animal (horse)

Causes	Intrinsic causes	Incidental causes
Matter	Flesh, bones, hair, blood, heart	Waste products, mucus, bile
Mover, source of change	the father, embryological-development processes	Bucephalus; A horse-breeder; jockey
Form	Vegetative and locomotive soul	Arabian; brown
End	Life, survival, reproduction, flourishing, pleasure	Racing, riding, food, farming, gambling, warfare

while in one sense a good (insofar as it is useful to the human), is not an intrinsic good, but a good incidental to the nature of the animal itself. Thus Aristotle's application of this distinction between kinds of animal motion, and his invocation of the homology with the good, is further confirmation that Aristotelian teleological explanations are exclusively oriented towards the good of the natural kind itself. For what determines the natural and intrinsic motion and good of the animal kind is the good of the animals or specimens of that kind, not the relationship of its species to something else, or some other kind of good. The latter kind of good is incidental to the animal's nature, and thus not an aspect of the teleological explanation of that kind of animal. Table 7.2 represents the intrinsic causes of an organism (a horse) alongside some of its possible incidental causes.

The table again serves to show what kinds of factors Aristotle is ready to consider bona fide aspects of the scientific explanation of a natural substance, in this case an organism, an animal, a horse. The intrinsic causes all have an explanatory role to play in the explanation of what this organism is and how it functions. The incidental causes indicate particular features of an individual, but are not properly aspects of the scientific explanation of horses. Again, this is not to say that such information is totally useless or irrelevant. In the *Daily Racing Form*, none of the intrinsic causes are important, except to the extent that they must exist in order for there to be horses to bet on in the first place. But in a scientific explanation of the natural kind itself, none of the incidental causes should be mentioned. They are mentioned in discussions of human needs and priorities, but those are understood as incidental to the natural thing itself. In the next chapter, where we will discuss humans, we will see how these incidental causes can become objects of technical knowledge. Here we stress that it is impossible to construct syllogisms explanatory of the function or functions of a kind of animal, in which the middle term is some use of the animal, and this is in a relation of hypothetical necessity to the material and moving processes which are responsible for the generation of the animal.

It follows for better or worse that, as far as the science of nature is concerned, one kind of organism cannot exist for the sake of another kind of organism: each organism lives for the sake of itself. Grass cannot be thought to exist for the sake of being eaten by a cow, for instance, or a cow for being eaten by a human, any less

than a human can be thought to exist for the sake of a mosquito that bites it and derives nourishment from its blood. None of the movements, parts, or processes of a horse, pig, fish, grass, or human can be explained naturally by something incidental, much less antithetical, to its own survival and reproduction. On the contrary, these things are threats to its existence that make the explanation of its survival and way of life more difficult and require extra comment and further consideration. But whether you think that species are eternal and fixed, or mutating and liable to extinction, you simply cannot explain that an organism has a part by stating that the part sub-serves its own destruction as, for example, by another organism 'higher on the food chain'. It is interesting that this is common ground for natural scientists whether evolutionary adaptationists or steady-state adaptationists: only that which promotes the survival and reproduction of the individual is explanatory of a part. In the final section of this chapter, we will see that the same applies to the behavior of the organism.

7.3 ANIMAL BEHAVIOR

All animals possess, in addition to the nutritive-reproductive power of the soul, the ability to perceive (*GA* i 23, 731^{a}30–4; cf.: *Anima* ii 2, 413^{b}2; iii 1, 425A8–10; iii 12, 434B17–24; *Sens* 1, 436^{b}11; *Juv* 1, 467B24–5; *Meta* i 1, 980A27–8). Animals can be defined, simply, as beings that can perceive (*PA* ii 5 651^{b}3–4; iii 4, 666^{a}34–5).[24] Because this is also the highest function of all non-human animals, it is, in the final analysis, their end: 'Perception and thought is the end (τέλος) for every being to which either of these pertains. For these are the best, and the end is what is best (τὸ δὲ τέλος βέλτιστον)' (*Somn* 2, 455^{b}23–5; cf. *NE* ix 9, 1170A16–19).

At the most basic level, animal perception amounts to what we in English vaguely call touch or feeling, and this is most clearly manifest in the desire for food and sexual intercourse, and the pleasure that attends upon the satisfaction of these (*Anima* ii 3, 414B4–16). The power of perception greatly expands the activities, practices, and characters of animals, but these are most clearly manifested in the activities of feeding and of rearing the young. Of course, this is just what one should expect, given the fact that this kind of activity is directly related to the primary functions of the animal soul: nutrition and reproduction.

> Throughout the entire animal scale there is a graduated differentiation in amount of vitality and motion. A similar statement holds good with regard to actions of life. Thus of plants that spring from seed, the one function (ἔργον) seems to be the reproduction of their own particular species, and the sphere of action with certain animals is similarly limited to this function (ἔργον). This kind of activity, then, is common to all alike. If sensibility be superadded, then their lives will differ from one another in respect to sexual intercourse through the varying amount of pleasure derived therefrom, and also in regard to modes of parturition

[24] Cf. Code 1995, p. 140.

and ways of rearing their young. Some animals, like plants, simply procreate their own species at definite seasons; other animals busy themselves also in procuring food for their young, and after they are reared quit them and have no further dealings with them; other animals are more understanding and endowed with memory, and they live with their offspring for a longer period and on a more social footing. The life of animals, then, may be divided into two activities—procreation and feeding; for on these two activities all their interests and life concentrate. (*HA* viii 1, 588B21–9A5, ROT modified)

The possession of more advanced capacities of the soul does not reduce the importance of the primary and basic ones. On the contrary, the more advanced powers result in more complex, social, and intelligent behaviors or technologies in support of those basic functions. These more advanced behaviors vary owing to a number of factors, especially the physiology of the animal kind, and the environment and climate in which it lives. Various animal behaviors can be described as adaptations of the organism to such environmental conditions (*HA* 596^{b}20–3; cf. 615^{a}24–5, 620B10–11, and *Resp* 477B17–23).

Some kinds of animal exhibit industry, resourcefulness, and a sort of practical intelligence in these regards, and hence their behaviors are to some extent comparable to those of humans. Some of the gregarious animals are even said to be political.[25] These traits must not be considered merely metaphorical; rather the human versions are intensifications and modifications of these.[26] The characters of many animals manifest gentleness, timidity, courage, tameness, and even intelligence and stupidity (καὶ νοῦν τε καὶ ἄνοιαν, *HA* 610^{b}20–2). This is more apparent to us in the case of the smaller animals, such as insects, where we seem to observe acute intelligence indeed (τὴν τῆς διανοίας ἀκρίβειαν, 612^{b}18–21). Ants, for example, appear most industrious (ἐργατικώτατον, 622^{b}19), in their various activities connected with the gathering of food, the provision of shelter, and the facilitation of reproduction. Spiders are most refined, resourceful, and skilful (τεχνικώτατοι, 622^{b}23) in building webs on which to live and gather food; a certain species of spider is superlative in this regard— 'most wise' (σοφώτατον, 623^{a}8). Among bees, there is a great diversity in methods of working and way of life (τὴν ἐργασίαν αὐτῶν καὶ τὸν βίον, 623^{b}26), and the complexity of their activities occasions unavoidable analogies with human political structures, with 'kings' and 'workers' in the cells of the hive.[27] But even the largest animals display something like intelligence; for instance, the elephant is very sensitive and superior in intelligence to other animals (630^{b}21), as evidenced by its tameness and trainability.

Some animals even have memory, and thus can learn and be taught (*Meta* i 1, 980^{b}21–5). But, for all that, non-human animals are not in fact intelligent in the sense that humans are. Aristotle attributes the power of thinking and thought only

[25] *HA* i 1, 488A7–8; viii 1, 589A1–2; *Pol* i 3, 1253^{a}7–9.

[26] Labarriere 1987; cf. Depew 1995, p. 170.

[27] On the sense in which some non-human animals (namely ants, bees, wasps, and cranes) are 'political animals', see: Cooper 1990, pp. 220–7; Depew 1995, p. 171.

to 'humans and possibly another similar kind or something superior' (*Anima* ii 3, 414^{b}18–19). As a whole, non-human animals 'live by appearances and memories, and have but little of connected experience; the human race, however, lives also by art and reasoning' (*Meta* i 1, 980B27–8; cf. *Anima* ii 10, 433^{a}11–2; *Pol* vii 14, 1332^{b}4–5). Non-human animals are incapable of discourse (*HA* iv 9, 536^{b}1–3; cf. *Pol* i 2, 1253^{a}7–18 and i 5, 1254^{b}23), and so of deliberation, inquiry, and technology. Nonetheless, Aristotle recognizes that they engage in highly advanced and complex activities, especially with regard to their own survival and reproduction. That is evidence that nature is a cause for the sake of something.

> In those cases where there is an end (ἐν ὅσοις τέλος ἔστι τι), the things which precede and go before are done for the sake of this. Therefore, as things are done, so they are by nature, and as they are by nature, so each is done, if nothing prevents it. And things are done for the sake of something. And therefore they are by nature for the sake of something. For example, if a house were a thing that came to be by nature, it would come to be just as it does now by art. And if the things that come to be by nature could come to be not only by nature but also by art, they would come to be just as they do by nature. Therefore the one is for the sake of the other. In general, art in some cases completes that which nature is unable to finish, and in other cases imitates that which it is. So if things in accordance with art are for the sake of something, it is clear that things in accordance with nature are as well. For the relation between that which comes before and that which comes after is the same in things in accordance with art and with nature. And this is most obvious in the case of the other animals, which make things, not with art, nor by inquiring, nor by deliberating. Because of this, people wonder whether spiders, ants, and the like produce things by means of intelligence or something else. Proceed a little further and there is evidence in the plants of things that conduce towards an end (πρὸς τὸ τέλος), like leaves for the sake of protection of the fruit. So if it is both by nature and for the sake of something that the swallow makes the nest, and the spider the spider web, and the plant the leaves for the sake of the fruit, and the roots do not grow up but down for nourishment, then it is evident that this kind of cause exists in the things that come about and exist naturally. (*Phys* ii 8, 199^{a}8–30)

The fact that animals and even plants do not deliberate, and yet do accomplish end-oriented activities, is for Aristotle observational evidence in favor of a natural cause for the sake of which. Notice that Aristotle does not indulge in anthropomorphism in order to explain these phenomena.[28] On the contrary, it is the fact

[28] Contemporary ethologists also describe the functional or end-oriented behavior of non-human animals, and do not consider such forms of explanation problematic. Consider the following remarks from standard ethology textbooks: 'When an ethologist observes an animal performing a certain action, he may ask why the animal behaves in this and not some other manner. If we hear a bird sing, we may ask just why it does so. In what way does his song contribute to the preservation of that particular species; that is, what selective advantage does the song confer upon the animal' (Eibl-Eibesfeldt 1970, pp. 1–2). 'Behavioral ecology is about functional explanations (the answers to "why" questions) of behavior. . . . Although it is important to be clear about the distinction between causal ["how?"] and functional explanations, it is equally valuable to recognize that the two kinds of question are complementary and that asking "why?" questions can often help to understand the answers to "how?"questions, or vice-versa' (Krebs and Davies 1987, p. 351).

that end-oriented activities are performed by beings (plants and animals) that are incapable of human deliberation, inquiry, and skill that forces the conclusion that these ends exist naturally, independent of deliberate human activity. In fact Aristotle goes so far as to entertain de-anthropomorphization of human technology in a thought experiment.

> It is absurd to think that nothing comes to be for the sake of something unless that which effects the change is observed to deliberate. In fact, even the art does not deliberate. And if the art of making ships were present in the wood, it would make the same way as in nature. So, if the [cause] for the sake of something (τὸ ἕνεκά του) is present in the thing produced by art, so it is in the thing produced by nature. (*Phys* ii 8, 199^{b}26–30)

Aristotle's discussion of how it is that ends are in fact realized by animals and plants, even without deliberation, is consistent with his discussion of how ends are realized by simple substances like stars and terrestrial elements. In the case of the stars, which are alive, it is intelligence, but not human intelligence, which causes them to rotate in circles. In the case of the terrestrial elements, there is the evidence of their cycles' natural motions and transmutations (which resembles the heavenly circular motion), even though they are not alive. Living is not a precondition to exhibiting natural order; but, in fact, all living things, including human affairs, manifest natural order. As Aristotle says, 'human affairs form a circle, and there is a circle in all other things that have a natural motion and generation and destruction' (*Phy*s iv 14, 223B24–6). What is common between these cases is that stars, elements, plants, and animals all achieve ends, always or for the most part, unless something inhibits them (i.e. they complete circles or cycles, or reproduce, grow and flourish); thus we hypothesize the presence of the cause for the sake of which.

There is in fact no particular reason to associate the existence of ends as such with the existence or activities of humans, except for our parochial perspective, as humans. The vast majority of end-oriented processes have nothing to do with humans, and among those that do, some of the more obvious do not even involve deliberation. Of course, human ends appear to us to be most salient and important, especially those within our power or influence. Because these ends are so compelling to us, they can lead us into the errors of anthropomorphism (the attribution of uniquely human traits to non-humans) and anthropocentrism (the assimilation of all ends to human ends). The critics of anthropomorphism are certainly right to stress the illegitimacy of attributing uniquely human capacities and activities to non-humans. But they make an equally serious mistake if they fail to recognize the existence of natural ends, because of the anthropocentric assumption that only humans can accomplish end-oriented activities or processes. For Aristotle at least, human ends may be more apparent to us, but non-human ends are just as obvious or (in the case of the stars) even more so in nature.

Animals are completely focused on their own survival and reproduction, and their various activities in accordance with these functions are natural, even if not deliberate or intentional.

The life of animals, then, may be divided into two parts, procreation and feeding; for on these two acts all their interests and life concentrate. Their food depends chiefly on the matter of which they are severally constituted; for the source of the growth for each will be out of this in accordance with nature. What is in accordance with nature is pleasant, and all animals pursue pleasure in keeping with their nature. (*HA* viii 1, 589[a]2–9, ROT modified)

The pleasure that attends upon the satisfaction of their basic functions (procreation and nutrition) is manifest to animals' sense perception, their highest function. Because their modes of procreation, nutrition, and parturition are different, the sensations and pleasures that correspond to successful activity in these regards are different. This is but a further piece of evidence supporting the interpretation of Aristotelian teleology that emphasizes specific kinds, and is really just a development of the more general doctrine that different kinds of things (both natural and artificial) are completed in different ways.[29]

Because Aristotle never describes the behavior of any animal (or plant, for that matter) as if its interests or activities depended on the lives of any other species of animal, one might object that the emphasis on the individual species and its success (in terms of survival and reproduction), in isolation of other species, amounts to a failure to account for the ecological interdependence of organisms. The problem cannot be entirely avoided by appealing to Aristotle's belief in the eternality of species, as if belief in the doctrine that species do not become extinct obviates the need for explanation about the physiology and ethology of the organism in question. If that were how Aristotle saw the matter, then there would be no need to explain the functionality of animal parts, or the behavioral adaptations that he describes as necessary for their survival and flourishing. Obviously, there could be no explanation for the great variety of animal adaptations (parts and behavior) if these did not relate to their survival or reproduction in some way.[30]

Consider the very interesting case of the feeding behavior of sharks, dolphins, and whales, as discussed in two parallel passages.

So for the other fishes, the catch of smaller ones comes straight into their mouths, while they swim in their natural position. But the selachians, dolphins, and all the cetaceans catch while turning over on their backs, for (γὰρ) they have their mouth below. Because of this, the smaller fish are saved more often (διὸ σώζονται μᾶλλον οἱ ἐλάττους). If this was not the case, they think (δοκοῦσιν), the smaller fish would be quite few, since the speed and voracity of the dolphin seem (δοκεῖ) incredible. (*HA* viii 2, 591[b]23–30)

[Fishes] also have differences with respect to the mouth. For some have the mouth in the front at the extremity, but others underneath, like the dolphins and the sharks. These get their food by turning over. It appears that nature made this so not only for the sake of saving the other animals (ἡ φύσις οὐ μόνον σωτηρίας ἕνεκεν ποιῆσαι τοῦτο τῶν ἄλλων ζῴων) (for in the turning over the others are saved by the delay—for all these kind of fishes eat

[29] In this connection, Aristotle asserts that there are different pleasures unique to each kind of animal at: *NE* iii 14, 1119A7–8, x 5, 1176A5–9; *EE* vii 2, 1237A26–9; and *Pol* i 8, 1256A27–9.

[30] Cf. Furley 1996, pp. 68 and 73.

other animals), but also to prevent their gluttony concerning food. For had their acquisition of food been easy, they would perish from their rapid repletion (διεφθείρετ' ἂν διὰ τὴν πλήρωσιν ταχέως). In addition, the nature of their snout is wide and small, not permitting easy opening. (*PA* iv 13, 696^{b}24–34)

Between the passages, there are several considerations about the behavior of the big sea creatures that turn over while feeding: (1) their mouths are located on their underside; (2) eating straight on would cause repletion and death; and (3) smaller fish are saved. Is the third consideration causally related to the animal's physiology (i.e. the location of their mouths) or behavior (i.e. the turning over)? If Aristotle thought so, then he would appear to be offering a teleological explanation that focuses on the success not of a single kind, but of a relation to other kinds as well.

There are several reasons that militate against this interpretation. First of all, the *HA* passage appears to advocate the first consideration (location of mouth) as the true explanation (γὰρ, *HA* 591^{b}27), and the second (saving other animals) as a consequence of the fact of taking time to turn over (διὸ, *HA* 591B27). The locution 'they think' (δοκοῦσιν) also could indicate that this was a popular explanation that Aristotle is showing to be a mere consequence of the true explanation.[31] If so, this would be in keeping with Aristotle's practice of trying to ascertain limits in the application of teleological explanations. At any rate, there are other reasons to think that Aristotle does not countenance the saving of the other fish as a genuine explanation. Most importantly, he also offers the explanation about how this situation is beneficial for the big fish themselves (by avoiding repletion). This in fact is a very typical sort of teleological explanation: explaining a benefit that accrues to the survival or flourishing of the target species from a given part or behavior (or modality thereof, such as location of the organ, or attitude of the body while using it).

Additionally, there is the important circumstantial evidence that this would be the only such explanation in any of the biological works. Aristotle nowhere else offers an explanation of a part or behavior on the basis of its advantage for another species. This explanation, if it is one, swims alone in a sea of individual kind-oriented teleological explanations. Aristotle apparently has either no, or vanishingly little, enthusiasm for such explanations. To the extent that it does not fit with other crucial methodological considerations, it is also clear that Aristotle's theory of teleological explanations could not be expanded to accommodate further such explanations.

[31] Balme goes even further and argues that the second passage contains 'a sarcastic rejection of popular teleology (the saving of other animals) and its replacement by a genuine advantage to these (the avoidance of over-eating)' (*HA*, Loeb, note at 591^{b}27). He also argues that 591^{b}27 is 'clearly based on *PA* 696^{b}27' and that the *HA* passage is meant to 'state the bare fact without discussion of final causes'. I am not convinced that there is a reliable way to establish either an absolute or relative dating; it seems to me equally plausible that the *PA* passage is based on the *HA* one (in keeping with Aristotle's stated procedure at *HA* i 6, 491^{a}10–14 and *PA* ii 1, 646^{a}8–12), since the latter passage does seem to refer to a popular and flawed 'teleological' explanation.

Of course, Aristotle is well aware of predation and the conflict among animals for space and food within what can reasonably be called ecological niches. His observations in the *History of Animals* on the subject, like his discussion of the defensive organs possessed by animals, confirm the general rule that teleological explanations are oriented towards the individual species whose behavior or part is being discussed. We will dwell on this issue at some length in the next chapter where we discuss inter-species conflict between humans and other animals.

For now, we finish the general discussion of animal behavior, and are led to the conclusion that Aristotle's explanations in this field (what we call ethology) conform to his general pronouncements that the activities of animals serve to support the primary functions of their souls, survival (nutrition and growth) and reproduction. In animals with greater capacities, the lower-level activities exist for the sake of the higher, such as perception, namely pleasure. In the next chapter we will see that this fact about teleological explanation is key to understanding Aristotle's teleological explanation of human activity and ethics.

8

Teleology and Humans

Teleological explanations have a special role to play in the case of humans, because here we are dealing with a kind of living thing capable of deliberate and intentional action in pursuit of ends. No other natural kinds that occupy Aristotle's cosmos do that. Stars are extra-terrestrial living intelligences, but they have no need to deliberate about the means to their end, because simple motion is their nature and internal principle. Animals are terrestrial living things, but incapable of speech and reason, and so they cannot deliberately pursue their ends of survival, reproduction, and flourishing. Plants too are alive, but incapable of perception and self-motion, and so *a fortiori* are incapable of engaging in deliberate activity. The elements are neither alive nor sentient, and so although they change naturally (both in their local motions and in their reciprocal transmutations), they too reach their ends without deliberate activity.

It has been argued that teleological explanations are only legitimately applied to human action, because other natural substances do not deliberate or intentionally pursue ends. Aristotle rejects this view. As we saw at the end of the last chapter, he argues that it is absurd to deny that there are ends for natural things just because some of them do not deliberate (e.g., spiders who weave webs, birds who build nests, plants whose roots grow down instead of up). The motivation for the rejection of teleological explanations outside the framework of intention, however, is a good one: the desire to avoid anthropomorphism. It is legitimate to try to avoid the misleading consequences of transferring to other natural kinds the unique capacities of human beings.

In this chapter we will consider several teleological issues unique to humans. These issue not only from the fact that humans can deliberately pursue ends, but also from the fact that they can generalize, repeat, learn, and institutionalize those acts by inventing arts that imitate, complete, or even transgress nature, and by inventing sciences that contemplate nature. Section 1 examines the nature of deliberate and intentional action and choice, and shows how these relate to Aristotle's teleological conception of art and science. There are two major kinds of science: practical-productive knowledge, pursued for the sake of producing an effect (an action or product); and theoretical knowledge (contemplation of causes and explanations) pursued for its own sake. Section 2 examines Aristotle's determination

of the ultimate end of human life as contemplation—pursuit of knowledge for the sake of knowledge itself. Section 3 examines the differences between the ends of other kinds of organisms, and the ends deliberately pursued by humans. Theoretical knowledge is predicated on the determination of explanations, causes, and ends for other organisms, independently of the exigencies of human interest. Productive-practical knowledge, on the other hand, considers natural things like animals only insofar as they are means for achieving various human ends. But the recognition that non-human animals have ends independent of humans, and that humans have ends independent of other humans, raises two problems that are addressed in the remaining sections. Section 4 discusses the art of using other organisms as means for human ends. Section 5 discusses the justification for the human subordination of other humans, and the use of other humans as means.

8.1 DELIBERATION, INTENTION, ART, AND SCIENCE

Humans are unique among animals and, more generally, among natural substances, in that they are capable of choice and deliberation. Deliberation (βούλευσις) is the speculation about the cause for the sake of something with respect to action (*EE* ii 10, 1226^{b}21–30); it aims to ascertain the means or the best means to a given end. The end itself is the object of desire, not deliberation or choice. Choice (προαίρεσις) is a combination of desire and reason that results in deliberate action—action for the sake of something.

> The origin of action—the source of motion, and not that for the sake of which—and that of choice, is desire and reason that is for the sake of something (πράξεως μὲν οὖν ἀρχὴ προαίρεσις–ὅθεν ἡ κίνησις ἀλλ' οὐχ οὗ ἕνεκά–προαιρέσεως δὲ ὄρεξις καὶ λόγος ὁ ἕνεκά τινος). That is why there is no choice without intelligence and intention and character. For good action and the opposite does not exist without intention and character. But intention by itself moves nothing, but only intention that is for the sake of something and is practical does. This too is the origin of production. For everyone who produces does so for the sake of something, and this is not an end without qualification, but is towards something and for something (καὶ οὐ τέλος ἁπλῶς ἀλλὰ πρός τι καὶ τινός). But what is done is that too. For the good action is an end, and desire is for this. That is why choice is either desiderative intelligence or intentional desire, and the origin of this kind of thing is a human. (*NE* vi 2, 1139^{a}31–^{b}5)

Humans are the origin of choice, and intentional and deliberate action. This follows from the fact that choice involves reason and intention in addition to desire, and only humans use the rational faculty to modify their desires with thought. Humans are the only animals capable of deliberation. That is to say, only humans are capable of rationally modifying their desires, of deliberating about the best means to achieve their desires, and hence of intentionally pursuing their ends. In some cases, the ends of human actions are so important and so common that humans have established techniques (skills, crafts, arts) and lines of inquiry that

aim at those ends. Thus every such technique and inquiry aims at some end—a good (*NE* i 1, 1094ª1–9).

Aristotle provides us with a classification of knowledge based on different dispositions to ends. When the end is a product, the techniques that result in the production are called productive sciences. The productive art of cobblers aims at the end of producing good shoes, and the productive art of rhetoric aims at the production of good speeches. When the end is an activity, the techniques that result in a good performance of the actions are called practical sciences. Thus the practical art of gymnastics aims at good athletic practice and vitality, and the practical art of astronautics aims at good piloting of space ships. Finally, when the end is just knowledge, Aristotle calls the science theoretical. Theoretical knowledge of nature, or of numbers, or of god is supposed to be an end in itself.

Although ends are not objects of deliberation, they are objects of inquiry. And herein lies another crucial distinction between theoretical and non-theoretical forms of inquiry. Although one does not deliberate about ends when one's purpose is some kind of action (since, again, we *desire* and wish to be healthy, but *deliberate* about the means to that), when the end is knowledge itself, there is inquiry into ends. This we have seen again and again, in the last two chapters. Having gathered together data about animal parts in the *History of Animals*, for example, Aristotle proceeds in the *Parts of Animals* to inquire into their causes and ends.[1] Indeed, he inquires into their ends first among causes.

Thus there are critical differences between the theoretical and non-theoretical (i.e. practical and productive) sciences. They differ both with respect to their objects (inquiry into ends versus inquiry into means), and with respect to the purpose of the inquiry itself (knowledge, versus action or production). From this perspective, it makes little difference whether we think of the political art as aiming at *practicing* good government, or at *producing* law and order. Rhetoric's end can similarly be described both in terms of the *practice* of speaking well, and in terms of the *production* of good speeches. Gymnastics results in both athletic actions (e.g. running a four-minute mile) and in the production of fast runners. All such inquiries, for present purposes, can be regarded as 'productive' sciences based on their purpose, as Aristotle himself occasionally does.[2] So the critical distinction is between the theoretical and the other kinds of knowledge, and it turns on whether the end of the knowledge is nothing other than the nature that it contemplates, or something else that is to be done or produced.[3]

[1] See *HA* i 6, 491A10–13; *PA* ii 1, 646ª8–12; *IA* 1, 704B8–11. There is some indication that a similar procedure has been followed for politics. Thus the 'collection of 138 constitutions', of which the *Athenian Constitution* is probably a fragment, appears to have been a fact-gathering work not unlike the *History of Animals*, which would then be subject to the causal-explanatory scheme in the *Politics*. It is also possible, although there is less evidence for the view, that a similar method was followed with respect to the *Ethics*: the data about character and virtue is gathered together, and then subjected to the causal-explanatory system, and other techniques (including the doctrine of the mean).

[2] For example: *Meta* xii 9, 1074B38–5A5 and *EE* i 5, 1216A38–B25; for an analytical assimilation of practical and productive sciences, see *NE* iii 3; cf. *NE* vi 4.

[3] See *EE* i 5, 1216B10–16.

To put the distinction in the simplest possible terms, there is a distinction between sciences that aim at the production of an effect (whether an action or an artifact), and those that aim at knowing the causes of a given effect. In the former case the end is an activity or artifact, in the latter it is knowledge itself. In the case where the end is something other than knowledge, it may be that the best means involves pursuing theoretical knowledge of the subject, but not necessarily. Thus Aristotle observes that there are cases where the person of mere experience can be better at a given activity (i.e. producing a certain effect) than the person who has theoretical knowledge of the subject.[4] But there is no question whether Aristotle considers theoretical or practical-productive knowledge to be better in general. His views on that are quite explicit, for better or worse, as is well known and as we will soon see. These views will become very important later when we evaluate some tenets of productive-practical arts and science that seem at odds with the results of theoretical sciences. Before that, we introduce the issue by observing that some arts are subordinate to others.

> where such arts fall under a single capacity—as bridle-making and the other arts concerned with the equipment of horses fall under the art of riding, and this and every military action under strategy, in the same way other arts fall under yet others—in all of these the ends of the master arts are to be preferred to all the subordinate ends; for it is for the sake of the former that the latter are pursued. It makes no difference whether the activities themselves are the ends of the actions, or something else apart from the activities, as in the case of the sciences just mentioned. (*NE* i 1, 1094A9–18, ROT; cf. *NE* i 5, 1097A15–24)

This passage introduces us to the complicated issue of rank ordering among the scientific disciplines, that is, the determination of the relative worth of various kinds of knowledge. Because some forms of knowledge are instrumental to other kinds of knowledge, and thus are pursued for the sake of the latter, it is obvious that some kinds of knowledge are more valuable than others. And their value is determined, at least in part, by the extent to which certain ends can be subordinated to certain other ends. Aristotle extends this line of reasoning to the whole of science, and concludes that there must be a supreme science: 'the science which knows to what end each thing must be done is the most authoritative of the sciences, and more authoritative than any ancillary science; and this end is the good in each class, and in general the supreme good in the whole of nature' (*Meta* i 2, 982B4–7).

There is considerable difficulty in establishing just what this science might be. From a practical perspective, it seems to be politics since, on a quantitative level at least, politics is concerned with the ends that are distributed over the most number of people.

> If, then, there is some end of the things we do, which we desire for its own sake (everything else being desired for the sake of this), and if we do not choose everything for the sake of something else (for at that rate the process would go on to infinity, so that our desire would

[4] *Meta* i 1, 981A12–24.

be empty and vain), clearly this must be the good and the chief good. . . . If so, we must try, in outline at least, to determine what it is, and of which of the sciences or capacities it is the object. It would seem to belong to the most authoritative art and that which is most truly the master art. And politics appears to be of this nature; for it is this that ordains which of the sciences should be studied in a state, and which each class of citizens should learn and up to what point they should learn them. (*NE* i 1, 1094A18–B2, ROT; cf. *Pol* iii 12, 1282^{b}14–18)

Thus every other end is, in a way, subordinate to politics. But this is just because the end of the political art is human success itself, and 'we all do everything for the sake of success' (1102^{a}2–3). The real question is exactly what human success is. Ultimately, Aristotle thinks that this is theoretical wisdom, and not any kind of practical wisdom. In fact, to the extent that politics is a practical-productive art, political knowledge would be inferior and subordinate to theoretical wisdom, insofar as that kind of knowledge does not *have* an end (like happiness or anything else), but *is* the end.

We have said in the *Ethics* [book vi] what the difference is between art and science and the other kindred faculties; but the point of our discussion is this, that all men suppose what is called wisdom to deal with the first causes and the principles of things. This is why, as has been said before, the man of experience is thought to be wiser than the possessors of any perception whatever, the artist wiser than the men of experience, the master-worker than the mechanic, and the theoretical kinds of knowledge to be more of the nature of wisdom than the productive. (*Meta* i 1, 981^{b}25–2^{a}1, ROT)

Later, we will examine more specific passages in which Aristotle argues that practical and political knowledge cannot be the highest form of wisdom. Aristotle gives several reasons for this, but the focus of our attention will be on the passages where he asserts that political knowledge cannot be the highest science or identical with wisdom because it is exclusively concerned with human affairs, but there are many other entities in the cosmos, some of them more perfect than humans and all, in their own way, good. Thus the logic of passages asserting the primacy of politics is dialectical, and qualified by further considerations about the value of various objects of knowledge, which considerations turn out to be definitively criterial for the rank ordering of kinds of knowledge.

One must not confuse the idea of an architectonic science of politics with the subordination of all knowledge to social or political knowledge. Aristotle denies that this is possible, since there cannot be a singular science of the good. His reason for this is that the good is not a singular object, and thus cannot be the object of a single science. To put it linguistically: the term good is not univocal, and its various meanings cannot be assimilated to some single, overarching notion of the good. Aristotle presents this argument, in *Nicomachean Ethics* i 4 and *Eudemian Ethics* i 8, in the context of a critique of the Platonic-Academic notion of a 'form' or 'idea' of the 'good itself'.

In the *Eudemian Ethics*, Aristotle points out that the discussion of the existence of a separate idea of the good itself belongs to a 'more abstract' inquiry than that of

the anthropological one of the ethical discourses. But he offers 'to speak briefly about these matters', going on to offer three arguments. 'First,' he says, 'it is to speak abstractly and idly (κενῶς) to assert that there is an idea whether of the good or of anything whatever' (1217^{b}20–1). Here Aristotle simply invokes his repeated criticisms of the theory of ideal forms, referring to both popular and philosophical works.

'Next,' he says, 'however much there are ideas and in particular an idea of the good, they are perhaps useless with a view to a good life and to action; for the good has many senses, as numerous as those of being' (1217^{b}23–6; cf. *NE* i 4, 1096^{a}23–9, 1097^{a}6–14). This contains the core of Aristotle's positive argument about the existence of a separate good itself. Since the good is found in each of the categories (substance, quantity, quality, time, etc.), and the categories indicate the equivocal senses of being, the various senses of good will themselves be equivocal. Now Aristotle's position on being is that it is a special kind of equivocal term, one including a special member towards which all other senses are somehow related, just as the term healthy has many senses, but all of them are related to the sense of health in the body. Gymnastics, dietetics, and surgery all have different senses of health as their aim (e.g. fitness, nutrition, and disinfection), but each of these aim at health of the body. Still, there is no overarching sense of health that is the univocal aim of these practices. 'Being is not one in all that we have just mentioned, so neither is good, nor is there one science either of being or of the good' (1217B33–5; cf. *NE* i 4, 1096^{a}29–34 and *Protr* 87.9–11). Aristotle gives a quick summary of the good in each of the categories: 'in substance as intelligence and god; in quality as justice, in quantity as moderation, in time opportunity' (1217^{b}30–2), and so forth. Even within a single category, there are equivocal senses of good, since moderation with regard to food and with regard to troops are different goods entirely, and hence the objects of different sciences, namely medicine and strategy. This needs to be stressed: there is simply no single science of the good. Thus the good for everything cannot be found in politics, anthropology, theology, or even cosmology. At most, one of these sciences could have as its object some one kind of good that is the 'focus' of other kinds of good, like health of the body is to the various sciences that promote health. Whatever good means in these various sciences then, it is not a univocal sense that applies to the good of everything.

Aristotle's third argument (1218^{a}2–15; cf. *NE* i 4, 1096A34–B7) is against the postulation of a generic 'good itself' as a universal, eternal, and separable entity, held to be a superior good, identical to the common good, or the good of all things taken together. For something is not made more good by making it eternal (that is, making it good for a longer period of time). Further, some goods, like justice and bravery, are not separable from matter; bravery or justice in the abstract is nothing admirable or virtuous. Aristotle is critical of those who, in connection with this, attempt to 'show the nature of the good itself' (δεικνύουσι τὸ ἀγαθὸν αὐτό, 1218^{a}16), by taking that which is not agreed to possess the good, numbers, and to try to demonstrate that things agreed to be good, like justice and bravery,

are good because they correspond to good arrangements of numbers. 'But they ought, from what are admitted to be goods, e.g. health, strength, and temperance, to demonstrate that beauty is even more present in the changeless, for all these things are order and rest; but if so, then the changeless is still more beautiful, for it has these attributes still more' (1218[a]21–4). At this point it is unclear what the hypostatization of inseparable goods (like strength) would accomplish, but at least such a project avoids the error of supposing either a single good itself (an idea of the good) to which all good things answer, or a common good (the good as universal) which is abstracted from all the good things. The difficulty with the good itself, then, is that it is either too abstract or too general: 'to say that all existing things desire some one good is not true; for each seeks its own special good, the eye vision, the body health, and so on. There are then these difficulties in the way of there being a good itself; further, it would be useless to political philosophy which, like all others, has its particular good, just as gymnastics has a good bodily condition' (1218A30–36).

Although he rejects the idea of the good and the universal good, Aristotle does not completely reject the search for the good itself, however.[5] Instead, he offers his own, teleological, program for finding it.

> The good itself that we are seeking is neither the idea of the good nor the good as universal; for the idea is unchanging and not practical, and the universal, though changing, is still not practical. But that for the sake of which, as an end, is best, and a cause of everything under it, and first of all goods. This would be the good itself, the end of human actions. And this is the good under the master art of all. And this is politics, economics, and prudence. For these habits differ from all others by being like this. But whether they differ from each other will have to be discussed later. (*EE* i 8, 128B7–16)

What Aristotle settles for, then, is the determination of a practicable good at which humans can aim. 'Even if there is some one good which is universally predicable of goods, or is something separate and independent (ἢ χωριστὸν αὐτό τι καθ' αὑτό), clearly it could not be attained by a human; but we are now seeking something attainable' (*NE* i 4, 1096[b]32–5). Other kinds of things have other aims, and it is not possible to determine a good at which both humans and all other things aim, but it is perhaps possible to determine that at which all humans ultimately aim. In the next section, we will examine Aristotle's position on what this highest human good is. In the following section, we will take up again the question that he has here deferred: whether this science is identical to politics, economics, or wisdom.

8.2 ULTIMATE ENDS OF HUMANS

In both the *Eudemian* and *Nicomachean Ethics*, just after he argues that there is no univocal concept of the good, or at any rate no useful or attainable separate good,

[5] *Menn* 1992, pp. 548–51 is exceptionally clear about this.

Aristotle attempts to establish what the ultimate good and end of a human being is (*EE* ii 1 and *NE* i 5). The argument in both cases makes use of some quite familiar teleological concepts, and is even commonly referred to as 'the function argument' or 'the *ergon* inference'. This is not the place to evaluate the merits of that argument or its wider implications for ethical theory.[6] Its importance for the present investigation lies exclusively in the fact that it is a teleological explanation, and we want to know whether or to what extent it conforms to the general pattern of teleological explanations that were exhibited in the foregoing chapters.

