David E. Hahm

The Origins of Stoic Cosmology

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Though there never was in antiquity a single, all-pervasive ideology or school of philosophy, for half a millennium beginning about 300 B.C., the Stoic outlook, as it apprehended both the physical and ethical universes, captured a sufficiently large number of adherents to be considered the ancient counterpart of the currently popular scientific world view.

This world view of the Stoics appealed to all classes and attracted slaves and laborers as well as kings and emperors. Its ideas and tenets infiltrated and shaped all branches of art and learning—poetry, drama, religion, theology, science, medicine, law, and government—and its concepts influenced and informed the later doctrines of Christianity, Gnosticism, Neo-Pythagoreanism, and Neoplatonism.

Despite its undoubted historical importance, however, the question of Stoicism's origin has usually been passed over with glib generalizations; and there has remained, until the appearance of Professor Hahm's book, a crucial need to undertake a systematic study of all the evidence in order to determine conclusively from whom the ideas of the Stoics were derived, what sorts of ideas they appropriated, and how they used this borrowed material to create a new and enduring popular philosophy.

Professor Hahm performs this service for one of the major areas of Stoic philosophy. On the basis of a new and more careful reconstruction of the cosmological theories of Zeno, Cleanthes, and Chrysippus, the three heads of the Stoic school in the third century B.C., Hahm demonstrates that Stoic cosmology grew directly out of the contemporary philosophical and scientific debates and was, in fact, a unique, original synthesis of the latest Greek theories of cosmology and biology.

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TO FRIEDRICH SOLMSEN

Contents

Preface

Although I can never adequately express my gratitude to all who aided me in writing this book, I would like to acknowledge at least my most outstanding personal debts. My foremost obligation is to my teacher and friend, Friedrich Solmsen, to whom this book is gratefully dedicated. It was he who through his writings and personal discussions awakened in me a zeal for Greek philosophy in general and an interest in Stoic physics in particular. In writing the thesis from which this book evolved and in reshaping it for publication, I was guided by his encouragement and his generous and painstaking criticism.

I would also like to thank those who enabled me to devote a full year to reshaping this work, namely, the National Endowment for the Humanities, which awarded me a summer fellowship, and the Center for Hellenic Studies in Washington, D.C. together with its director Bernard M. W. Knox, which provided me a year of leisure in an idyllic *mouseion*. I am also grateful to Charles L. Babcock, Herbert M. Howe, Robert J. Lenardon, Mark P. Morford, Paul Plass, Wesley D. Smith, and several anonymous referees for ideas, advice, criticism, and encouragement along the way, to Vicki Nau for typing the manuscript, to the Ohio State University College of Humanities for a grant-in-aid to defray the cost of typing the manuscript, and to Sarah T. Millett of the Ohio State University Press for many refinements in the text.

Finally my deepest debt is to my wife, Donna, not only for eliminating countless errors, suggesting many improvements, and proofreading the entire manuscript, but above all for her patience, understanding, and unfailing support, without which this book would never have been written.

The manuscript of this book was completed a few years ago. Since then many important publications have appeared of which I have been unable to take account. I particularly regret that I have been unable to make use of L. Bloos, *Probleme der stoischen Physik,* Hamburger Studien zur Philosophie 4 (Hamburg, 1973); A. Graeser, *Zenon von Kition: Positionen und Probleme* (Berlin, 1975); M. Lapidge, "Αρχαί and στοιχεῖα: A Problem in Stoic Cosmology," *Phronesis* 18 (1973): 240–78; J. Longrigg, "Elementary Physics in the Lyceum and Stoa" *Isis* 66 (1975): 211–29; and K. von Fritz, "Zenon von Kition," *RE,* 2d ser. 10A (Munich, 1972): 83–121.

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Abbreviations

Abbreviations of the names of ancient authors and works follow the systems used in *The Oxford Classical Dictionary* (Oxford, 1949; 2d ed., 1970) and H. G. Liddell, R. Scott, and H. S. Jones, eds., *A Greek-English Lexikon*[9] (Oxford, 1940). Citations are normally by book and chapter or paragraph, or by standard page number and line. Where pages and lines of a specific edition, or where fragments are cited, I have added the editor's name. All translations are my own. In addition, I have used the following abbreviations for common journals, collections of sources, and an index:

AbhMainz	*Abhandlungen der Akademie der Wissenschaften und der Literatur in Mainz*
AC	*L'Antiquité Classique*
AGP	*Archiv für Geschichte der Philosophie*
AJP	*American Journal of Philology*
BICS	*Bulletin of the Institute of Classical Studies of the University of London*
Bonitz	H. Bonitz, *Index Aristotelicus* (Berlin, 1870; 2d ed., Graz, 1955)
CQ	*Classical Quarterly*
DG	H. Diels, *Doxographi Graeci* (Berlin, 1879)
DK	H. Diels, and W. Kranz, *Die Fragmente der Vorsokratiker*[11] (Berlin, 1964)
GGA	*Göttingische Gelehrte Anzeiger*
JHI	*Journal of the History of Ideas*
JHS	*Journal of Hellenic Studies*

MNAW	*Mededelingen der koninklijke Nederlandse Akademie van Wetenschappen, Afdeeling Letterkunde*
MusHelv	*Museum Helveticum*
NGG	*Nachrichten von der Gesellschaft der Wissenschaft zu Göttingen*
PhilosRev	*Philosophical Review*
RE	A. Pauly, G. Wissowa, et al., *Real-Encyclopädie der classischen Altertumswissenschaft*
RPhL	*Revue Philosophique de Louvain*
SIFC	*Studi Italiani di Filologia Classica*
SVF	J. von Arnim, *Stoicorum Veterum Fragmenta* (Leipzig, 1903–05; indices by M. Adler, Leipzig, 1924) The fragments of Zeno, Cleanthes, and Chrysippus are normally cited by volume and fragment number unless pages (with line numbers) are expressly mentioned. The fragments of the minor early Stoics are cited by volume, name, and fragment number. Names are abbreviated as follows: Ant. = Antipater of Tarsus; Apollod. = Apollodorus of Seleuceia; Arch. = Archedemus of Tarsus; Diog. = Diogenes of Babylon.
TAPA	*Transactions of the American Philological Association*

Introduction

For half a millennium Stoicism was very likely the most widely accepted world view in the Western world. Although there was, of course, never a single all-pervasive world view in antiquity, yet from the third century B.C. to the second century A.D. more people in the Mediterranean world seem to have held a more or less Stoic conception of the world than any other. The Peripatos had its following among a few intellectuals; Platonism was dormant while skepticism ruled in the Academy; and even if Epicureanism had a slightly larger following, it, too, was limited to a small coterie of ardent believers with a somewhat larger group of sympathizers, particularly among the Roman aristocrats. The Stoic world view, however, appealed to all classes, attracting slaves and laborers as well as kings and emperors. Its ideas infiltrated religion and science, medicine and theology, poetry and drama, law and government. Even when it had to yield to other world views, it left its mark on Christianity, Gnosticism, Neo-Pythagoreanism, and Neo-Platonism.[1] For a variety of reasons the Stoic outlook, both physical and ethical, captivated a large number of people in the ancient world, probably many more than we shall ever realize;[2] and, in fact, in view of its pervasiveness, it may not be much of an exaggeration to say that the Stoic physical world view was the ancient counterpart of our current, popular, scientific world view.

In spite of the historical importance of Stoic physics, the question of its origins is usually passed over with glib generalizations or incompletely tested hypotheses. The ancient intellectual historians, who sought simple family trees, probably traced Stoicism back to Socrates by way of an alleged Cynic school.[3] Another tradition made Stoicism an heir of the Platonic school.[4] Modern discussions, particularly the earlier ones and the handbooks, are fond of making Stoic physics essentially a revival of Heraclitus, on the grounds that several Stoics wrote books about Heraclitus, and that there are some similarities between Heraclitus and Stoicism.[5] Most careful scholars, however, have been aware of the clear traces of Platonic and Aristotelian ideas in Stoicism and therefore have avoided making Stoicism a simple revival of Heraclitus.[6] Some have attempted to show how the problems of Platonic and Aristotelian philosophy could lead to a viewpoint similar to that of Heraclitus, or could at least prepare the way for the acceptance of Heraclitean views.[7] Then, too, there have been occasional attempts to detect influences from other quarters, such as the late fourth-century Academy, Pythagoreanism, Greek medical thought, and Zeno's Semitic background.[8] Since none of these attempts has yet proven, or could possibly prove, that Stoicism is essentially identical with some earlier philosophical system, the result has been that Stoicism has been left looking like some kind of schizophrenic eclecticism. Because of this situation Max Pohlenz, while admitting some Heraclitean, Aristotelian, and Semitic influences, has argued eloquently for the essential unity and originality of Stoic philosophy.[9] Finally, to round out this gamut of opinions, we must mention the view that quests for the intellectual roots of Stoicism serve no useful purpose, because Stoic doctrines were chosen solely for their popular appeal, to win converts to Stoicism as a social movement.[10]

The problem facing the student of Stoicism today is not that the question of the formative influences on Stoic physics has received no answer; the problem is that it has received too many partial answers. All attempts to solve the problem either have drawn hasty generalizations on the basis of a few selected Stoic ideas or have considered only broad, abstract, structural characteristics (such as the immanence of deity or ultimate mover) and ignored the details of the system. In every case conclusions have been based on partial evidence. Thus there seems to be a real need for a systematic study of all the evidence to see from whom the Stoics derived ideas, what sorts of ideas they borrowed, and how they used this borrowed material to create a new popular philosophy.[11] By posing the question in this way one may also transcend the false dichotomy that has so often forced Stoicism to be either original or derivative. A careful comparison of Stoic physics with its predecessors can reveal both the sources of Stoic ideas as well as the nature of Stoic originality and thus may provide some insight into the conscious and unconscious operation of the Stoic mind. This study is an attempt to make such a comparison for one preliminary topic, the theory of corporealism, and for one of the major divisions of Stoic physics, namely cosmology.[12] In the course of this investigation it will also be necessary to discuss some Stoic biological theories and to make a tentative identification of their origins; but a thorough study of Stoic biological and psychological theories, such as would be required to reach firm conclusions in these areas, still remains to be done. Similarly, though some aspects of Stoic theology will enter into the discussion, I will not attempt a detailed study of the Stoic views of god, providence, and fate.