The fact that the *ergon* argument occurs in both major ethical works just after the critique of the idea of a singular form of the good is obviously not accidental. On the contrary, the *ergon* argument depends on the position that there are in fact different ends for different kinds of substances, tools, activities, capacities, arts, and sciences.[7] If it was the case that all of these were ultimately related to some one good, then that would be the end of everything, and there would be no promise in looking to what is unique about this kind of natural substance or animal. But, as Aristotle reasons, there is a reason to do so.

> let it be assumed as to excellence that it is the best disposition or state or faculty of each class of things that have some use or function (ἔργον). This is clear from induction, for we posit this in all cases: for instance, there is an excellence that belongs to a coat, for a coat has a particular function and use, and the best state of a coat is its goodness; and similarly with a ship and a house and the rest. So that the same is true also of the soul, for it has a function (ἔργον) of its own. And therefore let us assume that the better the state is, the better is the function of that state (βέλτιον τὸ ἔργον), and that as states stand in relation to one another so do the functions that result from them. And the function of each thing is its end (καὶ τέλος ἑκάστου τὸ ἔργον). (*EE* ii 1, 1218^{b}37–1219^{a}8)

Given what we have seen in Aristotle's account of natural substances like elements, stars, plants, and animals, it is not at all surprising that he should hold that there is a characteristic function of human beings.[8] On the other hand, Martha Nussbaum has said, with reference to the first of these passages, 'Functions are, in

[6] A recent commentator summarizes the main kinds of objections: '(1) at its appeal to peculiarity in determining human function . . . (2) at its validity—e.g., does it not fallaciously infer from a premise about how a good human specimen lives to a conclusion of about how it is good *for* a human to live? (3) and at its attribution of a function to human beings in the first place—e.g., does not talk about function require a designer, whereas for Aristotle humans are neither artifacts nor theofacts?' (Lawrence 2001, p. 445). The first and second arguments will be discussed briefly in what follows, insofar as they pertain to a general account of Aristotelian teleology. The third argument we can dismiss on the basis of conclusions that we have reached in the preceding chapters, since we have seen how Aristotle justifies discussion of functions and ends without reference to a designer (and in fact takes products of design to be posterior to and imitative of nature).

[7] Lawrence points out: 'it is these formal relations between function and excellence that Aristotle is exploiting equally in the Function argument. It is then a further question in any particular case, including the human, what the proper excellences specifically are' (2001, p. 451).

[8] The *ergon* argument is thus not 'a paradigm of *pars pro toto* fallacy' as alleged by McLaughlin (2001, p. 301). McLaughlin assumes that Aristotle's inference is only from the function of parts (i.e. organs) to whole organisms (i.e. man). But this is only a part of his argument. He is also inferring that humans have a function from the fact that other natural substances have them as well (given that

biological works, never ascribed to creatures as wholes, since this would serve no analytical purpose. But in the *Nicomachean Ethics* we are suddenly confronted with a strange passage' (1978, p. 100):

> just as a flautist, a sculptor, or any artist, and in general, for all things that have a function and an activity (ἔργον τι καὶ πρᾶξις), the good and the well seem to exist in their function (ἐν τῷ ἔργῳ δοκεῖ τἀγαθὸν εἶναι καὶ τὸ εὖ), so it would seem to be for a human, if in fact there is a function (ἔργον) of him. Are there functions and activities for the builder and the tanner, but not for a human? But is he functionless by nature (ἀργὸν πέφυκεν)? Or, as eye and hand and foot and in general each of the parts appears to have some function (ἔργον), so too must one put down some function (ἔργον) of a human apart from these? What then can this be? (*NE* i 6, 1097^{b}25–33)

Nussbaum is keen to deny that there are functions for organisms themselves because she wants to close the door to broader, 'overall' conceptions of teleology.[9] Although I share this concern, I think that Nussbaum's denial of an 'analytical purpose' to the organism is misguided because Aristotle can limit the discussion of functions to the level of the whole organism itself, e.g. to the tree or fish or plant under discussion. At any rate, it is clear that Aristotle does invoke the notion of a function of plants and animals. He says, for instance, 'the function of most animals is, you may say, nothing else than to produce young, as the function of a plant is to produce seed and fruit (ἐστι δὲ τῶν μὲν πλείστων ζώων ἔργον σχεδὸν οὐθὲν ἄλλο πλὴν ὥσπερ τῶν φυτῶν σπέρμα καὶ καρπός)' (*GA* i 4, 717^{a}21–2, ROT); 'the functions and the substance for each of the animals (τὰ ἔργα καὶ τὴν οὐσίαν ἑκάστῳ τῶν ζώων)' (*PA* ii 2, 648A15–16; cf. *GA* i 23, 731^{a}24–^{b}8). Thus he clearly invokes functions of whole animals for the 'analytical' purpose of describing what their parts and motions as a whole are for the sake of. Thus the argument is not at all 'surprising'; on the contrary, it is quintessentially Aristotelian. And so I think that the procedure that we have followed in determining the ultimate function of various kinds of natural substances can guide us and assist us in understanding Aristotle's use of the *ergon* argument.[10]

The trick, of course, is in the determination of just what the ultimate function of the human being is: what is it for a human to function as a human? For it is only if

humans are themselves natural substances). And the inference from the fact that a part has a function to the fact that the whole has a function is not 'obviously invalid' (p. 202) because, as Aristotle argued, it would be absurd if the parts of something had functions, but the whole was functionless. And the function of the whole can be determined to some extent from the nature of the parts. It is reasonable to infer, for example, from the fact that animals have sense organs that they naturally function to perceive.

[9] See 'Aristotle on Teleological Explanation' (Essay 1 in Nussbaum 1978). She says that 'if the argument does not . . . imply that man is an artifact, it does at least seem to ask us to look at the entire universe, and to see how human purposes fit in with the life and activity of the whole. As we have argued earlier, such an approach would be a violation of Aristotle's constraints on teleology, and an exception in the *corpus*' (p. 101). As we have seen, the notion that whole organisms (as well as plants and elements) have functions requires neither a designer nor an 'overall' teleology, so long as the *telos* is in every case understood as an explanatory principle that indicates why something is better not generically but with respect to the substance itself.

[10] On Nussbaum's account, the existence of the theoretical intellect is teleologically problematic, since she holds that there can be no function of the whole organism, and only parts or behaviors can

that determination can be made that the science of ethics can determine its end with reference to a unique function, and not have to remain content with the platitude that the good for a human being is 'success' (εὐδαιμονία).[11] There is every reason to assume that this will be a much more complicated process than the determination of the function of an artifact, organ, or banausic art. And yet, we have already developed resources for approaching the question. For humans are natural substances, to wit living things and animals. And we have already gone through the process of establishing the ends of other natural substances, from stars and terrestrial elements, through organs, plants, and other animals. Presumably the same kinds of techniques employed to determine their ends could be used here.

We said that the principle of a living thing and the cause of its being alive is its soul. We distinguished between kinds of soul, and observed that souls are ordered serially such that those organisms that possess more complex capacities and faculties also possess all the other less complex ones. The capacities of plants, we saw, are limited to nutrition and reproduction. Thus the end of plant life is growth and reproduction, since these are the functions of the kind of soul they have. We saw that animals, in addition to the vegetative soul, possess higher faculties of perception and locomotion. Thus the end of animal life is perception and motion. Now we also saw that animals' perceptual and motor faculties were for the most part oriented towards their survival, nutrition, and reproduction. That stands to reason, since these are all preconditions to the functioning of their higher capacities. So we say that the life of an animal depends on the functioning of its capacities such that they succeed in allowing it to survive and reproduce, and that the good life for an animal was the optimal functioning of these, corresponding to some kind of pleasure. The exact kind of pleasure that constitutes the end for each animal is specific to each kind of animal. We have seen this before,[12] but it is worth calling attention to yet another passage that makes the same point.

Each animal is thought to have a proper pleasure, as it has a proper function; viz. that which corresponds to its activity. If we survey them species by species, too, this will be

have teleological explanations. 'Aristotle would hold that *most* activities are somehow connected to the "nutritive soul"; in the case of intellect, he could refuse altogether to give its purely theoretical exercise a functional account, or he could make an exception to the usual rule that functional accounts are relative to nutrition and reproduction' (1978, p. 82). This is a very serious deficiency of her account: it requires that 'the *ergon* argument' is either not a teleological argument, or that it is an exception to Aristotle's standard teleological procedures. On my account, on the other hand, the *ergon* argument is shown to be an exemplary teleological argument, not only consistent with his general methodology, but possibly the most important application of it.

[11] It is hotly disputed just how the term should be translated, and there are other options, such as 'happiness', which is the standard translation, and 'flourishing' (recommended by Cooper 1975, pp. 89–90, and Nussbaum 1994, p. 15). The problem with 'happiness' is that the term connotes a temporary state of mind, which is very different from the formal criteria determined by Aristotle. The problem with 'flourishing', as I see it, is that this term applies primarily to plants (what happens when they throw out leaves and shoots, see *OED* s.v.), but Aristotle's argument requires a stark distinction between what is good for plants and what is good for humans.

[12] *HA* viii 1, 589^{a}2–9; *NE* iii 14, 1119A6–9; *EE* vii 2, 1237A26–7; *Pol* i 8, 1256A27–8.

evident; horse, dog, and man have different pleasures, as Heraclitus says 'asses would prefer sweepings to gold'; for food is pleasanter than gold to asses. So the pleasures of creatures different in kind differ in kind, and it is plausible to suppose that those of a single species do not differ. (*NE* x 5, 1176A3–9, ROT)

Humans possess the vegetative, moving, and perceptive soul, and so the good functioning of these will be necessary—but not sufficient—conditions of human success.[13] Thus human happiness will in some way depend on the provision of goods and property that make for good nutrition, reproduction, and, I suppose, locomotion,[14] and even, to some extent at least, on pleasure.[15] But the ultimate human success can only be determined by ascertaining what is unique to humans.[16]

Whatever then would this be? For living seems to be common even with plants, but that which is unique is being sought. At the same time, one must exclude the life of nutrition, reproduction, and growth. Next would be some kind of perception, but that seems to be in common with the horse and ox, and all animals. Thus there remains an activity of that which possesses reason. (Of this, one part is obedient to reason, and the other has the reason and thinks about it.) But since this is spoken of in two ways, we must establish what we mean in the sense of activity, for this seems to be the most proper sense. But if the function of a human soul is an activity in accordance with reason (εἰ δ' ἐστὶν ἔργον ἀνθρώπου ψυχῆς ἐνέργεια κατὰ λόγον) or not without reason, and if we say that this is a function for that kind

[13] There is an ongoing debate about whether the function argument should be understood as implying a 'inclusive' or a 'dominant' view of the excellences in accordance with which a human being is said to be happy. The dispute originated in Hardie 1965, who introduced the terms 'inclusive' and 'dominant', which subsequent commentators adopted. Under a radical interpretation of the 'dominant' view, the only virtue that really matters for Aristotle is intellectual virtue and the activity of contemplation. Under a radical version of the 'inclusive' view, the moral virtues and external goods are constitutive of human success as well. Those siding with an 'inclusive' view of one kind or another include, among others, Ackrill 1974, pp. 27–8, Cooper 1975, pp. 99f., and Nussbaum 1978, p. 106. Among those criticizing the 'inclusive' view, Kraut 1989 contains the most comprehensive analysis of the evidence, and offers a useful heuristic for understanding the hierarchical arrangement of human goods (see esp. p. 8 n. 13 and ch. 5). Hardie himself shifted to speaking in terms of 'comprehensive' and 'paramount' in order to avoid the impression that there is any direct tension in understanding happiness in both ways (1968). For a history of the dispute, see Natali 2001, pp. 111 f. Lawrence has recently used the terms 'selective' and 'comprehensive' to represent his position in the dispute (2001, p. 447 and *passim*). These terms are even better, I think, in conveying that there is no direct tension, much less contradiction or incoherence, in maintaining both that a variety of things are components of human success, while at the same time selective emphasis in some contexts needs to be put on one or another. For an interesting recent approach to the issue which gives due attention to the constraints of Aristotle's teleology, see Richardson Lear 2004.

[14] 'External goods' including good birth and descendants (NE i 8 *passim*) and in general 'necessities' (*Pol* i 4, 1253^{b}24–5).

[15] *NE* i 9, 1099A7–15.

[16] In order to illustrate the intuition that the higher-level capacities, especially active reasoning, are the key human function, Lawrence recommends a thought experiment. It involves imagining that you are deciding whether or not it would be worth it to survive an operation that diminishes various capacities of your soul. Lawrence argues that death would be preferable to staying in a dreamless sleep, or a vegetative state; the bestial life is harder to dismiss. But the exercise is useful in establishing that 'what matters to us is our humanity—not just the activity of nutrition, or simple perception, but reason-involving activity' (2001, p. 461). For his part, Aristotle offers his own thought experiment. He imagines that we are transplanted to the Isles of the Blessed, where nothing is lacking. The only activity that we would find ultimately fulfilling in that situation would be contemplation. See *Protr* 83.5–84.2.

of thing and a good one of those, like a lyre player and a good lyre player, and so without qualification in all such cases, eminence is established with reference to the excellence for that function (ἔργον). For of a lyre player it is playing the lyre, and the one who plays the lyre well is a good lyre player. If this is so, and we put it down that for a human some kind of living is the function (ἔργον ζωήν τινα), and this is a functioning of the soul and an activity in accordance with reason (ψυχῆς ἐνέργειαν καὶ πράξεις μετὰ λόγου), and the functioning of the good man is the noble and fine activities of these, and each good thing is perfected in accordance with its native excellence (ἕκαστον δ' εὖ κατὰ τὴν οἰκείαν ἀρετὴν ἀποτελεῖται), then the human good becomes a functioning of the soul in accordance with excellence (τὸ ἀνθρώπινον ἀγαθὸν ψυχῆς ἐνέργεια γίνεται κατ' ἀρετήν), and if these excellences are several, according to the best and most complete (τελειοτάτην). (*NE* i 6, 1097B33–8A17)

The point in exhibiting this argument is to demonstrate its consistency with Aristotle's uses of teleological explanations with respect to other kinds of natural substances. The phrase 'native excellence' (οἰκείαν ἀρετὴν), for example, we saw introduced back in the terminological survey, in the definition of the term 'complete' (τέλειον),[17] which can be applied to any natural substance whatsoever. Whatever one thinks of the merit of the argument, its form and logic are fully consistent with the general methodology of teleological explanations employed in the physical and biological works. For here we see how the *ergon* argument is really an application of the general principle that different kinds of things are completed or perfected by different things, and thus have individual excellences or virtues, and that teleological explanations are to be made with reference to these specific excellences.[18]

8.3 DIFFERENT ENDS OF HUMANS AND OTHER ORGANISMS

If the *ergon* argument works, it must be the case that other kinds of beings besides humans have their own functions and goods and states of perfection.[19] And this

[17] *Meta* v 16, 1021^{b}12–1022^{a}3; cf. *NE* x 5, 1175^{a}22–6.

[18] I think that there is now a consensus that this is how the *ergon* argument is supposed to work: it is, as presented, an argument that shows the 'formal' (or 'universal') conditions for the human good—an activity of the soul in accordance with excellence—without specifying the 'material' (or 'particular') excellences (i.e. by indicating specific virtues in accordance with which one should live). Although it is true that Aristotle goes on to give an account of all the specific virtues, these arguments are not directly pertinent to the *ergon* argument itself and its validity. This 'formal' as opposed to 'material' reading of the notion of excellence has recently been defended by Lawrence 2001 (who points out that this is the consensus, pp. 447–50), but he is in substantial agreement on this point with Ackrill 1974, p. 20, Cooper 1975, p. 146 (who thinks the argument suffers on this score by being too abstract and inadequately specific), Hutchinson 1986, pp. 46–7 (who defends the argument on this score as being informative by relating it to other physical and metaphysical doctrines), and Broadie 1993, pp. 37–9.

[19] Nussbaum, in her effort to prove that Aristotle's ethics is 'anthropocentric in a stronger sense' (1986/2001, p. 291) says that 'the *Nicomachean* discussion of the good life begins with an account of the specific and characteristic functioning of the human being, and, in effect, restricts its search for good functioning for us to a search for the excellent performance of these characteristic functions'

proposition comports with everything else we have seen about Aristotle's use of ends: ends are always determined with respect to the kind of thing whose activity is being considered. And we have also seen that Aristotle is hostile to the notion of an overall singular form of the good, which would assimilate all things to some one end.

Non-human animals are no exception to the rule. Their highest capacity, perception, has a good state of functioning, to wit, pleasure. If there are values among animals, they are relative to the different pleasures they enjoy. The good life for an animal is the attainment of the kind of pleasure that its kind enjoys. Animals that have voice thus use it to express the pains and pleasures that dominate their lives (*Pol* i 2, 1253^{a}10–15), although they lack articulate speech, and so justice. But despite not having justice as a principle for ordering whatever kinds of social existence they do have into a political life, animals nonetheless have better or worse lives, even if they cannot be said to enjoy the same kind of 'success' that humans can.

> Of the other animals, which are inferior by nature to humans, none has a part in this [success]. For a horse is not successful, nor bird, nor fish, nor any other being which is called by a name not participating in something divine, but according to some other kind of good they have a share of better or worse living (κατ᾽ ἄλλην τινὰ τῶν ἀγαθῶν μετοχὴν τὸ μὲν βέλτιον ζῇ τὸ δὲ χεῖρον αὐτῶν). (*EE* i 7, 1217^{a}24–9; cf. *NE* i 10, 1099B32–1100A1)

Another key aspect of the *ergon* argument is that there must be a good and best condition for various parts or capacities of the soul. There must be a good condition of both the non-rational and the rational parts of the soul. In the most general sense, this good condition, whether of non-rational or rational parts of the soul, is said to be an intermediate state between excess and defect (*NE* vi 1, 1138^{b}18–20). In all cases there is a standard (ὅρος, 1138^{b}23, 34), that determines this intermediate state, in accordance with right reason.

It is on the basis of the possibility of being deficient, excessive, or in accordance with this standard that we are permitted to speak, with respect to the capacities higher than perception, of intellectual excellences (or virtues). Aristotle discusses intellectual excellence at length in *Nicomachean Ethics* vi. It is worth examining some of his arguments there in detail, since they are teleological in structure, and they have a direct bearing on several other issues we have been discussing.

Aristotle begins *Nicomachean Ethics* vi by distinguishing between the deliberative and scientific faculties of the rational soul. The former deals with things that can

(ibid., p. 292). This claim fails to acknowledge the crucial role that being able to identify the good for other kinds of living things (plants, brutes) plays in the determination of the good of humans. For it is only if we can identify their goods that we can eliminate them as candidates for the uniquely human good. The same applies to Michael Woods' comment that 'Aristotle's procedure in his ethical writings is undoubtedly anthropocentric in a way in which his procedure in metaphysics or biology is not' (1993, p. 30). Although I agree with some of what Woods has to say in his criticism of 'ethical anthropocentrism', I think that he too has failed to grasp how important the scientific rejection of anthropocentrism is for Aristotle's own ethical procedure. In a way, it is just as crucial to the ethical as it is to the scientific methodology.

be otherwise, the latter with things that cannot. Then Aristotle makes the point, by now very familiar to us, that the excellence of these faculties must be determined with respect to their proper functions.

> One must grasp what is the best condition of each of these [the scientific and calculative parts of the soul]. For this is the excellence of each, and the excellence is relative to the appropriate function. (ληπτέον ἆρ' ἑκατέρου τούτων τίς ἡ βελτίστη ἕξις· αὕτη γὰρ ἀρετὴ ἑκατέρου, ἡ δ' ἀρετὴ πρὸς τὸ ἔργον τὸ οἰκεῖον). (*NE* vi 2, 1139^{a}15–17)

Truth, with respect to both parts of the rational soul, is the function (τὸ ἔργον, 1139B12). This is more obvious with respect to the scientific aspect of the soul. But with respect to the deliberative part of the soul this is so because it too involves reason, as we saw; the end of deliberation is choice, and choice is 'either desiderative intelligence or intellectual desire'. Under either formulation, choice involves thought, and so truth as well, just as scientific thought does. But the determination of truth as the excellence of both these parts of the intellectual soul invites a question about just how different they really are. If decision-making and choice were rational, then the faculty that corresponds to choice and decision would appear to have the same status as the faculty that corresponds to scientific knowledge.

This is an outcome that might have been expected from the discussion above that resulted in the consideration that politics not only has the status of a science in the full sense but also, what is more, has the status of the highest and most authoritative art. But we also mentioned that there are other currents of Aristotle's philosophy that flow against the supremacy of the political art, namely, the promotion of theoretical science above practical-productive science, and the association of wisdom with things that cannot change. The contest between practical and theoretical wisdom for supremacy comes to the fore in Aristotle's discussion of the intellectual virtues, and so it is here that he addresses the issue head-on.

After arriving at the result that truth is the function of both the deliberative and the scientific capacities of the soul, Aristotle decides to begin the discussion anew (ἀρξάμενοι, 1139^{b}14). He enumerates five ways that the soul can possess truth by means of affirmation and denial: art, science, prudence, wisdom, and intelligence (τέχνη, ἐπιστήμη, φρόνησις, σοφία, νοῦς, *NE* vi 3, 1139^{b}16–17). After discussing and distinguishing the first three, Aristotle turns to the discussion of wisdom. Before examining that section, recall that the highest and most authoritative kind of knowledge has been identified as wisdom, as was argued at length and according to a number of different criteria in *Metaphysics* i 2. There Aristotle resolved that theoretical knowledge was 'more of the nature of wisdom than productive knowledge'. Aristotle now makes the point that wisdom is the most accurate of the kinds of knowledge (δῆλον ὅτι ἀκριβεστάτη ἂν τῶν ἐπιστημῶν εἴη ἡ σοφία, 1141^{a}16–17). Wisdom is also comprehension of the highest objects of knowledge, and so it is intelligence plus knowledge, the most valuable kind of knowledge (ὥστ' εἴη ἂν ἡ σοφία νοῦς καὶ ἐπιστήμη, ὥσπερ κεφαλὴν ἔχουσα ἐπιστήμη τῶν

τιμιωτάτων,1141ª18–20). None of these descriptions is surprising, or problematic, or even very interesting. What is interesting is what Aristotle says immediately after this description.

It would be absurd to think that politics, or prudence, is the best knowledge, unless a human was the best thing in the cosmos (μὴ τὸ ἄριστον τῶν ἐν τῷ κόσμῳ ἀνθρωπός ἐστιν). If what is healthy and good is different for humans and fishes (ἀγαθὸν ἕτερον ἀνθρώποις καὶ ἰχθύσι), but what is white and straight is always the same, then one should think that the wise is always the same, but the prudent is different. For the one observing each thing in relation to itself is prudent, and such things are entrusted to this one. That's why among the beasts there is said to be prudence, in those in which there appears a power of foresight concerning their own lives. But it is also obvious that wisdom could not be politics. For if wisdom concerned the things beneficial to the one speaking, there would be many wisdoms (εἰ γὰρ τὴν περὶ τὰ ὠφέλιμα τὰ αὑτοῖς ἐροῦσι σοφίαν, πολλαὶ ἐσονται σοφίαι). For there is not one [wisdom] concerned with the good of all animals, but a different one for each (οὐ γὰρ μία περὶ τὸ ἁπάντων ἀγαθὸν τῶν ζώων, ἀλλ᾽ ἑτέρα περὶ ἕκαστον), if there is not one medical science concerned with all beings. (*NE* vi 7, 1141ª20–33; cf. *MM* i 1, 1182ᵇ25–30)

This passage contains an exceptionally clear expression of the fact that other animals can have goods and interests and ends in total independence of humans. For it recognizes that there are different goods for fishes and for humans, thereby opening a logical space for the possibility of a conflict between the good for humans and the good for fishes. The existence, not to mention possibility, of such a conflict comes as no surprise to most people, least of all fishers. Yet it is impossible for there to be such a conflict if all value and good is determined with reference to human goods. Anthropocentrism is such a position, but Aristotle clearly thinks it is untenable.[20]

It makes no difference if it is held that a human is better than the other animals (εἰ δ᾽ ὅτι βέλτιστον ἀνθρωπος τῶν ἄλλων ζῴων, οὐδὲν διαφέρει). For there are beings much more divine by nature than humans, for example, most obviously, the beings out of which the cosmos is constituted. From what has been said it is clear that wisdom and science and intelligence are the most valuable by nature. That's why Anaxagoras and Thales and that kind of person are said to be wise, not prudent, as they are seen to be ignorant of the things advantageous to themselves. And we say the things they know are extraordinary and amazing and difficult and inspired, but useless, because they aren't searching for the things good for humans. Prudence, on the other hand, is concerned with human affairs (ἡ δὲ φρόνησις περὶ τὰ ἀνθρώπινα) and that about which it is possible to deliberate. For this we most say to be the function of the prudent, to deliberate well concerning the practical good, and no one

[20] Nussbaum has argued that, 'what ethics appropriately seeks is the good of the human being' (1993, p. 82). The term 'ethics' in this remark should, as a matter of Aristotelian interpretation, be replaced with 'practical wisdom' or even 'human prudence'. As Aristotle clearly states here, and as will be discussed in what follows, some other animals have a kind of practical wisdom, and even those which do not (including organisms like plants that do not even have the power of perception) nonetheless have their own goods. I argue below that ethics—including human practical wisdom—must acknowledge and take into account those other goods, and not exclusively focus on human goods.

councils either about that which cannot be other than it is, or about things of which there is no end. But the one who is without qualification good at deliberation is the man who aims with calculation at that which is practically best for a human (ὁ τοῦ ἀρίστου ἀνθρώπῳ τῶν πρακτῶν στοχαστικὸς κατὰ τὸν λογισμόν). (*NE* vi 7–8, 1141^{a}33–^{b}14)

David Sedley, in his affirmative response to the question—'is Aristotle's teleology anthropocentric?'—appears to gesture at the first lines of the first of the last two quotations when he says, 'Stoic teleology is strongly anthropocentric, despite the fact that man is not the best being in the world. This is the view I wish to attribute to Aristotle' (1991, p. 180). Yet he neither mentions either passage nor confronts their arguments. Nonetheless, they contain the undoing of the anthropocentric interpretation. This is particularly the case if one wants to make, as Sedley does, a comparison with Stoic teleology, which indeed is strongly anthropocentric. Sedley describes Stoic teleology thus: 'In the Stoic world . . . man's ultimate aspiration is to contemplate and imitate the highest being, god. But things are so arranged that the entire contents of the natural world, including not only plants and animals but perhaps even seasons and weather, exist and function primarily for the benefit of man' (1991, p. 180). Sedley does not refer to any texts as evidence, but the description is uncontroversial. Now we can develop the comparison between the Stoics and Aristotle by relating it to the preceding passages from *Nicomachean Ethics*. Stoic teleology is anthropocentric because it holds that the human good is in some sense identical with the cosmic good, which is why god has arranged everything for the ultimate benefit of humans, and why the end of human action is life in accordance with nature. Knowledge of the human good entails knowledge of the cosmic good, and these entail right action. Thus for the Stoics there is some kind of identity between prudence and excellence, and knowledge and wisdom, because knowledge of humans and their good, and knowledge of the cosmos and its good, are in some sense identical.[21]

[21] Sedley does not refer to the following text, but it serves quite well as an encapsulation of Stoic teleology. 'For nor is there anything else besides the world which has nothing missing, and which is equipped from every point of view, perfect, and complete in all its measures and parts. As Chrysippus cleverly put it, just as the shield-cover was made for the sake of the shield and the sheath for the sake of the sword, so too with the exception of the world everything else was made for the sake of other things: for example, the crops and fruits which the earth brings forth were made for the sake of animals, and the animals which it brings forth were made for the sake of men (the horse for transport, the ox for ploughing, the dog for hunting and guarding). Man himself has come to be in order to contemplate and imitate the world, being by no means perfect, but a tiny constituent of that which is perfect. But the world, since it embraces everything and there is nothing which is not included in it, is perfect from every point of view. How then can it lack that which is best? But nothing is better than intellect or reason. Therefore the world cannot lack these. Therefore Chrysippus did well to prove by appeal to analogies that all things are better in perfect and mature specimens—for instance, in horse than in foal, in dog than in pup, in man than in child. Likewise, he argued, that which is the best thing in the whole world should be found in something which is perfect and complete. But nothing is more perfect than the world, and nothing better than virtue. Therefore virtue is intrinsic to the world. Indeed, man's nature is not perfect, yet virtue is achieved in man. Then how much more easily in the world! Therefore there is virtue in the world. Therefore the world is wise, and hence is god' (Cicero, *Nat. Deor.* 2.37–9, trans. Long and Sedley 54H).

The contrast between a position like this, and Aristotle's position, should now be clear. Human prudence and excellence is not identical with wisdom for Aristotle, because there are many kinds of prudence (one for each kind of animal, just as there is a different kind of pleasure for each kind of animal), while there is only one theoretical wisdom. Knowledge of the cosmos and knowledge of what is good for humans are, for better or worse, two different things for Aristotle, just as knowledge of what is good for humans is different from knowledge of what is good for fishes. For the Stoics, on the other hand, the good for fishes and the good for humans are identical: the benefit of humans.

Further, the very same thing that potentially makes humans the best things in our region of the cosmos, also, by its absence, can make humans the very worst of all living things.

> Just as when perfected a human is best of the animals (τελεωθὲις βέλτιστον τῶν ζώων ἀνθρωπός), so when separated from law and justice [a human is] worst of all (χείριστον πάντων). For most dangerous is armed injustice. And the human grows up with arms for wisdom and excellence, which are possible to use for the most opposite purposes. That is why they are the most unholy and most savage without excellence, and most lustful and gluttonous. (*Pol* i 2, 1253^{a}31–7)

It follows that humans, simply by virtue of being human, cannot be the center of the axiological cosmos for Aristotle in the way that the earth is the center of the spatial cosmos. Not all good is directed at them. That which accrues to humans at birth makes them neither good or bad, it merely gives them the ability to deliberate and intentionally act in ways either good or bad. Things no more 'function primarily for the benefit' of bad humans, than they do for good fishes.

Returning to our main line of inquiry, we now have a resolution of the apparent tension between the position that the highest and most authoritative kind of knowledge is theoretical wisdom, and the position that political science is the most authoritative art, since it is concerned with the greatest number of human ends. For even if there were a single science that had as its object all the ends of all human beings, a proposition which Aristotle flatly rejects, it would still have as its object a small (though not insignificant) part of the cosmos. Although perfection in this region of the cosmos, on the rare occasion that it happens, makes humans the most excellent of the animals, that perfection does not amount to much in the grand Aristotelian scheme of things. After all, we cannot ignore the fact that, although they sometimes resemble the divine, humans inhabit the least perfect region of the cosmos. The good and the perfect are far more likely to be found rotating in celestial orbits than in a terrestrial biped.

As for the apparent authority of prudence ('practical wisdom'), which stems from the fact that this faculty is integral to politics and issuing orders to the other sciences for the sake of the good of humans, Aristotle says the following.

> But it [prudence] is not superior to wisdom— i.e. to the superior part—just as medicine is not superior to health. For the former does not use the latter, but seeks to bring it about. It

issues orders for the sake of this, not to this (ἐκείνης οὖν ἕνεκα ἐπιτάττει, ἀλλ᾽ οὐκ ἐκείνη). Further, that would be like saying that politics rules the gods because it issues orders concerning all the things in the city. (*NE* vi 13, 1145A6–11)

Thus the authority of prudence and political science is ultimately subordinate to theoretical wisdom because of the simple fact that the former exist for the sake of the latter, and not vice versa. Even if politicians have the power to order how much of society's resources will be allocated to theoretical sciences like astronomy, it does not follow that practical science has authority over astronomy unequivocally, since politicians do not issue orders to the stars. And the success of humans, in accordance with their function, is more closely related to knowledge of the stars than to knowledge of how much of society's resources should be allocated to the science which studies the stars, simply because theoretical science is more of the nature of wisdom than any practical-productive science.

As a matter of Aristotelian interpretation, these positions are borne out by the discussions of the ultimate end of human life in both *Nicomachean Ethics* (especially x 6–8) and *Politics* (especially vii 1–3). In those texts, Aristotle argues that theoretical knowledge—contemplation—is more important for human success than practical-productive science, since the former does not merely determine the best means to success, but rather constitutes success itself. The conclusion of these arguments is asserted in no uncertain teleological terms:

the activity of this part in us [νοῦς] in accordance with its native excellence would be complete success. We already stated that this is contemplation (ἡ τούτου ἐνέργεια κατὰ τὴν οἰκείαν ἀρετὴν εἴη ἂν ἡ τελεία εὐδαιμονία. ὅτι δ᾽ ἐστὶ θεωρητική, εἴρηται). (*NE* x 7, 1177^{a}16–18)

That which is native to the nature of each (τὸ γὰρ οἰκεῖον ἑκάστῳ τῇ φύσει) is the best and most pleasant for it. And for a human this is the life of intelligence, since this most of all is human. Therefore this will be the most successful life (εὐδαιμονέστατος). (*NE* x 7, 1178^{a}5–8)

complete success (τελεία εὐδαιμονία) is some kind of theoretical activity (θεωρητική τις ἐστὶν ἐνέργεια). (*NE* x 8, 1178^{b}7–8)

the activity of the divine (ἡ τοῦ θεοῦ ἐνέργεια), set apart in blessedness, must be contemplation (θεωρητική). So, among human activities, that which is most similar to this is most successful (εὐδαιμονικωτάτη). (*NE* x 8, 1178^{b}21–3)

This means that even the perfection of the human being (itself not the best thing in the universe, even when perfected) depends on the contemplation of theoretical entities, as opposed to the merely human entities considered by prudence or politics or practical wisdom.[22] These theoretical entities include the forms of

[22] According to Nussbaum, 'there is incompatibility here, not just difference of emphasis' (1986/2001, p. 375) between the emphasis on contemplation in *NE* x 6–8 and what Nussbaum interprets as 'the general anthropocentrism of Aristotle's ethical method' (ibid., p. 373). I take this to be a further advantage of the present interpretation, that it avoids the so-called incompatibility. For if one rejects anthropocentrism in all its forms, there is no incompatibility between Aristotle's position

other living things, among them other plants and animals.[23] Thus even from the human perspective, and of what is centrally important to humans themselves, the ultimate good and best is not something human.[24]

8.4 THE USE OF OTHER LIVING THINGS AS INSTRUMENTS

It is only once we grasp the status and place of prudence and political science (i.e. 'practical wisdom') in Aristotle's overall conception of the sciences and wisdom, and their role in human success, that we can make sense of the following remark in the *Politics* that seems to conflict with his teleological principles as established in the works on natural science.

[**a**] As need constrains them, so people support themselves in a particular way. This kind of acquisition is evidently given by nature herself to all, both immediately once they are born (κατὰ τὴν πρώτην γένεσιν εὐθύς), so also when they have completed development (τελειωθεῖσιν). [**b**] For among the animals, some produce from the beginning an amount of food that is sufficient until they are able to provide for themselves, for example those

on contemplation, his scientific works on the ends of other animals, and his ethical position that aims to establish the end of human life. Human beings ought to organize their practical lives so as to maximize contemplation and theoretical activity. (I reject the notion that this implies some kind of monkish or solitary activity—on the contrary, Aristotle conceives of theoretical activity and philosophy in general being carried out among friends and other philosophers.) Theoretical activity is the end of human life, as both a scientific and an ethical analysis reveals (the analyses are, in fact, one and the same). In other words, for Aristotle to hold that anthropocentrism works practically, he would have to accept that it works theoretically as well, since the end of practical wisdom is, ultimately, the active exercise of theoretical wisdom. But since anthropocentrism fails as science, as Nussbaum acknowledges, it must fail as a practical guide to human life as well.

[23] Richardson Lear has characterized the objects of contemplation as 'theological (or quasi-theological) truths' (2004, p. 108) and stated: 'Aristotle says that *sophia* studies the most honorable (*timiōtatoi*) objects. It is unclear whether he intends this to be the study of divine objects, or cosmology, or whether he thinks cosmology *is* theology' (p.108 n. 40, emphasis in original). She is wrong to say that, 'as Aristotle has described the range of theoretically knowable objects in *NE* vi 1, biology and physics—the study of changing things—are not theoretical knowledge' (p. 96). On the contrary, physics and biology (or zoology or, less anachronistically, the life sciences), along with astronomy, are for Aristotle the main theoretical sciences. That all living things are objects of contemplation is clear from the protreptic in *Parts of Animals* i 5, in which Aristotle says that, 'even in the contemplation of animals disagreeable to perception, the nature that crafted them likewise provides extraordinary pleasures to those who are able to know their causes and are by nature philosophers . . . in all natural things there is something marvelous . . . in every one there is something natural and good. For what is not haphazard but rather for the sake of something is in fact present most of all in the works of nature; the end for the sake of which each animal has been constituted or comes to be takes the place of the noble. If someone has considered the study of the other animals to lack honor (ἄτιμον), he ought to think the same thing about himself as well' (*PA* i 5, 645A7–28). Insofar as the forms of all living things (not just the stars) are themselves eternal (and to that extent divine), *zoology* could be considered theology were we to follow Richardson Lear's train of thought. Perhaps this is why Aristotle reminds us of Heraclitus' invitation to 'enter without fear because there are gods here too' (*PA* i 5, 645A17–19) in recommending the study of 'the less valuable animals'.

[24] Cf. Protr 79.9–81.20, which is essentially an extended teleological argument for this conclusion.

born as grubs and born in eggs. Those born live have food for their offspring in themselves for a certain time, which is the nature of what is called milk.[25] [**c**] So similarly it is clear also why one should think[26] that after animals are born, plants are for their sake, and the other animals for the benefit of humans (ὥστε ὁμοίως δῆλον ὅτι καὶ γενομένοις οἰητέον τά τε φυτὰ τῶν ζώων ἕνεκεν εἶναι καὶ τὰ ἄλλα ζῷα τῶν ἀνθρώπων χάριν), the tame for both use and food and, among the wild, if not all, still most of them for the sake of food and other support (βοηθείας ἕνεκεν), so that clothing and other tools come from them.[27] [**d**] If, then, nature makes nothing either incomplete or in vain, it is necessary that for the sake of humans all these things[28] have been made by nature (εἰ οὖν ἡ φύσις μηθὲν μήτε ἀτελὲς ποιεῖ μήτε μάτην, ἀναγκαῖον τῶν ἀνθρώπων ἕνεκεν αὐτὰ πάντα πεποιηκέναι τὴν φύσιν). [**e**] That is why natural acquisition is a kind of war, for hunting is a part of this [war], which it is necessary to use against those beasts and humans who will not submit to natural rule, since a war over such things is just by nature.[29] (*Pol* i 8, 1256^{b}6–26)

[25] The point here is to justify the first part of the above claim, that means of subsistence exist for animals at their birth (γένεσιν εὐθύς). The next paragraph is meant to justify the second part of the claim, that means of subsistence are also available to animals when they are developed (τελειωθεῖσιν). The distinctions made here between the ovipara, animals that lay eggs or grubs (there is no separate class of 'vermipara'), and vivipara is discussed at *GA* ii 1, 732^{a}25 f. The distinction has great axiological import for Aristotle: the degree of perfection of an animal at birth in general corresponds to its overall perfection in the animal series. Humans, vivipara, are in some sense at the head of this series, as the present passage seems to imply.

[26] The dialectical term οἰητέον occurs often (and perhaps only) in Aristotle. I have made a study of the 22 occurrences of it, throughout the corpus. He often uses it, both in the *Politics* and elsewhere, in contexts where he is representing the opinions of others, and judging them. It seems highly likely that he is referring to a widespread and popular viewpoint that plants and animals were created for the sake of humans. We saw this sort of position put in the mouth of Socrates by Xenophon in an argument about religion, and adapted by Plato in the *Timaeus*. It can also be found in Herodotus 3.107. The popular conception was not unopposed: consider, for example, the injunctions against killing and eating animals of Empedocles and some Pythagoreans.

[27] The inference from the natural providing of food, to the providing of clothing and tools does not seem to have a warrant, unless it is assumed that human existence would be incomplete or in vain without these.

[28] Does this mean: (1) all plants and animals; (2) all wild animals; or (3) all animals? Each alternative has problems. First, 'all animals', in any alternative, seems to ignore the statement just made that, among wild animals, 'if not all, most' exist for the sake of use and food. Second, it cannot be that all plants and animals must exist for the sake of humans or be in vain, since plants have just been said to exist for the sake of animals in general, and so they wouldn't be in vain if not for the sake of humans.

[29] There are several important Platonic passages that bear on the interpretation of this argument. First, there is the story told by Protagoras that the arts necessary for humans to acquire food were given by Prometheus to humans in compensation for their lack of natural equipment, but that this art alone was insufficient for survival because humans could not protect themselves against wild animals, since they did not yet possess the art of politics, of which war is a part (*Prot* 322ab). Second, there is Socrates' thought experiment in which the city is built up from its natural beginnings, and it is not until humans want to acquire goods beyond what is necessary that they have to have hunters, more servants, and 'many more cattle, if the people are going to eat meat' (*Rep* ii 373b). Third, there are several cases where Plato classifies war as a kind of hunting, as in *Euthydemus* (290bd). In the *Sophist*, there is the following technical division: hunting divides according to its targets into (1) swimming animals, and (2) land animals. The second group further divides into (3) wild and (4) tame. The hunting of tame animals further divides into (5) war, or hunting by force, and (6) persuasion, or hunting by words. Included in (5) war are piracy, enslavement, and tyranny (*Sph* 221e–2d). In *Laws* vii there is a division of hunting, but it is no longer binary, for it divides according to the following

One strategy that has been employed to cope with this passage has been to disclaim its relevance to theoretical science and confine it to merely practical-productive philosophy.[30]

[Politics i 8] should not be interpreted as implying a universal teleology. For Aristotle is not concerned there with the philosophy of nature, but with the practical question, how man establishes himself in the world and makes use of things in the world . . . the passage cannot be taken without qualification as a proposition of theoretical philosophy. (Wieland 1975, p. 158)

This passage is from an introductory section of the work, a section concerned with stating the appearances; it assumes an anthropocentric vantage point . . . it is a preliminary *phainomenon*, from the human-practical standpoint, not a serious theoretical statement. (Nussbaum 1978, p. 96, cf. 1990, p. 176 n. 29)

More recently, commentators have simply dismissed the passage as an outright contradiction.

it is impossible that he could have meant this literally. It comes in a rhetorical or popularizing account . . . But when Aristotle considers the final cause of living things, he says that the natural philosopher must explain 'how it is better so, not absolutely, but in relation to each thing's being' (*Ph*. II. 198b9). This must rule out the face value of *Politics* [i 8] 1256b16. (Balme 1987B, p. 279)

My answer is simply to deny that this text has any theoretical import for his natural philosophy . . . Aristotle's philosophy is littered with both examples and theories whose reconciliation is desperately problematic, if not impossible . . . If I can establish that the decision should go against anthropocentric teleology, then Aristotle's political doctrine must be badly out of kilter with his natural philosophy . . . It is not implausible that *Politics* i 8 might be another such aberration. (Wardy 1993, pp. 22–3)

None of these positions, as stated, seem to me adequate to deal with the issue. Wieland and Nussbaum simply assert that the context is non-technical and has no bearing on theoretical philosophy, but do not develop their positions to say how this is so or, more importantly, what is to be made of the fact that a central tenet of theoretical philosophy apparently contradicts a central tenet of practical-productive philosophy. Balme and Wardy require that we simply reject an Aristotelian text that does not conform to their conception of Aristotelian teleology. David Sedley, in his defense of the anthropocentric interpretation of Aristotelian teleology, has said the following about these kinds of responses.

Any such dismissal invites three rejoinders. First, this is hardly the kind of argument you would expect to hear from someone who has taken a conscious decision to reject

targets: (1) water animals, (2) air animals, and (3) land animals. The third group further divides into (4) wild animals, and (5) humans. Humans are said to be hunted in two ways: (6) in war, by bandits and armies, and (7) by lovers (823b). Thus Aristotle's divisions are consistent with those in *Sophist* and *Laws*: war, against animals and humans, is a kind of hunting.

[30] This is also the position of Dierauer 1977, pp. 155 f.

anthropocentrism. Second, Aristotle does not merely assert the anthropocentric teleology, but argues for it: given that the mother's milk exists by nature for the sake of her offspring, there is no ground for denying the same natural function to external food sources, which take over the job of milk exactly where it leaves off. Third, Aristotle is here engaged in a complex argument of the utmost seriousness. By showing that human acquisitiveness is founded in the natural order of things, he aims to prove the naturalness of the household, and thereby of the city. (Sedley 1991, p. 181)

Let us begin our own examination of the issue with reference to these three points.[31] The first is an assertion that the passage does in fact support anthropocentrism. Anthropocentrism is, again, using Sedley's own formulation, the position that 'the entire contents of the natural world, including not only plants and animals but perhaps even seasons and weather, exist and function primarily for the benefit of man' (1991, p. 180). The passage is clearly a long way from saying that. The closest it comes is in [**cd**]. But there it is said that plants are there for the sake of other animals (τά τε φυτὰ τῶν ζῴων ἕνεκεν), and the other animals for the benefit of humans (τὰ ἄλλα ζῷα τῶν ἀνθρώπων χάριν). There is nothing that implies that plants and animals 'function primarily for the benefit of man'.

If function translates *ergon*, then it will be seen quite readily that this interpretation is impossible: the most natural *ergon* of living things (φυσικώτατον γὰρ τῶν ἔργων τοῖς ζῶσιν, *Anima* ii 4, 415^{a}26–7) is the activity of their own vegetative soul, that is, their own nutrition and reproduction; that is what everything strives for, and for the sake of this it does everything that it does naturally (πάντα γὰρ ἐκείνου ὀρέγεται, καὶ ἐκείνου ἕνεκα πράττει ὅσα πράττει κατὰ φύσιν, 415^{b}1–2). Animals have additional functions beyond these, owing to their possession of a faculty of perception, and so their functionality is considerably more complex, although it never conflicts with their own survival or reproduction. Thus from the standpoint of their functions, it cannot be the case that plants and animals 'function primarily for the benefit of man'. That is why in the books where Aristotle discusses the functions of animals, and the parts, movements, and behaviors that manifest those functions, these are always described in terms of the organism's own well-being. We do have a single passage that, in addition to this regular kind of explanation, also offers an explanation that involves nature doing something as well 'for the sake of

[31] I focus on Sedley's arguments because they are the most comprehensive and formidable. I have also addressed the 'ethical anthropocentrism' advanced as an interpretation of Aristotle by Nussbaum (1986/2001, 1993), although Nussbaum is not committed, and even opposes, anthropocentric teleology in her interpretation of the scientific works (i.e. in 1978, essay 1). My main line of argument against her position is that it is impossible to maintain 'ethical anthropocentrism' if anthropocentric teleology in general fails, because Aristotle employs homologous techniques for determining the end of human life as he does in determining the ends of other animals in the scientific works, and because the kind of activity at the summit of a happy human life involves the contemplation of non-human natures, and thus acknowledging their own ends and goods in total independence of their instrumental goods for humans. The charge of anthropocentrism has also been leveled against Aristotle by Brown 1982, p. 167, Hughes 1985, p. 68, Lanata 1994, pp. 18–27 (cf. Vegetti 1994, pp. 131 f.) and Amigues 1999, p. 149. On the issue in ancient philosophy generally, see Dierauer 1977.

other animals [namely smaller fishes]' (ἡ φύσις οὐ μόνον σωτηρίας ἕνεκεν ποιῆσαι τοῦτο τῶν ἄλλων ζῴων, *PA* iv 13, 696B27–8, but cf. *HA* viii 2, 591^{b}23–30), but we do not have a single passage in the whole of the biological works which describes the natural functioning of any animal for the sake of human beings. Yet if this were the primary function of plants and animals, why all this discussion of their own survival and flourishing? Rather we should expect a book like that of the Stoic Chrysippus, which detailed the way in which every known species of animal exists for the benefit of humans.[32]

It is true enough that humans and other animals benefit from plants and other animals, but we can no more infer from this that they function primarily for our benefit, than we can infer that humans function primarily for the sake of mosquitoes, since they benefit from biting us. Although animals and plants can function as instrumental goods for human beings and other animals, these functions will be incidental, not intrinsic ends. Recall the table comparing incidental and intrinsic causes of an animal, a horse (Table 7.2). It is clear that we can use horses for entertainment, transportation, gambling, food, war, labor, and so forth. But the reason that none of these uses—benefits to humans who use horses in various ways—plays into the scientific account of what a horse is, is that these are incidental ends. The horse's ends, again, are its own survival, reproduction, and pleasure. These are active states of its intrinsic capacities. Now the human uses do play into other schemes of knowledge—human *technai*—such as horse-breeding, ring-leading, agriculture, warfare, gambling, and so forth. In these contexts the 'ends' of horses are pulling carts, transporting troops, running around a racetrack, or providing meat. There is no more contradiction in recognizing these instrumental uses and ends of horses (and of other animals and plants, *mutatis mutandis*), while recognizing that horses as natural substances also have their own ends, than there is in recognizing that horses also have their own natural motions in addition to the possible ways that we can force them to move (for example by lifting them with a crane into a cage).

The second of Sedley's arguments is that Aristotle argues for anthropocentric teleology in [**bd**]. Briefly, it is there stated that animals are provided with food until they can provide it for themselves, and the case of viviparous animals, such as humans, being provided with milk is offered as evidence. After this provision is no longer sufficient, humans are provided with the other animals as food. Notice that the inference applies just as well not only to all other viviparous animals besides humans (who need to be provided with external food once maternal milk is no longer sufficient), but also to the oviparous animals as well, who will need food

[32] Plutarch and Porphyry have preserved for us some examples from the book. See Long and Sedley 54OP. 'It was certainly a persuasive idea of Chrysippus' that the god made us for our own and each other's sakes, and animals for our sake: horses to help us in war, dogs in hunting, and leopards, bears, and lions to give us practice in courage. As for the pig, that most appetizing of delicacies, it was created for no other purpose than slaughter, and god, in furnishing our cuisine, mixed soul in with its flesh like salt' (Porphyry, *Abst.* 3.20.1=LS 54P; cf. Plutarch, *Mor.* 1044d=LS 54O).

once the nourishment of their eggs is depleted. If such provisions were not forthcoming for all these animals, their existence would be in vain.[33]

With respect to anthropocentric teleology, the key statement is obviously contained in the protasis of the conclusion: 'If, then, nature does nothing either ἀτελὲς or in vain' [**d**]. The term ἀτελὲς must not be translated 'purposeless' (as in the Loeb and Barker), because the issue isn't the 'purpose' of the plant or animal that becomes food; its 'purpose', if it can even be said to have one, is not as food for humans but its own survival and reproduction. Rather we must translate 'incomplete' (as with Jowett), since the point is that nature would have made an animal that is 'incomplete' (or 'imperfect') if it did not have provision of food from birth through adulthood. No animal, whether oviparous or viviparous, exists (i.e. survives) that cannot provide itself with food after the source that accompanied it at birth has dried up. Thus humans have means for providing themselves with food, such as hunting and agriculture. The fact that humans can hunt and eat other animals, and this serves the function of their own survival, does not imply that other animals 'function primarily for the benefit of other animals', any more than it implies that all the other animals that are prey exist and function primarily for the benefit of their predators. And although Aristotle describes predator–prey relations at length in *History of Animals*, he never makes any such argument to the effect that prey exists for the sake of predators. On the contrary, he says the following:

> There is enmity between such animals as dwell in the same localities or subsist on the same food. If the means of subsistence runs short, creatures of like kind will fight together. Thus it is said that seals which inhabit one and the same district will fight, male with male, and female with female, until one combatant kills the other, or one is driven away by the other; and their young do even in like manner. All creatures are at enmity with the carnivores, and the carnivores with all the rest, for they all subsist on living creatures. . . . One may go so far as to say that if there were no lack or stint of food, then those animals that are now afraid of man or are wild by nature would be tame and familiar with him, and in like manner with one another. This is shown by the way animals are treated in Egypt, for owing to the fact that food is constantly supplied to them the very fiercest creatures live peaceably together. The fact is they are tamed by kindness, and in some places crocodiles are tame to their priestly keeper from being fed by him. And elsewhere also the same phenomenon is to be observed. (*HA* ix 1, $608^{b}19$–$9^{a}4$, ROT, with modifications)

Thus Aristotle can envisage beasts and humans coexisting peacefully, where there is no need for the latter to hunt, kill, and eat the former. Presumably, the animals that supposedly otherwise 'function primarily for the benefit of humans' would nonetheless still have functions; of course they would still have their most natural functions, namely their own survival and reproduction. But the anthropocentric

[33] Brown misunderstands this point when he asserts that the passage 'discloses [nature's] questionable concern for anything less than man . . . the lower provisions of nature are necessarily for the purpose of man's subsistence' (1982, p. 167).

interpretation cannot make sense of this thought experiment. If humans got to a point where they did not need to use animals for food (or transportation, labor, clothes, entertainment, etc.), then we would have to say that the animals had lost their functions.[34] But one cannot gain or lose functions of the soul because of an extrinsic relationship to some other being. Rather a function of the soul may be exploited by another being (typically a human) for its own purposes. But then the ends are the human's, not the animal's, just as the ends of a saw are the human's, not the saw's. Thus the uses to which a human or other animal can put another animal or plant cannot be understood as intrinsic functions of the organism so used, but are instead incidental functions.

Sedley's third argument against the attempts to dismiss the passage beginning at *Politics* 1256^{b}6 was that its context is 'a complex argument of the utmost seriousness . . . [b]y showing that human acquisitiveness is founded in the natural order of things' (1991, p. 181). This is in fact the key to understanding Aristotle's meaning in the disputed passage. But a full consideration of the nature of human acquisitiveness gives a result that Sedley has failed to address.

Acquisition is an art or skill, a part of the art of household management, practiced by humans. Like all kinds of practical-productive knowledge, its end is a human good. In this case that end is central to the survival and flourishing of humans, and so the art is, somewhat paradoxically, natural, to the extent that the survival and flourishing of animals, including humans, is natural. (There is also an unnatural version of the art of acquisition, which we will discuss in due course.) The fact that acquisition is an art, and thus practical and productive knowledge, is crucial to situating its status with respect to theoretical science. As Aristotle remarked above, practical wisdom is not identical with wisdom, e.g. 'the good for fishes and humans is different'. And the art of acquisition shows rather vividly just how different the good for humans and fishes is, especially if we consider the art of fishing (a kind of hunting that is a natural art of acquisition). From the perspective of the theoretical science of nature, the good of fishes is the survival and flourishing of kinds of fishes, and this was established in the biological works in complete independence of any discussion of the exigencies of the human art of fishing or acquisition. Recall that this is the crucial point of departure between theoretical and practical-productive knowledge: for theoretical knowledge there is no other end than the natural objects themselves; any possible use or benefit is incidental to the science.[35]

The passage that immediately follows the alleged defense of anthropocentric teleology goes on to show how Aristotle holds not simply that human acquisition

[34] Consider the thought experiment in *Protrepticus* (83.5–84.2; cf. *Pol* vii 13, 1334^{a}31) about the Isles of the Blessed. If you were transplanted to a world without scarcity where you had no material needs, then everything would be valued not for its use but as an object of contemplation.

[35] For a thorough discussion of the art of acquisition, see Natali 1990. See also Brown 1982. The best general discussion of the crucial differences between theoretical and political science can be found in Kullmann 1991, pp. 109 f.

is natural, as Sedley summarized it, but that only certain kinds of acquisition are natural, while other kinds of acquisition are unnatural.

> One kind of acquisition is, in accordance with nature (κατὰ φύσιν), a part of household management, insofar as it is necessary to possess or to provide supplies that are needed for life, and are useful in the community of a city or household. And this seems to be that from which true wealth comes. For the kind of acquisition sufficient for the good life is not unlimited (ἡ γὰρ τῆς τοιαύτης κτήσεως αὐτάρκεια πρὸς ἀγαθὴν ζωὴν οὐκ ἄπειρός ἐστιν), as Solon poetically suggests: *'of wealth no bound appears set for man'*. For it is set, just as in the other arts. For no instrument of an art is ever unlimited either in amount or magnitude, and riches are the several instruments of household management and civil politics. So that there is acquisition in accordance with nature for householders and civil politicians, and the explanation for this, is clear.
>
> But there is another kind of acquisition that is commonly called—and it is right to call it this—'wealth-getting', and it is because of this that there seems to be no limit to wealth and acquisition; because many consider them one and the same, since they are neighbors. But this is neither the same as the one previously discussed [i.e. the legitimate art of acquisition], nor is it far from it. One of these is natural, but the other is not natural (ἡ μὲν φύσει ἡ δ' οὐ φύσει αὐτῶν), rather it comes about through experience and art. (*Pol* i 8–9, 1256B26–7A5)

The kind of acquisition that is here said to be natural corresponds to the kind of acquisition mentioned in the first line of the passage at *Politics* 1256^{b}6 f. Acquisition is natural insofar as it is necessary to provide for the things needed in order to live. But it is not natural if it is not necessary for survival. This is why it is wrong to hunt and eat other humans: cannibalism is not necessary for survival (*Pol* vii 2, 1324^{b}39–41). Notice that this fits perfectly with our interpretation, since the kind of acquisition that it justified, and thus the sense in which it held that animals are for the sake of or benefit humans, was the kind of acquisition needed to provide nourishment once that provided with birth is depleted. And it also fits with the fact that, were there no scarcity and so no need to hunt and kill animals for food, there would be no natural need of this kind of acquisition, nor would there be enmity between animals. As it is, there is such a need, and so this kind of acquisition is natural (*Pol* i 10, 1258^{a}34–8). But some humans try to get wealth, not only insofar as this is necessary for their survival, but for its own sake.

> Some people try to get wealth from everything, thinking this is the end, and that it is necessary to direct everything towards the end. Thus we have discussed the non-necessary art of wealth-getting, both what it is, and why some want this. And we have also discussed the necessary art of household management, which is different than this in that it is, in accordance with nature, the provision of food. Unlike the former, it is not unlimited but has a boundary (οὐχ ὥσπερ αὐτὴ ἄπειρος ἀλλὰ ἔχουσα ὅρον). (*Pol* i 9, 1258^{a}12–18)

Aristotle holds that capitalization or profiteering as such is unnatural. But how could it be, if all other plants and animals 'exist and function primarily for the sake of humans'? So here is another case where Aristotle cannot be interpreted as being

anthropocentric. There are natural limits on the extent to which humans can justifiably use natural things like plants and animals for their own purposes.[36] Beyond that limit, plants and animals cannot justifiably be exploited, and Aristotle condemns those humans who do transgress this natural limit in no uncertain terms.

To my mind, Aristotle offers a balanced approach to the exploitation of natural resources. We must agree with him that some kinds of predation are inevitable and natural, and that we will have to use other living things for our own benefit, most urgently our own survival. But this does not imply a blanket license to exploit and consume every living or natural thing on earth. A society or individual oriented around consumption and profit is not natural but, in Aristotle's words, contrary to nature. But whatever we make of Aristotle's value-judgments regarding the various kinds of art of acquisition, we can be assured that it is at any rate an art, and thus its propositions, the knowledge of which constitutes a practical-productive science, are understood from the perspective of what is good for human beings, and not good for other species, or good in general or absolutely.

The real lesson of *Politics* 1256^{b}6 ff is not that Aristotle's teleology is anthropocentric, but rather that Aristotle's use of teleological explanation here is consistent with the uses to which it has been put elsewhere: teleological explanations always refer to the benefit of specific natural kinds. The passage relates how, by means of a certain art, humans utilize other animals for the sake of their own survival. But it avoids doing so by making the plants and animals themselves out to be things that function 'primarily for the sake of human beings', and makes it clear that other kinds of animals have their own ends as do humans. This gives excellent sense to the somewhat cryptic remark about art in the *Physics*: 'we use everything as if it exists for our sake, for in that way we become a kind of end'.[37]

8.5 SOCIAL ORGANISMS AND ORGANIZATIONS

We have now seen how Aristotle uses teleological notions to determine the ends and ultimate end for a human, and also how these ends relate to non-human natural substances. We are now in a position to examine how Aristotle applies his teleological analysis to relationships between humans. The primary places in which human relationships occur, according to Aristotle, are in the household and in the city. Although countless particular associations are formed in and between these, the relationships are reducible, for Aristotle's purposes at least, to these: husband–wife; parent–child; master–slave; ruler–subject; and citizen–citizen.

[36] Aristotle seems confident that the limit can be determined with reference to the natural needs of humans, just as with all other animals. Lloyd argues that Aristotle cannot in fact draw a very sharp line here (1996, pp. 193–5).

[37] *Phys* ii 2, 194A35.

Aristotle applies the model of whole and part in teleological explanations in order to describe and explain (and, to some extent, to proscribe) these relations. A result is the justification of various kinds of domination, including patriarchy and slavery. It is difficult to square Aristotle's justification of these with his other commitments. For example, how can Aristotle argue that there is a kind of human, a slave, naturally subordinate to another human, when elsewhere he has argued that a human requires autonomy in order to achieve his ultimate end as a human?

We will see that the tension in this and related positions stems from the attempt to apply a model of teleological explanations of organic parts and wholes to the very different case of relationships between organisms. Because these relationships do not genuinely have the kind of organic unity that real organisms do, the extrapolation of teleological explanations from organisms to relations between organisms must be judged a failure. But this fact cannot be used to impugn Aristotle's method of teleological explanation altogether, for it just shows that it cannot, as presented, be successfully extended to situations more complex than organisms. We will see evidence that Aristotle himself was aware of the problem of excessive theoretical unification of complex social relationships for the purpose of propounding a political theory.

Teleology and Cities

Aristotle treats political science to some extent like a natural science, considering that 'if someone examines things as they naturally grow from a starting point, just as in the other disciplines, one will get the best view of them' (*Pol* i 1, 1252^{a}24–6). He thus asserts that the object of political science, the city, like all natural substances, has an end and a function[38] and exists for the sake of some good.[39]

The complete city (τέλειος πόλις), constituted out of several village communities, has already achieved a limit of self-sufficiency (πέρας τῆς αὐταρκείας), so to speak, and having come about for the sake of life, continues to exist for the sake of good life (γινομένη μὲν τοῦ ζῆν ἕνεκεν, οὖσα δὲ τοῦ εὖ ζῆν). That's why every city is natural (πᾶσα πόλις φύσει), if indeed the first communities were. For it is the end of them, and nature is an end (τέλος γὰρ αὕτη ἐκείνων, ἡ δὲ φύσις τέλος ἐστίν). For example, that which each thing becomes when complete (ἕκαστόν ἐστι τῆς γενέσεως τελεσθείσης), this we say to be its nature, just as with a man, a horse, or a house. Again, that for the sake of which and the end are best, and self-sufficiency is both an end and the best (τὸ οὗ ἕνεκα καὶ τὸ τέλος βέλτιστον· ἡ δ αὐτάρκεια καὶ τέλος καὶ βέλτιστον). From this it is clear that the city exists by nature, that a human is by nature a political life form (φύσει ἡ πόλις ἐστί, καὶ ὅτι ὁ ἄνθρωπος φύσει πολιτικὸν ζῷον), and

[38] 'Because there is a function for a city (ἐστι γάρ τι καὶ πόλεως ἔργον) as for a person, one ought to consider to be the best the one most able to accomplish this' (*Pol* vii 4, 1326^{a}13–14). For some qualifications about how the naturalness of the city is to be understood, see Kullmann 1991, pp. 98 f.

[39] 'Every community is constituted for the sake of some good' (πᾶσαν κοινωνίαν ἀγαθοῦ τινος ἕνεκεν συνεστηκυῖαν, *Pol* i 1, 1252^{a}2).

that he who by nature, and not mere chance, lives without a city is either less or more than human. (*Pol* i 2, 1252^{b}27–3^{a}4)

As we noted in the last chapter, there are non-human political animals, and Aristotle does not mean this merely metaphorically. The social insects, such as bees and ants, are political according to Aristotle. To be a political animal means to be a kind of gregarious (as opposed to solitary) animal that participates in a way of life involving cooperation with other animals of one's kind, according to a differentiation of roles, towards a common goal.[40] Political animals cooperate in order to sustain life. Humans are a kind of political animal that cooperates not merely for life, but the good life.[41] That is what differentiates human politics from that of animals, and why neither slaves nor beasts can form a city.

A city exists for the sake of a good life, and not for the sake of life only; but if the city existed only for the sake of life, then slaves and the other animals could have a city. But in fact they cannot, because they do not have a share in success or the life in accordance with choice. (*Pol* iii 9, 1280^{a}31–4)

The city has this single ultimate end, the good life, to which all the ends of its parts and functionaries are subordinate. Its parts, like organs, function organically for the sake of the life and the good life of the city.[42] Although Aristotle's use of biological analogy or metaphor in the *Politics* produces results, only some of which fit with his biological doctrines as expressed in such works as the *Parts of Animals*,[43] still there is no doubt that Aristotle's methodology in both works is thoroughly teleological.[44] This can be seen easily from a glance at the terminology

[40] Kullmann 1991, pp. 106–8; Cooper 1990, p. 225; Depew 1995, pp. 157, 162, 170.

[41] 'First let us establish that for the benefit of which the state is constituted (τίνος χάριν συνέστηκε πόλις), and how many kinds of rule there are for humans and the community in which they live. It was said in the first part of the treatise, in the context of household and slave management, that by nature a human is a political animal. That is why, even when they no longer need the protection of living together, they desire to bond. Not only that, but the common advantage also brings them together, insofar as it extends to each a part of the good life. So this above all is the end, both collectively and individually (μάλιστα μὲν οὖν τοῦτ' ἐστὶ τέλος, καὶ κοινῇ πᾶσι καὶ χωρίς)' (*Pol* iii 6, 1278B15–24).

[42] Among the practical consequences of this, Aristotle holds, is that all education should be public: 'since the whole city has one end, it is manifest that education should be one and the same for all, and that it should be public and not private . . . Neither must we suppose that any one of the citizens belongs to himself, for they all belong to the city, and are each of them a part of the city, and the care of each part is inseparable from the care of the whole' (*Pol* viii 1, 1337^{a}21–30, ROT modified)

[43] A most important passage in this regard is Aristotle's discussion of the method of classifying cities in analogy to the classification of animals (*Pol* iv 4, 1290^{b}21–39). An example of an analogy that seems to go off the rails in terms of biological doctrine is Aristotle's argument that if a city grows too big, it will change into another species, as with animals (*Pol* v 3, 1302^{b}34–3A2; *Pol* vii 4, 1326A35–B2). Some ramifications of this example are discussed by Pellegrin 1986, pp. 132 f. Kullmann (1998, pp. 321 f.) cites this as an example of the reason why we cannot straightforwardly accept the biological assertions found in the *Politics*, and uses it to militate against the biological consequences of 1256B6 f. For an important use of the analogy between animals and the city used to make a point about animals, and not about the city, see *Motu* 703^{a}29–B2.

[44] Ferguson 1985 is the best comprehensive overview of the teleological aspects of the *Politics*, although I do not agree with his conclusions, nor with his suggestion that the fact has generally gone

of *Politics* i 2. The question to ask is to what extent Aristotle is justified in treating the city (or any other political entity) as a natural substance, even a living thing, and thus as a thing with a natural end. In order to answer that, we need to examine his explicit methodological statements in this regard.

A Part–Whole Analysis of Social Organizations

The method of analyzing a whole into its parts, a procedure familiar to us from his treatment of organisms, is applied throughout Aristotle's political writings.[45] This methodology is brought to bear on an astounding number of different levels.

> Now, as the city is composed of heterogeneous things, and soul of reason and desire, and a household of man and woman, and property of master and slave, in the same way, a city is composed of all these and of other heterogeneous kinds, and so it is necessary that there not be a single excellence of all the citizens, just as there is not, within the chorus, of the leader and those who accompany. (*Pol* iii 4, 1277^{a}5–12)

Among the things here described as parts of the city, we have entities that in the context of another analysis are substantial wholes in their own right; for instance, a human, a man, a woman. But in the political analysis, these entities are treated as parts of the city. As is the case with all parts, they are posterior to the whole of which they are parts.

> Prior by nature is the city to the household, and each of the others. For the whole is necessarily prior to the part. For if the whole is removed there is neither hand nor foot, except equivocally, as if someone were talking about a statue of a hand, since a severed hand is the same kind of thing. But because everything is defined with respect to its function and power (πάντα δὲ τῷ ἔργῳ ὥρισται καὶ τῇ δυνάμει), so one should no longer say that these things exist as the same kinds of things, except equivocally. Now, that the city is by nature prior to each individual is clear. For if each is not self-sufficient in separation, then they are in the same condition as the other parts are in relation to the whole. And the person who is unable to form part of a community, or because of self-sufficiency does not need to, is no part of city, like a beast or a god. (*Pol* i 2, 1253A19–29)

The city is prior to its parts because it is a whole, and a whole that is not dependent on any of its particular parts. The particular parts—individual humans, households, associations, etc.—are, on the other hand, dependent on it. This is an application, legitimate or not, of the ontological principle of existential priority. In political

unnoticed. Ferguson offers his analysis in support of the notion that 'Aristotle might still believe in an overriding teleology' (p. 272).

[45] 'As in the other disciplines, it is necessary to dissolve the composite into simples, for these are the smallest parts of the whole (ὥσπερ γὰρ ἐν τοῖς ἄλλοις τὸ σύνθετον μέχρι τῶν ἀσυνθέτων ἀνάγκη διαιρεῖν (ταῦτα γὰρ ἐλάχιστα μόρια τοῦ παντός))' (*Pol* i 1, 1252^{a}18–20). 'Since the city is among the things that are composite, just like any other of the wholes which are composed out of many parts, it is clear that prior [to determining what a state is], he who is citizen must be investigated. For the city is something composed of several citizens' (*Pol* iii 1, 1274^{b}38–41).

contexts, this ontological principle translates into a justification for political subordination in the following way. Whoever is best suited to rule a city is the legitimate government of a city (whether an individual, as in a kingdom, or a few people, as in an aristocracy, or all citizens, as in a polity), and is furthermore the 'whole' of which the other members of the city are parts. The city can exist without individual citizens, but not, at least in its present form, without its legitimate governors. Aristotle has this in mind when he says, 'The whole is naturally superior to the part, and he who has this pre-eminence is in the relation of a whole to a part' (*Pol* iii 18, 1288^{a}26–8, ROT). This principle of subordination is operative not only with respect to the government of the city, but for any organization that can be described as a part–whole arrangement.

> Authority and subordination are conditions not only inevitable but also expedient; in some cases things are marked out from the moment of birth to rule or to be ruled. And there are many varieties both of rulers and of subjects. And the higher the type of the subjects, the loftier is the nature of the authority exercised over them, for example to control a human being is a higher thing than to tame a wild beast; for the higher the type of the parties to the performance of a function, the higher is the function (βέλτιον ἔργον), and when one party rules and another is ruled, there is a function performed between them (ὅπου δὲ τὸ μὲν ἄρχει τὸ δ' ἄρχεται, ἔστι τι τούτων ἔργον)—because in every composite thing, where a plurality of parts, whether continuous or discrete, is combined to make a single common whole, there is always found a ruling and a subject factor, and this characteristic of living things is present in them as an outcome of the whole of nature, since even in things that do not partake of life there is a ruling principle, as in the case of a musical scale. (*Pol* i 5, 1254^{a}21–33, Loeb)

We are to some extent familiar with this doctrine from its application to the explanation of organisms. For animals, plants, and even humans, we have seen that all the parts are functional with respect to the whole organism; the whole organism itself being identified with its highest capacities. Thus in organisms capable only of nutrition and reproduction, all of their parts serve this purpose: reproduction is, so to speak, the only function of a plant. For animals, which are capable of perception as well, all the parts exist either to promote survival and reproduction—life itself—and life itself exists for the sake of some kind of perception, especially pleasure. For humans, the parts exist to promote survival and reproduction and perception and thus life, but especially to serve the functioning of the intellect; in a sense, Aristotle says, we just are this highest part.[46] So in these functional complexes, as in the city, the most advanced part is the ruling or governing part, which takes on the character of the whole, while the other parts serve those functions. Aristotle explicitly makes this argument in what follows the just quoted passage. After asserting, somewhat cryptically, that this applies to the musical scale, he explains how this principle applies to organisms: 'A living creature consists in the first place of soul and body, and of these two, the one

[46] *NE* ix 4, 1166^{a}17; ix 8, 1169^{a}2; x 7, 1177^{b}34–8A8.

is by nature the ruler and the other the subject' (*Pol* i 5, 1254[a]34–6, ROT). Within a human being, we see that the same arrangement applies within the soul between the intellect and the appetite: 'for the soul rules the body with a despotic rule, whereas the intellect rules the appetites with a constitutional and royal rule' (1254B4–6, ROT). But we must carefully observe how the argument continues.

> It is clear that the rule of the soul over the body, and of the intelligent and the rational element over the passionate, is natural and expedient; whereas the equality of the two or the rule of the inferior is always hurtful. The same holds good of animals in relation to humans; for tame animals have a better nature than wild, and all tame animals are better off when they are ruled by humans; for then they are preserved. Again, the male is by nature superior, and the female inferior; and the one rules, and the other is ruled; this principle, of necessity, extends to all humankind. Where there is such a difference as that between soul and body, or between men and animals . . . the lower sort are by nature slaves, and it is better for them that they should be under the rule of a master. (*Pol* i 5, 1254[b]6–20, ROT with modifications)

In what follows, we will see how this analysis is used to justify diverse forms of domination between humans.

Natural Forms of Domination and their Justification

Aristotle's defense of slavery as natural is a famous case, perhaps the most famous, of teleological reasoning gone awry. Less famous, although garnering increasing attention, is Aristotle's justification of the patriarchal subordination of women and children to the adult male father.[47] A more subtle issue, but one with equally important ramifications, is Aristotle's argument for the subordination of the individual to the political community of which he is a part. These positions are at odds with other positions advanced by Aristotle outside the *Politics*. The apparent inconsistency can be broadly summarized as follows. In every case we have examined, Aristotle's teleological explanations are directed towards the benefit of the natural substances involved. Motions, parts, and behaviors have all been explained in terms of the benefits that accrue to the natural substance whose movements, parts, and behaviors are under consideration. This was shown, for example, to be the case with respect to celestial bodies and terrestrial organisms, as well as with respect to individual humans. The most elaborate of these was the argument about the good for humans, the so-called *ergon* inference. The positions expressed in the *Politics* i, and elsewhere, which appear to argue that some humans (women, children, and slaves) are naturally subordinate to other humans (the adult male patriarch), seem to conflict with this methodology of teleological explanation. If slaves exist for the sake of something else, then how can they be regarded as natural substances? If only a mitigated form of justice can be extended

[47] See, for example: Spelman 1983, pp. 17–30; Deslauriers 1998, pp. 155 f.; Swanson 1999.

to women and children because they are somehow a 'part' of the patriarch, then how can they be regarded as natural substances? Why should not the *ergon* inference apply equally to all members of the species? Should not the possibility of their use by other humans be regarded as incidental to their own end? To get clearer on this, consider Table 8.1, which compares intrinsic and incidental causes of a human being.

The problem with this table, unlike the others we have constructed, is that the two columns cannot possibly be consistent, on account of the difference in ends. A slave is not in a position to fulfill an end as a human if his or her end is determined to be service to another person. The problem can be presented as one of justification: How can one be justified in using another human as a means to one's own ends? And this is just how Aristotle treats it. He tries to justify slavery as a natural practice, as something grounded in the nature of things, just as the end of an element or plant or animal is grounded in its nature. The same goes for women and children. As we will see, Aristotle thinks that the justification of their domination is rooted in their nature. So let's examine why Aristotle thinks that subordination can be justified by nature.