Here several words of warning are in order. Though a detailed comparison of Stoic theories with those of their predecessors may reveal the origins of Stoic physics, it cannot give a fair impression of the Stoic system as it appeared to its followers. Stoicism was a tightly knit, interrelated system. An analysis of its origins requires pulling apart what the Stoics deliberately put together. Thus such an analysis cannot and should not replace the standard, comprehensive accounts of Stoic philosophy. A second limitation of this sort of study is that one can seldom answer the question why Stoicism is precisely as it is. In the absence of extensive polemics against rejected ideas, one can only determine which ideas the Stoics adopted and used, not why they preferred the ideas they adopted to those they rejected.

Finally, no study of Stoicism may begin without the conscious recognition that the sources for early Stoic philosophy are tragically inadequate. Since not a single complete treatise of any of the Stoics of the third century B.C. survives intact, all reconstructions of Stoic doctrine must rely on second- and third-hand reports or on later Stoic writers. Herein lies a host of difficulties. First of all, the sources seldom record the philosophical differences between Zeno, Cleanthes, and Chrysippus, the three heads of the Stoa in the third century B.C.; and so it is possible neither to reconstruct in detail the physical philosophy of Zeno, the founder of Stoicism nor to ascertain with certainty the innovations of Cleanthes or Chrysippus. Consequently, I have decided to follow the common practice of regarding the philosophy of the early Stoa as a unit, except where our sources allow us to differentiate between individuals.[13] Even this practice is not without pitfalls, since our sources do not always distinguish the philosophy of the early Stoa from its later adaptations. To maintain a degree of probability in reconstructing early Stoic cosmology, I have tried to rely mainly on quotations and paraphrases explicitly attributed to one of the three early Stoics, supplementing these sources with more general references, when the general references seemed to be compatible with statements explicitly attributed to an early Stoic. Even so gaps remain that can only be filled by conjecture.[14]

The fact that the reconstruction of early Stoic cosmology is at best probable and sometimes plainly conjectural casts a shadow over any study of its origins; and this is not the only difficulty resulting from the inadequacy of our sources. When the early Stoa is regarded as a unit and the individual views of the different Stoics are ignored, the intellectual background against which Stoicism must be compared is widened by a whole century; and we are forced to consider not only the influences on Zeno but also the influences that might have affected Zeno's successors, Cleanthes and Chrysippus. Moreover, as third-century Stoicism defended itself against attacks from other schools, it undoubtedly consolidated its position and welded its system into a tighter, more unified whole, obscuring debts to individual predecessors and incorporating further developments on the basis of its own premises. Since in our quest for origins we must take a whole century of philosophical development, with its varying trends and emphases, and treat it as a single, synchronous unit, it is natural that our results will be only approximate, and that we may never know for certain whether some Stoic idea was a single, bold step of Zeno, a result of several, more conservative steps by each of the old Stoics in turn, or even a belated attempt of Chrysippus to bring the Stoa into conformity with views that had by his time become current outside the Stoa.

Recognizing the difficulties and limitations, we might begin the quest for the origins of Stoic cosmology by looking at the ancient reports concerning the lives of the early Stoics to see whether they harbor any clues. However, after subjecting these reports to critical analysis we will only find them suggesting that Zeno and his successors were open to all the philosophical influences of the day.[15] Zeno is portrayed as a man of insatiable curiosity, an avid hearer of nearly every current philosopher, and a voracious reader of Greek literature and philosophy. Similarly his successors obviously did not shut themselves off from outside influences, but were familiar with the wisdom of the past and kept up with contemporary developments in philosophy and science. Consequently, it seems clear that if we wish to discover the origins of Stoic cosmology, we may as well ignore the biographical tradition and turn instead to the doctrines themselves, in the hope that by analysis and comparison with antecedents we may discover where the Stoics went to quarry cosmological ideas and how they erected their cosmological system from these ideas.

1. The influence of Stoicism has received a thorough discussion in M. Pohlenz, *Die Stoa: Geschichte einer geistigen Bewegung*[3] (Göttingen, 1964). See also the apology for the study of Stoicism by L. Edelstein, *The Meaning of Stoicism*, Martin Classical Lectures 21 (Cambridge, Mass., 1966), vii–x.

2. Reasons for the widespread appeal of Stoicism are discussed by E. Bevan, *Stoics and Sceptics* (Oxford, 1913), 23–33 (with some necessary corrections by L. Edelstein [above, note 1], 12–18), and by W. W. Tarn, *Hellenistic Civilization*[3] (London and New York, 1952), 325–35. For the social and economic conditions that encouraged Stoicism, see Tarn (above), 79–125, and "The Social Question in the Third Century" in J. B. Bury, et al., *The Hellenistic Age* (Cambridge, 1923; reprint ed., New York, 1970), 108–40; and more generally, M. Rostovtzeff, *The Social and Economic History of the Hellenistic World* (Oxford, 1941). Cf. also H. Simon and M. Simon, *Die alte Stoa und ihr Naturbegriff* (Berlin, 1956), 13–28.

3. This family tree lies behind the statement of Diogenes Laertius 2.47 and the arrangement of Books 6 and 7. See Appendix 1, note 7

4. See Diog. Laert. 7.2 (=*SVF* 1.1) and Appendix 1.

5. E.g., É. Bréhier, *The History of Philosophy: The Hellenistic and Roman Age*, trans. W. Baskin (Chicago, 1965), 31; F. Copleston, *A History of Philosophy*[2] (Westminster, Md., 1950), 387–88; B. A. G. Fuller, *A History of Philosophy*[3] (New York, 1955), 253, 258; H. Meyer, *Geschichte der alten Philosophie* (Munich, 1925), 392, 396–98; P. E. More, *Hellenistic Philosophies* (Princeton, 1923), 78; F. Ueberweg and K. Praechter, *Grundriss der Geschichte der Philosophie des Altertums*[10] (Berlin, 1909), 257; W. Windelband, *History of Ancient Philosophy*[2], trans. H. E. Cushman (New York, 1906), 314–15, *A History of Philosophy*, trans. J. H. Tufts (New York, 1901), 180; E. Zeller, *Stoics, Epicureans and Sceptics*, trans. O. J. Reichel (London, 1880), 161, 197–98, 204–5, 393–96; E. Zeller and W. Nestle, *Outlines of the History of Greek Philosophy*[13], trans. L. R. Palmer (London, 1931), 211. Many special monographs on the Stoa take the same attitude, e.g., E. V. Arnold, *Roman Stoicism* (Cambridge, 1911), 35–37, 70–71, 161, 176–77, 190–91, 195, 243, 260–61; Bevan (above, note 2), 40–41, 43; É. Bréhier, *Chrysippe et l'ancien stoïcisme*[2] (Paris, 1951), 134–36, 141–44, 176–77; A. Bridoux, *Le stoïcisme et son influence* (Paris, 1966), 48 and note 2; W. L. Davidson, *The Stoic Creed* (Edinburgh, 1907), 23, 85–87; P. P. Hallie, "Stoicism," and "Zeno of Citium," *Encyclopedia of Philosophy* (New York, 1967), 8.19, 368; R. D. Hicks, *Stoic and Epicurean* (New York, 1910), 10–13, 31; R. Hirzel, *Untersuchungen zu Cicero's philosophischen Schriften* (Leipzig, 1882), 2.38–40, 120–82; A. C. Pearson, *The Fragments of Zeno*

and Cleanthes (London, 1891), 21–23; Pohlenz, *Stoa* (above, note 1), 1.160; and R. M. Wenley, *Stoicism and its Influence* (Boston, 1924), 81–83. A notable exception is A. H. Armstrong, *An Introduction to Ancient Philosophy*³ (London, 1957), 122–25, who seems to regard the similarities to Heraclitus as superficial.

6. Arnold (above, note 5), 55, 165–66, 192; Bréhier, *Chrysippe* (above, note 5), 108–211; Copleston (above, note 5), 387–88; Davidson (above, note 5), 22–23; Fuller (above, note 5), 258–59; Hicks (above, note 5), 13, 28, 31–32, 41, 61–65; Meyer (above, note 5), 392, 396–98; More (above, note 5), 73–74; Pearson (above, note 5), 23–26; F. E. Peters, *The Harvest of Hellenism* (New York, 1970), 131–37; Pohlenz, *Stoa* (above, note 1), 1.64–110; 2.37–63; Ueberweg and Praechter (above, note 5), 257–58; G. Verbeke, *Kleanthes van Assos*, Verhandelingen van de Vlaamse Academie voor Wetenschappen, Klasse der Letteren, Vol. 11, no. 9 (Brussels, 1949), 118–200, and esp. 232–33; Windelband, *History of Ancient Philosophy*² (above, note 5), 314–15; *A History of Philosophy* (above, note 5), 180–82; Zeller, (above, note 5), 194–96, 202–6, 396–400, but cf. 133 (Zeno was "repelled by the Peripatetic school"); Zeller and Nestle (above, note 5), 211. Cf. J. Moreau, *L'âme du monde de Platon aux Stoiciens* (Paris, 1939), for a discussion of the continuity of the motif of the world soul in Plato, Aristotle, and the Stoics. Though ethics is not within the scope of this study, I might note that Aristotelian influence on Stoic ethics has been the subject of recent discussions by A. A. Long, "Aristotle's Legacy to Stoic Ethics," *BICS* 15 (1968): 72–85; and J. Rist, *Stoic Philosophy* (Cambridge, 1969), 1–21.

7. H. Siebeck, "Die Umbildung der peripatetischen Naturphilosophie in die der Stoiker," *Untersuchungen zur Philosophie der Griechen*² (Freiburg, 1888), 181–252. In the edition of 1873 Siebeck discussed how certain fundamental doctrines in Stoicism evolved out of Aristotelianism; but in the edition of 1888 he replied to his conservative critics that he intended not to deny the influence of Heraclitus but merely to show how problems posed by Aristotelian metaphysics prepared the way for an acceptance of Heraclitean views (see pages iii–iv, 181–83). This had the effect of inhibiting for a time research into the influence of fourth-century philosophy on Stoicism. The approach was picked up again by E. Grumach, *Physis und Agathon in der alten Stoa*, Problemata 6 (Berlin, 1932), 44–71. Armstrong (above, note 5), 122–25, 131–32, and Peters (above, note 6), 132–37, also seem to regard Aristotle as the chief influence on Stoic physics.

8. W. Wiersma, "Die Physik des Stoikers Zenon," *Mnemosyne*, 3d ser. 11 (1943): 191–216, sees Pythagoreanism and the Academy at the root of Zeno's physics, limiting the influence of Heraclitus to Cleanthes and the influence of Aristotle to Chrysippus. The influence of Greek medical thought is discussed by G. Verbeke, *L'évolution de la doctrine du pneuma du Stoicisme à S. Augustin* (Paris and Louvain, 1945), 12–15; Bréhier, *History of Philosophy* (above, note 5), 31–34; F. Solmsen, "Cleanthes or Posidonius? The Basis of Stoic Physics," *MNAW*, n.r. 24 (1961): 265–89, and "Greek Philosophy and the Discovery of the Nerves," *MusHelv* 18 (1961):180–81; and Peters (above, note 6), 132–37; cf. also H. Siebeck, "Die Entwicklung der Lehre vom Geist (Pneuma) in der Wissenschaft des Altertums," *Zeitschrift für Völkerpsychologie und Sprachwissenschaft* 12 (1880): 372–80. Attempts to discern Semitic and oriental influences on the Stoa have been made by M. Pohlenz, "Stoa und Semitismus," *Neue Jahrbücher*, n.s. 2 (1926):257–69; and J. Bidez, "La Cité du Monde et la Cité du Soleil chez les Stoiciens," *Bulletin de la classe des Lettres de l'Académie Royale de Belgique*, 5th ser. 18 (1932):244–94; cf. also Bréhier, *History of Philosophy* (above, note 5), 34–36.

9. Pohlenz, *Stoa* (above, note 1), 64–110, and esp. 159–67 Another advocate of the essential unity of Stoicism is J. Christensen, *An Essay on the Unity of Stoic Philosophy* (Copenhagen, 1962).

10. H. Simon and M. Simon (above, note 2), 95–96.

11. The need for such a study has been felt by Solmsen, "Cleanthes" (above, note 8), 23–24, and H. K. Hunt, "The Importance of Zeno's Physics for an Understanding of Stoicism during the Late Roman Republic," *Apeiron* 2 (1967): 5, 11.

12. I have tried to include all of the Stoic doctrines pertaining to the origin, structure, and life cycle of the universe. I have, however, omitted a discussion of the Stoic concepts of mixture and time, and of several incidental meteorological and geological topics, because they did not seem essential to the story of the career of the cosmos. These topics, however, are important aspects of Stoic physics and still deserve detailed study for their origins.

13. Since our sources preserve more of Chrysippus's formulation of Stoicism, this reconstruction will most likely be closer to the philosophy of Chrysippus than to that of Zeno. Some of the rare instances in which Zeno's doctrine can be distinguished from that of Chrysippus are considered by M. Pohlenz, "Zenon und Chrysipp," *NGG*, Phil.-hist. Kl., N.F., Fachgruppe I, vol. 2 (1938), 173–210. A reconstruction of the philosophy of Cleanthes is attempted by G. Verbeke, *Kleanthes* (above, note 6) and the philosophy of Chrysippus by J. B. Gould, *The Philosophy of Chrysippus*, Philosophia Antiqua 17 (Leiden and Albany, N.Y., 1970).

14. The way in which fragmentary ideas are assembled makes an astonishing difference in the final appearance of a philosophical reconstruction. For example, compare how a difference in emphasis affects the appearance of Stoic physics in Pohlenz, *Stoa* (above, note 1), 1.64–110; S. Sambursky, *Physics of the Stoics* (London, 1959); and J. Christensen (above, note 9).

15. See Appendix 1.

THE ORIGINS OF STOIC COSMOLOGY

CHAPTER I

Corporealism

No idea is more deeply ingrained in Stoic philosophy than the conviction that everything real is corporeal. This notion is found in Stoic logic, epistemology, cosmology, psychology, theology, and ethics, in fact, wherever the Stoics discussed what they believed to be real. Consequently, an examination of this fundamental belief makes an appropriate prelude to a discussion of Stoic cosmology.

According to the Stoics the only things that really exist are material bodies (*σώματα*, *SVF* 2.319, 320, 329, 525, cf. 2.336, 469). One Stoic definition of body was "that which is spatially extended in three dimensions with resistance" (*τὸ τριχῇ διαστατὸν μετὰ ἀντιτυπίας*).[1] A second, far more significant definition of body was "that which is capable of acting or being acted upon" (reconstructed from *SVF* 1.90, 146b, 518; 2.140, 363, 387; 3.84). This definition is not found in our sources as a theoretical definition, but is always found within an argument as a mark of body. It is frequently used as the major premise of a syllogism: "Everything which either acts or is acted upon is body. This thing acts [or "is acted upon"]. Therefore, this thing is body." In its simple form this definition was used to prove the corporeality of voice or sound (*φωνή*, *SVF* 2.140, 387). The same definition was modified somewhat to prove the corporeality of the soul. For instance, Cleanthes, after enumerating examples in which wounds to the human body cause pain to the soul and similarly examples in which passions of the soul affect the body, asserted that this mutual action and suffering, which he called intercommunication of affections, is a mark of body and therefore proof that the soul is corporeal (*SVF* 1.518; cf. 2.792; 3.84).

The doctrine of the corporeality of the soul was too important to Stoic philosophy to be dismissed with a single argument, and so it was buttressed by others based on still other marks of body. In one argument Chrysippus assumed that only bodies can come into contact with each other; therefore only bodies can experience the contrary of coming into contact, namely separation. Since in death the soul separates from the body, the soul must also be body (*SVF* 2.790, 791; cf. 792). In still another proof Cleanthes asserted that similarity is a property of body alone. Since children are sometimes similar to their parents in character and hence in soul, the soul is capable of similarity and must therefore be body (*SVF* 1.518; cf. 2.792).

Finally, the Stoics asserted that if the constituent material of a thing is body, the thing itself is body. Since the soul is composed of *pneuma*, a corporeal substance, the soul must be body (*SVF* 1.137; 2.774, 792; 3.305; cf. 2.793). This last proof, from constituent material, was also used to maintain the corporeality of sound and of god (*SVF* 2.141 [cf. 139, 140], 1032, 1035 [cf. 1031]). The most startling application of this mark of body, however, is found in the field of ethics. The Stoics seem to have thought of a quality as "matter in a certain state" (ὕλη πως ἔχουσα), though direct evidence for such a definition is slight (cf. *SVF* 2.376, 379, 380). Apparently they regarded the substrate of a quality as comparable to the constituent material of an object and therefore concluded that the qualities of corporeal things are themselves corporeal (*SVF* 2.377, 380, 381, 383, 388, 389; cf. 2.410; 3.84). This assumption required that even the qualities of the soul, the virtues and vices, and knowledge, be corporeal (*SVF* 2.132, 848; 3.84, 305; cf. 2.797, 801; 3.85); for virtue is "the soul [or its "chief part"] in a certain state" (ψυχή πως ἔχουσα or ἡγεμονικόν πως ἔχον), and the soul had been proven to be corporeal (*SVF* 3.307, cf. 305).[2] The corporeality of the passions was confirmed by two of the other marks of body. Since the passions cause changes in facial expression, they must be capable of action on the one hand, and also of contact, since change cannot be caused without contact (*SVF* 3.84). Finally, the Stoics maintained that even the activities of living corporeal subjects are themselves living corporeal beings, e.g., walking, dancing, cutting leather, and hammering bronze (Plut. *Comm. Not.* 1084b–c; cf. *SVF* 2.801).

Thus by positing a handful of corporeal characteristics, namely, spatial extension with solidity, action and suffering, contact and separation, similarity, and finally corporeal composition, the Stoics were able to maintain that all real things are bodies. Conversely, they could maintain that whatever lacks these characteristics is both incorporeal and nonexistent. Among the incorporeals recognized by the Stoics were time, place, void, and certain logical entities that exist only in thought, e.g., predicates and propositions (*SVF* 2.132, 166, 170, 331, 335; cf. 1.89; 2.336).