The logic of the argument is an extension of the method of analysis that is routinely applied by Aristotle to part–whole relationships, most readily in the context of organisms. The difference here is that the model is applied not to an organic whole, but to relationships between organisms: between humans and animals, men and women, masters and slaves, and, eventually, between those that rule and those that are ruled. We can discern the analogies in Table 8.2, based on the application of the method of analysis to all these organisms and organizations.

Table 8.1 Intrinsic and incidental causes of an animal (human)

Causes	Intrinsic causes	Incidental causes
Matter	flesh, bones, hair	pale skin, black hair
Mover, source of change	father; self	a Scythian, a gambler
Form	soul; rational animal; terrestrial biped	blind, amputee, five-feet tall
End	*eudaimonia*, excellent activity; autonomy; contemplation	service to another man

Table 8.2 Ruled rulers

Organization	Ruler	Rules
organism	soul	body
human	intellect	appetite
environment	human	animal
marriage	man	woman
family	father	child
household	master	slave
city	ruler	subject

It seems to me that the soundness of this argument depends on the legitimacy of extending the method of analysis of parts and wholes beyond organisms to relationships between organisms. For even if we can conceive of the relationships between animals, women, men, slaves, children, parents, citizens, governors, and so forth, in terms of 'part–whole' relationships, do such relationships manifest the same relations between part and whole that obtain in actual organic wholes?[48] In the case of slavery, those who disagree with Aristotle's justification of the subordination of one person to another find it difficult to conceive of the quasi-organic whole of which the slave and master are parts. On the other hand, it is commonplace to conceive of the household as a kind of organized whole in which there is a natural authority of the parents (particularly the father) over the children. Organistic metaphors, of course, pervade our political language, what with the body politic, heads of state, and so forth. But it is unclear whether or not the persistence of these metaphors signals a conception of the state as an organic whole, whether they are merely worn-out metaphors, or whether they are metaphors that have become so deeply integrated into a conceptual scheme that they are no longer recognizable even as metaphors.

At any rate, our purpose here is not to assess the arguments for patriarchy, slavery, and other forms of 'natural authority', but to see how they relate to Aristotle's general methodology of teleological explanation. We quoted Balme and some others above who hold that these arguments outright contradict other tenets of Aristotle's teleology. But there are many features of the arguments that do fit with the theory and practice of explanation as we have seen it deployed in physical and biological contexts, given the caveat that there seems to be some stretching, perhaps beyond the breaking point, of the logic of part and whole.

A crucially important feature of Aristotle's use of teleological explanations is that they be directed towards the benefit of the substance that is being explained (and not of some other substance, or of a generic good). This requirement is attended to in Aristotle's justifications of slavery and patriarchy. For Aristotle holds that slavery, for example, benefits the slave, since the slave is part of a complex, the whole of which is the master: 'it is necessary for the ruler to rule as rulers rule in nature, and also [for the slave] to submit, and bad rule is disadvantageous for both. For advantage is the same for the part and the whole, as in body and soul, and the slave is some part of the master, like something living separated from his body but still a part' (*Pol* i 6, 1255^{b}7–12). Furthermore, the same logic applies throughout the domestic sphere: patriarchy benefits not only the slave, but also the wife and children. Aristotle makes this case most directly in his discussion of justice in Book v of the *Nicomachean Ethics*. An issue there is whether justice exists in the domestic sphere. Although there are differences between the kind of

[48] As Kullmann points out, 'according to Aristotelian doctrine, any individual or group of people, i.e. any unit below the level of the species of "man" [=human] cannot be adequately conceived of by theoretical science' (1991, p. 109).

justice accorded to the slave, and that to the wife or children, there is a fundamental similarity. Since slave, child, and wife are all in a way 'parts' of the patriarch, and since no one can treat oneself unjustly, there is only a qualified ('domestic') kind of justice that applies in the household.

> What is just for a master and what is just for a father are not the same as these, but are similar, since there is no such thing as injustice towards what is yours as such, and a man's chattel slave and a man's child (until he reaches maturity and is on his own) are like a part of himself (ὥσπερ μέρος αὐτοῦ), and nobody decides to harm himself; that is why there is no such thing as injustice towards oneself. (*NE* v 10, 1134^{b}8–13)

> Metaphorically and in virtue of a certain resemblance there is justice, not indeed between a man and himself, but between certain parts of him (τῶν αὐτοῦ τισίν); yet not every kind of justice, but that of master and servant or that of husband and wife. For these are the ratios in which the part of the soul (μέρος τῆς ψυχῆς) that has reason stands to the irrational part; and it is with a view to these parts that people also think a man can be unjust to himself, viz. because these parts are liable to suffer something contrary to their desires; there is therefore thought to be a mutual justice between them as between ruler and ruled. (*NE* v 15, 1138^{b}5–13)

So this much, at least, of the logic of teleological explanation is preserved in Aristotle's discussions of patriarchy and slavery: there is an analysis of part and whole, the superior element being equated with the whole, to which the parts are subservient, and the parts function for the good of the whole, which includes those parts.

There are undoubtedly several ways to criticize Aristotle's justifications for these unsavory institutions. With respect to the issue of consistency with Aristotle's own considerations about the nature, scope, and limitations of teleological explanation, we have seen that the same outward or superficial structure is maintained, although that structure is seriously strained by stretching the logic of the relationships between parts in an organic whole to relationships between whole organisms. Aristotle himself does not seem to be unaware that this kind of analysis is ontologically problematic. Consider his criticisms of Plato's communalist scheme from *Republic*.

> Again, the means to the end (ἔτι δὲ πρός τὸ τέλος) that he [Plato] says it is necessary for the city to have, is, literally, impossible, and yet how it should be interpreted is never defined. I'm talking about the unity that he says must exist for the city to be the best that it possibly can be, for this is an hypothesis Socrates supposes. And yet it is obvious that as it comes to be and develops more unity it will no longer be a city. For plurality is the nature of the city, and what will come to be more unified out of a city is a family, and out of a family a human. For the family would appear to be more a unity than a city, and the individual more so than the family. So that, even if to do this would be possible, one ought not to make it so. For the city will be destroyed. (*Pol* ii 2, 1261A12–22)

> Hence it is obvious that the city is in no way naturally one, as some claim, and that which is said to be the greatest good in the cities destroys the city. Surely the good of each thing preserves each thing (καίτοι τό γε ἑκάστου ἀγαθὸν σῴζει ἕκαστον). (*Pol* ii 2, 1261^{b}6–9; cf. ii 5, 1263^{b}30–6)

Aristotle's criticism, which here seems quite reasonable, recognizes that excessive theoretical unification of a political community destroys political analysis by making the community into a family, and eventually into an individual, where quite different ends are operative.[49] This criticism comes at the beginning of *Politics* ii, but should be read in connection with the claim at the outset of *Politics* i, that power differences in society are not merely a function of differences of quantity (how many people are ruled), but are differences in kind: the father, husband, master, politician, and so forth rule in different ways. These differences in government cannot be assimilated, and so neither should the conception of the individual, household, and city be assimilated. For the kind of constitution that properly governs an organism (a natural substance in the full sense), that determines how its parts should be related, does not apply, at least not without qualification, to a household, a kingdom, or a city. And yet Aristotle, who clearly recognizes this, requires the analogy as an expedient in his justification for the power structures that seem natural to him, such as patriarchy and slavery. Without stretching and straining the analogy, however, the position cannot be defended by means of teleological explanations that conform to the standards or limits developed for these in the logical, physical, and biological works.

It does not follow from the fact that Aristotle's extension of teleology to the social and political sphere is unsuccessful (or worse—positively evil) that his entire methodology of teleological explanation is a failure. It is not even necessary to conclude that a better teleological analysis of social organizations cannot be performed. It just means that we have to be very careful when extending the analysis of parts and wholes, and the teleological explanation of parts and wholes, to more complex entities. I think that this lesson should also be kept in mind as we, in the next chapter, consider the extent to which we should read Aristotle as offering a teleological explanation of the universe as a whole.

[49] For further analysis of the argument see Cooper (1990, p. 233 n. 15) and Nussbaum (1990, p. 164).

9

Teleology and the Cosmos

In the last four chapters, we have examined the teleological explanations offered by Aristotle for the activities of specific natural substances: stars, elements, plants, animals, and humans. In this final chapter, we will examine some difficult and influential texts in which Aristotle discusses the nature of substance and motion in general, in what we might call an ontological or cosmological mode. The task is made difficult by the daunting complexity of the texts and their arguments. Nonetheless, there is a clear motive for undertaking it, in that we want to determine if Aristotle holds that there is a teleological explanation that goes beyond specific natural kinds, perhaps extending to the universe as a whole.

From one perspective, the answer is obvious. Aristotle holds that the universe is composed entirely of natural substances, and natural substances, as we have seen, are all subjected to teleological explanation by Aristotle. Therefore, one might conclude that, for Aristotle, the universe—i.e. the totality of substances—is teleologically explicable. But we still want to know whether there is, above and beyond the teleological explanation of these individual substances, a teleological explanation that extends to the universe as a whole. Is there a separate good towards which everything in the universe is ordered, arranged, or directed? Certainly the view has had both defenders and detractors of equal eminence.

The question is directly addressed in *Metaphysics* xii (Λ) 10. Unfortunately, it is not possible to arrive at the answer simply by reading that chapter. For one thing, it comes at the end of a long line of highly compressed argumentation, chapters 1–9 of Λ itself. For another, we need to expand on its arguments with reference to related discussions, especially *Physics* viii. Thus in the present chapter we begin with *Physics* viii, summarizing its conclusions (in section 1). We then proceed to examine Λ 1–9 (in section 2). In Λ 7, Aristotle specifies the mode of divine causality as an unmoved mover: 'that for the sake of which is found among the unmovables . . . it produces motion by being loved, and it moves the other moving things' (1072B1–4, ROT). He does not elaborate in the chapter on how this kind of causality is explanatory in a scientific sense. Since we are not aided by the text of Λ itself, we have to refer to discussions elsewhere in the corpus where the relevant mode of causality is explicitly discussed, especially *On the Soul* ii 9–10 and *On Animal Motion* 6. Upon having examined these texts, which together yield some general conclusions regarding the role that the cause for the sake of which plays in

explanations, we will have made the necessary preparations to examine the aporia of Λ 10 itself (in section 5). Finally, we conclude with some general observations about how Aristotle's account of the way in which the good exists in the universe should affect the way that we relate to other natural entities that share our cosmos.

9.1 THE PRIMARY CAUSE OF NATURAL MOTION

Natural motion involves substances that have an internal principle of motion and rest. Such substances are both moved and cause other things to move. Substances that either cannot be made to move, or do not cause other things to move, are not natural, and so the investigation of them belongs to some discipline other than physics. As for the substances investigated by physics, they are all moved movers. Every kind of substance that we have hitherto examined is of this kind. Thus the stars are caused to move, but also cause other things to move as well. The same goes for terrestrial elements and organisms, including plants and animals. Aristotle does not merely assert this criterion of natural substance (that natural substances are both moved and movers), he also proceeds through each kind of natural substance and shows how this is so.

Aristotle points out that this fact about natural change has led some to suppose that nothing that causes motion or change could itself be immobile or immutable (*Phys* iii 1, 201A25–6). Aristotle rejects this position, and argues not only that it is possible, but also that it is necessary, for something to cause motion, but not through its own motion. In *Physics* vii, Aristotle raises the cosmological questions. Could there ever be a beginning of all motion in the cosmos, and hence a time before which there was no motion? Conversely, could there ever be an absolute end to motion in the cosmos, and hence a time after which there would be no motion? Aristotle recommends investigating the issue in order 'to see the truth not only about the study of nature, but also about the investigation of the first principle' (*Phys* viii 1, 251^{a}5–8). He begins the investigation by restating his definition of change in the most general terms: 'change is a state of completion of the changeable insofar as it is changeable' (*Phys* viii 1, 251^{a}9–10).

Aristotle holds that 'change is eternal and cannot have existed at one time and not at another' (252^{a}4). His reasons for advocating that position are instructive and pertinent to an investigation of teleology for a number of reasons. First, his criticism of the alternatives on this point is a special and applied case of the dialectical criticism of his predecessors that we examined in Chapter 4. We saw there how important those criticisms were for the development of Aristotle's own positive views about the nature of teleological explanation.

Second, the examination will be valuable for us because the eternality of change and motion generates the following aporia about teleology. Aristotle's most simple answer to the question about the eternality of motion is that motion could never absolutely begin or end because that would imply an unlimited state of disorder

either before or after motion itself began. This would be a state during which there was no ordered motion, e.g. of the elements towards their proper places in the cosmos. But there is no sufficient reason for such a state of disorder, that is, no reason why disorder would be unlimited, and order limited, to the time after or between an infinite period of disorder. But this way of putting things brings us back to the aporia of Theophrastus, who called for an inquiry capable of producing a 'delimitation of how far the ordered extends, and why more of it is impossible or the change would be for the worse' (*Metaphysics* 7^{b}7–8, trans. Van Raalte). Theophrastus had pointed out a number of cases in the cosmos (mostly in the sublunary sphere, but also with respect to the rotary motions in the celestial as well) where it is not obvious that nature exists for an end. We have now seen, in our studies of elemental and animal substances and motions, that Aristotle agrees with Theophrastus' position that not absolutely everything in the cosmos is for the sake of an end. And so Theophrastus' question is a valid one, about how far order, along with what we might call 'endedness' in the cosmos, does extend.

In order to see Aristotle's answer to this, we will have to proceed from his critique of those who believe in a beginning of motion in *Physics* viii.[1] Aristotle considers his predecessors' treatment of the origin or eternality of motion to be inadequate. Anaxagoras and Empedocles posit a single or dual principle to account for it (the former, intelligence (νοῦς); the latter, love and strife). Anaxagoras, according to Aristotle, says that intelligence started, after an infinite amount of time, to move, separate out, and order the world. Aristotle thinks that is impossible for the following reason: 'That which is by nature and natural is never disordered (ἄτακτον). For nature is everywhere a cause of order (ἡ γὰρ φύσις αἰτία πᾶσιν τάξεως). But the relationship between the unlimited and the limited is not a ratio, and order always involves a ratio' (*Phys* viii 1, 252^{a}11–14). Aristotle holds that there could not have been an infinite amount of time where everything was at rest, mixed together, disordered, or non–existent, before a cause like intelligence set everything in motion or brought it into being. That is because there is no reason why intelligence should have started motion at the moment it did, and not the moment before. And the argument goes down the road to infinity: the moment before motion started was of no particular importance, and so on. At least, Anaxagoras does not explain why at a certain time (the beginning of our cosmos or world order) intelligence would choose to order things, but before that time nature was in a state of disorder for an infinite amount of time. On Aristotle's

[1] The exact connection between *Physics* viii and *Metaphysics* Λ is a vexed issue. Perhaps the safest conclusion is that reached by Manuwald (1989), that the unmoved mover of *Physics* viii is not identical to that of *Metaphysics* Λ, but that there is no contradiction between the works, the differences being due to differences of perspective and procedure. The issues raised by Theophrastus are often treated as if they are exclusively directed at *Metaphysics* Λ, by Devereux, for example: 'all of the Aristotelian doctrines discussed come from a single book of the *Metaphysics*: Book Lambda' (1987, p. 168). It is true that Theophrastus' work shows no awareness of the middle books of the *Metaphysics*, but I think Devereux's statement is too strong, because I cannot completely separate the discussion of *Physics* viii from that of *Metaphysics* Λ.

view nature cannot be disordered at any time, since nature is a principle of order (τάξις) and regularity, and it must be at all times rationally explicable.

Aristotle would reject both creationism and the 'big bang' hypothesis, as pieces of cosmological reasoning, for the same reason: neither can be considered an explanation of a natural phenomenon. Natural phenomena happen for a reason in an ordered cosmos (to speak redundantly), but there can be no reason why existence should start, or start expanding, at any particular time after an infinite period of non-existence or rest. Aristotle treats Anaxagoras' assertion that it does as a special case of Anaxagoras' general failure, from the standpoint of teleological explanation, actually to explain anything with reference to intelligence (νοῦς), as opposed to invoking intelligence when an actual explanation is not forthcoming.

Empedocles' view is represented as an improvement, since there is a kind of order to the alternation between motion and rest (here superficially identified with strife and love). But even here Aristotle thinks that no explanation (οὐκ αἴτια, 252A25) has been provided—Empedocles fails to give any cause for the alternating predominance of love or strife. And that nature should alternate between organization and chaos is not intuitive since such a state of affairs, at least in Aristotle's view, has no counterpart in nature.

Democritus' account comes closest to explaining why things should be continually changing, since he describes natural things in terms of necessity, and so indicates that natural things happen now, as always, in a certain way. Nonetheless, Aristotle thinks that simply referring to necessity leaves one without an overall explanation of why they should be that way in the first place ($252^{a}32$–B5).

The result of this dialectical engagement with the predecessors is that there needs to be both (1) an explanation for the primordial cause of motion[2] (as Anaxagoras and Empedocles attempt to offer), and (2) a recognition that motion is eternal (as Democritus offers).

Some of Aristotle's predecessors held that motion is not eternal, since it had a beginning in time. A reason why some might think it possible that all motion and change had a beginning in time would be an inference from the apparent fact that animals can initiate motion. Animals appear to be able to produce a beginning of motion from within themselves, unlike inanimate objects that are always set in motion by something external (*Phys* viii 2, $252^{b}18$–28). If animals can initiate their motions, then it is possible for motion to be initiated from a state of rest, and so it is possible that primordial motion was started in the universe after a period of rest. Aristotle responds to this suggestion in a surprising and significant way: he denies that animals are capable of completely initiating their own movement, or

[2] It is worth emphasizing that what Aristotle demands an explanation of is precisely this: the eternality of motion and change—as opposed to the existence of change. Aristotle is not interested in proving the mere existence of change and motion. This he makes a fundamental assumption or hypothesis of the science of nature (i.e. physics), one that he holds to be readily verifiable by observation. People who want to refute the existence of motion and change just are not in the business of talking about nature (*Phys* i 2, $184^{b}25$–$5^{a}20$; ii 1, $193^{a}1$–9; viii 3, $253^{a}32$–$^{b}6$).

of completely bringing themselves to rest (*Phys* viii 2, 253A11–19; viii 6, 259^{b}6–16). The animal does not initiate many of its motions (growth, digestion, respiration, circulation, wasting, etc.), and even in the case of locomotion, the animal does not control all of the parts and processes that contribute to the motion.[3]

Aristotle thus argues that even the paradigm case of self-motion—animals moving locally—is not an example of the absolute initiation of motion. Therefore, there is no case of absolutely original motion in nature. If animals cannot totally originate motion or change, then, *a fortiori*, inanimate objects cannot initiate change. Thus nothing in nature appears to be able to. It follows that there is more reason to think that motion and change in general did not start up at some point after absolute rest. This view has already been encouraged by the exposure of the failure of his predecessors to provide an explanatory cause for the origin of motion. This is enough to convince Aristotle, although he examines several other arguments: concluding, 'there never was a time when there was not motion and never will be a time when there will not be motion' (252^{b}5–6).[4]

The upshot of this is that all natural things that are in motion are moved by something else. But if this is the case then there will have to be either something that imparts motion itself but not through its own motion, or else there will have to be an infinite series of movers that impart motion by virtue of their being moved by something else, since only an infinite number would suffice to account for the eternality of motion (*Phys* viii 5, 256^{a}26–9). It is on the basis of the requirement that this infinite regression be blocked that Aristotle concludes that 'there must necessarily be something eternal, whether one or many, that first imparts motion, and this first mover must be unmoved' (*Phys* viii 6, 258B10–12).

Aristotle's proof for the existence of an unmoved mover, accordingly, is an infinite regression argument. He tries to prove absurd the suggestion that an infinite chain of movers could account for the two facts, that motion is eternal, and that everything that is moved must be moved by something.[5] The kernel of this infinite regression argument is *Physics* vii 1 (α), 242^{a}49–^{b}53, which is then built upon in *Physics* viii.[6] An infinite series of movers is shown to be equivalent to single infinite motion, which is impossible. The impossibility and absurdity of this is taken to constitute a proof of a single unmoved mover (242^{b}72–243^{a}31).[7]

[3] Susan Suavé Meyer (1987) has argued that all natural motions are determinate in this way, and that being an unmoved mover indicates the ability to cause a determinate outcome (e.g. health), not a set of actions with no antecedent moving causes. This presents the interesting possibility of a 'compatibilist' reading of Aristotle.

[4] I am focusing, as does Aristotle, on the argument for there being no beginning of motion in time, and not on the argument for there being no *end* of motion. Aristotle to some extent runs the arguments together, offering the following as a forced choice: 'these things must either have a beginning before which they had no being, or they must be eternal' (251^{a}16). If there was no beginning of motion, then the cause of motion must extend forever into the past, but if so, then it is eternal: if no beginning, then no end. Is it possible that there has been motion infinitely in the past, but it will come to an end in the future? Such issues, which go beyond the scope of the present discussion, are discussed in *Phys* viii 6.

[5] See also: Gill 1991/1994, pp. 243, 245; Oates 1963, p. 59.

[6] Wardy 1990, pp. 89, 99 f., and 331–2.

[7] See also Ross, *Aristotle Physics*, p. 671.

An indication that the avoidance of infinite regression is Aristotle's real concern is the final summary of the argument at the end of *Physics* viii, where he insists on the necessity of the series of motions coming to an end: 'so we have a series that must stop and a point at which motion is initiated by something unmoved' (*Phys* viii 10, 267^{b}1–2). Aristotle uses the prohibition on infinite series to establish the following premises, all central to his argument: (1) that there must be a first mover or the chain of change will be unlimited (*Phys* vii 1, ἢ τὸ ἄπειρον, 242^{b}71); (2) that motion cannot begin absolutely or the time before which there is motion will go to infinity (*Phys* viii 1, πρὸς τὸ ἄπειρον, 252^{a}13); (3) that not every mover can be moved or the number of movers will be infinite (*Phys* viii 5, ἢ εἰς ἄπειρον, 256A28); and (4) that there should be only one unmoved mover or there will have to be an unlimited number (*Phys* viii 6, ἢ ἄπειρα, 259A9). Consider further this last point:

> Since motion is eternal, the first mover will be eternal as well, if there is one. But if there are many, there will be many eternal movers. But one ought to think there is one, not many, and a limited number, not an unlimited number. For one ought rather to assume that things are limited in number. For with respect to natural things there should be delimitation and the better (δεῖ τὸ πεπερασμένον καὶ τὸ βέλτιον), if possible, instead of the reverse. And here one is sufficient, a primary thing among unmoved things, which is eternal, and will be a principle of motion for the others. (*Phys* viii 6, 259^{a}6–13)

Even an infinite number of unmoved movers (one for each case of moved motion) would succeed in blocking the most pressing infinite regresses regarding the ultimate cause of motion. For then even though the causes of motion would be infinite, there would not be a vicious infinite regression—i.e. an explanatory regress, since the specified causes would be explanatory. But Aristotle does not consider an infinite number a good solution, on other grounds. He places methodological value on limits, and so will choose limits over an infinite series, all other things being equal. So he states his preference for one rather than infinite unmoved movers. This is not Aristotle's final word on the subject, but it is as much coverage of the issue as can be had from a strictly physical inquiry. The further determination of the exact number of unmoved movers is the subject of astronomy (i.e. the kind of inquiry conducted at Λ 8).

Thus far, we have been talking about the first mover 'not in the sense of the [cause] for the sake of which, but in the sense of whence the source of motion' (μὴ ὡς τὸ οὗ ἕνεκεν, ἀλλ᾽ ὅθεν ἡ ἀρχὴ τῆς κινήσεως, *Phys* vii 2, 243^{a}32–3). The reason for that is that our topic was natural motion, that is, motion in which the thing that causes motion does so through a motion of its own. This kind of motion applies to all natural bodies, including elements, compounds, plants, animals, and so forth. But our analysis of how this motion is possible has led us to posit a mover (i.e., a thing which causes motion in others) that is not itself moved. Strictly speaking, that takes us outside the science of nature, since a thing that can cause change without being changed, that can affect others without being affected, can

no longer be considered natural (οὐκέτι φυσικῆς, *Phys* ii 7 198ª28, 198A35–B4). So the *Physics* ends having proved the existence of, but not extensively elaborating on, the causality of a primary unmoved mover. The elaboration of the mode of causality of unmoved movers will come in texts like *On the Soul*, where Aristotle discusses how self-motion happens in animals, and in *Metaphysics* Λ, where Aristotle discusses how self-motion happens in the heavens and the cosmos as a whole.

9.2 THE MOST GENERAL TELEOLOGICAL EXPLANATION OF MOTION

In the twelfth book (Λ) of *Metaphysics*, Aristotle makes it clear that the primary unmoved mover is to be conceived of teleologically.[8] In order to see how he arrives at that position, there is a need to represent briefly the contents of the book. Aristotle begins by presenting some ontological theses about the nature of substances and their modifications, which he treats as settled facts (chs. 1–5). He then presents some physical theses about the ultimate causes of the motions of these substances (ch. 6). Here, he represents his case for the eternality of natural motion, and argues that this necessitates a primary unmoved mover. Next he describes the kind of causality, number, and mode of activity of unmoved movers (chs. 7–9). First he specifies that the primary unmoved mover causes motion by being a cause for the sake of which, like the object of desire (ch. 7). Then he tries to calculate the number of unmoved movers necessary to account for the motions of the primary substances whose motions are perfect, that is, all the celestial bodies including the sun and moon (ch. 8). He then discusses further the mode of causality of the unmoved mover (ch. 9). Finally, he announces an aporia about the extent of the good in the universe, and engages some of his predecessors on the issue of the universal good (ch. 10).

Thus book Λ as we have received it, by starting with conclusions about substances and ending with an aporia and survey of the predecessors, is structured in the reverse of the conventional order of an Aristotelian treatise. One expects

[8] Does he also think that the unmoved mover has another mode of causality? Yes, of course. The fact that Aristotle says that the unmoved mover moves as a 'for the sake of which' does not exclude him also considering it a 'whence motion originates'. In fact, that conclusion stems from reading the obvious into *Phys* viii. Thus the position of the Greek, Arabic, and Latin commentators on this, going back to Ammonius, should not, to that extent, be considered controversial. Aristotle frequently talks about combinations of causes, as we have seen several times now. It is reasonable to allow that the unmoved mover be considered 'both an efficient and a final cause'. See, on this point: Kahn 1985, p. 188; Judson 1994, pp. 164–7; Matthen 2001, p. 192. Ross shows his wisdom in a remark on this point: 'There has been much controversy over the question whether God is for Aristotle only the final cause, or the efficient cause, as well, of change. There can be no doubt about the answer. "Efficient cause" is simply the translation of ἀρχὴ τῆς κινήσεως, and God is certainly this. The truth is that the opposition of οὗ ἕνεκα to ἀρχὴ κινήσεως is not a well-chosen one. The οὗ ἕνεκα is one kind of ἀρχὴ κινήσεως' (*Aristotle's Metaphysics*, vol 1, p. cxxxiv).

Aristotle to present an aporia, survey the predecessors, refute their positions, and recommend his own solution. Issues of direct significance to the investigation of Aristotle's teleology begin at the end of Λ 5, where Aristotle, operating at a maximum level of generality, considers the extent to which all things may be said to have the same cause.

> It is clear that each of the causes is said in many ways, and when they are distinguished they are not the same but different, except in a certain way. They are the same or analogous in the following way: [**a**] matter, form, privation, and the mover and [**b**] in a certain way the cause of substance is cause of everything, because if it is removed, everything is destroyed. And again, [**c**] that which is the first in a state of completion (τὸ πρῶτον ἐντελέχια). (*Meta* xii 5, 1071ª31–6, cf. xiv 2, 1089B4–5)

We have already seen how, in the context of the soul, Aristotle combines the causes of form, mover, and end. But the combination of causes in [**a**] is interesting because it is very different. Here Aristotle groups together matter, form (and privation), and mover. What about the end? What role does it play in this analogical identification of the causes? In [**b**] Aristotle says that the causes of substance are the causes of everything. Thus there is a sort of identity of causes in that the causes of all substances are the same—the four. Or is it three? The fourth appears, perhaps, set apart, in [**c**]: The cause for the sake of which, or the end (τέλος), here appears in the phrase τὸ πρῶτον ἐντελέχεια.

The analogical identification of the causes is due to the fact that, speaking with maximum generality, the causes of the universe are the same. The universe has its own matter, form, and mover. The matter of the universe is the elements; its form is a sphere that is segregated according to the natural places of the elements; and its mover is the prime unmoved mover. When taken as a whole, the universe has its matter, form, and mover.[9] If you take away these causes, then nothing remains.

But what about the end, or that for the sake of which? Is there a single 'end' or 'for the sake of which' of the whole universe? Let us be clearer about what we are asking. If there were some end of the whole universe, this would be a good, since all ends are goods, whether really or apparently. So what we are asking is: is there a good of the whole universe, independent of the various goods of all the natural kinds? As far as I can tell, Aristotle never says that there is.

The primary unmoved mover certainly is an end and that for the sake of which (as an aim, not as a beneficiary). But the unmoved mover is not the universe itself, but rather a substance at the limiting perimeter or boundary of the physical universe and outside of nature. The universe itself does not have an end[10] in the way it has matter or form. Things have ends when they have potential for moving, growing, or changing, if nothing blocks them. But the universe as a whole does not move locally, grow, or change into something else. It doesn't have potentials,

[9] For a discussion of the notion of the matter and form of the universe, see Matthen and Hankinson 1993.

[10] Against Woodfield 1976, p. 122.

powers, or capacities to do any of these things because it is always active and in a state of completion. This is what is meant by the phrase 'first in a state of completion' in [c]. The universe thus does not have 'a proper motion'[11] at the end of which lies its natural place or an object of its wish. This is because it is always already 'in a state of completion' and has nowhere to go, and nothing else to become. The substances that are contained within it move and grow and change for the sake of something, in the final analysis resembling or imitating its eternality and perfection, and they do this by being like it in whatever way they can, whether through rotary motion, cyclical transmutation, reproduction, or intellectual activity. Still, the motions internal to the universe are all for the sake of those natural bodies moved and the good of their kinds. The universe as a whole, on the other hand, is neither in motion like an elemental body, nor alive like an animal;[12] further, it doesn't need anything, it cannot be benefited, and it has no further end beyond itself for the sake of which it would move itself or be moved by something else.

In fact, the context of the passage just quoted about the analogical identity of all the causes includes an argument about how we must be careful that when we provide an account of causes we avoid generality and universality, except where appropriate.

> Again, we must observe that some causes can be given universally, but others cannot. The primary principles of all things are the primary active individual, the form, and another thing which is potential. For it is the particular man that is the principle of particulars, human in general is the principle of human in general, but there is no such person as 'Human', whereas Peleus is the principle of Achilles and your father of you, and this particular B of this particular BA, but B in general is the principle of BA regarded absolutely. Even if the principles of substances are universal, the causes and elements of different things are different, as has been said: [the causes and elements] of things not of the same kind (of colors, sounds, substances, quantities) [are not the same], except analogically. And the causes of things that are the same in form are different, not in form, but because the causes of individuals are different: your matter and form and moving cause are different than mine, though the universal formula is the same. (*Meta* xii 5, 1071^{a}17–29)

Aristotle never tires of emphasizing that our account of causes should be as specific as possible. I contend that there simply is no account of causes so general and universal that it indicates an overall good of the entire universe. There is no 'purpose' of all of existence; purpose, if it exists, is in the individual things that exist. Goods are *in* the universe or, more accurately, *in* the substances in the universe. There is neither sense nor profit in talking of the overall good of the universe.

An examination of Λ 6–9, and later of 10, will make this clearer. It is illuminating to compare Aristotle's procedures in *Physics* viii, which we have already discussed, and Λ. In *Physics* viii 1, recall, Aristotle's proceeds from his definition of motion

[11] Against Matthen: 'I contend that there is motion proper to the cosmos too' (2001, p. 191).
[12] *Anima* 411A7–24. Lloyd 1966, p. 258; Van Raalte 1988, pp. 198 f.

(in terms of activity), to the prima-facie case for the eternality of motion, and then criticizes his predecessors (naming Anaxagoras, Empedocles, and Democritus) for positing principles of eternal motion, but failing to provide an explanation of these principles. In *Metaphysics* xii 6, Aristotle represents the case for the eternality of motion, and then concludes from this that 'there must be a principle whose substance is activity' (δεῖ ἄρα εἶναι ἀρχὴν τοιαύτην ἧς ἡ οὐσία ἐνέργεια, 1071^{b}19–20). He then criticizes his predecessors for inadequately explaining this principle, naming Anaxagoras, Empedocles, Leucippus, and Plato. The arguments against Anaxagoras and Empedocles are abbreviations of the ones we examined above, from *Physics* viii 1. The arguments in *Physics* viii 1 against Democritus are here leveled against Leucippus and Plato. Both are said to assert that there is eternal movement, but they say neither why, nor for what, nor the cause (ἀλλὰ διὰ τί καὶ τίνα οὐ λέγουσιν, οὐδὲ, ὡδὶ, οὐδὲ τὴν αἰτίαν, 1071^{b}33–4).

So far there is a close correspondence between the arguments in both books. The next step in both cases is the argument for the primary unmoved mover. In *Physics* viii, this takes more than ten pages, but in *Metaphysics* xii less than ten lines (1072^{a}9–18). What we get in the remaining chapters, beginning with 7, is an elaboration of the nature of the unmoved mover and that which it moves. And it is here that the teleological aspect of the primary unmoved mover becomes clear.

> There is something that is always moved with unceasing motion, which is in a circle, and this is evident not only in argument but also in fact, so that the first heaven must be eternal. There is also something that moves it. But since there is a moved, and a mover, and an intermediate, the last is something that unmoved causes motion, being eternal, substantial, and active. And the object of desire and thought moves in this way: it causes motion not being moved. (*Meta* xii 7, 1072^{a}21–7)

Objects of desire and thought can cause other things to move, while not being moved. They are unmoved movers, meaning they cause motion, but not by being moved or changed themselves. (It does not necessarily mean that they are not moved at all, for some unmoved movers can be moved accidentally, but only that the way they cause motion is not through being moved.)[13] Aristotle frequently applies this cause of movement in explanations in psychology and biology. We are presently interested in this mode of causality as a general explanation for the continuity of all motion. The preceding passage has made it clear that we are to conceive of the causality of the unmoved mover of the cosmos teleologically. Now we can see why the teleological cause was separated out from the other three in 1071^{a}36 and called the 'first in a state of completion': as the primary or first mover, it is the first or primary thing in a state of completion (recall the definition of movement itself in these terms). And that this is a teleological notion, if it is not already obvious, is made clear in what follows, where Aristotle explains the way in

[13] Susan Sauvé Meyer rightly points out that the distinction between moved and unmoved movers is a distinction between the causes, not subjects, of motion (1987, p. 175).

which the unmoved mover exists as a cause 'for the sake of which': as an aim (τινός), not as a beneficiary (τινὶ). We have already examined this passage in Chapter 3, where we saw that it is crucial to distinguish the two senses of the cause for the sake of which. In Λ, Aristotle simply points out that there exists a beneficiary of the cause for the sake of which under discussion (ἔστι γὰρ τινὶ τὸ οὗ ἕνεκα, 1072B: E J, Bekker). What this means is that the things that imitate the unmoved mover(s), i.e. the stars, move for the sake of the unmoved mover(s) as an aim—in order to imitate eternal activity, but not for the sake of a different beneficiary. After all, the stars do not benefit the primary unmoved mover by imitating it: it needs nothing; it has nothing to gain by being imitated; it cannot even be flattered.

That the way in which the primary unmoved mover causes other things to move is teleological makes sense, not only because motion itself is conceived of teleologically by Aristotle, but also because the proof for the existence of the unmoved mover of the cosmos, as we saw in the last section, is an infinite regression argument, and we know that Aristotle invokes ends as limits in order to block infinite regression. In Chapter 3, we saw that this was the case in logical, ethical, and physical contexts. We also saw that Aristotle's preference for limits, and his abhorrence of infinity (i.e. the unlimited and indefinite) led him to assert that one should assume, all other things being equal, that there is one rather than an infinite number of unmoved movers.

But in another context (Λ 8) Aristotle modifies this latter statement to say that there is a limited plurality of heavenly unmoved movers, fifty-five or fifty-six.[14] It is up to astronomy to determine the exact number, by calculating the smallest—that is, most limited—number of unmoved movers that are necessary to move not only the first heavens, but the other eternal celestial bodies as well. Aristotle takes a stab at calculating how many there are, but does not claim certainty. What he is sure of is that these unmoved movers must cause to move (i.e. move locally, transitively) the things they do for the sake of something, and that that something must be the benefit of the stars themselves. Again, the ultimate justification of this is the avoidance of an infinite regression.

> The number of spheres is so many, so that both the substances and the immovable principles are so many is reasonably inferred. As for the necessity that this is so, it will be left for people stronger on this point to assert. But if there is no moving [in the heavens] that is not oriented towards the moving of a star, and if every nature and every unaffected substance that has accomplished the best for itself must be considered an end (καθ' αὑτὴν τοῦ ἀρίστου τετυχηκυῖαν τέλος εἶναι δεῖ νομίζειν), then there can be no other nature besides these—this is necessarily the number of substances. For if there were others they would cause motion by being an end of motion (κινοῖεν ἂν ὡς τέλος οὖσαι φορᾶς). But other movements besides

[14] Others have followed Jaeger in asserting that ch. 8 is a later insertion into the main body of Λ (1923/1934, pp. 342–67). For a perspective on the issue that utilizes the contents of Theophrastus' *Metaphysics*, see Devereux 1987, pp. 170–1.

those mentioned are impossible. That is reasonably inferred from the fact that they are moved. For if every mover naturally benefits that which is moved (πᾶν τὸ φέρον τοῦ φερομένου χάριν πέφυκε), and moving is carried out for this, then no movement could be for the sake of any other movement (οὐδεμία φορὰ αὐτῆς ἄν ἕνεκα εἴη οὐδ' ἄλλης φορᾶς) but for the sake of the stars (τῶν ἄστρων ἕνεκα). If a movement will be for the sake of a movement, then this too will necessarily exist for the benefit of something else (εἰ γὰρ ἔσται φορὰ φορᾶς ἕνεκα, καὶ ἐκείνην ἑτέρου δεήσει χάριν εἶναι), but this cannot go on to infinity, and so the end of every movement will be one of the divine bodies that is being carried across the heaven (τέλος ἔσται πάσης φορᾶς τῶν φερομένων τι θείων σωμάτων κατὰ τὸν οὐρανόν). (*Meta* xii 8, 1074[a]14–31)

Although everything that is moved must be moved by something, still there must be a limit to the chain of movers. That there is something that moves other things but not through its own motion is an hypothesis advanced to deal with this requirement. One way to conceive of this limit is as an 'end': the specification of that for the sake of which it is moved blocks the infinite regression by providing an end for the motion. There is then no vicious infinite regression of the explanation for motion, even though it is eternal, since a teleological cause has been provided as an end.

The cause or end which serves this role is teleological in three senses: (1) by being 'a state of completion' (ἐντελέχεια), with respect to motion and change in general; and (2) by being an end which serves as a limit to all motion and change, blocking the infinite regression which would render motion and change impossible or, at any rate, vain and ineffectual; and (3) by being an aim of other motions, an object of emulation, like the object of wish or desire.

9.3 NO 'TELEOLOGICAL' PROOF FOR THE EXISTENCE OF GOD IN ARISTOTLE

Because in the argument we have just been discussing, the aim of natural motions is eternal and ever active, it is reasonable to call the object god. In this limited and unusual sense, then, it might be right to say that Aristotle advanced a kind of 'teleological' proof for the existence of god, but it is far more accurate to refer to the proof as a proof from the necessity of a first mover.[15] Aristotle does not advance a 'teleological' proof for god's existence in the more traditional sense of natural theology, for example along the lines of that discussed by Averroes in *The Exposition of the Methods of Proof* or Paley in his *Natural Theology*. Even Averroes stated that the proof of god from the necessity of a first mover was the best, truest, and 'most Aristotelian' method of proof.

[15] As Menn has pointed out, the names god (*theos*) and divine (*theios*) do not give us any very useful information about Aristotle's first principle and, 'for this reason, Aristotle puts no weight on them' (1992, p. 546).

Nevertheless, influential interpreters of the fragments of Aristotle's popular work *On Philosophy* have claimed to discover the first articulation of a teleological proof for the existence of god.[16] (Brentano even claimed to find it in the extant works of Aristotle, but his arguments have already been ruinously refuted.[17]) This would be a proof that reasons from the intricacy and usefulness of natural things to the existence of a designer and creator of them, which is identified with god. One of these interpreters has even gone so far as to rate this as Aristotle's greatest contribution to posterity, dwarfing in significance and influence the doctrines of the treatises which we possess in a more complete form.[18]

In this section, we will briefly digress to assess the fragmentary evidence that has been offered to construct or reconstruct a teleological proof for god's existence from *On Philosophy*. I argue that none of the fragments supports such a proof, and that in fact some of what the fragments say contradicts the basis of such a proof.

The evidence is based on a few passages, from Cicero (106–43 BC), Philo of Alexandria (20 BC–AD 40), and Sextus Empiricus (third century AD). The most important and credible piece is from Cicero.

> Aristotle says brilliantly, 'if there were beings who had always lived beneath the earth, in comfortable, well-lit dwellings, decorated with statues and pictures and furnished with all the luxuries enjoyed by persons thought to be supremely happy, and who though they had never come forth above the ground had learnt by report and by hearsay of the existence of certain deities or divine powers; and then if at some time the jaws of the earth were opened and they were able to escape from their hidden abode and to come forth into the regions which we inhabit; when they suddenly had sight of the earth and the sea and the sky, and had come to know of the vast clouds and mighty winds, and beheld the sun, and realized not only its size and beauty but also its potency in causing day by shedding light all over the sky, and, after the night had darkened the earth, they then saw the whole sky spangled and adorned with stars, and the changing phases of the moon's light, now waxing and now waning, and the risings and settings of these heavenly bodies and their courses fixed and changeless throughout all eternity,— when they saw these things, surely they would think that the gods exist and that these mighty marvels are their handiwork.' Thus far Aristotle. (Cicero, *Nat. Deor* ii. Xxxvii.95–6, Loeb; cf. Ross, *On Philosophy* frag. 13)

What is genuinely Aristotelian in spirit about the passage is the way that it subordinates the products of art to the objects of nature. The cave dwellers come to see that the products of art with which they have surrounded themselves pale in

[16] Jaeger 1923/1934, ch. vi, esp. pp. 158 f.; Chroust 1973, ch. xiii, *passim*. Unfortunately, one still comes across references to the notion of a creator god in Aristotle. For example, this in the leading scientific journal *Science*: 'Galen . . . was convinced, like Aristotle, that the body had been carefully designed by a provident and purposeful creator' (Nutton, 2002, p. 801).

[17] Brentano 1867 and 1911. Brentano's arguments have been answered in detail by Ross, *Aristotle's Metaphysics*, vol. 1, pp. cxxxiii–cxxxix. See also Berti 2001, pp. 146–9.

[18] 'Compared with certain passages from the *On Philosophy*, which in their deathless significance touch on the ultimate issue of all religions and of all philosophies, the later doctrinal treatises credited to Aristotle become almost insignificant—almost a monumental irrelevance of astute, but empty, quibbling' (Chroust 1973, p. 174).

comparison to the objects of nature. This is parallel to Aristotle's *a fortiori* argument about the role of art as a cause: art imitates nature, and so the more that art is taken to be a cause, all the more that nature must be acknowledged as a cause. Aristotle elsewhere states, 'surely it would be unreasonable, even absurd, for us to enjoy contemplating likenesses of animals—on the grounds that we are at the same time contemplating the art, such as painting or sculpture, that made them—while not prizing even more the study of things constituted by nature, at least not when we can behold their causes' (*PA* i 5, 645A10–15). Thus Cicero's fragment does not support the notion that the universe is an artifact of the gods, but rather supports the standard Aristotelian position that nature itself is prior to any work of craft.

In fact, the passage is inconsistent with the notion that god created the universe. The reference to 'heavenly bodies and their courses fixed and changeless throughout all eternity', which is consistent with Aristotle's official position in *On the Heavens* and elsewhere that there was no beginning of motion in time, excludes the possibility of these things being created at some point in time by god. The prospect reminds one of Aristotle's criticism of Anaxagoras on the grounds that it makes no sense to say that things were disordered, and then intelligence happened to order them at some point in time. Thus the reference to gods' 'handiwork' is just a metaphor. It is likely that the original version argued, as Aristotle does in his extant works, that the fact that the stars rotate endlessly in perfect circles is observational evidence that they are divine. Thus the cave dwellers are led to believe in the gods because they can see them in the sky, not because they think they are artifacts of some divine creation. In fact, the whole point of the passage, as I have argued, is that the cave dwellers are impressed because the natural things are so much greater than any handiwork. If they did think that these things were the artifacts of some god, similar in principle to the furniture of their cave, then they would certainly be mistaken, according to Aristotle, even if they were led by this mistake to the true conclusion that the gods do exist.

Much of the impetus for the discovery of a teleological proof comes from an article on *On Philosophy* by Ingram Bywater. Bywater's brilliant identification, in an earlier article,[19] of passages of Aristotle's *Protrepticus* in Iamblichus' book of the same name has been confirmed by much subsequent research.[20] But the enthusiasm that this success generated for identifying fragments of other lost works of Aristotle often far exceeded the available evidence for the attributions. The evidence is at its weakest in Bywater's contention that many arguments attributed to the Stoics in Book II of Cicero's *On the Nature of the Gods* are ultimately attributable to Aristotle.[21] Bywater's arguments had a tremendous impact: they influenced Rosse's collection of fragments, and thereby Jaeger, and then Walzer's collection of fragments and thereby Ross'. The result is that there has been a tendency to

[19] Bywater 1869. [20] See Hutchinson and Johnson 2005.
[21] Bywater 1877, pp. 76 and 86.

assume that Aristotle must have advocated a Stoic theory of design, creation, and anthropocentrism, apparently in the dialogue *On Philosophy*. Bywater argued that the Stoics were dependent on the *On Philosophy*, and thus Cicero's sources were unconsciously under the influence of Aristotle in articulating their own design arguments. But there is no way to control attributions, other than following what Cicero says. (Notice how careful Cicero was in the above quotation to indicate where he started and stopped quoting Aristotle.) It begs the question to argue that Cicero was not aware of his source's dependence on Aristotle, since what is at issue is whether Aristotle's dialogue contained the arguments in the first place. And Cicero was, after all, directly familiar with Aristotle's dialogues, and so was in a better position than Bywater or any of us to detect the influence of Aristotle's dialogues on the Stoics. Bywater's suggestion that the whole of the following passage is traceable to the *On Philosophy* is also untenable: 'just as the horse is designed by nature for running, the ox for ploughing, and the dog for hunting, so man, as Aristotle observes, is born for two purposes, thought and action: he is as it were a mortal god' (Cicero, *On Ends*, ii.xiii.40, Loeb). It is only possible to attribute the part about the purpose of humans to Aristotle—as Cicero indicates—but not the anthropocentric arguments about horses and dogs that precede it. Those arguments are, of course, purely Stoical in origin (although they are traceable back to the tradition exemplified by Xenophon), and their source is most likely to be the compendium of Chrysippus that revealed the uses for humans for which all the other animals had been designed.[22] Besides the absence of any evidence in the text of Cicero for an attribution of these ideas to Aristotle, there is independent confirmation available, in the form of Cicero's own words, that one should not attribute to Aristotle an argument from design along the lines of that associated with the Stoics: 'When your wise Stoic has said all these things to you syllable by syllable, Aristotle will come with the golden flow of his speech, to say that the Stoic is talking nonsense; he will say that the world never came into being, because there never was a new design from which so noble a work could have taken its beginning' (Cicero, *Lucullus* 38.119, Plasburg; trans. frag. 20 Ross).

The cave passage in Cicero with which we started this discussion is about what might cause people to think that there are gods in the first place. The remaining fragments alleged to support a teleological proof for the existence of god from the *On Philosophy* are all concerned with the same issue: what is the cause of humans coming to believe that there are gods? This applies to the passages by Sextus Empiricus (*M*. ix. 20–3, and 26–7=fragments 12a[23] and 12b[24]), and Philo of Alexandria (*Leg. Alleg.* 3.32.97–9=fragment 13[25]).

[22] For which, see above in p. 233 n 32.

[23] The fragment begins: 'Aristotle used to say that men's thought of gods sprang from two sources' (Ross).

[24] The fragment begins: 'Some men, when they come to the unswerving and well-ordered movement of the heavenly bodies, say that in this the thought of the gods had its origin' (Ross).

[25] The fragment begins: 'The earliest thinkers inquired how we came to recognize the divine' (Ross).

Although these fragments are of great interest for an anthropological investigation of the origin of religious belief, they in no way commit Aristotle to the notion that god created and designed the world. For even if it is conceded that Aristotle is the author of the passages, we have independent evidence that Aristotle considers the sources of traditional belief about the gods to be of very limited scientific import.

> A tradition has been handed down by the ancient thinkers of very early times, and bequeathed to posterity in the form of a myth, to the effect that these heavenly bodies are gods, and that the divine pervades the whole of nature. The rest of their tradition has been added later in a mythological form to influence the vulgar and as a constitutional and utilitarian expedient; they say that these gods are human in shape or are like certain other animals, and make other statements consequent upon and similar to those which we have mentioned. Now if we separate these statements and accept only the first, that they supposed the primary substances to be gods, we must regard it as an inspired saying and reflect that whereas every art and philosophy has probably been repeatedly developed to the utmost and has perished again, these beliefs of theirs have been preserved as a relic of former knowledge. To this extent only, then, are the views of our forefathers and of the earliest thinkers intelligible to us. (*Meta* xii 8, $1074^{a}38$–$^{b}14$, Loeb)

Thus even if Aristotle argues that a source of belief in the gods is the conception that natural things must be the products of a divine craftsman, Aristotle himself is of course not committed to the position. Recall that Aristotle holds that, 'the divine is not an ordering ruler, since he needs nothing, but rather is that for the sake of which wisdom gives orders (and that for the sake of which is said in two senses, and has been determined elsewhere) (οὐ γὰρ ἐπιτακτικῶς ἄρχων ὁ θεός, ἀλλ᾽ οὗ ἕνεκα ἡ φρόνησις ἐπιτάττει (διττὸν δὲ τὸ οὗ ἕνεκα· διώρισται δ᾽ ἐν ἄλλοις), ἐπεὶ κεῖνός γε οὐθενὸς δεῖται)' (*EE* vii 15, 1249B13–16). Aristotle explicitly repudiates the anthropomorphic conception of the gods, which ought to include the picture of gods as craftsmen. Further, consider the only surviving reference to the *On Philosophy* by Aristotle himself. In *Physics* ii 2, he says, 'As we said in *On Philosophy*, the for the sake of which has two senses (διχῶς γὰρ τὸ οὗ ἕνεκα)' (194A35–6). This connects with the passage we just quoted about having to understand god as a cause for the sake of which in only one of two senses. It is entirely possible that Aristotle in the *On Philosophy* corrected the traditional views, pointing out that the gods do not design, create, and arrange things like a human craftsman, because they are not a cause for the sake of which in the sense of a beneficiary. Given the scant evidence, this seems far more plausible than that he contradicted his highly developed views in *On the Heavens* and *Metaphysics*. Thus there is no good evidence, direct or indirect, that Aristotle supported a 'teleological proof for the existence of god', whether in the lost work *On Philosophy*, or anywhere else.

But if Aristotle does not simply permit us to refer to the intentions of a creator god in order to understand the ultimate source of teleological causation in the universe, then how are we to understand it? All that we seem to have to go on is the assertion that the ultimate source of motion, the unmoved mover or god, must move by being an object of love and desire, as an aim for the sake of which (as opposed to something

for the benefit of which). Now these descriptions of the unmoved movers' activity are not particularly explanatory, and so Λ appears somewhat obscure on an issue of great importance: How and why are things moved at all?

The apparent lack of explanatory content is due to the fact that, at this level of generality, no further specification is possible. For we are here dealing with the teleological aspect of motion and change that applies to all moved substances. For more specificity, there are two options. The first is to look at the teleological explanations actually offered for specific kinds of natural substance and their motions, provided in the physical and biological works. This is what we have done in the preceding four chapters. The second would be to try to elucidate the mode of causality 'for the sake of which' by examining further its application to a subset of substances about which we have more information, to wit animal and human locomotion. This is the goal of the sequel.

9.4 LOCOMOTION AS THE PARADIGM OF CHANGE FOR THE SAKE OF SOMETHING

In this section we aim to elucidate the teleological mode of causality of the primary unmoved mover with reference to texts that discuss the nature of unmoved movers or self-movers in animals, especially in *On the Soul* and *On Animal Motion*. We want to understand better how that which imparts motion, but not by being in motion, does so, and we have to proceed by comparison to something that both imparts motion and is itself moved.

An animal is such a thing, insofar as it is capable of locomotion. The basic model is that the soul imparts motion to the locomotive organs of the animal,[26] causing it to move, which at the same time causes what could be described as a motion of the soul itself, insofar as it is transported along as the animal moves. But this transportation of the whole organism (including the soul with its locomotive powers) is not an intrinsic motion of the soul, rather such motion is incidental to it. It is not really correct to say that the soul is moved in this case, because of the distinction we discussed earlier:

> No doubt the soul may incidentally be moved by something else: an animal may be moved by force. But that which is intrinsically self-moved cannot be moved by something else, except incidentally, just as that which is good in itself or by its own nature can only incidentally be good because of, or for the sake of, something else (ὥσπερ οὐδὲ τὸ καθ' αὑτὸ ἀγαθὸν ἢ δι' ὑτό, τὸ μὲν δι' ἄλλο εἶναι, τὸ δ' ἑτέρου ἕνεκεν). (*Anima* i 3, 406B5–10)

Previously, this distinction—between natural and forced, intrinsic and incidental motion—was illustrated with reference to elemental local motion: an element's

[26] The mechanism for this is the connate pneuma mentioned in *Motu* 10. See generally: Bos 2003; Reiche 1960, pp. 84–100; Nussbaum 1978, essay 3; and Rist 1989, ch. 7.

motion to its natural place in accordance with its internal principle (natural motion), was compared to an element's motion away from its natural place, in opposition to its internal principle (forced motion). The former kind of motion is intrinsic to the element; a natural substance, for example earth, moves downwards towards the center of the cosmos, as opposed to moving upwards when forcibly thrown up into the air. In the case of an animal, the implication is this: the locomotive soul that imparts motion (to the locomotive organs of the animal body) is only incidentally a moved mover. Naturally and intrinsically it is an unmoved mover.

Aristotle's model of an unmoved mover is art (τέχνη), especially the arts of architecture (or 'housebuilding', οἰκοδομική) and medicine (ἰατρική).[27] The crucial aspect of an art like medicine is that it affects a patient without being affected.

> 'Mover' is said in two ways: that in which the principle of motion exists is said to be the mover, and so is the last thing, the thing proximate to the thing being moved and coming to be. So likewise with 'agent': for we say both that the doctor is what heals and that the wine is. So nothing prevents the first mover in a motion from being unmoved (and in some cases this is even necessary), whereas the last [mover] always moves by being itself moved; and so too in action the first [agent] is unaffected, but the last is itself affected. For those [agents] which do not have the same matter [as their patients] act without being affected (like the art of medicine, which in producing health is in no way affected by the person who is being healed); but the food is also an agent [of health] and it is affected (for it is heated or cooled or affected in some other way at the same time that it acts). Here the art of medicine is [the agent] as the principle, and the food as the last [agent] and as the thing in contact [with the patient]. So those agents which do not have their form in matter are unaffected, whereas those which are in matter [sc. the same kind of matter as the patient] are subject to affection. (*GC* i 7, 324A26, trans. Menn 2002, p. 96)

The doctor's instruments, such as scalpels or drugs, are moved movers in that they cause health by being moved (by the doctor) and by moving (things within the patient). The doctor moves the instruments, but he is moved by the art of medicine, which is not itself moved.[28] Aristotle's account of the soul takes this as a model: the soul causes things to move or change in the living thing, by means of its organs.

We have already seen how the vegetative soul is fundamental to all living things, and it is with respect to its functions that Aristotle's notion of an unmoved mover modeled on art is a truly radical innovation.[29] Aristotle replaces the earlier 'naturalistic' model of nutrition and growth being a matter of two aspects (nutrition and what is nourished), with three aspects: that by means of which something is

[27] The point has been well made by: Sauvé Meyer 1987, pp. 178 f.; and Menn 2002, pp. 95 f.

[28] That the art is not moved does not mean that it does not change—Aristotle clearly thinks that the art of medicine does change in the sense of progress (*Pol* 1268B32–40). The crucial point is that with respect to its modality of cause, it does not change or move. It is a moving cause that does not cause change through being moved.

[29] Menn 2002, pp. 116–23.

nourished (i.e. food), that which is nourished (i.e. the body); and that which nourishes or causes nourishment (i.e. the nutritive soul) (*Anima* ii 4, 416B20–4). This is not a case of multiplying entities unnecessarily. Aristotle argues that there must be a faculty that maintains the appropriate body size and shape for each kind of animal or plant, and this source of constancy is thus an unmoved mover. The food is an instrument, like the doctor's tools and drugs, by means of which the body as patient is affected by the nutritive soul as doctor or agent. The same model is applied to reproduction and generation: seed and blood are used as instruments for the nutritive soul to produce a new body (*GA* ii 4, 740^{b}25–741A2; cf. i 22, 730^{b}19–23).[30]

What we want to know for the present context, however, is how this model is supposed to work in the case of locomotion, since Aristotle's account of this kind of self-motion in animals promises to elucidate how the primary unmoved mover causes the stars, and everything else by extension, to move and change. To this end, we have to determine the exact part of the animal soul responsible for locomotion, and so we will follow Aristotle's attempt to isolate the soul or part of the soul that imparts motion from the other faculties and capacities of the soul in *On the Soul* iii 9–10.

Let us first eliminate the various kinds of animal motion that do not apply here. First would be motions imparted to the animal from outside, by its environment. This includes all forced or constrained motions: that of a bird being blown off course by a strong wind, a fish being pulled out of the water on a hook, or a cow being lifted by a crane and loaded into a cattle car. Here the motion of the bodies is determined not by the animal's nature, but by either the motions of another animal or human, or by the mutual impact ('pushing and pulling') of material bodies. None of these motions are natural or intrinsic to or originated by the animal itself, and so are not relevant to the issue of self-motion.

Next, we need not consider motions and changes that are internal to the animal but do not cause the animal to move with respect to place, and which can be attributed to another, more basic soul or part of the soul. Such would be all motions caused by the vegetative soul (*Anima* iii 9, 432B8–13). This soul governs reproduction, development, aging, and decay of the organism; in brief its vegetative functions. In animals it also governs all hypothetically necessary physiological movements and processes—involuntary but regular and natural—that are required for super-ordinate functions, whether of life itself (as in the case of the lungs contracting and expanding), or for the good life (as in the case of the kidney, which is said to aid in the removal of residual waste). So neither external environmental nor internal physiological processes can elucidate self-motion for the sake of something.

> That it is not the nutritive faculty is obvious; for this kind of movement [that we are seeking] is always for the sake of something (ἀεί τε γὰρ ἕνεκά του ἡ κίνησις αὕτη) and

[30] Menn 2002, pp. 122–5.

follows imagination and desire. Nothing moves without impulse towards or away from something, except by force (ἀλλ' ἢ βία). (*Anima* iii 9, 432^{b}14–17)

Now vegetative activities and movements are also obviously for the sake of something, namely the organism's survival and reproduction. But these functions are neither initiated by a cognitive faculty of the animal (such as imagination, desire, and so forth), nor are they cases of locomotion. The sense in which the vegetative soul resembles the model of arts like medicine and house building is in its mode of causality of causing movement but not through its own motion; it is disanalogous to these arts insofar as the arts presuppose deliberation, memory, thought, and so forth. (Although even the arts do not necessarily require deliberation, as Aristotle argues in *Physics* ii 8.) Thus the explanation of how or why an animal digests food, grows, and breathes indicates how these serve its survival and reproduction—and are carried out on the level of the functioning of its nutritive soul, not the locomotive, sensitive, or intellectual. If these kinds of basic functions necessarily involved the locomotive soul, then plants (which also have these functions) would have to be able to move locally and would have organs for that purpose.

If then nature never makes anything incomplete and never leaves out what is necessary (except in the case of mutilated or imperfect growths; and that here we have neither mutilation nor imperfection may be argued from the facts that such animals can reproduce their species and mature and decline), it follows that, had they been capable of originating forward movement, they would have possessed the organs necessary for that purpose. (*Anima* iii 9, 432B21–6, ROT)

Thus the initiation of locomotion by the animal cannot be attributed to the more basic vegetative soul, the one shared by plants.

Nor can it be attributed exclusively to thought and higher intellectual faculties possessed by some animals, specifically humans. For many or all other animals initiate local motion, but 'in all animals other than humans there is no thinking or calculation but only imagination' (*Anima* iii 10, 433^{a}11–12). The fact that Aristotle excludes this soul or function of the soul from the basic explanation of animal locomotion is highly significant for evaluation of the charge that Aristotle's teleological explanations are anthropomorphic. For here Aristotle deliberately refrains from extending uniquely human and higher level functions to non-human animals. He refuses to consider such so-called explanations as explanatory. Anthropomorphism is hence consciously avoided by Aristotle and excluded from the teleological explanation of animal motion.

Aristotle further argues that the cause of locomotion in the animal cannot just be intelligence, since intelligence is not concerned with the practicable. 'Intelligence is never found producing movement without appetite' (*Anima* iii 10, 433^{a}22–3):

neither can the calculative faculty or what is called intelligence be the cause of such movement [locomotion]; for the theoretical never contemplates that which is practicable—it never says anything about an object to be avoided or pursued. But this movement [locomotion] is always in something that is pursuing or avoiding an object. (*Anima* iii 9, 432^{b}26–9)

The remaining alternative is desire (ὄρεξις). Desire is the necessary factor in self-motion, and higher souls influence motion insofar as they are combined with desire. Without desire for the sake of something, in pursuit or avoidance of something, motion is neither possible nor sensible, thus there is nothing that could or would initiate it. Intelligence by itself remains at rest until moved by desire, while desire and its attendant perception are continually moved by their objects until there is interruption by intelligence. Thus both motion and rest are initiated by intelligence, but only in connection with desire and perception.

> Both intelligence and desire originate local movement, then, but intelligence meaning he who calculates for the sake of something and the practical reasoner. But practical intelligence is different than the theoretical kind because its end [is different]. And desire too is always for the sake of something. For the desire is for something, which is the principle and beginning of practical intelligence, and [in this sense] the final is the beginning of action (τὸ δ' ἔσχατον ἀρχὴ τῆς πράξεως). (*Anima* iii 10, 433ª13–17)

We thus have a scheme for the relationship between intelligence, desire, and action, and a notion of how these can combine in reasoned action. Without intellect, desire is the only remaining motive, and so it is clear that the description of non-human motion will be substantially simpler than that of human action. Ideally both human action and non-human motion, in other words animal behavior or ethology writ large, would be demonstrable syllogistically. But how such a scheme would work in practice is a difficult subject that cannot be pursued here.[31]

In effect, 'teleological explanation' ends here and gives way to another, more elaborate, specific, and variegated account of motives for action and desire. Thus the facts that the dog pursues the rabbit because it is hungry, or the beaver builds its lodge for protection, are of course teleological explanations. But the debate about how such explanations work, and even whether or not they are true, is not a matter of the logic of teleological explanations, much less of the state of teleological science. Rather they are questions that require examination and scrutiny by ethologists employing empirical and comparative methods. Deliberate, intelligent, intentional, and rational human action is similarly clearly teleologically explicable. But that really is not saying much. Thus the fact that I drank the lemonade because I was thirsty is certainly a 'teleological explanation'. But the real explanation would be provided by behavioral psychology, cognitive ethology, or perhaps sociology or anthropology, if there is in fact any scientific account that can be given. At any rate it is not the object of a science called 'teleology' or any conceivable sub-field thereof. Further, deliberate human activity, however important, is far from typical of a motion that Aristotle considers teleologically explicable. More typical, of course, is animal motion in general, and it is this that serves as the basis for Aristotle's generalizations about the explanatory parameters of the cause for the sake of which.

[31] There is a lot of debate on the existence, nature, or value of the so-called practical syllogism in Aristotle. For a good summary of recent work, and a balanced view, see Natali 2001, ch. 3.

In a key passage in which Aristotle analyzes animal motion into its component aspects, we can see how Aristotle intends to explain locomotion in the same way that he did nutrition—according to the model of the arts.[32] The medical art, as we saw, has three components: the medical art itself (the unmoved mover), the patient (the moved), and the instruments (scalpels, drugs, etc., moved movers). In nutrition, we also have three components: '(1) that which nourishes, which is the first [i.e. vegetative] soul, (2) the thing that is nourished is the body which has this soul, and (3) that by means of which it is nourished is the food' (τὸ μὲν τρέφον ἐστὶν ἡ πρώτη ψυχή, τὸ δὲ τρεφόμενον τὸ ἔχον ταύτην σῶμα, ᾧ δὲ τρέφεται, ἡ τροφή, *Anima* ii 4, 416B20–3). In locomotion we also have three components.

> All movement involves three factors, (1) that which originates the movement (τὸ κινοῦν), (2) that by means of which it originates it (ᾧ κινεῖ), and (3) that which is moved (τὸ κινούμενον). The expression 'that which originates the movement' is ambiguous: it may mean either (a) something which itself is unmoved or (b) that which at once moves and is moved. Here that which moves without itself being moved is the practicable good (τὸ πρακτὸν ἀγαθόν), that which at once moves and is moved is the faculty of desire (for that which is influenced by desire so far as it is actually so influenced is set in movement, and desire in the sense of actual desire is a kind of movement), while that which is in motion is the animal. The instrument that desire employs to produce movement is no longer psychical but bodily: hence the examination of it falls within the province of the functions common to body and soul. (*Anima* iii 10, 433^{b}13–21, ROT, with modifications)

As Aristotle says at the end of the passage, the specific explanations of animal motion require an examination of the specific kind of animal, its locomotive parts, and the operative incentives to motion involved. The best we can do without getting into specifics of this kind is to generalize about the various kinds of self-motion (e.g. stellar rotation, animal locomotion, human action), and then compare the general accounts to one another, and determine what is common. That will give us the conditions for teleological explanation of the most general kind and, perhaps, provide insight into why explanation by means of the cause for the sake of something constitutes knowledge. For that purpose we have the following excellently suited text.

> [**a**] Now whether the soul is moved or not, and, if it is moved, how it is moved, has already been discussed in our work on the soul. Since all lifeless things are moved by something else, and since we have set forth in our work on first philosophy our views concerning how the first and eternally moved is moved, and how the first mover imparts motion, it remains for us to consider how the soul moves the body, and what is the origin of an animal's motion. [**b**] For if we exclude the motion of the universe, living creatures are responsible for the motion of everything else, except such things as are moved by each other through striking against each other. Hence all their movements have a limit; for so do the motions of living creatures. For all animals both impart movements and are moved for the sake of

[32] As Menn says, 'Aristotle intends his treatment of the quasi-art of nutrition as programmatic for the other psychic powers as well' (2002, p. 121).

something, so that this is the limit to all their movement: the thing for-the-sake-of-which (πάντα γὰρ τὰ ζῷα καὶ κινεῖ καὶ κινεῖται ενεκά τινος, ὥστε τοῦτ᾽ ἔστιν αὐτοῖς πάσης τῆς κινήσεως πέρας, τὸ οὗ ἕνεκα). [**c**] Now we see that the movers of the animal are intelligence and *phantasia* and choice and wish and appetite. And all of these can be reduced to thought and desire. For both *phantasia* and sense-perception hold the same place as intelligence, since all are concerned with making distinctions—though they differ from each other in ways we have discussed elsewhere. Wish and spiritedness and appetite are all desire, and choice shares both in reasoning and in desire. So that the first mover is the object of desire and also of intelligence; not, however, every object of intelligence, but the end in the sphere of actions (τὸ τῶν πρακτῶν τέλος). So it is a good of this sort that imparts movement, not everything noble. For insofar as something else is done for the sake of this, and insofar as it is an end of things that are for the sake of something else, thus far it imparts movement (ᾗ γὰρ ἕνεκα τούτου ἄλλο, καὶ ᾗ τέλος ἐστὶ τῶν ἄλλου τινὸς ἕνεκα ὄντων, ταύτῃ κινεῖ). And we must suppose that the apparent good ranks as a good, and so does the pleasant (since it is an apparent good). [**d**] So it is clear that the movement of the eternally moved by the eternal mover is in one respect similar to that of any animal, but in another respect dissimilar; hence the first is moved eternally, but the movement of animals has a limit (πέρας). But the eternally noble and that which is truly and primarily good, and not good at one time but not at another, is too divine and too honorable to be relative to anything else. [**e**] The first mover, then, imparts movement without being moved, and desire and the faculty of desire impart movement while being themselves moved. But it is not necessary for the last of the things that are moved to move anything. And from this it is obvious, too, that it is reasonable that movement from place to place is the last of the movements in things subject to becoming. For the animal moves and progresses in virtue of desire or choice, when some alteration has taken place in accordance with sense-perception or *phantasia*. (*Motu* 6, trans. Nussbaum, with modifications)

This passage considers every kind of local motion that Aristotle recognizes. In each case, the rule that what is moved must be moved by something is maintained. We can combine the results of this passage with the three factors of motion delineated in *On the Soul* 433^{b}13–14, with the results summarized in Table 9.1

On Animal Motion 6 is in substantial agreement with the analysis at *On the Soul* iii 9–10, and extends that analysis to a comparison with the primordial motion ('the first moved and the eternally moved'). The comparison yields both a fundamental

Table 9.1 Moved and unmoved movers

Moved (τὸ κινούμενον)	Mover (τὸ κινοῦν)	Means (ᾧ κινεῖ)
Animate elements	Object of thought—primary unmoved mover	Internal principle of motion
Inanimate elements	Animate elements	Internal principle of motion
Animals	Objects of desire	Appetite, locomotive organs
Humans	Objects of desire and thought	Appetite, wish, locomotive organs
Everything else	Corporeal bodies	Mutual impact, 'pushing and pulling'

similarity and a fundamental difference between kinds of motion. The similarity is that stellar rotation, animal locomotion, and human action are all motivated by that which is practicably good. The difference is that the stellar rotation is eternal, while animal and human locomotion is limited in time. Animal and human actions have a beginning, middle, and end in the literal sense. The dog is thirsty, it sees the puddle of water, it moves to the puddle and drinks. Once the water is drunk, the limit of the action has been reached, the action comes to an end, and the motivating practicable good takes on a different character with respect to the animal, which is no longer thirsty. The stars (including planets, sun, and moon), on the other hand, are motivated by the perfection and eternality of the unmoved mover(s), and the completion of a rotary cycle, while an end in a sense (which is also a beginning in a sense), remains ever an object of emulation, whose character does not change upon completion of the action. Of course, the rotation, despite its eternality, has an end, not only in the more literal sense that it completes a circular orbit, but, more importantly, in the sense that the celestial body itself is benefited by the motion.

Thus what is fundamental to self-locomotion is the existence of a practicable good (whether real or apparent) that benefits the thing that moves. Were it not for the existence of such a good, or such goods, there would be no stellar rotation, no elemental transmutation, and no animal or human motion. Everything would remain at rest, with the terrestrial elements segregated into their spheres on the basis of their heaviness or lightness. In this hypothetical situation, the sun would not rise or set; there would be no cycles of birth and decay, nor any weather or meteorological phenomena. Without the practicable good, there could never be a force that would upset this global inertia, whether necessity, love, or intelligence. Not necessity, *pace* Democritus, because there would be no (hypothetical) necessity for anything to move, and there would be no mutual impact if there was not a primary motive for action or movement. Not love, *pace* Empedocles, because love only moves when its object is a practicable good and generates desire, and so to posit a force called love without the practicable good is to posit a force empty of content. And not intelligence, *pace* Anaxagoras, because intelligence has no motive to move either itself or anything else absent desire for a particular practicable good.

Thus the promise of teleological explanation, whether on a physical, biological, human, or cosmological level, depends on the possibility of an identification of practicable goods: goods that benefit the natural substances that attain them, really or apparently. Thus stars, imbedded in an ethereal medium, complete their circles because they want to imitate the eternal activity of the unmoved mover(s). Terrestrial elements complete transmutation cycles and natural rectilinear motions because they are influenced by stars (especially the fixed stars in connection with the sun) to complete their own cycles, and are benefited by a kind of 'perpetuity' also known as existence. Plants reproduce in kind and thus complete circles of their own because they have the relevant reproductive organs and are in connection with terrestrial elements (i.e. earth and water). Animals reproduce for the

same reason, and also move locally, because they have locomotive organs and, crucially, perception, by means of which they sense and desire what is practically good for them, that is, what causes them pleasure. Finally, humans can do all of this, but also by planning and projecting their goals and ends, and deliberately pursuing them.

9.5 A FINAL APORIA: HOW DOES THE GOOD EXIST IN THE UNIVERSE?

What has just been shown is that different kinds of natural substances and motions are fundamentally similar insofar as they possess generically the same object—the practicable good. But we have seen that robust explanations of these phenomena require specifications of functions and beneficiaries that Aristotle discusses in the contexts of principles of nature, stars, animals, plants, and humans. Does he see any more substantial interrelationships or commonality between them and their goods? The key text addressed to this question is the opening of Λ 10.[33]

[**a**] We must also consider in which way the nature of the whole (ἡ τοῦ ὅλου φύσις) possesses the good and the best, whether as something separated and itself by itself, or as its order (κεχωρισμένον τι καὶ αὐτὸ καθ' αὑτό, ἢ τὴν τάξιν).

[**b**] Or is it in both ways, like an army? For the good is both in the order and the general, and more so the general. For he is not due to the order, but the order is due to him (οὐ γὰρ οὗτος διὰ τὴν τάξιν ἀλλ' ἐκείνη διὰ τοῦτόν ἐστιν).

[**c**] And all things are somehow jointly ordered, but not in the same way, for both fishes and birds, and plants.

[**d**] And it is not such that one thing has no relationship to another; but there is some relationship. For all things are jointly ordered with respect to one thing (καὶ οὐχ οὕτως ἔχει ὥστε μὴ εἶναι θατέρῳ πρὸς θάτερον μηδέν, ἀλλ' ἔστι τι. πρὸς μὲν γὰρ ἓν ἅπαντα συντέτακται).

[**e**] But it is as in a household, where the free have least licence to act as they chance to (τι ἔτυχε ποιεῖν), but all or most of what they do is arranged, while the slaves and beasts can do a little towards what is communal, but act mostly as they chance to (ὅ τι ἔτυχεν).

[**f**] For that is the kind of principle that nature is of each of them (τοιαύτη γὰρ ἑκάστου ἀρχὴ αὐτῶν ἡ φύσις ἐστίν).