In seeking the origin of the Stoic belief that only bodies exist, two possible explanations may be dismissed at once. In view of the supposed influence of Heraclitus on the Stoics, one might conjecture that his apparent corporealism gave impetus to the Stoic doctrine.[3] But the corporealism of Heraclitus was, at best, implicit and quite a different thing from the explicit corporealism of the Stoics; so there is still the question of how the Stoics came to adopt an explicit corporealism. Moreover, it may be going too far even to say that Heraclitus's philosophy was implicitly corporealistic.[4] Although the distinction between corporeal and incorporeal may already have been made, it had not been applied to the problem of the nature of existing things; and it is unfair to impute to any man the answer to a question he has not heard. The formulation of Heraclitus's philosophy presupposes no distinction between body and nonbody; and it is possible that if Heraclitus had thought in terms of this distinction, his philosophy would have had an entirely different formulation. Therefore, there is no justification at all for deriving the Stoic doctrine from Heraclitus.

Another explanation that could be advanced is the spirit of the times.[5] It is true that the Epicureans and third-century Peripatetics, such as Strato, were also corporealists. But far from explaining the origin of Stoic corporealism, this explanation begs the question and only whets one's curiosity even more to know how all these schools came to adopt the corporealist view, after the fourth-century Academic and Aristotelian philosophies had given such prominence to the incorporeal.

Since the roots of Stoic corporealism do not lie in the time of the early pre-Socratics before the question had been raised or in the Hellenistic period when the question had been answered, they must lie in the intervening period, during which the question of the nature of truly existing things was raised and subsequently discussed until it reached such a state that the Stoic view was, if not inevitable, at least reasonable.[6]

Discussion of the relation between corporeality and that which truly exists seems to have been inaugurated by the Eleatics, probably first by Melissus. In his defense of Parmenides' assertion that "what is" must be one and homogeneous, Melissus added that it must also be without body (σῶμα) or thickness (πάχος).[7] His assertion that "what is" must be incorporeal provoked an immediate reaction. Not only did Gorgias of Leontini, in refutation of the Eleatics, acknowledge body as a possible candidate for the title of what truly exists (DK 82 B 3.73), but most of the natural philosophers of the latter part of the fifth century explicitly attributed corporeality to the elemental realities in their systems. The atoms of Leucippus and Democritus (DK 68 B 156; cf. index, DK 3.419a16–27), the air of Diogenes of Apollonia (DK 64 B 7), and even the monads of the Pythagorean Ecphantus (DK 51.2; cf. 51.1, 4) were explicitly called bodies.[8] From this time on, "bodies" was the standard name given to the material elements.

It was at this point that Socrates entered the scene and shifted the entire emphasis of philosophical inquiry. In investigating the basis of man's ethical behavior, Socrates now began inquiring into the content and definition of ethical terms, such as temperance, courage, piety, beauty, and justice. In the next generation Plato carried Socrates' investigation one step further and inquired also into the nature of these terms, or rather of the realities they describe. His conclusion was the theory of Forms, according to which universals, including the ethical predicates, exist apart from the particular manifestations of them, and these transcendent universal ideas are the only true beings (ὄντα).[9] Plato believed that these truly existing Forms are incorporeal (*Phaedr.* 247c, *Soph.* 246b, 247b–c, *Polit.* 286a, cf. *Rep.* 5.476a). The theory of Forms brings us back in one respect to the position of Melissus, in that what truly exists is incorporeal; but Plato's reason for taking this position was totally different from that of Melissus. Whereas Melissus had arrived at his position by abstract logic, Plato was led there by seeking the objective realities denoted by ethical terms, a problem that he felt was bound to trouble all but the most irrationally stubborn materialist.[10] For the materialist assumption that all that truly exists is corporeal must lead to one of two absurd consequences—either the well-known virtues do not exist or else they too are corporeal (*Soph.* 245e–247c). Plato felt he could solve this dilemma only by positing a set of truly existing incorporeal Forms to serve as the objects of thought, one Form corresponding to each universal concept.

The history of the question of the corporeality of real entities suggests that by the mid-fourth century there was only one outstanding proponent of incorporeal real entities, that is, Plato and his Academy. Before Zeno the Stoic appeared on the scene, the Platonic theory of Forms was to become the subject of much discussion and criticism. The most vociferous critic of all was Aristotle. Aristotle's criticisms are to be found in several of his works, especially in *On Ideas, On Philosophy, Posterior Analytics, On Generation and Corruption,* and the *Metaphysics.*[11] In these works Aristotle brought many arguments against the theory of Ideas, showing that Plato's theory leads to contradictions, for which a single, fundamental error is responsible, namely, that the Ideas exist separate or apart from the individual particulars.[12] Aristotle insisted that to avoid contradictions the Ideas must be considered universals inherent in the particulars.[13] For Aristotle, universals are inseparable from objects, and separability is a mark of substance (οὐσία). Hence universals cannot be called substances (οὐσίαι).[14] This, however, does not mean that they do not exist or that they can be ignored; for, in fact there can be no science or knowledge without universals (*Metaph.* 3.6.1003a13–15, 11.2.1060b19–21, 13.9.1086b5–6, 10.1086b32–37; *De An.* 2.5.417b22–23; *Eth. Nic.* 6.6.1140b31–32, 10.9.1180b15–16). Universals must, therefore, have some mode of existence, and Aristotle's conception of this mode of existence can be deduced from his descriptions of universals. For instance, Aristotle spoke of a universal as something spoken or predicated universally of more than one thing (e.g., *Int.* 7.17a39–bl; *Anal. Post.* 2.12.96a12–15 [cf. 1.31.87b32–33]; *Metaph.* 3.3.999a20–21; 5.26.1023b29–32; 7.13.1038b8–12; *Part. An.* 1.4.644a27–28); thus the universal exists in human language. Moreover, Aristotle described the process of induction (ἐπαγωγή), by which a man comes to the knowledge of a universal concept, and therein made it clear that the universal also exists in the human mind.[15] Thus Aristotle asserted that though the universal per se does not exist apart from particulars, it is separable by the mind, as a universal concept, and may, in turn, be expressed in language. The relation between the realms of language, thought, and objects is summarized in the introductory paragraph of *On Interpretation,* where it is stated that words are signs (σύμβολα or σημεῖα) of thoughts (νοήματα or παθήματα τῆς ψυχῆς), and thoughts correspond to (ὁμοιώματα) things (πράγματα).[16] In this scheme the Aristotelian universal would find no place among things, but would exist as a thought, which could be represented by a word. Aristotle's criticism of Plato had the effect of removing the Platonic Form from the throne of sole independent reality to the position of mental concept, although in this position it was still allowed to retain some of its Platonic attributes, i.e., incorporeality, eternity, and imperishability.[17]

The Stoics, entering the philosophical scene a decade after the death of Aristotle, followed him closely in their assessment of the Platonic Ideas. Zeno and Cleanthes stated simply that the Platonic Ideas are thoughts in our mind and, as such, are nonexistent (*ἀνυπάρκτους*, *SVF* 1.65, 494; cf. 2.360). Zeno even used Aristotle's favorite examples, men and horses. Furthermore, the Stoics followed the analysis of *On Interpretation* and distinguished the word (*φωνή* or *σημαῖνον*), the concept (*σημαινόμενον*) and the actual object (*τυγχάνον*). Two of these, the voice (struck air) and the object, are corporeal. The third, the concept, the group in which the Platonic Ideas would be found, is incorporeal.[18] Not only is the content of this analysis dependent on Aristotle,[19] but even the vocabulary is Aristotelian, for *φωνή* and the verb *σημαίνω* were also used by Aristotle in this context. Thus it is apparent that the Stoics were studying Aristotle and accepting his criticisms. This explains how the incorporeal entities of the Platonic theory of Forms came to be retained by the Stoic system, stripped of their real, separate existence, but still retaining their incorporeality.

The similarity between the Aristotelian and the Stoic attitude toward the Platonic Ideas might suggest that Aristotle's ontology lies at the root of Stoic corporealism. Aristotle did maintain that only substance (*οὐσία*) is self-subsistent; qualities, quantities, and all the other categories must be present in or predicated of some substance (*Metaph.* 7.1.1028a13–b7; 9.1.1045b27–32; 11.3.1061a7–10; 12.5.1071a1–2; 13.2.1077b4–9; 14.2.1089b24–28; *Phys.* 1.2.185a31–32; *Cat.* 5.2a34–b6; 2b15–17). Only substance may be said to be primarily and without qualification (*Metaph.* 5.11.1019a4–6; 7.1.1028a13–b7; 9.1.1045b27–32; 12.1.1069a18–24; cf. 7.3.1029a7–9). Moreover, there are two types of substance. The species and the genus, such as man and animal, are secondary substances (*δεύτεραι οὐσίαι*); and even they cannot exist apart by themselves, but are predicated of some individual. In the last analysis, only the individuals, the primary substances (*πρῶται οὐσίαι*), are not present in or predicable of any subject, and so exist apart by themselves (*Cat.* 5.2a11–3b23; *Metaph.* 7.1.1028a10–b7; 12.1.1069-a18–24).

Aristotle's insistence that only particular substances are self-subsistent might by pressed into service as an antecedent of the Stoic view that only bodies exist,[20] but this would certainly be misleading if not incorrect. Even though Aristotle did maintain that only particular substances are self-subsistent, he in no way believed that only particular substances exist. On the contrary, he repeatedly insisted that being may be predicated of any number of things, indeed, of everything that can be placed under one of the categories.[21] Moreover, he mentioned more than once without approval the very theory that only perceptible bodies exist.[22] In addition, he himself believed that alongside perceptible movable entities there is an eternal, unmoved being, the incorporeal, prime mover.[23] This belief is patently incompatible with the notion that only bodies exist. In short, there is still a wide gulf between Aristotle's ontology, which found a way for everything, corporeal and incorporeal alike, to exist, and Stoic ontology, which recognized only two possibilities, corporeal being or nonexistence.[24]

Nor will the subsequent Peripatetic discussion of the nature of the soul and of god be of much use in explaining the origins of Stoic corporealism.[25] Of course, before the Stoics could maintain that every real thing is corporeal, they did have to assert the corporeality of god and soul, in opposition to the views of Plato and Aristotle; but the origin of the Stoic doctrines of a corporeal soul and a corporeal god cannot be more than a small part of the explanation for the Stoic view that only bodies exist. At most, these Stoic doctrines constitute a necessary, but not sufficient, condition for Stoic corporealism.