[**g**] I mean, for example, that at least each of them must necessarily come to be separated (διακριθῆναι); and there are likewise other things in which all share towards the whole. (*Meta* xii 10, 1075^{a}11–25)

The passage has been over-translated in the most influential English translations, and this is apparently motivated by an interpretation that reads into Aristotle's text an 'overall' teleological system. The words 'for all are ordered together to one

[33] I have followed Sedley's translation (2000, pp. 328–9), with several modifications, as well as his division of the passage.

end' (OT, ROT) and 'everything is ordered together to one end' (Loeb) are used in the standard translations to render πρὸς μὲν γὰρ ἓν ἅπαντα συντέτακται (1075ª18–19). But the word 'end' (τέλος) does not appear in the text.[34] Nor is it reasonable to supply it, as will be shown. What is remarkable, in fact, is that the passage is not straightforwardly 'teleological' at all, at least not in its terminology: there is reference here neither to the cause for the sake of which, nor to ends (much less 'one end'). Thus we must advance our interpretation of this passage in connection with an inquiry into teleological explanation with due caution.[35]

Aristotle begins by stating that we must 'investigate' (ἐπισκεπτέον) in which way nature—the nature of the whole (ἡ τοῦ ὅλου φύσις) has, or is in a condition of (ἔχει), the good and the best. The term nature appears later as well, where reference is made to 'the kind of principle that nature is for each of them'.

There is no positive doctrine of an overarching cosmic good—some single good of the whole cosmos—articulated in this chapter. In fact, the chapter ends not with a conclusion about how the nature of the universe has or is good, but instead with a refutation of predecessors who have attempted to advance various theses on the topic (1075ª25–6A4), and a cryptic Homeric quotation. The chapter turns out to be more useful in indicating ways that Aristotle *does not* want us to think about nature possessing the good, than it does in expressing a positive doctrine. And we ought not to assume that there is some more elaborate treatment that we are missing simply by chance.[36]

The question posed in [**a**], and the alternatives initially offered for how the nature possesses the good—separately and independently, or in its arrangement as well—immediately suggest two other well-developed doctrines in Aristotle. First is the doctrine of *Physics* ii 1, that nature is an internal not external principle of motion and rest (192ᵇ21–3). Since we know that nature is an *internal* principle,

[34] Furley also translates this way, in the context of supporting his broad interpretation of Aristotelian teleology (1996, p. 75).

[35] Kahn 1985 has argued for a 'theocentric' interpretation of Aristotle's teleology (p. 196 and *passim*), and Sedley 1991 aligns himself with this position, while at the same time maintaining anthropocentrism. 'In one very strong sense, then the world is *theo*-centric: god is the ultimate focus of all aspirations. But in another sense, and an important one, it remains anthropocentric. All sublunary nature is organized in a cooperative hierarchy, in which the lower benefits the higher. And at the apex of this hierarchy stands the highest beneficiary of all, man' (Sedley 1991, p. 196). But the marriage between the theo- and anthropocentric interpretations is a difficult one. On the one hand, Λ 10 gives no support to the anthropocentric interpretation (indeed, it does not even mention human beings, though it does creatures that swim, fly, and plants). On the other hand, the chief passages supposed to support anthropocentrism, especially *Phys* ii 8 and *Pol* i 8, say nothing whatsoever about god, the unmoved mover, or the cosmic good. The passage that does mention them all together, *Motu* 6, gives no support to the anthropocentric interpretation, as we saw (Sedley 1991 only briefly refers to it in a note, p. 193 n. 23). Furley in a note says that although he accepts the notion of an overall teleology, he is not convinced that it is anthropocentric (1996, p. 76 n. 14).

[36] 'The negativity is Aristotle's best shot at demarcating and clarifying what is distinctive about his own divine first principle. It would be a mistake to imagine that sheer bad luck in the survival of texts has robbed us of some more positive and explicit description of the cosmic role of Aristotle's god' (Sedley 2000, p. 328).

how could the good exist either 'separately' or by virtue of a relation (as an 'arrangement' would imply)? The second doctrine we are reminded of is Aristotle's denial that there is an 'idea of the good', or 'universal good' in *Nicomachean Ethics* i 4 and *Eudemian Ethics* i 8. Since Aristotle denies that there is a univocal sense of 'good', that there is anything like a Platonic form of the good, and that there is any value in positing a universal or common good above and beyond all the various kinds of goods, we are also led to wonder how the good could exist separately.

Stephen Menn has argued that [**ab**] should be read as accepting the existence of a separate good:

> When Aristotle asks whether the good is 'something separate and itself-by-itself,' he is obviously and self-consciously using Plato's terms, to ask whether there is some one first separate Good-itself through which other things are, in a weaker sense, good; and he is saying that Plato was right. The phrase in which this affirmation is initially made looks tentative, but this is typical of Aristotle and implies no real hesitation. As the rest of the chapter bears out, Aristotle is firmly committed to identifying the first principle as the Good-itself. (*Menn* 1992, p. 547)

I have already stated that I do not believe that the rest of the chapter commits Aristotle, whether firmly or not, to the position that the first principle is a separate good itself. And it is hard for me to see what role this 'some one first separate Good-itself' would play in his philosophy of nature, which is the announced subject of the aporia. It seems to me that the aporia is about whether the good exists only separately in each kind of thing (stars, elements, plants, animals, humans, cities, etc.), or also in terms of relationships between these things as well, insofar as they constitute an order or arrangement.

Menn argues that by his tacit endorsement of a separate good in [**ab**], Aristotle is 'here only carrying out the program of *Metaphysics* i 2, which had said that wisdom should be the science of treating the for-the-sake-of-which, and that "this is the good of each thing, and universally, the best in nature"' (1992, p. 547). But a fuller version of what Aristotle there says is: 'the science which knows that for the sake of which each thing must be done is the most authoritative of the sciences, and is more authoritative than any ancillary science; and this end is the good of each thing, and universally, the best in the whole of nature' (982^b5–7). Here Aristotle is clearly referring to a good that is the object of a human science and thus practicable for humans. This is a point he stressed as well in both the *Nicomachean* and *Eudemian Ethics* passages, in rejecting the ideal of the good and the universal good. 'Even if there is some one good which is universally predicable of goods, or is separate and independent (ἢ χωριστὸν αὐτό τι καθ' αὑτό), clearly it could not be attained by a human; but we are now seeking something attainable' (*NE* i 4, 1096^b32–5). In those passages as well, Aristotle refers to this good as the cause of good in other things, but he still has in mind a practicable human good:

> The cause for the sake of which, as the end, is best, and is a cause of what comes under it, and the first of all. This, then, would be "the good itself"–the end of all human actions.

And this is what comes under the master art of all: politics, economics, and prudence. For these habits differ from all others by being like this. Whether they differ from each other, we must say later. (*EE* i 8, 1218B10–16)

It seems to follow that, if Aristotle does endorse the existence of a highest good in nature, or even a 'separate good', then it must be something attainable by humans. Otherwise we are idly talking about a 'form of the good' or the 'universal good'. The most obvious candidate for a 'highest good in nature', that is also attainable by humans, is intelligence (νοῦς), and the activity of theoretical science and wisdom. Aristotle says that νοῦς 'either is itself also something divine, or is the most divine part in us' (εἴτε θεῖον ὂν καὶ αὐτὸ εἴτε τῶν ἐν ἡμῖν τὸ θειότατον, *NE* x 7, 1177^{a}15–16). This is 'the intelligence, i.e. the god' of *Eudemian Ethics* (ὁ νοῦς καὶ ὁ θεός, 1217^{b}30–1), and 'the god, i.e. the intelligence' of *Nicomachean Ethics* (ὁ θεὸς καὶ ὁ νοῦς, 1096^{a}24–5). It may be that this intelligence is in ontological terms a separately existing good. Aristotle in fact says that, 'the [happiness] of the νοῦς is separate (ἡ δὲ τοῦ νοῦ κεχωρισμένη)' (*NE* x 8, 1178^{a}22). The extraterrestrial intelligences, the stars, also enjoy νοῦς and its activities, probably to a higher degree than even we do, and they are natural entities. Thus there are fitting candidates for νοῦς and god(s) in nature, without having to reify the highest good into 'some one first separate Good-itself' (as Menn puts it), separate from all the things like stars and humans that naturally have it; at least not in the context of an aporia about how the good exists in nature.

The good exists in nature in individual natural substances, especially living things like stars and animals, but in the elements as well. So how else does it exist in the order (τάξις) of those natural substances? This I take to be the central issue of Λ 10. The notion of an order is central to Aristotle's teleology, as can be seen from his reference to it in the dialectical engagement with Anaxagoras: 'someone suggested that intelligence (νοῦν) exists, and is, as in the animals so in nature, the cause of the cosmos and order of everything (τὸν αἴτιον τοῦ κόσμου καὶ τῆς τάξεως πάσης) (984B16–17).[37] The question is what kind of order could constitute the good, above and beyond the separate goods of each kind of thing. The first clue is in the analogy with the general and the army.

The Analogy of the General and the Army

The word τάξις is in fact at root a military term: its primary meaning is 'the order or disposition of an army' (LSJ, s.v.). This is clearly Aristotle's motivation in pursuing the military analogy already alluded to by Anaxagoras and also Plato:[38] the philosophical term of art had been borrowed by philosophers from the military lexicon, and Aristotle is trying to develop the metaphor as an analogy.

[37] See also: 'for there is an order for all things (πάντων γάρ ἐστι τάξις)' (*GC* ii 10, 336^{b}12).
[38] Plato: *Tim* 30a5, etc.; *Leg* X, 898a9, 904^{c}8.

Unfortunately, Aristotle cannot make use of the most obvious and straightforward application: that the god, like a general, gives orders and commands to natural substances, as to an infantry and cavalry, to be organized and arranged in a certain way, and they consciously obey him. For Aristotle clarifies that the divine, in its mode as cause for the sake of which, does not issue orders. God does not even act so as to affect the order of the cosmos. God, unlike a general, is 'not an ordering ruler, since he needs nothing, but rather is that for the sake of which wisdom gives orders, and that for the sake of which is said in two senses, and has been determined elsewhere (οὐ γὰρ ἐπιτακτικῶς ἄρχων ὁ θεός, ἀλλ᾽ οὗ ἕνεκα ἡ φρόνησις ἐπιτάττει (διττὸν δὲ τὸ οὗ ἕνεκα· διώρισται δ᾽ ἐν ἄλλοις), ἐπεὶ κεῖνός γε οὐθενὸς δεῖται, *EE* vii 15, 1249B13–16).[39] Thus it is impossible that the analogy should be understood to imply that god or the unmoved mover is somehow actively ordering and arranging the things in the cosmos in the way a providential or creator god might.[40]

The analogy is very limited in explanatory potential,[41] unless it shows that Aristotle wants to stress that the good is not separate from the individual things that are good, but is rather an immanent principle that accounts for the organization of the many things that are good, like the general who has been elected to lead his fellow citizens on a campaign in which they all, as citizens of a city, have a stake.[42]

[39] The analogy might be taken to imply that the good in the soldiers and in the general is identical, although present in them to different degrees, since there is ontological dependence of the soldiers on the general. Thus if the army wins the war, it is good for both the general and the soldiers, but especially for the general, since he was responsible for the survival of the army and the execution of the campaign. The Athenian army was not what we would call a professional force, but was composed out of citizens and its generals were elected. Thus the aims and goals of the general, the soldiers, and the army as a whole could be thought of as identical, to the extent that the good of the city and of the citizens can be thought of as identical.

[40] This applies not only to the providential and creator god as characterized by Xenophon, but also to Plato's description of a demiurge that is responsible for ordering everything in the universe for the best. The model of an intelligence acting like a craftsman in creating and ordering things will not work, for the same reason that the craft model is inadequate to explain the reproduction and development of living things. Nature is prior to craft, and something prior cannot be explained by something posterior. Aristotle makes it very clear, in *Meta* xii 9, that the divine thinks not about earthly things and things that change (like plants, animals, and humans), but about itself only ($1074^{b}33$–4).

[41] A general is in an army, the same army (and universe) as the soldiers, and so the analogy lends no support to a 'transcendental' interpretation (nor does the later reference to the inhabitants of the household, since neither are they transcendent with respect to the household). Against Ross: 'The doctrine here stated is that goodness exists not only immanently in the world but transcendently in God, and even more fundamentally in Him' (*Aristotle's Metaphysics*, vol. 2, at $1075^{a}11$–15, p. 401). For Aristotle's de-emphasis on political analogies in cosmology relative to his predecessors, see Lloyd 1966, pp. 229–30.

[42] I can find no support in the text for Kahn's remark that 'The literal sense of these metaphors—what some would call their cash value—lies in this notion of a universal tendency towards positive being, realized form, and unceasing activity' (1985, p. 200). I do not see what these notions have to do with the analogy of the general and the army, and furthermore, I cannot see that these notions go beyond what Aristotle expresses as an intrinsic principle of natural things (an internal principle of change towards an end which is the form in a complete state of development, the excellence of which is the characteristic activity of the thing's function).

The same goes for the final cryptic remark, an incomplete quotation of Homer: 'The rule of many is not good, let there be one ruler' (*Iliad* ii 204). Sedley closes his article on Λ 10 with the remark that, 'The closing Homeric quotation—one commander good, many commanders bad—resumes the army analogy which, among the various images . . . was the most explicit in fixing the prime mover's teleological relationship to the world as a whole' (2000, p. 350). This is an odd remark and, if true, puts us in an awkward situation, since Aristotle himself elsewhere states that what is meant by 'many' in this very quotation is 'unclear' (ἄδηλον, *Pol* iv 4, 1292ª15).[43] The attempt to justify the attribution of a non-imminent teleology to Aristotle suffers fatally from this fact. All such interpretations rely on the analogies of the general and the army, and the master and the household, to justify the extension of the good beyond a natural principle that is imminent to the natural kind in which it is intrinsic.[44] But the analogies that are supposed to supply the speculative basis for this enterprise are fundamentally unclear and inconclusive. And so the burden is upon those who see an overall teleology to explain what the superordinate good is, and to what end it exists, if it is to be other than the end of the individual natures themselves (in which case there is no need to posit some good above and beyond them).

The Analogy of the Master and the Household

The next analogy that Aristotle explores for how the good exists in nature is the household. The free of the household have the least liberty to do anything by chance (ὅ τι ἔτυχε ποιεῖν), since all or most of what they do must be ordered (ἀλλὰ πάντα ἢ τὰ πλεῖστα τέτακται), while slaves and beasts contribute little to what is common, since the good of their actions coincides with the common good of the household more by luck or chance (ὅ τι ἔτυχεν) [e]. The key to the interpretation of this is Aristotle's doctrine of luck developed in *Physics* ii 4–8. The example there was a man who goes to the market for the purpose of collecting subscriptions, happens to run into his debtor, and hence accomplishes a good for the sake of both: the payment of the debt happens to be achieved. The lender and the debtor came to the market for separate reasons, and so the good served by their fortuitous

[43] Ὅμηρος δὲ ποίαν λέγει οὐκ ἀγαθὸν εἶναι πολυκοιρανίην, πότερον ταύτην ἢ ὅταν πλείους ὦσιν οἱ ἄρχοντες ὡς ἕκαστος, ἄδηλον (*Pol* 1292ª13–15). What is unclear here is whether Homer means that having several different people sharing power is bad (i.e. a corporate arrangement), or whether he means multiple people with power is bad (i.e. a pluralistic arrangement).

[44] Kahn says: 'the autonomy of biological development and function is not undermined . . . by the larger cosmic pattern of teleology, since the growth, nutrition, and reproduction of living things, like the appetites which accompany some of these functions, turn out to be simply a special case of the universal tendency to realized form and continuous activity' (1985, p. 203). But the question is: what exactly does the 'larger cosmic pattern of teleology' add? Aristotle holds that the 'tendency to realized form and continuous activity' are a matter of a thing's nature—i.e. an internal principle of change and an end. The 'universal' tendency is just the generalization of this principle over all natural things. It appears to have no further explanatory power.

meeting was brought about incidentally. In [**e**] the actions of the slaves, and less so of the beasts, happen to coincide with the common good of the household, but incidentally with respect to their own good. So if a chicken lays an egg, this turns out to be a good for the household, but incidentally for the chicken, since the chicken was not trying to provide omelets. The slave who cooks the eggs is carrying out orders, and has an interest in obeying. But the good for the slave in this case is in avoiding punishment and satisfying the master, not in enjoying the benefits of a well-cooked omelet. The household manager, on the other hand, who has arranged for the house to have chickens laying eggs, and servants to cook and serve omelets, has performed actions whose purpose is non-incidentally related to the common good of providing food for the household. We are supposed to see from this model that it is possible for things to be pursuing their own goods, but that those actions can have benefits for other things, sometimes deliberately, otherwise coincidentally. Recall that it is possible to discern incidental ends of humans and other kinds of organisms, just as it is with organs (I can use an eye not to see, but to eat or sell). These incidental ends contribute to the good of things other than themselves, but this has nothing to do with their own nature, which consists of a principle contrasted with luck in the strongest possible terms.

Recall also that in *Politics* i the household is treated as a natural entity, and not (as in the present passage) a microcosmic analogy for the nature of the whole. We saw in our analysis of passages from the *Politics* the need for extreme caution in extending the whole–part analysis beyond organic substances to relations between organisms such as obtain in the household. And [**e**] is not just a reference to the household: integral to its analysis is the distinction between a slave and a master within a household. Needless to say, this is not a happy basis on which to build a theory about how the good exists in the universe. We also saw that Aristotle himself shows concern about the exaggeration of the degree of unity that applies to relationships like families and cities in determinations of their good. These concerns apply here insofar as both of the examples that Aristotle offers in his discussion of the aporia about the good in the cosmos are human organizations (an army, a household). For the determination of the good of part and whole in such organizations and relationships is a thorny and difficult issue, one that, as we saw, is a lot more difficult than the same determination for individual kinds of natural substance (stars, plants, fishes, humans, etc.), difficult as those might be.[45]

A striking parallel to the analogies in Λ 10, and one with very serious ramifications for the interpretation of Aristotelian teleology as we have already seen, is the discussion of the aporia about the order in the celestial realm in *On the Heavens* ii 12. Aristotle there discusses the ways in which the stars, sun, moon, and earth can be said to achieve their own good, and explained with reference to the cause for the sake of which. An analogy is made to the way that living things do the same

[45] This again counts against the use of the general and the army metaphor, since Aristotle explicitly speaks out against the military as a paradigm for the organization of a city (*Pol* vii 2, 1324B8–26).

here on earth. Crucial to both *On the Heavens* ii 12 and *Metaphysics* xii 10 is the sense in which the various natural kinds involved are oriented towards the best (πρὸς τὸ ἄριστον). The way in which they differ in this regard is related to the number and variety of actions of which they are capable. The unmoved mover, and the ultimate for the sake of which, does not move at all. The next most perfect things, stars, move with simple motions in order to attain their good. Next are the things that achieve their good through several motions: the planets (including sun and moon) in analogy to human beings (who have the most diverse and complex motions of all). Next are the things that have a limited range of motion: the terrestrial elements (which move in accordance with a single natural principle) in analogy to animals (which move in accordance with desire). Finally there is that which does not move, and attains a very limited good, if any at all: earth (which remains at rest in the center of the cosmos), which is compared to plants (which are incapable of locomotion and so attain good only through growth, reproduction, and flourishing). Notice that in all these cases, Aristotle is talking about these natural substances achieving their own goods, however slight relative to the perfect motions of the stars. There is no argument, in *On the Heavens* ii 12, or anywhere else for that matter, that these various motions happen for the sake of an overall good, or for the sake of natural substances other than the ones that are in motion. Here we may also call attention to the passage at Λ 8 (1074^{a}14–31), in which Aristotle asserts that there can be no other direct beneficiary of the stars' movements than the heavenly bodies themselves.

An Arrangement for the Sake of the Natural Substances Themselves

In support of the location of the good of nature in the organism or natural substance itself is the pithy remark in Λ 10: 'all things are somehow jointly arranged, but not in the same way, for both fishes and birds, and plants' [c], which is a crucial reiteration of a doctrine that we have seen to be at the heart of Aristotelian teleology, that the good which teleological explanations make reference to is specific to the natural kind being explained. The good is not the same for all kinds of things, for fishes, birds, and plants (not to mention stars, elements, households, cities, etc.). This calls to mind Aristotle's assertion that the 'good is different for humans and fishes (ἀγαθὸν ἕτερον ἀνθρώποις καὶ ἰχθύσι)' (*NE* vi 7, 1141A22–3), and in fact to the central methodological claim that the cause for the sake of which must be determined as follows: 'because better thus—not absolutely, but in relation to the reality of the thing concerned (διότι βέλτιον οὕτως, οὐχ ἁπλῶς, ἀλλὰ τὸ πρὸς τὴν ἑκάστου οὐσίαν)' (*Phys* ii 7, 198B8–9).

The fact that each of the living things mentioned has a good, although that good is not the same for each, reminds us of Aristotle's doctrine that there is no univocal good, and hence no 'form of the good' or 'universal good'. For Aristotle, the term 'good', like the term 'being', is not univocal. This was made clear in *Nicomachean Ethics* i 6, and *Eudemian Ethics* i 8. In both places, Aristotle says that,

'things are said to be good in as many ways as they are said to be (for things are called good both in the category of substance, as god and intelligence, and in quality, as the virtues, and in quantity, as the moderate, and in place, the right locality, etc.)' (*NE* i 4 1096^{a}23–7; cf. *EE* 1217^{b}25–33).

But the good is not unqualifiedly equivocal either, just as 'being' is not. Rather it exhibits what commentators call 'focal meaning' or 'focal connection' or 'core-dependent homonymy'.[46] This occurs when the ambiguity of an equivocal term can be reduced with reference to some one thing (πρὸς ἕν) to which all the various meanings relate. Aristotle uses this technique of disambiguation throughout several important works, including *Metaphysics*, and on important terms, such as being (τὸ ὄν).[47] Aristotle asserts that, in addition, 'we will find other things spoken of in a similar manner to these—so too is being said in many ways but always in relation to a single principle' (*Meta* iv 2, 1003B4–6). Although it has apparently escaped the attention of commentators,[48] he seems to refer to it again here in the words 'And it is not such that one thing has no relationship to another. But there is some relationship: For all things are jointly arranged in relation to one thing (καὶ οὐχ οὕτως ἔχει ὥστε μὴ εἶναι θατέρῳ πρὸς θάτερον μηδέν, ἀλλ᾽ ἔστι τι. **πρὸς** μὲν γὰρ **ἓν** ἅπαντα συντέτακται)' ([**d**] 1075^{a}17–19). That core dependence and focal connection (sometimes also called simply 'the πρὸς ἕν relation') are at work here, and not (as the standard translations make up) a reference to 'one end', is confirmed by the following parallel.

> The good, therefore, is not something common answering to one idea. But how then are things said to be good? For they do not seem to be like the things that only have the same name by luck. But is it from being one thing, or by completing everything relative to one thing (πρὸς ἓν ἅπαντα συντελεῖν), or rather by analogy? (*NE* i 4, 1096^{b}25–8, ROT)

This passage is another key to the interpretation of Λ 10, not only because it shows that Aristotle rejects the notion of one univocal form of the good or universal good as the end for everything (fishes, humans, plants, etc.), but also because it suggests that the good does not extend to the other extreme of being absolutely equivocal, so that goods interrelate only luckily (ἀπὸ τύχης). But how then are they related to one thing, and how does the good that Aristotle has in mind exhibit focal equivocity?

[46] For the last term, and a comprehensive account of the issue, see Shields 1999.

[47] 'That which is, is said in many ways, but in relation to one thing and a single nature, and not homonymously, but rather as everything that is healthy is in relation to health, some by preserving it, others by producing it, others by being indicative of health, others by being receptive of the same, and as that which is medical is in relation to medicine . . . and we will find other things spoken of in a similar manner to these—so too is being said in many ways but always in relation to a single principle (οὕτω δὲ καὶ τὸ ὂν λέγεται πολλαχῶς μὲν ἀλλ᾽ ἅπαν πρὸς μίαν ἀρχήν)' (*Meta* iv 2, 1003^{a}33–^{b}6; cf. 1030^{b}3, 1061^{a}11).

[48] Shields, who has made a monograph-length study of homonymy in Aristotle, and uses many other passages from the work to make his case, does not index *Metaphysics* xii 10. And, at least as far as I can tell, none of the commentators on xii 10 makes reference to the *pros hen* relationship.

The Kind of Principle that Nature is of Each of Them

The clarifying remark 'for that is the kind of principle that nature is of each of them' (τοιαύτη γὰρ ἑκάστου ἀρχὴ αὐτῶν ἡ φύσις ἐστίν, [e] 1075ª22–3) can be understood in connection with these considerations. Several commentators have emended the text[49] in order to permit a construal like that of Ross in his commentary, 'For the nature of each of them is such a principle' (ad loc.), which is substantially preserved in both the Oxford and Loeb translations. But here the issue is not the individual natures of the members of the household, but the sort of principle that nature is both in general and for any of the substantial things whose principle is natural.[50] Aristotle's position on the kind of principle that nature is has been explicitly stated in *Physics*: nature is an *internal* principle of motion and rest. Thus the point of the remark is to stress the relevance of the kinds of motion (or rest) that apply to the different kinds of things in the cosmos,[51] as well as to stress that the principle is to be understood as internal to natural substances. In this connection, we should recall that Aristotle considers each natural substance to have its own principle of motion, and its own good, and this is always to be contrasted with the incidental motions that can be imposed on it from outside, or goods or uses that it can be said to have in relation to other things.[52] The latter kind of motions and goods are related to the natural substance only incidentally.

The final positive statement on the issue of how the good exists in the cosmos, which gives a concrete example of how each thing can contribute to a common good, refers to the process of separation (τὸ διακριθῆναι) [g]. Commentators, along with the Oxford and Loeb translations, take this to refer to a process of disintegration or dissolution into elements such that the elements can be

[49] Jaeger, Zeller. See Sedley 2000, p. 329.

[50] This is rightly emphasized by Sedley 2000, p. 329.

[51] That Aristotle has kinds of motion in mind, in particular locomotion here, is indicated by the fact that he refers to 'creatures which swim, creatures which fly, and plants' [c]. Sedley 2000 (p. 328) gives this translation, a modification of his 1991 translation, which had 'fishes, fowls, and plants' (p. 193). The latter is more suggestive of the anthropocentric interpretation, since we are accustomed to eating 'fishes and fowls' but don't like to think of these as 'creatures which swim and fly'. Sedley comments on the significance of the change of translation (2000, p. 335 n. 14). The proper motions of a thing are directly related to its own intrinsic good, as we have argued extensively.

[52] See *Anima* i 3, 406ᵇ7–10. Also relevant here is the doctrine that the category of relation is the least substantial category, since 'nature is always in a substance', and it is hard to see how the nature of something could be in its relation to other substances: 'what is relative is least of all things a kind of entity or substance, and is posterior to quality and quantity; and the relative is an accident of quantity, as was said, not its matter, since something with a distinct nature of its own must serve as matter both to the relative in general and to its parts and kinds. For there is nothing either great or small, many or few, or, in general, relative to something else, which without having a nature of its own is many or few, great or small, or relative to something else. A sign that the relative is least of all a substance and a real thing is the fact that it alone has no proper generation or destruction or movement, as in respect of quantity there is increase and diminution, in respect of quality alteration, in respect of place locomotion, in respect of substance simple generation and destruction. In respect of relation there is no proper change; for, without changing, a thing will be now greater and now less or equal, if that with which it is compared has changed in quantity' (*Meta* xiv 1, 1088A22–35, trans. Ross).

reformed into other natural substances.[53] Although this is not an impossible interpretation, there is at the same time nothing in the text, and very little in other texts,[54] to support it.

Aristotle uses the terms 'separate' (διακρίνειν), and its antonym 'combine' (συνκρίνειν) in representing and critiquing the views of his predecessors.[55] For example, Aristotle discusses Anaxagoras' view that intelligence initiated motion and 'separated' everything out,[56] and compares it with Empedocles' view that Love and Strife cause the elements to 'combine and separate'.[57] It is more plausible to suppose that this is what Aristotle mentions here, especially since the chapter is largely concerned with refuting the views of Empedocles and Anaxagoras. There is a parallel passage in which Aristotle's own positive views on these issues are especially clear, and it is worth examining the passage at length for the light it sheds on [**g**].

Leucippus and Democritus, who say that the primary bodies are in perpetual movement in the void or infinite, may be asked to explain the manner of their motion and the kind of movement which is natural to them. For if the various elements are constrained by one another to move as they do, each must still have a natural movement which the constrained contravenes, and the prime mover must cause motion not by constraint but naturally (δεῖ τὴν πρώτην κινοῦσαν μὴ βίᾳ κινεῖν, ἀλλὰ κατὰ φύσιν). If there is no ultimate natural cause of movement and each preceding term in the series is always moved by constraint, we shall have an infinite process (εἰς ἄπειρον γὰρ εἶσιν). The same difficulty is involved even if it is supposed, as we read in the *Timaeus*, that before the ordered world was made the elements moved without order (ἀτάκτως). Their movement must have been due either to constraint or to their nature. And if their movement was natural, a moment's consideration shows that there was already an ordered world. For the prime mover must cause motion in virtue of its own natural movement, and the other bodies, moving without constraint, as they came to rest in their proper places, would fall into the order in which they now stand, the heavy bodies moving towards the center and the light bodies away from it. But that is the order of their distribution in our world (ὁ κόσμος ἔχει τὴν διάταξιν). There is a further question, too, which might be asked. Is it possible or impossible that bodies in unordered movement (κινούμενα ἀτάκτως) should combine in some cases into combinations like those of which bodies of nature's composing are composed, such, I mean, as bones and flesh? Yet this is what Empedocles asserts to have occurred under Love. 'Many a head', says he, 'came to birth without a neck'. The answer to the view that there are infinite bodies moving in an infinite is that, if the cause of movement is single, they must move with a single motion, and therefore not without order; and if, on the other hand, the causes are of infinite variety, their motions too must be infinitely varied. For a finite number of causes would produce a kind of order (τάξις τις ἔσται), since absence of

[53] So Oates 1963, p. 258; Sedley 2000; Ross glosses the passage: '"all things, even if they make no other contribution to the whole, must at least come to be dissolved", sc. so that better things may be made out of their elements' (*Aristotle Metaphysics*, ad loc.).

[54] Although I can find no commentators who refer to other passages in the corpus that support such a reading, there are in fact some such passages. See, for example, *GC* 317^{a}27.

[55] e.g. *GC* 315^{b}17, 329A3–4.

[56] *Phys* 250B26; *Cael* 301^{a}14.

[57] *Phys* 196^{a}27; *GC* 333^{b}20; *Meta* 984A11.

order is not proved by diversity of direction in motions: indeed, in the world we know, not all bodies, but only bodies of the same kind, have a common movement. Again, disorderly movement means in reality unnatural movement, since the order proper to perceptible things is their nature (ἔτι τὸ ἀτάκτως οὐθέν ἐστιν ἕτερον ἢ τὸ παρὰ φύσιν· ἡ γὰρ τάξις ἡ οἰκεία τῶν αἰσθητῶν φύσις ἐστίν). And there is also absurdity and impossibility in the notion that the disorderly movement is infinitely continued. For the nature of things is the nature which most of them possess for most of the time. Thus their view brings them into the contrary position that disorder is natural, and order or system unnatural. But no natural fact can originate in luck (καίτοι οὐδὲν ὡς ἔτυχε γίγνεται τῶν κατὰ φύσιν). This is a point which Anaxagoras seems to have thoroughly grasped; for he starts his cosmogony from unmoved things. The others, it is true, make things collect together somehow before they try to produce motion and separation (πειρῶνται δὲ καὶ οἱ ἄλλοι συγκρίνοντές πως πάλιν κινεῖν καὶ διακρίνειν). But there is no sense in starting generation from an original state in which bodies are separated and in movement. Hence Empedocles begins after the process ruled by Love: for he could not have constructed the heaven by building it up out of bodies in separation (ἐκ κεχωρισμένων), making them to combine by the power of Love, since our world has its constituent elements in separation (ἐκ διακεκριμένων γὰρ συνέστηκεν ὁ κόσμος τῶν στοιχείων), and therefore presupposes a previous state of unity and combination (ἐξ ἑνὸς καὶ συγκεκριμένου). These arguments make it plain that every body has its natural movement, which is not constrained or contrary to its nature (Ὅτι μὲν οὖν ἐστι φυσική τις κίνησις ἑκάστου τῶν σωμάτων, ἣν οὐ βίᾳ κινοῦνται οὐδὲ παρὰ φύσιν). (*Cael* iii 2, 300B8–1A22)

The main positions expressed in this passage are already familiar, and we have discussed them at length. What makes the passage especially relevant to the interpretation of Λ 10 as well is that it not only gives a compact description of Aristotle's own account of the order (τάξις) of the universe, but also engages on the issue of the same predecessors whom he engages in the later parts of Λ 10.

We can now get a better idea of the meaning of the somewhat cryptic sentence: 'I mean, for example, that at least each of them must necessarily come to be separated' [**g**]. While we have previously discussed how the good can be achieved through the various motions of animate natural substances (stars, plants, animals, humans), Aristotle here discusses a minimum level of arrangement or order that can be assumed for the elements, in a kind of primordial state of separation. The terrestrial elements have natural motions which, if not subjected to other forces, will result in their separation out into independent spheres based on their natural movements and qualities. Thus even the simplest things in the universe, the terrestrial elements, in their own way, and through their own natural motions, exhibit the cosmic order and arrangement in their separation. As Aristotle makes plain, the natural tendency to this separation is a more basic cause of order than their possible combination to form more complex entities. Hence the interpretation of [**g**] that holds that the 'dissolution' contributes to the good by making possible the combination into further elements is probably an over-interpretation. Aristotle apparently holds that the separation itself is indicative of a natural order. Of course, it is possible that Aristotle implies that the separated elements can be combined into more complex entities in the words, 'and there are likewise other

things in which all share towards the whole'. All things are jointly arranged with respect to one thing, the good. Chiefly, this means their own goods, like reproduction for plants, and pleasure for animals. Clearly the highest good in nature is intelligence (νοῦς)—and it is identified with god, even with reference to its presence in the extraterrestrial intelligences and human beings. But the arrangement of nature is such that all the different kinds can coexist: their needs are not generally mutually exclusive. There is no need for one kind to exist only for the sake of another, much less all of them for humans. This is the good in the arrangement.[58] But that does not mean some single good above and beyond the individual kinds of things—substantial natures—that are so arranged. If that were the case, the one thing would be a completely separate and independent good, an option that Aristotle never explicitly takes in offering teleological explanations of his own, and that he seems to reject both in Λ 10 and in the ethical works. At any rate, reference to 'some one first separate Good-itself', even if this does not suffer the same problems as the 'form of the good' or 'universal good', apparently has no role to play in a scientific explanation, and so it is not surprising that we do not find any teleological explanations in Aristotle that refer to such a good, whether in the biological works, ethical works, or elsewhere. Much less does some human good play this role, as it would have to on the anthropocentric interpretation. Rather, all things are jointly arranged for their own good. This is the result we would expect from our investigation of the various kinds of natural substances in the works devoted to them. To take only the most salient case of humans: humans are oriented towards their own unique good, the active exercise of their highest function, νοῦς. But this good is not the same in all alike. Animals are not oriented towards this good, but towards their own goods, the pleasurable perceptions that motivate their locomotion. Plants do not even have appetite, because they lack perception and thus locomotion, and so their good is not that of humans and animals. Their good is strictly to be found in growth and reproduction (flourishing). The only thing genuinely in common between rotation, reproduction, pleasure, and contemplation is that they are practicable goods for certain kinds of beings, each of which is separate and independent of every other. Beyond the goods of these individual kinds of substances, and the principle that 'it is better to exist than not to exist' (βέλτιον δὲ τὸ εἶναι ἢ τὸ μὴ εἶναι, *GC* 336^{b}28–9, see also *GA* 731^{b}30), there is no 'separate and independent' good, and that is why the good is not the same for fishes, fowls, and plants, not to mention humans and stars, as the passage in question explicitly says [**c**].

Nonetheless, all natural things have goods, and these goods are interconnected by being goods that are practicable for each of them according to their own natures. A plant achieves its practicable good by growing, fructifying, and reproducing; an ox by moving around, perceiving, and copulating; and a human by

[58] Cf. Atran 1990, p. 103.

growing, walking, thinking, and loving. If the human collects and eats the fruit, and uses the ox for tilling the field, then the goods overlap, and not incidentally, because each is fulfilling its own good. Their goods are all interconnected. But notice that the good for each, the principle that nature is for each of them, is not the good of the others. Each has its own good. It is possible for there to be a conflict between the goods of one, and the goods of another. Taking the eggs of the chicken or carving up the ox, are not 'good' for the chicken or the ox. In cases where an intelligent agent is involved, such conflicts of goods constitute an ethical problem, which requires that the agent look to his or her own nature to determine the best and most noble course of action. In the conclusion we will consider further the implications of this.

Rejection of the Extrinsic Teleological Alternatives

Aristotle rejects what he takes to be the alternatives to the view that the good of each thing is intrinsic to it, in what remains of Λ 10. His treatment of other accounts of how the good operates as a cause of the generation and existence of things is illustrative because it further confirms the interpretation we have advanced throughout the chapter and indeed the study. For example, Aristotle rejects the view that the good and bad are not among the causes of anything, but are only the products of living things. 'Some do not treat the good and bad even as principles; yet in all things the good is in the highest degree a principle' (*Meta* xii 10, 1075A36–7; cf. 1072B30–4). Among those who recognize the good as a principle, some fail to indicate how it can actually be a cause—the basis of a scientific explanation—of a natural substance. 'Others are right in saying that it [the good] is a principle, but how the good is a principle, whether as end or mover or form they do not say' (*Meta* xii 10, $1075^{a}36$–$^{b}1$). Most instructive, it turns out, is Aristotle's response to Anaxagoras.

> Anaxagoras treats the good as a principle of motion. For intelligence causes things to move. But it moves for the sake of something, which is another, except on our account: for the medical art is, in a way, health. (Ἀναξαγόρας δὲ ὡς κινοῦν τὸ ἀγαθὸν ἀρχήν· ὁ γὰρ νοῦς κινεῖ. ἀλλὰ κινεῖ ἕνεκά τινος, ὥστε ἕτερον, πλὴν ὡς ἡμεῖς λέγομεν· ἡ γὰρ ἰατρική ἐστί πως ἡ ὑγίεια). (*Meta* xii 10, $1075^{b}8$–10; cf. xii 3, $1070^{a}29$–30, xii 4, 1070B28–35)

This passage is instructive because it expresses, in a very subtle way, the conclusion that we have affirmed so many times. That is the fact that for Aristotle the principle of motion and the cause for the sake of which are identified in the natural being (whether a star, an element, a plant, a fish, or a human). The motions have to be understood with reference to motions of a nature that is at the same time the beneficiary of those motions. In Anaxagoras' scheme, the mover is completely separate from the good for the sake of which it moves anything; like Dr Smith treating Mr Jones: the moving cause of the health is separate from the patient, who is the beneficiary of the health. Aristotle's view of nature, on the other hand

('our account', in the above passage) is like a Dr Smith treating himself: something moving in a way for its own benefit. The clear parallel for this, is the conclusion of *Physics* ii 8:

> If the [cause] for the sake of which is present in art, then it is present in nature too. The point is clearest when someone doctors himself: nature is like that. Thus that nature is a cause, and a cause in this way: for the sake of something, is plain. (εἰ ἐν τῇ τέχνῃ ἔνεστι τὸ ἕνεκά του, καὶ ἐν τῇ φύσει. μάλιστα δὲ δῆλον, ὅταν τις ἰατρεύῃ αὐτὸς ἑαυτόν· τούτῳ γὰρ ἔοικεν ἡ φύσις. ὅτι μὲν οὖν αἰτία ἡ φύσις, καὶ οὕτως ὡς ἕνεκά του, φανερόν). (*Phys* ii 8, 199^{b}30–3).

It is worth dwelling on Aristotle's use of the medical analogy, since he has so forcefully stated that this is the best way to understand nature, and because we have seen that this is his model for another aspect of his natural philosophy, one that is crucial to the interpretation of Λ: the causality of unmoved movers. Recall that the model for how an unmoved mover causes change or motion is the medical art. The medical art does not change, but causes the movement of the doctor and his instruments in order to affect the health of the patient. Similarly, the soul is an unmoved mover that uses the bodily organs as instruments for functions like nutrition and locomotion. Consider further the case of locomotion. The fact that the whole animal is moved through the causality of an unmoved mover, and to that extent 'moves' the body that contains the unmoved mover, is entirely incidental to the causality of the unmoved mover, since 'unmoved mover' designates the cause, not the subject of motion.

In his initial definition of nature in *Physics*, Aristotle explains the notion of incidental, as opposed to intrinsic, using the same medical analogy:

> Nature is a principle or cause of being moved and being at rest in that which it exists primarily, intrinsically and not incidentally. I say 'not incidentally' because (for instance) a man might himself be a cause of health for himself. Nevertheless it is not insofar as he is a patient that he possesses the art of medicine: it merely has happened that the same man is doctor and patient—and that is why these attributes are not always found together. (*Phys* ii 1, 192B21–7)

So in *Physics* ii 1, a doctor healing himself is the illustration of incidental change, but in *Physics* ii 8, this is said to be the best illustration of nature.[59] The two passages are consistent because in art the moving cause is separate from the end as

[59] There is another passage to consider here: 'nature in the sense of coming to be proceeds towards nature. For it is not like doctoring, which leads not to the art of doctoring but to health. Doctoring must start from the art, not lead to it. But it is not in this way that nature is related to nature. What grows *qua* growing grows from something into something. Into what then does it grow? Not into that from which it arose but into that to which it tends. The shape then is nature' (*Phys* ii 1, 193B12–18). This means that the form (or shape) that the art produces is not that of the art but the form of its product (Lennox 1982, p. 24 n. 10). The sculptor does not produce the art of sculpting in bronze, but *Diophorus*. So the doctor does not produce medicine in a patient, but health. Nature, on the other hand, is the principle of its own production: what the plant or animal grows into is identical to its nature. This does not in any way contradict the notion that nature is like a doctor treating himself.

beneficiary (so the medical art is separate from the health of the patient), but in nature the moving cause and the end for the sake of which—the beneficiary—are the same. Anaxagoras' scheme fits the pattern of art, not nature. The anthropocentric scheme would also be closer to this, since according to it humans would be the beneficiaries of the moving causes of other natural things, and thus the moving cause and the end would be separate, like Dr Smith and Mr Jones. But alas, 'there is no [wisdom] concerned with the good of all animals, any more than there is one art of medicine for all existing things' (*NE* vi 7, 1141A31–3).

The medical analogy is in this way far more fruitful in conveying Aristotle's point about nature and the good than the general and the army, even if the latter has more direct metaphorical appeal because of the military connotations of the term τάξις. In both animal self-locomotion and human deliberate action, the paradigm cases of natural change and motion that can be teleologically explained, the mover and the moved is both the agent and the beneficiary of the good and change for the sake of which, like a doctor treating himself or herself.[60]

I conclude that the two keys to Aristotle's teleological explanations are these: (1) natural motion happens for the sake of something, and (2) what it happens for, intrinsically, is the good of the natural substance that is moved.

[60] Cf. Sedley 1991, pp. 191–2.

10

Conclusion

Aristotle's teleology is most successful on the level of the explanation of organisms, and there is reason to think that his speculations were largely based on his investigations of that kind of entity. Certainly organisms are the paradigm of natural substances in his system. Contemporary biologists, some of great eminence, recognize his lasting value in this regard. This applies to physiology, embryology, genetics, and ethology. Not only are his 'why' questions considered quite legitimate in the study of evolutionary adaptation,[1] but his genetics offers insight into why intentionalistic discourse continues to pervade even contemporary genetic science. For if what is transmitted in a gene acts like an unmoved mover,[2] it has to be understood in terms of outcomes and results—ends—that cannot be accounted for by either material or mechanistic causes alone.[3] We can no more reduce or eliminate cybernetic notions in genetic science such as information,

[1] 'Aristotelian "why" questions are quite legitimate in the study of adaptations provided one has a realistic conception of natural selection and understands that the individual-as-a-whole is a complex genetic and developmental system' (Mayr 1983, p. 332). See also: Grene 1972; Boylan 1983, pp. 116–17; Cartwright 1986; Gotthelf 1989; Lennox 1993; Depew 1997.

[2] The Nobel laureate and founder of molecular genetics Max Delbrück remarks that Aristotle's 'biology abounds in aggressive speculative analysis of vast observations on morphology, anatomy, systematics, and most importantly, on embryology and development . . . the form principle is the information which is stored in the semen. After fertilization it is read out in a preprogrammed way; the readout alters the matter on which it acts, but it does not alter the stored information, which is not, properly speaking, part of the finished product. In other words, if that committee in Stockholm, which has the unenviable task each year of pointing out the most creative scientists, had the liberty of giving awards posthumously, I think they should consider Aristotle for the discovery of the principle implied in DNA' (1971, pp. 53–5).

[3] As Delbrück explains, 'the reason for the lack of appreciation, among scientists, of Aristotle's scheme lies in our having been blinded for 300 years by the Newtonian view of the world. So much so, that anybody who held that the mover had to be in contact with the moved and talked about an "unmoved mover" collided head on with Newton's dictum: Action equals reaction. Any statement in conflict with this axiom of Newtonian dynamics could only appear to be muddled nonsense, a left-over from a benighted, prescientific past. And yet, "unmoved mover" perfectly describes DNA: it acts, creates form and development, and is not changed in the process' (1971, p. 55). Cf. Matthen: 'genes and genetics can now be shown to be firmly rooted in the Newtonian scheme of local causation' (1989, p. 278). A full and fascinating discussion of Aristotle's teleology in relation to contemporary genetics is Kullmann 1998, p. 284–312. See also: Balme 1965; Bradie and Miller 1984; Boylan 1983, pp. 93–8 1984; Gutiérrez-Giralso 2001.

codes, messengers, and so forth, any more than Aristotle could eliminate notions such as striving, imitating, and doing nothing in vain.[4]

Aristotle's teleology is less successful on the levels of complexity below and above the organism. Thus his theory of the teleological movement of elements (in terms both of their locomotion and of their reciprocal transformations) has as little import for modern physics and chemistry as his notion that the stars are alive does for astronomy. And his application of teleology to political organizations, which ends up justifying 'natural' forms of domination—over slaves, women, and children—likewise has little to teach contemporary sociologists and political scientists, other than what to avoid. This does not mean that there is nothing of value in Aristotle's political theory, or even in his 'sociobiological' treatment of political entities as if they were natural substances. It simply means that the use to which Aristotle puts his teleological explanations in the context of politics is a spectacular case of failed extrapolation.

There is perhaps a common cause for the failure of Aristotelian teleology at the level of physics and chemistry on the one hand, and of politics and sociology on the other. The account of organisms as part–whole structures with an internal source of motion and end (in a word, a nature) is insightful and compelling. The account of elements and cities, on the other, is strained. This is because it is ultimately something outside the element that determines how elements move and where to, much like Aristotle's slave (or woman or child), who is supposed to be naturally controlled by someone else—the master and patriarch—in accordance with the patriarch's external ends.

Teleology appears to require a sufficient degree of complexity, that is, a sufficiently robust whole–part structure as its object; it suffers when the object has either too little or too much complexity. In the case of the elements, which Aristotle treats as 'simple', there is no immediate whole–part structure, except relative to their natural place in the universe.[5] At the other extreme of the city and society, there are simply too many complex interactions, and so an insufficiently determinate whole for which parts can be clearly discerned. But although Aristotle's theory is a mixed bag of results as far as its relevance to contemporary astronomy and sociology goes, his distinctions are of the utmost salience and relevance to our current concerns about how we ought to relate to other natural entities.

Observing the world from Aristotle's perspective can be humbling because, while offering numerous opportunities for the celebration of human uniqueness and magnificence, it at the same time forces us to recognize the great extent to

[4] Cf. Balme, who says of cybernetic mechanisms: 'it is doubtful that this modern view really preserves any meaning to teleology' (1965, p. 5). On the other hand, in 1987b he suggests that the cybernetic model and genetic coding are fundamentally teleological.

[5] Atran (1990 and 1995) shows that all cultures regard organisms as natural kinds, and as teleologically explicable, but that elements, events, and so forth are only sporadically recognized as such. He points out that: 'Earth, air, water, and fire may have been natural kinds for the ancient Greeks, but not for us or the Maya' (1995, p. 221).

which we, as natural creatures, are animals and, indeed, plants. What constitutes the good life for us can be determined by a process parallel to the determination of what is good for any organism,[6] and a not negligible part of our good life just is a flourishing of our plant and animal nature. We have plant and animal souls as surely as we do a human soul—there is no human being without one. To consider the contemplation of any organism to be disgusting because unsightly implies a low estimation of oneself, since humans are composed in a similar way: 'if someone has considered the contemplation of the other animals to lack value, he ought to think the same about himself as well' (*PA* i 5, 645A26–8).

While a lot has been said about the implications that Aristotle draws from his natural philosophy for his conception of the good life for humans (and thus for human ethics), next to nothing has been said about the implications of this view for other animals, not to mention plants. I summarized my interpretation of Aristotle's teleology with the positions that: (1) natural motion happens for the sake of something, and (2) what it happens for is the benefit or good of the natural substance that is moved. I have tried to show that Aristotle holds that the human uses and benefits of natural substances and motions are incidental to the objective causes and ends of those natural substances themselves. I think that this perspective has profound implications for how we should relate to other natural substances, especially organisms.

If practical wisdom was all there was to wisdom, and contemplation had no other or no greater object than the human good, then other natural things, like plants and animals, could justifiably be viewed solely as instruments for human ends. But as it is, the framework of practical reason is subordinate to theoretical wisdom. Theoretical wisdom demands recognition of the independence of other organisms and their ends from human ends, as goods and things of value in themselves, not as mere instruments of human actions. And this is so even from the limited standpoint of what is of value for human life. Contemplation is of natures, not of tools.[7] Any further use or benefit that can be had from natures is incidental to the theoretical knowledge of which they are the objects—these are ends themselves.

[6] John Cooper (1999, pp. 268–9) points out that the argument that our natural good is 'parallel to the similar arguments about the natural good for other kinds of organisms', however much it has fallen out of favor with contemporary philosophy, 'or even mainstream philosophical thought since the Renaissance', is nonetheless 'an intuitively compelling idea' because it rests on a 'strong intuitive basis'. Cooper acknowledges that 'this idea clearly lies behind all our discourse about what is harmful or beneficial for plants or animals'. While Cooper is interested in the implications of this strong intuitive basis for our reasoning about human ethics, it is high time that this discussion be extended to a consideration of its implications for our ethical relationships to non-human organisms.

[7] Sedley recognizes that natural sciences like zoology are what contemplation is about for Aristotle, and that contemplation is the end for humans, just as it is for the gods (1997, p. 338). As he points out, this is the uniquely human way to become like a god, according to Aristotle. But if animals were just instruments for human ends—i.e. they 'function primarily for the sake of humans', then contemplating them would be like contemplating instruments of practical activity and action. Were this the case, human contemplation would not be at all similar to that of the gods, and could hardly constitute the end of human life, since the object of contemplation would merely be a means.

If we were transplanted to the Isles of the Blessed, where there is no need of anything (or if we were gods, whose only activity is contemplation), we would see this—plants and animals would be valuable to us as objects of contemplation and beauty, and not because we could use them to serve our needs and interests. From this loftier perspective, consideration of the potential uses of nature for our needs is burdensome and boring—to use an unfashionable word, banausic. Philosophy, on the other hand, is a kind of biophilia, which loves and delights in natural objects and their causes (and in nature and its causes generally) in their own right, not insofar as they can turn a profit. Philosophy is less like fishing and hunting, and more like ichthyology and zoology. It is tiresome and irritating to keep asking of natural things 'What is the use?' or 'What is the payoff for us?'. Once we have got what we need to survive, we should turn our attention to understanding natures in terms of their own ends and goods.

Many will think that the notion that anything besides humans can have ends (either as an object or subject of value) is patently absurd. But the basis for the custom that says that things other than humans cannot have ends is the assumption that only humans can have conscious goals or purposes. Because non-human organisms do not have conscious goals or purposes, we assume that it is anthropomorphic to attribute ends to non-human things such as animals and plants. A consequence of this avoidance of anthropomorphism is the acceptance of anthropocentrism: if only humans can be the subjects of purposes and values, then only humans can be objects of purpose or value, and thus have ends.

But Aristotle offers us a way to think about ends and goods as natural phenomena, as objective causes out there in the world, and not merely as products of the human mind.[8] Of course only a mind can be conscious of the goods and ends in nature, but there does not need to be a mind or intelligence in order to have ends. We have seen how it is that Aristotle reasons about ends, functions, and goods without assuming conscious purposes and goals. His teleology, as I have characterized it, recognizes that

[8] It is a weakness of the 'internalist realist' position advocated by Nussbaum that it cannot accommodate this aspect of his thought. Nussbaum thinks that such a view is required because 'externalist' realist views have lost credit and fallen out of favor (1992, pp. 205–8). But 'internalist realism', since it eschews realism in general for a realism based solely in human experience and about human beings and their relationship to the world, fails to escape anthropocentrism and to recognize the objective causes of natural ends, independent of human ends. By restricting Aristotle's analysis to human essence, human needs and goals are treated as the only objective ends. But then we are entitled to ask to what extent Nussbaum is really offering, as she claims to be, 'a defense of Aristotelian essentialism'. Nussbaum tries to integrate Aristotle's concern for non-human nature by making 'relatedness to other species and to nature' (p. 219, 222) an essential feature of human beings. But Aristotle recognizes other natural substances as ends in themselves, in complete independence of their relatedness to humans. A better, though seriously underdeveloped, suggestion is made by Nussbaum in another essay, where she points out that their own capabilities ought to be the basis for a determination of 'what we owe to other species' (1990, p. 176 n. 29). For a good critique of Nussbaum's interpretation of Aristotle as an 'internalist realist' see Cooper 1988. Cooper (1995) also offers arguments, in a completely different context, for invoking concerns 'external' to ethics in the context of ethical theorizing. This is relevant because, on our argument, the nature of other living things has ethical implications for human beings.

different kinds of natural substances have their own ends which are the basis for determining what is good for them, independent of any use or benefit that they might have in relation to other things, like other animals or humans or gods.

Aristotle's scientific method gives us a framework for establishing what the intrinsic ends of various natural kinds are and, if justified, requires us to acknowledge them as goods. In fact, he requires that the determination of the cause for the sake of which be made with regard to what's better, 'not absolutely, but with respect to the particular substance'. Motions and ends that can be inflicted on the organism but are not natural to it are incidental and can function neither in a scientific explanation of the natural substance, nor in an estimation of its intrinsic goods or end.

In this way, Aristotle's philosophy can be used to critique both anti-teleological and teleological bases for anthropocentrism. Consider anti-teleological perspectives, like that of Descartes. If Aristotle's views are right, the Cartesian conception of animals as machines[9] cannot explain crucial features of animal reproduction, growth, development, perception, movement, behavior, and flourishing. Since there is in fact no way to reduce the explanation of animals to material or efficient causes, or even to identify the right object of explanation if we assume that these are the only kinds of causes, it follows that there is no way to avoid recognizing that they have ends, and thus goods. Hence other living things are not morally negligible entities; and their goods (survival, pleasure, flourishing) are every bit as real as the goods of human pleasure, survival, and so forth.

Aristotle's views constitute an even more serious challenge to teleological versions of anthropocentrism. This applies to the Xenophon-Socratic, Platonic, and Stoic (and later, Neoplatonic, Islamic, and Christian) idea of god creating all the plants and animals and providentially arranging everything for the sake of human beings. Such a conception, which requires that plants and animals function primarily for the sake of human beings, cannot stand up to the scientific principle that the explanation of the parts and behaviors of animals requires reference to the good of their own kind. Merely pointing out how various animals can be made to function for human interests has been exposed as non-explanatory from a scientific perspective. Thus it can constitute neither a basis for knowledge of nature, nor a coherent ethical framework for our relation to other natural beings.

It needs to be made clear that the axiological implications of Aristotle's theory of nature do not respond to every possible justification of anthropocentrism. Primarily, it responds to attempts to naturalize the grounds for anthropocentrism. There could very well be non-naturalistic reasons why humans are entitled to treat other beings instrumentally. (There are also naturalistic justifications for treating other natural beings instrumentally, up to a point, a point that Aristotle thinks can

[9] *Discourse on the Method* v (in Haldane and Ross, pp. 115–18); see also the letters of Descartes to the Marquess of Newcastle (November 23, 1646) and to Henry More (February 5, 1649). A comprehensive treatment is available in Des Chene 2001.

be objectively determined.) It would go far beyond the scope of the present study to consider all such possible justifications. Nevertheless, it is clear that such justifications, to the extent that they do depend on naturalistic arguments on any level, will have to confront the intrinsic goods that can be established in an Aristotelian framework. And even if they are somehow totally independent of any naturalistic framework, they will still have to deal with the tension between their framework and the naturalistic one.

The chief problem with theories that recognize the goods of non-human beings as intrinsically valuable can be stated as a dilemma: it leads either to radical egalitarianism, or it requires the establishment of a value hierarchy which adverts in the final analysis to the subjective value system that it seeks to replace.[10] Surely a theory of value that levels rocks, trees, cows, and humans is asinine and untenable. The author of a monograph on the subject[11] argues that Aristotle's philosophy of

[10] Regan 1992, pp. 175–81; cf. Van DeVeer 1995, pp. 1–3.

[11] Oates in *Aristotle and the Problem of Value* (1963), introduces the following thesis: 'Aristotle . . . developed an empiricist metaphysics which permitted him to build upon the logical aspect of Plato's ideas, and at the same time to make startling advances in ontology and epistemology, but which prevented him from coming to grips adequately with the problem of value and its relationship to being' (1963, p. 4). At the end of his book he represents the conclusion that Aristotle 'really never constructed an adequate or coherent axiology. That Aristotle's axiology is such, we hope we have been able to establish, and this result cannot fail to reinforce our view that a metaphysician would be well advised to keep always before him Being and Value as tightly conjoined' (1963, p. 372; cf. p. 6 and 56). Oates argues, like several others we have mentioned, that Aristotle believes in a cosmic teleology, over and above the ends of individual substances: 'Aristotle's teleology has two aspects, one a cosmic teleology where the Absolute Final Cause operates as End or Purpose, and the other the final cause or purpose which operates for an individual particular. And more than once we have noted Aristotle's inability to make these two aspects cohere with one another' (1963, p. 218). Potentially, either of these has promise as a theory of value, according to Oates. But in the final analysis, neither of them works. The cosmic teleology fails because it lacks a doctrine of creation, which Oates holds to be essential for it to have any significance for value theory: 'value cannot enter the universe from the final cause as a source if there be no doctrine of creation. Without a doctrine of creation, how in Aristotelian terms can you answer the question: What is the purpose of the universe? This question the conception of a cosmic Final Cause inevitably entails . . . if, as in Aristotle, one is faced with a "system" in which there is a God *without* a doctrine of creation, it is our contention that it is impossible to fashion a thoroughly coherent and self-consistent theory of value. Such a conclusion is substantiated by our estimate of Aristotle's teleology' (Oates 1963, p. 252). We can agree with Oates that cosmic teleology requires a creator if it is to have any chance of being explanatory, but disagree with him that Aristotle failed on this score, since on our view, Aristotle never tried to maintain a teleology of the universe as a whole, over and above the substances that make up the universe. As for the second kind of teleology, Oates states: 'The equation of form and goal or purpose in things of all orders, then, presupposes a kind of value system which is fundamentally objective in character. However, here it refers only to each of the infinite number of individual particular things in which the form, considered as equivalent of its purpose, reveals its value or worth. Now there is a sense in which this value system does recognize our postulate in regard to the co-presence of Being and Value, but Aristotle does not explicitly give any indication that he was engaging in a different kind of value thinking when he invoked his happiness principle or when he talked about "intelligence" and "nature" as sources of value in the perspective of the Universe. Furthermore, though Being and Value do come together in a way in the notion that the form of a thing is the equivalent of its purpose, yet there seems to be nothing in the thought of Aristotle, at least in the present context, which would help us determine the *relative* value of each of these particular things' (Oates 1963, p. 134).

nature provides no method for rank-ordering values in nature itself and, because his cosmology lacks a creator god, Aristotle provides no basis for an external value judgment. The result is that his philosophy offers no coherent basis for a theory of value at all.

But Aristotle's doctrine of natural capacities allows him to establish a hierarchy of values, and thus to avoid radical egalitarianism, while at the same time avoiding arbitrary relativism. Things can be rank-ordered for Aristotle on the basis of their capacities and functions, which can be arranged in a nested hierarchy of ontological dependence. Rocks and water are inanimate and so of very low intrinsic value relative to plants—but they do have minima of value, since it is better to be than not to be. Plants, on the other hand, are less valuable than animals, because the ability to move oneself and perceive is of great worth relative to lying motionless without any sensation. But animals are less valuable than humans, since the ability to deliberate and intentionally pursue goals, to develop good moral and intellectual habits, and even to contemplate the whole scheme of nature is of much greater value than an ability merely to move and experience pleasure.

But does this kind of hierarchy send us right back to the position of human dominance, and so effectively amount to the anthropocentrism that we were trying to avoid? One answer is that, even if it did, at least we would have a naturalized, objective basis for that apparently inevitable axiology. But the real answer is that it does more than this. What the recognition of intrinsic goods in nature does is to shift the burden of justification for upsetting natural ends and subverting natural goods onto the agent that would undertake to do so. Instead of assuming, as anthropocentrism does, that the only constraint on human exploitation of nature is the determination of the ultimate cost, benefit, or harm to human beings, a naturalized axiology requires us to justify exploitation of nature with reference to the ends of other natural entities as well—plant and animal species, for example. And this opens up the space for a realistic environmental ethic, one that accommodates the inevitability of predation and the real need for exploitation of nature not only by humans, but by all other living things as well. Recall that Aristotle holds that acquiring and consuming things, so far as is required for survival, is justified by nature, but that consumption for the sake of luxury or for the sake of acquisition itself is shameful and contrary to nature. He said that there is a natural limit to the extent to which wealth and consumption should be pursued. Thus there are natural constraints on the human exploitation of nature, and there is recognition that other things besides humans have intrinsic value.

I think that the kind of value system just described is fully consistent with Aristotle's philosophy, and reveals a deeply significant and largely unappreciated aspect of his thought. Unless we can produce rational justifications otherwise, air, water, and earth ought to rest unpolluted in their natural places; plants ought to be able to grow and flourish undisturbed; animals ought to be unharmed to the extent that we don't need to eat them or kill them to protect ourselves and to survive. Once we have secured the means of our survival, the value of other natural

things is as objects of contemplation and awe. Thus Aristotle thinks that humans should organize their communities so as to offer their citizens maximum opportunity to contemplate nature as it undergoes its cycles of growth and decay,

> omitting nothing in our power, whether of lesser or greater esteem. For even in the contemplation of animals disagreeable to perception, the nature that crafted them likewise provides extraordinary pleasures to those who are able to know their causes and are by nature philosophers … Surely it would be unreasonable, even absurd, for us to enjoy contemplating likenesses of animals—on the grounds that we are at the same time contemplating the art, such as painting or sculpture that made them—while not prizing even more the study of things constituted by nature, at least not when we can behold their causes … in all natural things there is something marvelous … in every one there is something natural and good. For what is not haphazard but rather for the sake of something is in fact present most of all in the works of nature; the end for the sake of which each animal has been constituted or comes to be takes the place of the noble. (*PA* i 5, 645A6–26)

Bibliography

EDITIONS AND TRANSLATIONS

The following abbreviations are used to refer to translation series.

Clar Clarendon Aristotle Series. J. L. Ackrill and L. Judson, general editors. Oxford.

Loeb Loeb Classical Library. *Aristotle in 23 Volumes.* H. L. Tredennick, general editor. Cambridge, MA and London.

OT *The Works of Aristotle Translated into English*. (The Oxford Translation.) J. A. Smith and D. Ross, general editors. 12 vols. Oxford, 1908–52.

ROT *The Complete Works of Aristotle: The Revised Oxford Translation*. J. Barnes, ed. 2 vols. Princeton, 1984.

For abbreviations of works of Aristotle, see pp. x–xi.

Anima

Hicks, R. D. *Aristoteles De anima. With translation, introduction, and notes*. Cambridge, 1907.

Ross, W. D. *Aristotle. De anima. Edited with introduction and commentary*. Oxford, 1961.

Smith, J. A. *On the Soul*. Princeton, 1984. (ROT)

Cael

Stocks, J. L. *On the Heavens*. Princeton, 1984. (ROT)

Cat and Int

Ackrill, J. L. *Aristotle's Categories and De interpretatione. Translated with notes*. Oxford, 1963. (Clar, ROT)

EE

Solomon, J. *Eudemian Ethics*. Princeton, 1984. (ROT)

Woods, M. *Aristotle. Eudemian Ethics. Books I, II, and VIII. Translated with a commentary*. Oxford, 1992. (Clar)

Frag

Ross, W. D. *Aristotle. Select Fragments*. Oxford, 1952. (OT)

—— *Aristotelis Fragmenta Selecta*. Oxford, 1955.

GA

Balme, D. M. *Aristotle. De partibus animalium I and De generatione animalium I. Translated with Notes*. Oxford, 1972. Rev. A. Gotthelf, 1999. (Clar)

Peck, A. L. *Aristotle. Generation of Animals with an English translation*. Cambridge, MA and London, 1942. (Loeb)
Platt, A. *Generation of Animals*. Princeton, 1984. (ROT)

GC

Joachim, H. H. *Aristotle. On Coming-to-be and Passing-away (De generatione et corruptione). A revised text with introduction and commentary*. Oxford, 1922.
—— *On Generation and Corruption*. Princeton, 1984. (ROT)

HA

Balme, D. M. *Aristotle. History of Animals VII–X. Prepared for publication by A. Gotthelf*. Cambridge, MA and London, 1991. (Loeb)
Peck, A. L. *Aristotle. History of Animals I–III*. Cambridge, MA and London, 1965. (Loeb)
—— *Aristotle. History of Animals IV–VI*. Cambridge, MA and London, 1970. (Loeb)
Thompson, d'A. W. *History of Animals*. Princeton, 1984. (ROT)

IA

Farquharson, A. S. L. *Progression of Animals*. Princeton, 1984. (ROT)

Meta

Kirwin, C. *Aristotle's Metaphysics Books* Γ, Δ, *E. Translated with Notes*. Oxford, 1971. (Clar)
Ross, W. D. *Metaphysics*. Oxford, 1908. (OT)
—— *Aristotle's Metaphysics. A revised text with introduction and commentary*. 2 vols. Oxford, 1924.
—— *Metaphysics*. Princeton, 1984. (ROT)
Tredennick, H. *The Metaphysics with an English translation*. 2 vols. Cambridge, MA and London, 1933. (Loeb)

Meteor

Lee, H. D. P. *Aristotle Meteorologica. With an English Translation*. Cambridge, MA and London, 1952. (Loeb)
Webster, E. W. *Meteorology*. Princeton, 1984. (ROT)

Motu

Farquharson, A. S. L. *Movement of Animals*. Princeton, 1984. (ROT)
Nussbaum, M. C. *Aristotle's de motu animalium. Text with translation, commentary, and interpretive essays*. Princeton, 1978.

NE

Rackham, H. *Aristotle. The Nicomachean Ethics with an English translation*. Cambridge, MA and London, 1926. (Loeb)
Ross, W. D. *Nicomachean Ethics*. Revised by J. O. Urmson. Princeton, 1984. (ROT).

PA

Balme, D. M. *Aristotle. De partibus animalium I and de generatione animalium I. Translated with notes.* Oxford, 1972. Revised by A. Gotthelf, 1999. (Clar)

Lennox, J. G. *Aristotle. On the Parts of Animals I–IV. Translated with an introduction and commentary*. Oxford, 2001. (Clar)

Louis, P. *Aristote. Les parties des animaux*. (Collection Budé). Paris, 1956.

Ogle, W. *Parts of Animals*. Princeton, 1984. (ROT)

Phys

Charleton, W. *Aristotle's Physics I and II*. Oxford, 1970 (Clar).

Hardie, R. P. and R. K. Gaye. *Physics*. Princeton, 1984 (ROT).

Ross, W. D. *Aristotle's Physics. A revised text with introduction and commentary*. Oxford, 1936.

Poet

Bywater, I. *Poetics*. Princeton, 1984. (ROT)

Pol

Barker, E. *The Politics of Aristotle. Translated with and introduction, notes, and appendixes*. Oxford, 1946.

Jowett, B. *Politics*. Princeton, 1984. (OT, ROT)

Newman, W. L. *The Politics of Aristotle. With an introduction, two prefatory essays, and notes critical and explanatory*. 4 vols. Oxford, 1887.

Prior and Post

Barnes, J. *Aristotle: Posterior Analytics. Translated with commentary*. Oxford, 1975. 2nd edn. 1993. (Clar, ROT)

Ross, W. D. *Aristotle's Prior and Posterior Analytics. A revised text with introduction and commentary*. Oxford, 1949.

Protr

Des Places, E. *Jamblique. Protreptique*. (Collection Budé). Paris, 1989.

Hutchinson, D. S. and M. R. Johnson. *Aristotle's Exhortation to Philosophy*. Translated with introduction and notes. Unpublished manuscript.

Rhet

Roberts, W. Rhys. *Rhetoric*. Princeton, 1984. (ROT)

Somn

Gallop, D. *Aristotle. On Sleep and Dreams. A text and translation with introduction, notes, and glossary*. Warminster, England, 1996.

COMMENTARIES ON ARISTOTLE

Alexander. *On Aristotle's Metaphysics 1*, trans.W. E. Dooley. Ithaca, NY, 1989.

Averroes. *Ibn Rushd's Metaphysics: A translation with introduction of Ibn Rushd's Commentary on Aristotle's Metaphysics Book Lâm*, trans. C. Genequand. Leiden, 1984.
Buridan, J. *Acutissimi philosophi reverendi magistri Joheanis buridani subtissime questiones super octo phisicorum libros Aristotelis*. Paris, 1509.
Coimbra. (Collegium Conimbricensis) *Commentarii Collegii Conimbricensis . . . in octo libros physicorum Aristotelis*. Coimbra, 1594. Repr. Hildes cheim, 1984.
Philoponus. *On Aristotle Physics 2*, trans. A. R. Lacey. London, 1993.
Simplicius. *On Aristotle on the Soul 1.1–2.4*, trans. J. O. Urmson. London, 1995.
—— *On Aristotle's Physics 2*, trans. B. Fleet. London, 1997.
Themistius. *On Aristotle On the Soul*, trans. R. B. Todd. London, 1996.
Thomas Aquinas. *Commentary on Aristotle's Physics,* trans R. J. Blackwell, R. J. Spath, and W. E. Thirkell. London, 1963.
—— *Commentary on Aristotle's De Anima*, trans. R. Pasnau. New Haven and London, 1999.
—— *Commentary on Aristotle's Metaphysics*, trans. J. P. Rowan. Chicago, 1964.

OTHER ANCIENT WRITERS

Anaxagoras. (DK59)
Cicero. *De Finibus Bonorum et Malorum with an English translation*, trans. H. Rackham, London and Cambridge, MA, 1914.
—— *De Natura Deorum with an English translation,* trans. H. Rackham, London and Cambridge, MA, 1933.
Democritus. (DK68)
Diogenes of Apollonia. (DK64) trans. R. Waterfield in *The First Philosophers*, pp. 196–202. Oxford, 2000.
Diogenes Laertius. *Lives of Eminent Philosophers*, trans. R. D. Hicks. 2 vols. Cambridge, MA and London, 1925.
Empedocles. (DK31)
Hippocratic Writings. *Hippocrates*. 8 vols. Cambridge, MA and London, 1923–95.
—— *Hippocratic Writings*, trans. and ed. G. E. R. Lloyd, and trans. J. Chadwick and W. N. Mann. London, New York, etc., 1950.
Plato. *Complete Works*, ed. J. Cooper and D. S. Hutchinson. Indianapolis, 1997. (*Letters*, trans. G. R. Morrow; *Laws*, trans. T. J. Saunders; *Phaedo*, trans. G. M. A. Grube; *Philebus*, trans. D. Frede; *Republic*, trans. Grube, rev. C. D. C. Reeve; *Timaeus*, trans. D. Zeyl)
Theophrastus
De Causis Plantarum, trans. B. Einerson and G. K. Link. 3 vols. London, 1976–90.
Historia Plantarum trans. A. Hort. 2 vols. Cambridge, MA and London, 1916.
Metaphysics, *with an introduction, translation, and commentary* by M. Van Raalte. Leiden and New York, 1993.
Xenophon
Conversations of Socrates, trans. R. Waterfield. London and New York, 1990.

COLLECTIONS OF ESSAYS (ABBREVIATED IN BIBLIOGRAPHY)

AB *Aristotelische Biologie: Intentionen, Methoden, Ergebnisse*, ed. W. Kullmann and S. Follinger. Stuttgart, 1997.

ACA *Aristotle: Critical Assessments*, ed. L. P. Gerson. 4 vols. London, 1999.

AML *Aristotle's Metaphysics Lambda. Symposium Aristotelicum*, ed. M. Frede and D. Charles. Oxford, 2000.

APhys *Aristotle's Physics: A Collection of Essays*, ed. L. Judson. Oxford, 1991.

APol *Aristoteles Politik*, ed. G. Patzig. Göttingen, 1990.

AT *Aristotle Transformed*, ed. R. Sorabji. London, 1990.

BLM *Biologie, Logique et Metaphysique chez Aristote*, ed. D. Deveraux and P. Pellegrin. Paris, 1990.

CCA *The Cambridge Companion to Aristotle*, ed. J. Barnes. Cambridge, 1995.

NLT *Aristotle on Nature and Living Things: Philosophical and historical studies presented to David M. Balme on his seventieth birthday*, ed. A. Gotthelf. Pittsburgh and Bristol, 1985.

PIAB *Philosophical Issues in Aristotle's Biology*, ed. A. Gotthelf and J. Lennox. Cambridge, 1987.

SM *Self-Motion: From Aristotle to Newton*, ed. M. L. Gill and J. G. Lennox. Princeton, 1994.

TS *Theophrastean Studies. On Natural Science, Physics and Metaphysics, Ethics, Religion and Rhetoric*, ed. W. Fortenbaugh and R. Sharples. New Brunswick, NJ, 1987.

OTHER WORKS CONSULTED

Ackrill, J. L. (1974). Aristotle on eudaimonia. In A. Rorty, ed. *Essays on Aristotle's Ethics*, pp. 15–34. Berkeley, 1980.

Adams, M. M. (2000). Final causality and explanation in Scotus's *De Primo Principio*. In C. Koyama, ed. *Nature in Medieval Thought*. Leiden.

Allan, D. J. (1952). *The Philosophy of Aristotle*. Oxford.

Alston, W. P. (1967). The teleological proof. In *The Encyclopedia of Philosophy*, vol. 8. New York.

Amigues, S. (1999). Les traités botaniques de Théophraste. In G. Wöhrle, ed. *Biologie. Geschichte der Mathematik und der Naturwissenschaften in der Antike, Band 1*. Stuttgart.

Annas, J. (1982). Aristotle on inefficient causes. *Philosophical Quarterly*, 32: 311–26.

Asma, S. T. (1996). *Following Form and Function: A philosophical archeology of life science*. Evanston.

Atran, S. (1990). *Cognitive Foundations of Natural History: Towards an anthropology of science*. Cambridge.

—— (1995). Causal constraints on categories and categorical constraints on biological reasoning across cultures. In D. Sperber, D. Premack, and A. J. Premack, eds. *Causal Cognition*, pp. 205–33. Oxford.

Averroes. *Tahāfut al-tahāfut (Incoherence of the Incoherence). Translated from the Arabic with introd. and notes by Simon van den Bergh*. London, 1954.