Since Stoic corporealism cannot easily be explained in terms of the general evolution of ontological speculation, we will have to examine the fragmentary details of Stoic ontological statements for clues to the origin of their doctrine. In so doing we cannot fail to notice immediately that in the extant fragments the thesis that only bodies exist is never found serving as a presupposition.[26] It is never used as a premise to prove the corporeality of anything, nor is it ever used to deny the existence of something demonstrably incorporeal. In fact, as a simple statement it is found only in a few late and hostile sources, namely, Plotinus, Alexander of Aphrodisias, and Plutarch (*SVF*

2.319, 320, 329, 525). Nevertheless, it cannot be disputed that the Stoics believed it. Hence it must have followed as a conclusion, on the one hand, presupposing the corporeality of god, the soul, virtues, and qualities, and, on the other hand, derived by argument from specific premises. This confirms our observation that the Stoic thesis that only bodies exist was not taken over fully evolved, but was a new thesis which the Stoics felt a need to demonstrate. It is to their demonstrations that we must now turn.

The first Stoic definition of body, "that which is extended in three dimensions with resistance" (*τὸ τριχῇ διαστατὸν μετὰ ἀντιτυπίας*), was used also by the Epicureans (Sext. Emp. *Math.* 1.21; 11.226; cf. 10.221–22, 240, 257; Plut. *Adv. Colot.* 1116d) and was based on the traditional mathematical definition of body. Aristotle gave this definition in nearly the same form, *τὸ πάντῃ* (i.e., *τριχῇ*) *διάστασιν ἔχον*, referring of course, to length, breadth, and depth as the three dimensions.[27] Before Aristotle, the three dimensions were considered characteristic of body by both Plato (*Leg.* 10.896c–d) and Gorgias (DK 82 B 3.73). From the descriptions of Plato and Aristotle it is clear that the mathematical definition of body is a result of the position body takes in the series: (1) point or number; (2) line or length; (3) surface or breadth; (4) body (solid, *στερεόν*) or depth. Since each member of the series has one dimension more than the preceding member, body has three dimensions (Plato *Rep.* 7.528a–b; cf. *Epin.* 990c–d; Arist. *De An.* 1.2.404b16–24; *Cael.* 1.1.268a6–8; *Metaph.* 5.6.1016b24–31, 13.1020a11–14). That the Stoics recognized the mathematical nature of this definition is clear from the fact that Apollodorus, the author of the first handbook of Stoic philosophy, lists the entire series, defining body as "that which is extended in three dimensions" (*τὸ τριχῇ διαστατόν*), and defining each subsequent member as the limit of the previous member, hence lacking one of the dimensions (*SVF* 3.Apollod. 6; cf. 2.357).

This definition of body, which the Stoics and Epicureans borrowed from mathematics, makes body a member of a series of mathematical entities and thus leaves the question of its materiality or corporeality open. Consequently the Stoics and Epicureans had to supplement it with the phrase "with resistance" (*μετὰ ἀντιτυπίας*). The verb *ἀντιτυπεῖν* means "to strike against," especially against a hard, resisting object (e.g., Arist. *Meteor.* 2.8.368a3; 3.1.370b18) or "to offer active resistance and strike back'' (as iron does to lightning that strikes it in Arist. *Meteor.* 3.1.371a24–26). Accordingly, the adjective (ἀντίτυπος) may mean ''firm, resistant,'' and may even serve as an explanation of hardness (as in Plato *Tim.* 62b–c). Consequently the phrase ''with resistance'' in the Stoic and Epicurean definition of body suggests that for them body is not only spatially extended in three directions, but that it is able to exert active opposition to a force that acts upon it.[28] In fact, the phrase seems to convey much of the content of the second Stoic definition of body, namely ''that which has the power of acting or being acted upon.''

The Stoic and Epicurean definition has a significant precedent in Plato, who listed the attributes of bodies as length, breadth, depth, and strength (ῥώμη, *Leg.* 10.896d). Apparently even before the Stoics arrived on the scene, the Greek philosophers were aware that the word ''body'' has two meanings: (1) the three-dimensional mathematical figure abstracted from the physical particulars,[29] which serves as the subject matter of solid geometry (στερεομετρία, Plato, *Rep.* 7.527d–528e, cf. *Epin.* 990d); and (2) the physical bodies that are also three-dimensional, but in addition are perceptible and serve as the subject matter of physics. The Stoics and Epicureans, attempting to set forth the second of these two meanings, did just what Plato had done and what others may also have been doing; they combined the mathematical definition of body with a phrase indicating physical existence and the power to interact.[30]

The second Stoic definition of body, ''that which either acts or is acted upon,'' was the most important, for this definition was actually used to prove the corporeality of sound, the soul, and the passions. Moreover, this definition was probably the one used to prove the all-important conclusion that only bodies exist. Unfortunately this important proof is not actually attested in the extant fragments, but it is possible to reconstruct it. Lucretius gives us the Epicurean proof that only bodies and void exist: ''Whatever exists by itself will either act on something or will itself have to be the recipient of an action when other things act upon it, or it will be such that things may exist and happen in it. But nothing can act or be acted upon without body, nor can anything offer space except the void and empty. Therefore, besides void and bodies no third nature by itself can be left in the sum of things'' (Lucr. 1.440–446). If we extract the argument for the existence of bodies, we find it is essentially a simple syllogism: "Whatever exists either acts or is acted upon. Nothing can act or be acted upon without body. Therefore, only bodies exist." The Stoics certainly agreed with the minor premise and conclusion (*SVF* 1.90, 146b; 2.140, 319, 320, 329, 363, 387, 469, 525; cf. 3.84); and the major premise is deducible from a principle that also seems to have been accepted by the Stoics, that is, "acting and being acted upon are characteristic of what is."[31] Thus it is likely that the Stoics, as well as the Epicureans, used this simple syllogism to conclude that only bodies exist.[32]

This proof is unknown before the Epicureans and Stoics used it. If we look for precedents for the premises of the proof, we find that the assumption that acting and being acted upon are marks of being was first stated explicitly by Plato in the *Sophist* (247d–e). However, an examination of Plato's use of this definition of being shows that the Stoics and Epicureans have grossly perverted its intent. Plato proposed this definition to the materialists as a mark of real being in place of their favorite marks, visibility and tangibility. Plato's argument was, in brief, as follows: The soul and its virtues, such as justice and wisdom, are real beings (*ὄντα*). These same beings are neither visible nor tangible (*ὁρατὸν καὶ ἁπτόν*), and are consequently incorporeal. Therefore, perceptibility by sense, or corporeality, cannot be a mark of the real. As a substitute Plato proposed "the power to act or be acted upon" (*Soph.* 246e–248a). Thus Plato intended this mark to include both corporeal and incorporeal realities, and to exclude tangibility as a characteristic of being.[33] Plato argued up to this mark of being on the premise that incorporeal entities exist; the Stoics and Epicureans, on the other hand, used Plato's definition as a premise to prove that incorporeal entities do not exist.

This complete inversion of Plato's argument could take place only on two conditions. First, Plato's mark of real being had to become accepted in its own right and not as the consequence of an argument presupposing incorporeal entities. Secondly, the minor premise of the Stoic and Epicurean argument, namely, that only bodies can act and be acted upon, had to be firmly established.

In his *Topics* Aristotle seems to know Plato's mark of the real as a familiar definition (*Top.* 5.9.139a4–8). The only fault Aristotle could find with it as a definition is that it has two parts, thus enabling anything that only acts, but is not acted upon, to be proven both existent and nonexistent (*Top.* 6.7.146a21–32). Since in the *Topics* Aristotle seems to have used propositions current in philosophical circles during his student days,[34] we may infer that this mark of being was far more widespread than its single occurrence in Plato's *Sophist* would suggest. Thus the first condition for the inversion of Plato's argument seems to have been met already by the time of Aristotle's youth.

Although Aristotle was clearly familiar with this definition of true being, he never once used it in his own metaphysical writings, apparently because he felt that the concepts of action and passion had no place in the science of metaphysics. This is not to say that these concepts were totally useless to him. On the contrary, when we turn to Aristotle's physical works, we find that acting and being acted upon are vital concepts, brought to bear on some of the most important physical problems, such as genesis, mixture, and the transformation of elements.[35] A point on which Aristotle insisted most firmly was that there can be no action or suffering without contact (ἁφή, *Gen. Corr.* 1.6.322b22–24, 26–29, 9.327a1–3; cf. *Phys.* 3.2.202a3–9; 7.1.242b24–27, 2.243a3–245b2; 8.10.266b27–267a20). From action and suffering he deduced not only contact but position (θέσις), existence in place (ἐν τόπῳ), and finally weight and lightness (*Gen. Corr.* 1.6.322b26–323a9). It is hard to imagine what besides body could have all these qualities.[36] Furthermore, acting and being acted upon are similar to moving and being moved. In fact, Aristotle often used the terms interchangeably.[37] Aristotle was willing to admit in a different context that there can be no motion apart from the physical body (ἄνευ φυσικοῦ σώματος, *Cael.* 1.9.279a15–16), and, again, that qualitative change, which is the strict meaning of "suffering" (πάσχειν, cf. *Gen. Corr.* 1.6.323a17–20; *Metaph.* 5.21.1022b15–21), can occur only by the action of perceptible things (αἰσθητά), presumably bodies (*Phys.* 7.3.245b3–6). Thus Aristotle came very close to asserting that there can be no acting or suffering without body, but he never quite made this statement. His reason for reluctance is obvious from the passage in *On Generation* in which he insisted on the necessity of contact for acting and suffering. Here we see that Aristotle had in the back of his mind his unmoved mover, which was without parts, without extension, and without material substrate (*Phys.* 8.10.266a10–267b26; *Metaph.* 12.6.1071b12–22). Since the most important mover or agent was without body, he could not simply assert that there can be no acting or suffering without body. In fact, even touch proved to be an embarrassing property of acting and suffering. To get around it Aristotle called upon a metaphorical meaning of the word "touch," which he detected in the statement, "One who grieves us touches us" (*Gen. Corr.* 1.6.323a32–33). The unmoved mover, which moves the outermost heaven "like the object of love" (*Metaph.* 12.7.1072b3), could then be said to touch the thing that is moved, without the moved object touching the unmoved mover (*Gen. Corr.* 1.6.323a28–32). Thus Aristotle found a device to allow an incorporeal and therefore untouchable mover to touch and act upon other things.

This far-fetched solution satisfied Aristotle; but his pupil Eudemus could not see how a partless mover could touch anything, and so he limited contact to movers that are themselves in motion (Eudemus, fr. 123a, b, Wehrli). Eudemus's solution to the embarrassment was to limit the universality of Aristotle's principle that there can be no acting or suffering without touch. The disadvantage of this solution was that it left unexplained how the unmoved mover could transfer its motion to the moved objects. There was another possible solution for avoiding this difficulty—that is, giving up the incorporeality of the first mover. This was the solution adopted by the Stoics. Since the Stoic deity and active cause (*ποιοῦν*) was corporeal, the universality of the principle that there can be no acting or suffering without contact or body could be maintained.

Thus the Stoics seem to have derived their most important mark of body from Aristotle. Whereas Aristotle's preconception of the incorporeality of the first mover had prevented him from asserting as a universal principle that there can be no acting or suffering without corporeal contact, the Stoics boldly accepted the promptings of Aristotle's physical researches and universalized his principle so that it could serve them as a mark of body. Since the only stumbling block in the path of its universality was the highly controversial Aristotelian doctrine of the first mover, the Stoics felt no reluctance to use the principle as a proven premise and apparently anticipated no objections from opponents. Finally, by combining this universalized Aristotelian principle with an Academic commonplace, "Being is that which is capable of acting or suffering," the Stoics and Epicureans came up with a conclusion that is neither Academic nor Aristotelian, but that to them must have seemed most probable, since its premises had the authority of the two most respected philosophical schools of Greece.

Another argument, this one used by Chrysippus to prove the corporeality of the soul, ran as follows: "Death is the separation (χωρισμός) of soul from body. Nothing incorporeal is separated from the corporeal, for nothing incorporeal comes into contact with [or "is joined to," ἐφάπτεται] the corporeal. The soul is joined to and is separated from the body. Therefore the soul is corporeal [*SVF* 2.790, 791; cf. 792]." The first premise in this argument is the hallowed Platonic dogma that death is the separation of soul from body (*Phaed.* 64c, 67c–d, *Gorg.* 524b, *Rep.* 10.609d, *Tim.* 81d, cf. *Leg.* 12.959b). Plato was not consistent in the word he used for separation, but χωρίζειν and χωρισμός were preferred in the well-known passage of the *Phaedo*.

Chrysippus's second premise is more difficult to trace. It is itself the conclusion to an independent argument, consisting of two subordinate premises: (1) nothing incorporeal can have contact with the corporeal, and (2) χωρίζειν is the opposite of ἐφάπτειν. The first of these subordinate premises seems to be that contact (ἁφή) is a property of body and only of body. The Greek word has two meanings. One meaning is simple "contact"; the other is the sense perception that operates through contact, namely, touch. Tangibility, that is, the capability of being perceived by touch, was a widely accepted mark of body.[38] But for Aristotle, who seems to have distinguished between the two meanings,[39] simple contact was not a property of body alone but also of the mathematical abstractions (*Gen. Corr.* 1.6.323a1–3). Chrysippus thus has not simply taken over a traditional mark of body (ἁφή, meaning "tangibility") but has changed it so that ἁφή, meaning "contact," is the mark. It is possible that he was unaware of the distinction in meaning and overlooked the fact that he had given an old definition a new meaning, thereby producing a sophistical argument. It is also possible that the change was intentional. When Aristotle was deducing the properties of things that act or suffer, he began with contact and worked through position, and in place, to weight and lightness (*Gen. Corr.* 1.6.322b21–323a9). He was obviously thinking primarily of bodies. Perhaps it was for this very reason that he pointed out that some of these attributes apply also to the mathematical figures that can be abstracted from bodies. To Aristotle's mind, then, contact may have been a property only of bodies and mathematical figures (and in a metaphorical sense also of the unmoved mover). The mathematical figures, however, do not exist outside of the mind according to Aristotle; they are really things that do not exist apart considered as though they do exist apart (*Metaph.* 13.3.1078a21–23; cf. 11.3.1061a28–b4; *Phys.* 2.2.193b22–35). Chrysippus, likewise, seems to have ranked them with the universal ideas, as thoughts in the mind.[40] Thus even if Chrysippus agreed with Aristotle that mathematical figures can, in a sense, be in contact, the only real things that can be in contact are bodies; and so for the sake of an argument concerning soul and body, two undeniably real things, the premise that contact is a mark of body was absolutely true.[41]

Chrysippus's second subordinate premise, that χωρίζειν is the opposite of ἐφάπτειν, is much more clearly dependent, directly or indirectly, on Aristotle; for Aristotle made ἅμα and χωρίς contraries and then went on to say that touch (ἅπτεσθαι) occurs to things whose extremities are together (ἅμα, *Phys.* 5.3.226b21–23). Aristotle, in turn, was dependent on Plato who said that what is about to touch must be apart (χωρίς, *Parm.* 149a4–5).[42] Since χωρίζειν and ἐφάπτειν are not commonplace opposites, it is likely that Chrysippus's premise depends on the Platonic and Aristotelian analyses of these terms.[43] From the two subordinate premises (that contact occurs only between bodies, and contact is the opposite of separation) Chrysippus concluded separation can occur only between corporeal substances. Then since the soul in death is separated from the body, he concluded the soul, like the body, must be corporeal. The method here, as in the other argument, is one of synthesis; Chrysippus has combined a Platonic definition with some totally unrelated suppositions, which seem to have some Aristotelian influence, and has come up with a new proof that the soul is corporeal.

A third argument, used by Cleanthes to prove the corporeality of the soul, ran as follows: Children are similar (ὅμοιος) to their parents not only in body but also in soul; that is, they have similar characters. Since the similar and dissimilar are characteristic of body, but not of the incorporeal, the soul must be corporeal (*SVF* 1.518; cf. 2.792). The argument is a strange one, for it presupposes that similarity is a mark of body, and it is not easy to see how Cleanthes should have come to hold this. Cleanthes seems to have assumed that similarity or dissimilarity may be predicated only of subjects that have qualities. This is an obvious assumption and one to which Aristotle called attention (*Cat.* 8.11a15–19). In fact, two of the respects in which Cleanthes thought children resembled their parents, namely in dispositions (διαθέσεις) and affections (πάθη), were given by Aristotle as types of qualities (*Cat.* 8.8b25–9a13, 9a27–10a10). So we must now ask how Cleanthes came to feel that qualities inhere only in corporeal subjects. Strictly speaking, this does not seem to be true; for the Stoics described the characteristics and qualities also of incorporeal subjects. For instance, the void is empty, unlimited, and, of course, incorporeal (*SVF* 1.95, 96; 2.331, 503, 509, 535, 539). Not only did the Stoics describe the negative qualities of incorporeal things, but they said void, place, and time are continuous and divisible to infinity (*SVF* 2.482, 509). Simplicius says the Stoics believed that the qualities of corporeal subjects are corporeal, whereas the qualities of incorporeal subjects are incorporeal (*SVF*. 2.388, 389). If Cleanthes held this view, his argument is not valid, for qualities do not inhere only in corporeal subjects; and consequently even incorporeal subjects can be compared for likeness. But it is possible that the theory of the qualities of incorporeal subjects had not yet been worked out in Cleanthes' day. The early Stoics were much more interested in the idea that qualities of corporeal subjects are themselves corporeal. If Cleanthes was thinking only of corporeal entities and of their corporeal qualities, it is somewhat easier to understand how he came to hold the theory that similarity and dissimilarity are marks of body. He must have felt similarity entails qualities and qualities entail corporeality. Even on this assumption his argument remains a curiosity and only partially explainable.[44]

Probably the most startling argument used by the Stoics to prove the corporeality of anything was that used to prove the corporeality of the virtues, vices, and qualities in general. Virtues, vices, truth, and knowledge were all said to be "states of the soul" or, alternatively, "the soul in various states" (*SVF* 2.132; 3.459[=1.202], 198, 307). To us, it makes a big difference whether one defines virtue as "a state (διάθεσις) of the soul" or "the soul in a certain state" (ψυχή πως ἔχουσα). Aristotle in his *Topics* had called it an error to make what is actually the subject of an affection the genus of that affection, for the genus must always be truly predicated of the thing defined, so that the predicates of the genus are true also of the species (*Top.*