Averroes *Al-Kashf 'an Manahij Al-Adilla (The Exposition of the Methods of Proof)*, trans. I. Y. Najjar in *Faith and Reason in Islam: Averroes' exposition of religious arguments*. Oxford, 2001.

Ayala, F. J. (1970). Teleological explanations in evolutionary biology. In C. Allen, M. Bekoff, and G. Lauder, eds. *Nature's Purposes: Analyses of function and design in biology*, pp. 29–50. Cambridge, MA, 1998.

Bacon, F. (1605). *The Advancement of Learning,* ed. G. W. Kitchen. London and New York, 1915.

Bailey, C. (1928). *Greek Atomists and Epicurus*. Reissued. New York, 1964.

Balme, D. M. (1939). Greek science and mechanism i. Aristotle on nature and chance. *Classical Quarterly*, 33: 129–38.

—— (1962). Development of Biology in Aristotle and Theophrastus: theory of spontaneous generation. *Phronesis*, 7: 91–104.

—— (1965). Aristotle's use of teleological explanation. Paper presented at the Inaugural Lecture, Queen Mary College, University of London.

—— (1972). *Aristotle. De Partibus Animalium I and De Generatione Animalium I. Translated with notes*. Reissued with a report on recent work and an additional bibliography by Allan Gotthelf. Oxford, 1992.

—— (1980). Aristotle's biology was not essentialist. *Archiv für Geschichte der Philosophie*, LXII: 1–12. In PIAB, pp. 291–312.

—— (1987a). The place of biology in Aristotle's philosophy. In PIAB, pp. 9–20.

—— (1987b). Teleology and necessity. In PIAB, pp. 275–86.

—— (1991). *Aristotle. History of Animals. Books VII–X*. Edited and translated by D. M. Balme. Prepared for publication by Alan Gotthelf.

Barbour, I. G. (1971). *Issues in Science and Religion*. Originally published New York, 1966.

Barnes, J. (1975). *Aristotle's Posterior Analytics*. Oxford.

—— (1997). Roman Aristotle. In J. Barnes and M. Griffen, eds. *Philosophia Togata II*. Oxford.

Barrow, J. D. and F. J. Tipler (1986). *The Anthropic Cosmological Principle*. Introduction by J. A. Wheeler. Oxford.

Bechler, Z. (1995). *Aristotle's Theory of Actuality*. Albany, NY.

Berti, E. (1989/90). La finalità in Aristotele. *Pubblicato nella rivista 'Fondamenti'* (Giardini editori, Pisa), nn. 14–16, pp. 8–44.

—— (2001). Brentano and Aristotle's metaphysics. In R. Sharples, ed. *Whose Aristotle? Whose Aristotelianism?*, pp. 135–49. Burlington.

Blair, G. A. (1967). The meaning of 'energia' and 'entelecheia' in Aristotle. *International Philosophical Quarterly*, 7: 101–17.

Bolton, R. (1995). The material cause: matter and explanation in Aristotle's natural science. In AB, pp. 97–123.

Bos, A. P. (2003). *The Soul and its Instrumental Body: A reinterpretation of Aristotle's philosophy of living nature*. Leiden and Boston.

Boylan, M. (1981). Mechanism and Teleology in Aristotle's Biology. *Apeiron*, 15: 96–102.

—— (1983). *Method and Practice in Aristotle's Biology*. Lanham, MD and London.

—— (1984). The Place in Nature in Aristotle's Teleology. *Apeiron*, 18: 126–140.

Boyle, R. (1688). *A disquisition about the final causes of natural things: wherein it is inquir'd whether, and (if at all) with what cautions, a naturalist should admit them?* In Thomas Birch, ed. *The Works of the Honorable Robert Boyle,* vol. 5. London.

Bradie, M. and F. D. Miller jr, (1984). Teleology and natural necessity in Aristotle. *History of Philosophy Quarterly*, 1: 133–45. In ACA, vol. 2, pp. 73–87.

Brentano, F. (1867). *The Psychology of Aristotle*, trans. R. George. Berkeley, 1977.

—— (1911). *Aristoteles und seine Weltanschauung*. Leipzig.

Broadie, S. W. (1987). Nature, craft, and phronesis in Aristotle. *Philosophical Topics*, 15(2): 35–50.

—— (1990). Nature and craft in Aristotelian teleology. In BLM, pp. 389–403.

—— (1993). *Ethics with Aristotle*. Oxford.

Brown, W. R. (1982). Aristotle's art of acquisition and the conquest of nature. *Interpretation*, 10: 159–96.

Buller, D. J. (1999). *Function, Selection, and Design*. Albany, NY.

Bunge, M. (1959). *Causality and Modern Science*. 3rd edn. Cambridge, MA, 1979.

Burnyeat, M. et al. (1984). *Notes on Books Eta and Zeta of Aristotle's* Metaphysics. Oxford.

Burtt, E. A. (1954). *The Metaphysical Foundations of Modern Science*. Rev. edn. First published 1952. Garden City, NY.

Byrne, C. (2002). Aristotle on physical necessity and the limits of teleological explanation. *Apeiron*, 35: 19–46.

Bywater, I. (1869). On a lost dialogue of Aristotle. *Journal of Philology*, 2: 55–69.

—— (1877). Aristotle's dialogue 'On Philosophy'. *Journal of Philology*, 7: 64–87.

Cartwright, N. (1986). Two kinds of teleological explanation. In A. Donagan, A. N. Perovich, Jr., and M. V. Wedin, eds. *Human Nature and Natural Knowledge*, pp. 201–10. Dordrecht.

—— (1989). *Nature's Capacities and their Measurement*, Oxford.

—— (1999). Aristotelian natures and the modern experimental method. In *The Dappled World: A study of the boundries of science*, pp. 77–103. Cambridge.

Charles, D. (1988). Aristotle on hypothetical necessity and irreducibility. *Pacific Philosophical Quarterly*, 69: 1–53.

—— (1991). Teleological causation in the *Physics*. In APhys, pp. 101–28.

—— (2000). *Aristotle on Meaning and Essence.* Oxford.

Charlton, W. (1970). *Aristotle's Physics I and II.* Oxford.

—— (1985). Aristotle and the Harmonia Theory. In NLT, pp. 131–50.

Cherniss, H. (1935). *Aristotle's Criticism of Presocratic Philosophy*. Reprinted 1971. New York.

Chroust, A. H. (1973). A cosmological (teleological) proof for the existence of god in Aristotle's *On Philosophy*. In *Aristotle: New light on his life and on some of his lost works*, vol. 2, pp. 159–74. London.

Clark, S. R. L. (1995). Objective values, final causes: Stoics, Epicureans, and Platonists. *The Electronic Journal of Analytic Philosophy*, 3 (ejap.louisiana.edu).

Code, A. (1984). The aporetic approach to primary being in *Metaphysics* Z. *Canadian Journal of Philosophy*, Supplementary volume 10, pp. 1–20.

—— (1986). Aristotle: Essence and accident. In R. Grandy and R. Warner, eds. *Philosophical Grounds of Rationality: Intentions, categories, ends*, pp. 411–39. Oxford.

—— (1987). Soul as efficient cause in Aristotle's embryology. *Philosophical Topics*, 15: 51–9. Reprinted in ACA, vol. 2, pp. 295–302.

Code, A. (1995). The priority of final causes over efficient causes in Aristotle's PA. In AB, pp. 127–43.
Cohen, S. M. (1978). Essentialism in Aristotle. *Review of Metaphysics*, 31, pp. 387–405.
—— (1989). Aristotle on heat, cold, and teleological explanation. *Ancient Philosophy*, 9: 255–70.
—— (1996). *Aristotle on Nature and Incomplete Substance*. Cambridge.
Cooper, J. M. (1975). *Reason and Human Good in Aristotle*. Cambridge, MA.
—— (1982). Aristotle on natural teleology. In M. Schofield, ed. *Language and Logos*, pp. 197–222. New York.
—— (1985). Hypothetical necessity. In NLT, pp. 151–67.
—— (1988). Review of M. Nussbaum, *The Fragility of Goodness: Luck and ethics in Greek tragedy and philosophy*. *Philosophical Review*, XCVII (4) pp. 543–64.
—— (1990). Political animals and civic friendship. In APol, pp. 220–41.
—— (1991). Metaphysics in Aristotle's embryology. In BLM, pp. 55–84.
—— (1995). Eudaimonism and the appeal to nature in the morality of happiness: Comments on Julia Annas, *The Morality of Happiness*. *Philosophy and Phenomenological Research*, 55: 587–98.
—— (1999). *Reason and Emotion: Essays on ancient moral psychology and ethical theory*. Princeton.
Curran, A. (2000). Form as norm: Aristotelian essentialism as ideology (critique). *Apeiron*, 21: 327–63.
Davidson, H. A. (1987). *Proofs for Eternity, Creation, and the Existence of God in Medieval Islamic and Jewish Philosophy*. Oxford.
Davies, P. S. (2001). *Norms of Nature: Naturalism and the nature of functions*. Cambridge, MA.
Delbrück, M. (1971). Aristotle-totle-totle. In J. Monod and E. Borek, eds. *Microbes and Life*, pp. 50–5. New York.
DeMarco, C. W. (1997). The greening of Aristotle. In T. Robinson and L. Westra, eds. *The Greeks and the Environment*, pp. 99–119. Lanham, MD.
Depew, D. (1995). Humans and other political animals in Aristotle's *History of Animals*. *Phronesis*, 40: 156–81.
—— (1997). Etiological approaches to biological aptness in Aristotle and Darwin. In AB, pp. 209–30.
Descartes, R. *The Philosophical Works of Descartes*, trans. E. S. Haldane and G. R. T. Gross. 2 vols. Cambridge, 1970.
Des Chene, D. (1996). *Physiologia: Natural philosophy in late Aristotelian and Cartesian thought*. Ithaca and London.
—— (2000). *Life's Form: Late Aristotelian conceptions of the soul*. Ithaca and London.
—— (2001). *Spirits and Clocks: Machine and organism in Descartes*. Ithaca and London.
Deslauriers, M. (1998). Sex and essence in Aristotle's metaphysics and biology. In C. Freeland, ed. *Feminist Interpretations of Aristotle*. University Park, PA.
Detel, W. (1997). Why all animals have a stomach. Demonstration and axiomatization in Aristotle's *Parts of Animals*. In AB, pp. 63–84.
Devereux, D. T. (1987). The relationship between Theophratus' *Metaphysics* and Aristotle's *Metaphysics* Lambda. In TS, pp. 167–88.
Diels, H. (1916). Etymologica: 3. Εντελεχεια. *Zeitschrift für vergleichende Sprachforschung*, 47: 200–3.

Dierauer, U. (1977). *Tier und Mensch im Denken der Antike. Studien zur Tierpsychologie, Anthropologie und Ethik*. Amsterdam.
Doyle, J. P. (2001). *The Conimbricenses: Some questions on signs*. Milwaukee.
Düring, I. (1961). Aristotle's method in biology. In S. Mansion, ed. *Aristote et les problèmes de méthode*. Louvain and Paris.
Dusek, V. (2001). Aristotle's four causes and contemporary 'Newtonian' dynamics. In D. Sfendoni-Mentzou et al., eds. *Aristotle and Contemporary Science*, vol. 2. New York.
Edmunds, L. (1972). Necessity, chance, and freedom in the early atomists. *Phoenix*, 26: 342–57.
Eibl-Eibesfeldt, I. (1970). *Ethology: The biology of behavior*. New York.
Ellis, B. (2001). *Scientific Essentialism*. Cambridge.
—— (2002) *The Philosophy of Nature: A guide to the new essentialism*. Montreal.
Fazzo, S. (2002). Lambda 7, 1072b2–3. *Elenchos* 23(fasc. 2): 357–75.
Ferguson, J. (1985). Teleology in Aristotle's *Politics*. In NLT, pp. 259–76.
Frede, M. (1987). The original notion of cause. In *Essays in Ancient Philosophy*, pp. 125–50. Minneapolis.
Freeland, C. (1991). Accidental causes and real explanations. In APhys, pp. 49–72.
Furley, D. J. (1966). Lucretius and the Stoics. *Bulletin of the Institute of Classical Studies at the University of London,* 13, pp. 97–113.
—— (1985). The Rainfall example in *Physics* ii 8. In NLT, pp. 177–82.
—— (1996). What kind of cause is Aristotle's final cause? In M. Frede and G. Striker, eds. *Rationality in Greek Thought.* Oxford.
Gaiser, K. (1969). Das zweifache Telos bei Aristoteles. In I. During, ed. *Naturphilosophie bei Aristoteles und Theophrast. 4 Symposium Aristotelicum*, pp. 97–113. Heidelberg.
Gallop, D. (1988). Aristotle on Sleep, Dreams, and Final Causes. *Proceedings of the Boston Area Colloquium in Ancient Philosophy*, 4: 257–90.
Garrett, D. (1999). Teleology in Spinoza and early modern rationalism. In R. J. Gennaro and C. Huenemann, eds. *New Essays on the Rationalists*. Oxford.
Gill, M. L. (1991/1994). Aristotle on self-motion. In APhys, pp. 243–65. In SM, pp. 15–34.
—— (1995). Material Necessity and *Meteorology* IV 12. In AB, pp. 145–61.
Ginsburg, H. (2004). Two kinds of mechanical inexplicability in Kant and Aristotle. *Journal of the History of Philosophy*, 42: 33–65.
Gómez-Lobo, A. The ergon inference. *Phronesis*, 34: 43–57. Reprinted in ACA, vol. 3, pp. 170–83.
Gomperz, T. (1909). *The Greek Thinkers: A history of ancient philosophy,* vol. 4: *Aristotle and his Successors,* trans. C. G. Berry. London, 1912.
Golden, O. (1996). *Explaining an Eclipse: Aristotle's Posterior Analytics 21–10*. Ann Arbor, 1996.
Gotthelf, A. (1987a). Aristotle's Conception of Final Causality. *Review of Metaphysics*, 30: 226–54. Revised. In PIAB, pp. 204–42.
—— (1987b). First principles in Aristotle's *Parts of Animals*. In PIAB, pp. 167–98.
—— (1988). The place of the good in Aristotle's natural teleology. *Proceedings of the Boston Area Colloquium in Ancient Philosophy*, 4: 113–39.
—— (1989). Teleology and spontaneous generation in Aristotle: A discussion. *Apeiron*, 22: 181–93.

Gotthelf, A. (1997). Understanding Aristotle's teleology. In R. Hassing, ed. *Final Causality and Human Affairs*, pp. 71–82. Washington, D.C.
Gottschalk, H. B. (1990). The earliest Aristotelian commentators. In AT, pp. 55–81.
Graeser, A. (1972). Aristoteles' Schrift 'Über die Philosophie' und die zweifache Bedeutung der 'causa finalis'. *Museum Helveticum*, 29: 44–61.
Graham, D. W. (1988). Aristotle's definition of motion. *Ancient Philosophy*, 8: 209–15. In ACA, vol. 2, pp. 53–62.
—— (1989). The etymology of ΕΝΤΕΛΕΧΙΑ. *The American Journal of Philology*, 110: 73–80.
Grene, M. (1972). Aristotle and modern biology. *Journal of the History of Ideas*, 33: 395–424.
Gutas, D. (1988). *Avicenna and the Aristotelian Tradition*. Leiden.
Gutiérrez-Giralso, D. (2001). ψνχη and genotype. In D. Sfendoni-Mentzou et al., eds. *Aristotle and Contemporary Science*. vol. 2, pp. 163–72. New York.
Halliwell, S. (1986). *Aristotle's Poetics*. London.
—— (1990). Aristotle's mimesis revisited. *Journal of the History of Philosophy*, 28: 487–510. In ACA, vol. 4, pp. 313–36.
Hankinson, J. (1995*a*). Philosophy of science. In CCA, pp. 109–39.
—— (1995*b*). Science. In CCA, pp. 140–67.
—— (1998). *Cause and Explanation in Ancient Greek Thought*. Oxford.
Hardie, W. F. R. (1965). The final good in Aristotle's ethics. *Philosophy*, 40: 277–95.
—— (1968). *Aristotle's Ethical Theory*. Oxford. 2nd edn. 1980.
Hegel, G. W. F. (1830). *The Encyclopedia Logic. Part I of the Encyclopaedia of the Philosophical Sciences*, 3rd edn., trans. T. F. Gerats, W. A. Suchting, and H. S. Harris. Indianapolis, 1991.
Honnefelder, L. (2000). The concept of nature in medieval metaphysics. In C. Koyama, ed. *Nature in Medieval Thought*, pp. 75–94. Leiden.
Huby, P. (1967). The first discovery of the free will problem. *Philosophy*, 42: 353–62.
—— (1991). What did Aristotle mean by nature does nothing in vain? In I. Mahalingam, ed. *Logical Foundations*, pp. 158–65. New York.
Hughes, J. D. (1975). *Ecology in Ancient Civilizations*. Albuquerque.
—— (1985). Theophrastus as ecologist. In TS, pp. 67–75.
Hutchinson, D. S. (1986). *The Virtues of Aristotle*. London.
Hutchinson, D. S. and M. R. Johnson (2005). Authenticating Aristotle's *Protrepticus*. *Oxford Studies in Ancient Philosophy* 28: 193–294.
Jaeger, W. (1923). *Aristotle. Fundamentals of the history of his development*, trans. R. Robinson. Oxford, 1934.
Janet, P. (1876). *Final Causes*, 2nd edn., trans. W. Affleck. Edinburgh, 1889.
Johnson, M. (2003). Was Gassendi an Epicurean? *History of Philosophy Quarterly*, 20: 339–60.
Joly, R. (1968). La biologie d'Aristot. *Revue philosophique*, 158: 219–53.
Judson, L. (1991). Chance and always or for the most part. In AP, pp. 73–100.
—— (1994). Heavenly motion and the unmoved mover. In SM, pp. 155–71.
Kahn, C. H. (1985). The place of the prime mover in Aristotle's teleology. In NLT, pp. 183–205.
Kant, I. (1790). *The Critique of Judgment*, trans. J. C. Meredith. Oxford.
Katyama, E. G. (1999). *Aristotle on Artifacts: A metaphysical puzzle*. Albany.

King, R. A. H. (2001). *Aristotle on Life and Death*. London.
Kirk, G. (1981). Sense and common sense in the development of Greek philosophy. *Journal of Hellenic Studies*, 81: 105–17.
Konstan, D. (2000). Democritus the physicist. *Apeiron*, 33: 125–44.
Kosman, L. A. (1969). Aristotle's definition of motion. *Phronesis*, 14: 40–62. In ACA, vol. 2, pp. 33–52.
Koyré, A. (1950/1965). The significance of the Newtonian synthesis. *Archives Internationales d'Histoire des Sciences* 3: 291–311. In *Newtonian Studies*, pp. 3–24. London, 1965.
Kraut, R. (1989). *Aristotle on the Human Good*. Princeton.
Krebs, J. R. and N. B. Davies (1987). *An Introduction to Behavioral Ecology*. 2nd edn. Oxford.
Kukkonen, T. (2002). Averroes and the teleological argument. *Religious Studies*, 38: 405–28.
Kullmann, W. (1974). *Wissenschaft und Methode: Interpretationen zur aristotelischen Theorie der Naturwissenschaft*. Berlin and New York.
—— (1979). *Die Teleologie in der aristotelischen Biologie: Aristoteles als Zoologe, Embryologe und Genetiker*. Heidelberg.
—— (1985). Different concepts of the Final Cause in Aristotle. In NLT, pp. 169–175.
—— (1991). Man as political animal in Aristotle. In D. Keyt and F. Miller, eds. *A Companion to Aristotle's Politics*, pp. 94–117. Oxford.
—— (1998). *Aristoteles und die moderne Wissenschaft*. Stuttgart.
Labarriere, J.-L. (1987). *De la Phronêsis Animale*. In BLM, pp. 405–28.
Laks, A. and G. W. Most (1993). *Théophraste Métaphysique. Texte édité, traduit et annoté*. Paris.
Lanata, G. (1994). Antropocentismo e cosmocentrismo nel pensiero antico. In S. Castignone and G. Lanata, eds. *Filosofi e Animali nel Modo Antico*, pp. 15–50. Genoa.
Lang, H. S. (1989). Aristotelian Physics: Teleological Procedure in Aristotle, Thomas, and Buridan. *Review of Metaphysics*, 42: 569–91.
—— (1992). *Aristotle's Physics and its Medieval Varieties*. Albany.
—— (1994). Why the elements imitate the heavens: *Metaphysics* ix 8.1050b28–34. *Ancient Philosophy*, 14: 335–54. Reprinted in ACA, vol. 1, pp. 317–37.
—— (1998). *The order of nature in Aristotle's physics: Place and the elements*. Cambridge.
Lawrence, G. (2001). The function of the ergon argument. *Ancient Philosophy,* 21, pp. 445–75.
Le Blond, J. M. (1939). *Logique et méthode chez Aristote*. Paris, 1939. 2nd edn., 1970.
Leibniz, G. W. *Philosophical Essays*, trans. R. Ariew and D. Garber. Indianapolis, 1989.
Leijenhorst, C. et al. (2002). *The Dynamics of Aristotelian Natural Philosophy from Antiquity to the Seventeenth Century*. Leiden.
Lennox, J. G. (1982). Teleology, chance, and Aristotle's theory of spontaneous generation. *Journal of the History of Philosophy,* 20: 219–38. In Lennox 2001a, pp. 229–49.
—— (1983). Robert Boyle's defense of teleological inference in experimental science. *Isis*, 74: 38–52.
—— (1984). Aristotle on chance. *Archiv für Geschischte der Philosophie*, 66: 52–60. In ACA, pp. 116–24.
—— (1985a). Plato's unnatural teleology. *Studies in Philosophy and the History of Philosophy*, 13: 195–218. In Lennox 2001a, pp. 280–302.

Lennox, J. G. (1985b). Theophrastus on the limits of teleology. In W. W. Fortenbaugh, P. M. Huby, and A. A. Long, eds. *Theophrastus of Eresus: on his Life and Work*, pp. 143–63. New Brunswick. In Lennox 2001a, pp. 259–79.
—— (1987a). Divide and explain: the *Posterior Analytics* in practice. In PIAB, pp. 90–119. In Lennox 2001a, pp. 7–38.
—— (1987b). Kinds, forms of kinds, and the more and the less in Aristotle's biology. In PIAB, pp. 339–59. In Lennox 2001a, pp. 160–81.
—— (1991). Between data and demonstration: The *Analytics* and the *Historia Animalium*. In A. Bowen, ed. *Science and Philosophy in Classical Greece*, pp. 261–95. New York. In Lennox 2001a, pp. 39–71.
—— (1992). Teleology. In E. F. Keller and E. A. Lloyd, eds. *Keywords in Evolutionary Biology*, pp. 324–33. Cambridge, MA and London.
—— (1993). Darwin was a teleologist. *Biology and Philosophy*, 8: 409–21.
—— (1996a). Aristotle's biological development: The Balme hypothesis. In W. Wians, ed. *Aristotle's Philosophical Development*, pp. 229–48. Savage, MD.
—— (1996b). Putting philosophy of science to the test: The case of Aristotle's biology. In AB, pp. 163–82. In Lennox 2001a, pp. 98–109.
—— (1999). The Place of Mankind in Aristotle's Zoology. *Philosophical Topics*, 27: 1–16.
—— (2001a). *Aristotle's Philosophy of Biology: Studies in the origin of life science*. Cambridge.
—— (2001b). *Aristotle. On the Parts of Animals I–IV. Translated with an introduction and commentary*. Oxford.
—— (2001c). Aristotle on the unity and disunity of science. *International Studies in the Philosophy of Science*, 15: 133–44.
Lerner, M. P. (1969). *Recherches sur la notion de finalité chez Aristote*. Paris.
Lewis, F. A. (1988). Teleology and Material/Efficient Causes in Aristotle. *Pacific Philosophical Quarterly*, 69: 54–98.
Lloyd, G. E. R. (1966). *Polarity and Analogy: Two types of argumentation in early Greek thought*. Cambridge.
—— (1989/1991). The Invention of Nature. Herbert Spencer lecture, Oxford. In *Methods and Problems in Greek Science*, pp. 417–34. Cambridge.
—— (1995). Ancient Greek concepts of causation in comparativist perspective. In D. Sperber, D. Premack, and A. J. Premack, eds. *Causal Cognition*, pp. 205–33. Oxford.
—— (1996). *Aristotelian Explorations*. Cambridge.
Long, A. A. (1989). Aristotle. In *The Cambridge History of Classical Literature*, vol. 1, part 3: *Philosophy, history, and oratory*. Cambridge.
Long, A. A. and D. Sedley. (1987) *The Hellenistic Philosophers*. 2 vols. Cambridge.
Mackie, P. J. (1995). Final causes. In T. Honderich, ed. *The Oxford Companion to Philosophy*, pp. 280–1. Oxford.
Mann, W. R. (2000). *The Discovery of Things: Aristotle's categories and their context*. Princeton.
Manuwald, B. (1989). *Studien zum unbewegten Beweger in der Naturphilosophie des Aristoteles*. Stuttgart.
Matthen, M. (1989). The four causes in Aristotle's embryology. *Apeiron*, 22: 159–79. In ACA, vol. 2, pp. 276–94.
—— (2001). The holistic presuppositions of Aristotle's cosmology. *Oxford Studies in Ancient Philosophy*, 20: 171–99.

Matthen, M. and R. J. Hankinson (1993). Aristotle's universe: Its form and matter. *Synthese*, 96: 417–35. In ACA, vol. 2, pp. 207–24.
Mayr, E. (1974). Teleological and telenomic: a new analysis. *Boston Studies in the Philosophy of Science,* 14, pp. 91–117.
—— (1983). How to carry out the adaptationist program? *The American Naturalist*, 121: 324–34.
—— (1988). *Toward a New Philosophy of Biology: Observations of an evolutionist*. Cambridge, MA.
—— (1992). The idea of teleology. *Journal of the History of Ideas*, 53: 117–35.
McKirahan, R. (1992). *Principles and Proofs: Aristotle's theory of demonstrative species*. Princeton.
McLaughlin, P. (2001). *What Functions Explain: Functional explanation and self-reproducing systems*. Cambridge.
Menn, S. (1992). Aristotle and Plato on God as Nous and as the Good. *Review of Metaphysics*, 45: 543–73.
—— (1994). The origins of Aristotle's concept of ἐνέργεια:ἐνέργεια and δύναμις. *Ancient Philosophy*, 14: 73–114.
—— (1995). *Plato on God as Nous*. Carbondale, IL.
—— (2002). Aristotle's definition of soul and the programme of the *De Anima*. *Oxford Studies in Ancient Philosophy*, 22: 83–139.
Meyer, H. (1919). *Natur und Kunst bei Aristoteles: Ableitung und Bestimmung der Ursächlichkeitsfaktoren*. Reprinted. Paderborn, 1967.
Meyer, S. S. (1987). Unmoved movers, form and matter. *Philosophical Topics*, 15: 171–96.
—— (1992). Aristotle, teleology, and reduction. *Philosophical Review*, 101: 791–825. In ACA, vol. 2, pp. 88–115.
Minio-Paluello, L. (1970). Aristotle. In Gillespie, C. C., ed. *Dictionary of Scientific Biography*, vol. 1. New York, 1970–80.
Modrak, D. (2001). *Aristotle's Theory of Language and Meaning*. Cambridge.
Moravcsik, J. (1974). Aitia as generative factor in Aristotle's philosophy. *Dialogue*, 14: 622–38.
—— (1991). What makes reality intelligible? Reflections on Aristotle's theory of *Aitia*. In AP, pp. 31–48.
Morrison, B. (2002). *On Location: Aristotle's Concept of Place*. Oxford.
Most, G. W. (1988) The relative date of Theophrastus' *Metaphysics*. In TS, pp. 224–33.
Natali, C. (2001). *The Wisdom of Aristotle*, trans. G. Parks. Albany, NY.
—— (1990). Aristote et la chrématistique. In APol, pp. 296–324.
Nissen, L. A. (1997). *Teleological Language in the Life Sciences*. Lanham, MD.
Nussbaum, M. C. (1978). *Aristotle's de motu animalium. Text with translation, commentary, and interpretive essays*. Princeton.
—— (1986/2001). *The Fragility of Goodness: Luck and ethics in Greek tragedy and philosophy*. 2nd edn. 2001. Cambridge.
—— (1990). Nature, Function, and Capability: Aristotle on Political Distribution. In APol, pp. 152–86.
—— (1992). Human functioning and social justice: In defense of Aristotelian essentialism. *Political Theory*, 20: 202–46.
—— (1993). Reply to Papers. *Philosophical Investigations*, 16: 46–88.
—— (1994). *The Therapy of Desire*. Princeton.

Nutton, V. (2002). Logic, Learning, and Experimental Medicine. *Science*, 295: 800–1.
Oakley, J. P. (1949). *Man the Tool-Maker*. Chicago.
Oates, W. J. (1963). *Aristotle and the Problem of Value*. Princeton.
Ockham, W. *Quodlibidal Questions, vol. 1 and 2, Quodlibits 1–7*, trans. A. J. Freddoso and F. E. Kelley. New Haven and London, 1991.
Osler, M. (1996). The reinterpretation of final causes in seventeenth-century natural philosophy. *Monist*, 79: 388–407.
Owens, J. (1968). Teleology of Nature in Aristotle. *Monist*, 52: 159–73.
Pellegrin, P. (1982). Naturalitie, excellence, diversite: Politique et biologie chez Aristote. In APol, pp. 124–51.
—— (1986). *Aristotle's Classification of Animals: Biology and the conceptual unity of the Aristotelian corpus*, trans. A. Preuss. Berkeley.
Peters, F. E. (1967). *Greek Philosophical Terms*. New York.
Pittendrigh, C. S. (1958). Adaptation, natural selection, and behavior. In A. Roe and G. G. Simpson, eds. *Behavior and Evolution*, pp. 390–419. New Haven.
Popper, K. (1945/1966). *The Open Society and its Enemies. vol. 1. Plato*. 5th edn. London.
—— (1957). *The Poverty of Historicism*. London.
Quarantotto, D. (2001). Ontologia della causa finale Aristotelica. *Elenchos* 22(2): 329–65.
Quine, W. V. O. (1966). Three grades of modal involvement. In *The Ways of Paradox*. New York.
Rae, M. (1998). Sameness without Identity: An Aristotelian solution to the problem of material causation. *Ratio*, 11: 316–28.
Regan, T. (1992). Does environmental ethics rest on a mistake? *Monist*, 75: 161–82.
Reiche, H. A. T. (1960). *Empedocles Mixture, Eudoxan Astronomy, and Aristotle's Connate Pneuma*. Amsterdam.
Repici, L. (1990). Limits of teleology in Theophrastus' *Metaphysics*? *Archiv für Geschichte der Philosophie*, 72: 182–213.
Richardson Lear, G. (2004). *Happy Lives and the Highest Good: An Essay on Aristotle's* Nicomachean Ethics. Princeton.
Rist, J. M. (1965). Some aspects of Aristotelian Teleology. *Transactions and Proceedings of the American Philological Association*, 96: 337–49.
—— (1989). *The Mind of Aristotle: A study in philosophical growth*. Toronto.
Ross, D. (1923). *Aristotle*. 5th edn. London and New York, 1949.
Schmitt, C. B. (1983). *Aristotle and the Renaissance*. Cambridge, MA.
Scotus, John Duns. *Opus Oxonienses*. In *Duns Scotus. Philosophical Writings*, trans. A. Wolter. Indianapolis, 1987.
Sedley, D. (1983). Epicurus' Refutation of Determinism. In Συζήτησις: *Studi sull'Epicureismo greco e romano offerti a Marcello Gigante*, vol. i, pp. 11–51. Naples.
—— (1989). Teleology and myth in the *Phaedo. Proceedings of the Boston Area Colloquium in Ancient Philosophy*, 5: 359–83.
—— (1991). Is Aristotle's Teleology Anthropocentric? *Phronesis*, 36: 179–96.
—— (1997). 'Becoming like God' in the *Timaeus* and Aristotle. In T. Calvo and L. Brisson, eds. *Interpreting the* Timaeus-Critias, pp. 327–39. Sankt Augustin.
—— (1998). Platonic causes. *Phronesis*, 43: 114–32.
—— (2000). Metaphysics Λ 10. In AML, pp. 327–50.
Sharples, R. W. (1983). *Alexander of Aphrodisias on Fate*. London.

Shields, C. (1999). *Order in Multiplicity: Homonymy in the philosophy of Aristotle*. Oxford.
Skinner, B. F. (1971). *Beyond Freedom and Dignity*. New York.
Solmsen, F. (1960). *Aristotle's System of the Physical World: A comparison with his predecessors.* Ithaca, NY.
Sorabji, R. (1964). Function. *Philosophical Quarterly*, 14: 289–302.
—— (1980). *Necessity, Cause and Blame: Perspectives on Aristotle's theory*. Ithaca, NY.
—— (1990a). The ancient commentators on Aristotle. In AT, pp. 1–30.
—— (1990b). Infinite power expressed: The transformation of Aristotle's physics and theology. In AT, pp. 181–98.
Spelman, E. (1983). Aristotle and the politicization of the soul. In S. Harding and M. B. Hintikka, eds. *Discovering Reality*, Dordrecht.
Suárez, F. (1597). *Disputationes Metaphysicae* in *Opera Omnia*, vols. 25–26. Paris, 1856–66.
Sprague, R. K. (1991). Plants as Aristotelian Substances. *Illinois Classical Studies*, 56: 221–9. In ACA, vol. 2, pp. 357–66.
Swanson, J. (1999). Aristotle on nature, human nature, and justice: A consideration of the natural functions of men and women in the city. In R. C. Bartlett and R. Goldberg, eds. *Action and Contemplation: Studies in the moral and political thought of Aristotle*, pp. 225–48. Albany.
Taylor, C. (1964). *The Explanation of Behavior*. London.
Taylor, R. (1967). Causation. In *Encyclopedia of Philosophy*, vol. 2, s.v. New York.
Theiler, W. (1925). *Zur Geschichte der teleologischen Naturbetrachtung bis auf Aristoteles*. Zurich. Reprinted. Berlin, 1965.
Van DeVeer, D. (1995). Interspecific justice and intrinsic value. *Electronic Journal of Analytic Philosophy*, 3. (ejap.louisiana.edu)
Van Inwagen, P. (1990). *Material Beings*. Ithaca.
Van Raalte, M. (1988). The idea of the cosmos as an organic whole. In TS, pp. 189–215. New Brunswick.
—— (1993). *Theophrastus-Metaphysics*, trans. with introduction and commentary. Leiden and New York, 1993.
Veatch, H. (1992). Modern Ethics, Teleology, and Love of Self. *Monist*, 75: 52–70.
Vegetti, M. (1994). Figure dell'animale in Aristotle. In S. Castignone and G. Lanata, eds. *Filosofi e Animali nel Mondo Antico*, pp. 15–50. Genoa.
Verrycken, K. (1990). The Metaphysics of Ammonius son of Hermeias. In AT, pp. 199–232.
Voltaire (1758). *Candide, or Optimism*, trans. J. Butt. London and New York, 1947.
Von Fritz, K. (1938). *Philosophie and sprachlicher Ausdruck bei Demokrit, Plato und Artistotles*. New York.
Wardy, R. (1990). *The Chain of Change: A study of Aristotle's* Physics *vii*. Oxford.
—— (1993). Aristotelian rainfall or the lore of averages. *Phronesis*, 38: 18–30.
—— (2000). *Aristotle in China*. Cambridge.
Westra, L. (1997). Aristotelian roots of ecology: Causality, complex systems theory, and integrity. In T. Robinson and L. Westra, eds. *The Greeks and the Environment*, pp. 83–98. Lanham.
Whewell, W. (1837). *History of the Inductive Sciences*. London.
White, N. P. (1972). Origins of Aristotle's essentialism. *Review of Metaphysics*, 26: 57–85.
Wieland, W. (1962). *Die aristotelische Physik: Untersuchungen über die Grundlegung der Naturwissenschaft und die sprachlichen Bedingungen der Prinzipienforschung bei Aristoteles.* Göttingen.

Wieland, W (1975). The problem of teleology. In J. Barnes, M. Schofield, and R. Sorabji, eds. *Articles on Aristotle*, vol. 1: *Science*, pp. 141–60. London.

Wiggins, D. (2001). *Sameness and Substance Renewed*, Cambridge.

Wippel, J. F. (2000). *The Metaphysical Thought of Thomas Aquinas: From finite being to uncreated being*. Washington, D. C.

Wisnovsky, R. (2003a). *Avicenna's Metaphysics*. London.

—— (2003b). Towards a history of Avicenna's distinction between immanent and transcendent causes. In D. C. Reisman, ed. *Before and after Avicenna*, pp. 49–68. Leiden.

Witt, C. (1994). *Substance and Essence in Aristotle*. Ithaca, NY.

—— (1998a). Teleology in Aristotelian Metaphysics. In J. Gentzler, ed. *Method in Ancient Philosophy*, pp. 253–69. Oxford.

—— (1998b). Form, Normativity, and gender in Aristotle: A feminist perspective. In C. A. Freeland, ed. *Feminist Interpretations of Aristotle*, pp. 118–37. University Park, PA.

Wolff, C. (1728a) *Philosophia rationalis sive logica*. Veronae. Reprinted, Hildesheim and New York, 1983.

—— (1728b) *Preliminary Discourse on Philosophy in general*, trans., R. J. Blackwell. Indianapolis, 1963.

Woodfield, A. (1976). *Teleology*. Cambridge.

Woods, M. (1993). Aristotle's Anthropocentrism. *Philosophical Investigations*, 16: 18–35.

Wright, L. (1976). *Teleological Explanations*. Berkeley.

Zeller, E. (1883). *Outlines of the History of Greek Philosophy*. 13th edn., rev. W. Nestle, trans. L. R. Palmer. New York, 1955.

Index of Texts and Commentaries

Averroes

Buridan

Coimbra

Philoponus

Simplicius

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Index of Names

Index of Subjects