4.5.127a3–17). Any student of Aristotle's *Topics* ought to have rejected a definition of virtue as a soul in a certain state, because the predicates of soul do not apply to the virtues. The Stoics, however, claimed that the virtues and other states of the soul are by definition souls and then boldly went on to attribute to states of the soul all the attributes of the soul itself. Accordingly, they concluded that truth, knowledge, the virtues, and the vices are corporeal (*SVF* 2.132, 848; 3.84, 305, cf. 2.797; 3.85). This approach even allowed the Stoics to make the extraordinary assertion that virtues are living beings, for the soul is a living being.[45]

These notions, so strange to our ears as well as to the ears of some ancient writers,[46] may not be as hard to account for as one might expect. The sources, fragmentary as they are, give a number of unmistakable clues to the origin of this theory. Chrysippus stated that the virtues and vices are qualities (*SVF* 3.259, cf. 255). They exist in the soul or its principal part (ἡγεμονικόν) as substance (ὑπόστασις, οὐσία *SVF* 3.305, 306). More generally, substance or matter (οὐσία or ὕλη) underlies all qualities (*SVF* 2.380). With this vocabulary there can be no doubt that the Stoics were operating with Aristotelian ideas.[47]

Returning to Aristotle we find that he maintained in the *Metaphysics* that qualities, like all the other categories except substance, have no separable existence, but subsist only in some primary substance. Aristotle actually mentions that someone might doubt whether "walking," "being healthy," and "being seated" (infinitives: βαδίζειν, ὑγιαίνειν, καθῆσθαι) exist, for they do not exist apart from substance (οὐσία). He points out, however, that "the walker," "the healthy one," and "the seated" (participles: τὸ βαδίζον, τὸ καθήμενον, τὸ ὑγιαῖνον) certainly do exist, for these have a substrate (ὑποκείμενον), which is the substance (οὐσία) and the individual (τὸ καθ' ἕκαστον). What is more, in this same context he mentioned that among things spoken of with a substrate is "the good" (τὸ ἀγαθόν, *Metaph.* 7.1.1028a10–29; cf. 9.1.1045b27–32; 12.1.1069a18–24, 5.1071a1–2; 13.2.1077b4–9; 14.2.1089b24–28; *Phys.* 1.2.185a31–32; *Cat.* 5.2a34–b6, 2b15–17.

To Zeno and the Stoics this analysis may have suggested that the very existence of the virtues and other qualities was problematic, and that the meaning of qualitative terms would have to be reinterpreted and definitions found that would ensure the reality of qualities. Aristotle would, no doubt, have been dismayed to learn that someone could come to such a conclusion after he had taken such pains to show how everything that falls under any of the categories can be said to exist,[48] but the Stoics clearly were not about to follow him in distinguishing different senses of the verb "to be." The Stoic defense of the reality of the virtues and other qualities was to be along a different Aristotelian line. This becomes clearest when we compare the type of definition used by the Stoics with some of Aristotle's thoughts on the subject of definitions.

We have already observed that in the *Topics* Aristotle criticized the type of definition that the Stoics ultimately chose (*Top*. 4.5.127a3–17); but this part of Aristotle's *Topics* was the work of his youth, and Aristotle did not necessarily approve philosophically of all the arguments he advanced.[49] Moreover, in the *Topics* he considered the definition only from the point of view of logic. In a discussion of substance in the *Metaphysics* Aristotle considered the definition from the point of view of ontology to determine the reality to which the definition corresponds (*Metaph*. 8.1–3.1042a3–1044a14). Here he pointed out that since substances may be either matter, form, or composites of matter and form, there are three kinds of definitions: (1) of the material alone (e.g., a house is stones, bricks, and wood); (2) of the form or actuality alone (e.g., a house is a covering for property and bodies); and (3) of the composite (e.g., a house is a covering made of bricks and stones lying in a certain way). He admitted that the matter which underlies processes of change is generally recognized as substance, and elsewhere he remarked on the natural philosopher's inclination to define things in terms of the matter alone (*De An*. 1.1.403a29–b12). What he felt compelled to add is that material definitions are inadequate. Since the qualifications of the differences in the matter make a thing what it is, the definition of anything requires specification of these qualifications and differences. These differences, although they do not constitute the full actuality, are analogous to the form, or actuality, and are essential in a definition of the form or of the composite of matter and form. As examples of such definitions Aristotle suggested: a threshold is wood or stone lying in a certain way (ὡδὶ κείμενον); a house is bricks and wood lying in a certain way (ὡδί); ice is water solidified in a certain way (ὡδί);[50] harmony is a particular sort of (τοιαδί) mixture of high and low (*Metaph.* 8.2.1043a7–11); or to speak generally, a thing is certain things disposed in a certain way (ὡδὶ ταδὶ ἔχοντα, *Metaph.* 7.11.1036b23–24).

This was just what the Stoics needed to ensure the existence of qualities even on their own premises. The qualities predicated of a particular object could be expressed in terms of a definition that stated both the material substrate and the specific differences that identified the quality. All the Stoics had to do now was to apply this theory to the affections or qualities of the soul. The Stoics could easily have taken this step by themselves, but Aristotle again led the way. Aristotle pointed out that observation shows the affections of the soul, such as anger, fear, and joy, to be inseparable from the body, that is, from the physical material of living things. The affections are, in fact, formulas in matter (λόγοι ἔνυλοι); and the definitions of them must include the material substrate in which they occur. Therefore, anger must be defined as a movement of a body (or a part or faculty of a body) in a particular state by a particular agent for a particular purpose. In fact, all definitions given by natural philosophers ought to include both the matter and the form (*De An.* 1.1.403a3–b19). The Stoics could not have asked for a plainer directive.[51] Following the examples given by Aristotle in the *Metaphysics*, they defined virtue and all affections and activities of the soul as "the soul disposed in a certain way" (ψυχή πως ἔχουσα).[52]

The result, however, was far removed from the Aristotelian point of view. Aristotle had used definitions of this type only of perceptible, natural objects, which were themselves corporeal.[53] Affections of the soul, for Aristotle, were not natural objects but were formulas embodied in matter and inseparable from body or natural material (*De An.* 1.1.403a10–27, b17–19). Anger he defined as a movement of some body, not a body itself (*De An.* 1.1.403a25–27). By defining affections of the soul as the soul disposed in a certain way, the Stoics extended the application of this type of definition in an unprecedented and un-Aristotelian way. Furthermore, they seem to have treated definitions as if they were Aristotelian definitions, consisting of a genus and specific differences, and so applied the predicates of the genus to the thing being defined.[54] Consequently the affections of the soul, being themselves souls, were called "bodies" and even "living beings."[55]

Whether the Stoics were aware of their violations of Aristotelian logic is not known. They made no pretense of being faithful to Aristotle or the Peripetos. They were using the philosophical material available and combining it in a new way to produce a new philosophy. The creation of a reasonable, unified system was a more important desideratum than faithfulness to the principles that had given them their starting point.

So it seems that all the Stoic proofs for corporeality, whether of the soul, of its dispositions and affections, or of all real things, were built on premises taken over from Plato or Aristotle or else followed from suggestions made by Aristotle's metaphysical and logical researches. Stoic corporealism, therefore, appears not to have been taken over intact from any predecessor, nor to have followed the general trend of Greek metaphysical speculation, but rather to be an entirely new philosophical creed, constructed in an ostensibly reasonable fashion out of current Greek philosophical ideas.

1. *SVF* 2.315, 319, 357, 381; 3.Apollod.6; cf. 2.501, 502. M. E. Reesor, "The Stoic Concept of Quality," *AJP* 75 (1954):57, denies that this is an actual Stoic definition of body. Her chief reason is that in her opinion "the term 'body' in Stoic philosophy designates a capacity to act or be acted upon, and not a three-dimensioned solid." Whereas it may be true that for the Stoics the capacity to act and be acted upon is the most significant property of body, this is no reason to deny that the Stoics had another description of body. Her explanation of the occurrence of this definition in several Stoic fragments is that critics "attacked Stoic philosophy, basing their objections on their own definition of body." But of the two critics she cites, one (Plotinus) criticizes the very definition itself (*SVF* 2.315) and in another fragment explicitly assigns one half the definition to his opponents (*SVF* 2.319), and the other critic (Galen or Albinus [see below, note 46]) expressly assigns the whole definition to them (*SVF* 2.381). Neither leaves any doubt that the Stoics actually used this definition. Reesor is, indeed, correct in thinking that the Stoics generally meant more by "body" than merely a three-dimensional figure (the exception is the definition of Apollodorus, *SVF* 3.Apollod.6; cf. 2.357). However, she fails to appreciate the significance of the addition of the phrase *μετὰ ἀντιτυπίας*. Correctly understood, this addition rids the definition of the abstractness to which Reesor objects.

2. Cf. M. Pohlenz, "Zenon und Chrysipp," *NGG*, Phil.-hist. Kl., Fachgruppe I, vol. 2 (1938), 182–85, and M. E. Reesor, "The Stoic Categories," *AJP* 78 (1957):67. Much more can be said about the Stoic concept of quality and its role in Stoic philosophy than I have said here. See especially the two articles by Reesor, P. De Lacy, "The Stoic Categories as Methodological Principles," *TAPA* 76 (1945):246–63, and J. Rist, *Stoic Philosophy* (Cambridge, 1969), 152–72. I am concerned here

only with the application that sheds light on the Stoic belief that all real things are corporeal.

3. Cf. E. Bevan, *Stoics and Sceptics* (Oxford, 1913), 40–41. This explanation was properly rejected by E. Zeller, *Stoics, Epicureans, and Sceptics*, trans. O. J. Reichel (London, 1880), 133–34. Unfortunately, Zeller also rejected the influence of Aristotle in this subject on the basis of the untested assumption (derived primarily from the silence of the sources) that Zeno was, in general, repelled by Peripatetic philosophy and owed little to Aristotle's researches except in a negative way (cf. 396–99). Zeller's own explanation (pp. 134–35), for the origin of Stoic materialism, i.e., the Stoics' practical turn of mind, is weak and unsatisfactory.

4. Cf., e.g., G. S. Kirk, *Heraclitus: The Cosmic Fragments* (Cambridge, 1954), 53, 69–70.

5. Cf. R. D. Hicks, *Stoic and Epicurean* (New York, 1910), 22–23.

6. For a very brief general overview of the philosophical development that prepared the way for Stoicism, see L. Edelstein, *The Meaning of Stoicism* (Cambridge, Mass., 1966), 19–22, and J. B. Gould, *The Philosophy of Chrysippus*, Philosophia Antiqua 17 (Leiden and Albany, N.Y., 1970), 22–27; cf. also F. E. Peters, *The Harvest of Hellenism* (New York, 1970), 131–32.

7. DK 30 B 9. Cf. G. E. L. Owen, "Eleatic Questions," *CQ* 10 (1960):95–101, and L. Taran, *Parmenides* (Princeton, 1965), 115–19, 150–60. The paucity of fragments of the early pre-Socratics precludes complete certainty whether Melissus was, in fact, the first to raise the question of the corporeality of real entities. The sudden subsequent interest in the problem after Melissus makes it probable that he was among the first; but G. Vlastos, "Zeno of Elea," *Encyclopedia of Philosophy* (New York, 1967), 8.377, has argued plausibly that Zeno preceded Melissus in asserting that "what is" is incorporeal. Moreover, H. Gomperz, "ΑΣΩΜΑΤΟΣ," *Hermes* 67 (1932):159–64, has argued for the authenticity of Anaximenes, DK 13 B 3, and of the content, though not the wording of Orpheus, DK 1 B 13. If he is right, the concept of incorporeality was not even original with the Eleatics. In fact, Melissus's own words in B 9 give no indication he is introducing a new concept. What does seem to be new with the Eleatics, if not with Melissus, is the relationship between what is real and corporeality. It should be noted that N. B. Booth, "Did Melissus Believe in Incorporeal Being?" *AJP* 79 (1958):61–65, does not agree with the current tendency to interpret DK 30 B 9 as a reference to Melissus's own Being; he still maintains with E. Zeller, *History of Greek Philosophy from the Earliest Period to the Time of Socrates*, trans. S. F. Alleyne (London, 1881), 1.631, and J. Burnet, *Early Greek Philosophy*[4] (London, 1930), 327–28, that this fragment is only a dialectical refutation of his opponents and not a proof for Melissus's own ideas.

8. The authenticity of Ecphantus is adequately defended by G. Vlastos, *Gnomon* 25 (1953):32, note 1 (for the state of the question, see W. K. C. Guthrie, *History of Greek Philosophy* [Cambridge, 1962],1.323–24). If Philolaus, DK 44 B 12, is genuine, the five elements of Philolaus can be added to the list of elements explicitly called bodies; but there is no agreement on the authenticity of fragment 12. It has been accepted by Guthrie, 1.267, but rejected by W. Burkert, *Weisheit und Wissenschaft: Studien zu Pythagoras, Philolaos und Platon* (Nürnberg, 1962), 255.

9. See W. D. Ross, *Plato's Theory of Ideas* (Oxford, 1951). For the role of Socrates in the origin of the theory of Forms see Ross, 154–60.

10. For the origin of Plato's theory, see Ross (above, note 9), 11–21, 154–60, and R. E. Allen, *Plato's 'Euthyphro' and the Earlier Theory of Forms* (New York, 1970), 67–166. Cf. also H. Cherniss, *Aristotle's Criticism of Plato and the Academy* (Baltimore, 1944), 213 and note 127 Ross, 163–64, develops the common view that there is no connection between Plato's theory and Eleatic philosophy; but as F Solmsen, "Parmenides and the Description of Perfect Beauty in Plato's *Symposium*," *AJP* 92 (1971):62–70, shows, this may be an oversimplification.

11. Aristotle's criticisms are analyzed with slightly different conclusions by Cherniss (above, note 10), 174–376; P. Wilpert, *Zwei aristotelische Frühschriften über die Ideenlehre* (Regensburg, 1949), 52–97; S. Mansion, "La critique de la théorie des Idées dans le ΠΕΡΙ ΙΔΕΩΝ d'Aristote," *RPhL* 47 (1949):169–202 (cf. also her review of Wilpert, *RPhL* 48 [1950]:398–416); E. Berti, *La filosofia del primo Aristotele* (Padua, 1962), 186–249; and I. Düring, *Aristoteles: Darstellung und Interpretation seines Denkens* (Heidelberg, 1966), 245–90.

12. *Metaph.* 13.9.1086b2–13, 10.1087a4–7; cf. 7.14.1039a24–b19, 15.1040a8–9, 16.1040b27–1041a5; 13.4.1078b30–32, 9.1085a23–29, 1086a32–34; *Eth. Eud.* 1.8.1217b14–16. The same criticism applies to the ideal numbers (*Metaph.* 13.9.1085b34–1086a21).

13. That the Ideas are really what Aristotle would prefer to call universals (τὰ καθόλου) is stated in *On Ideas*, frs. 2, 3, Ross; *Metaph.* 8.1.1042a15–16; 12.1.1069a26–28; 13.4.1078b30–32, 9.1086a32–34, cf. 1086b9–10. For the inherence or inseparability of universals see *Metaph.* 7.16.1040b25–27; *Anal. Post.* 1.24.85b18–19 (cf. 85a31). Aristotle also maintains the inseparability of the genus, which is a universal in the category of substance (*Metaph.* 3.4.999a29–32 [cf. 3.3.999a6–12]; 10.2.1053b21–22; cf. 7 12.1038a5) and of abstractions (τὰ ἐξ ἀφαιρέσεως λεγόμενα, *Anal. Post.* 1.13.81b2–5). On this whole line of thought see É. de Strycker, "La notion aristotélicienne de séparation dans son application aux Idées de Platon," *Autour d'Aristote: Recueil d'études de philosophie ancienne et médiévale offert à A. Mansion* (Louvain, 1955), 119–39.

14. On separability as a mark of substance (οὐσία), cf. *Metaph.* 7.3.1029a27–28; 11.2.1060b21–22, 5.1070b36–1071a1. That universals are not substances is proven in *Metaph.* 7.13.1038b8–1039a3, and is frequently stated elsewhere, e.g., 3.6.1003a7–12; 7.10.1035b27–30, 16.1041a3–5; 8.1.1042a21–22; 10.2.1053b16–17; 13.10.1087a1–2; cf. also *Soph. Elench.* 22.178b37–179a10. In *Cat.* 5.2a14–18, b7–37 the universals (species and genus) are called secondary substances (δεύτεραι οὐσίαι).

15. *Anal. Post.* 2.19.99b32–100b5; cf. *De An.* 2.5.417b22–24. The process of induction by which the universal comes to exist in the mind is further discussed in *Metaph.* 1.1.980a27–981a12. Cf. W. D Ross, *Aristotle's Prior and Posterior Analytics* (Oxford, 1949), 47–51, and J. Weinberg, *Abstraction, Relation, and Induction* (Madison, 1965), 123–28.

16. *Int.* 1.16a3–9. Lines 8–9 give a reference to τὰ περὶ ψυχῆς, which commentators have had great difficulty locating in *On the Soul*. One ancient commentator, Andronicus, rejected *On Interpretation* as spurious for this reason. The effects of his doubt still linger today, though the authenticity of the work has been adequately defended by H. Maier, "Die Echtheit der aristotelischen Hermeneutik," *AGP* 13(1900):23–72. However, Maier's, 35–37, suggestion to transpose the reference to

16a13 and then to relate it to *De An.* 3.6.430a26–28, though accepted by W. D. Ross, *Aristotle*[5] (London, 1949; reprint, Cleveland, 1959), 292, note 35, and E. M. Edghill in the Oxford translation ad loc., is almost certainly wrong, for it destroys the formal structure of the paragraph as indicated by the particles, μέν and δέ (or μέντοι). Far better is the suggestion of J. L. Ackrill, *Aristotle's Categories and De Interpretatione,* Clarendon Aristotle Series (Oxford, 1963), 113, that this reference is to the whole discussion of thinking in *De An.* 3.3–8. Düring (above, note 11), 55, regards the sentence as a later addition and so does not feel the need to identify the reference.

Unfortunately, the theory of the relationship between word, concept, and thing is explained nowhere else in Aristotle's works, but Aristotle does on occasion make use of this tripartite division. For example, he makes a distinction between the spoken word and the epistemological concept in *Metaph.* 4.4.1006a28–1007a7 (esp. 1006b5–11), 5.1009a18–22; and between the concept and the thing in *Metaph.* 11.8.1065a21–24; 6.4.1027b17–1028a2 (this latter passage discusses truth and falsehood in thought and closely resembles *Int.* 1.16a9–16). He appears to distinguish all three in *Anal. Post.* 2.7.92b5–8. *Cat.* 2.1a16–b9 distinguishes between words and ὄντα. The ὄντα here include universals and all categories, both substantive and attributive, thus embracing both separable and inseparable entities (compare the similar use of πράγματα in *Int.* 7.17a38–b1).

17. *Anal. Post.* 1.8.75b21–36, 24.85b15–18; cf. *Gen. An.* 2.1.731b31–732a1. In *Eth. Nic.* 6.3.1139b19–24 Aristotle makes the objects of knowledge eternal, ungenerated, and imperishable. As noted above these objects of knowledge are the universals. Aristotle does not expressly call the universals incorporeal, but he does imply they are immaterial (ἄνευ ὕλης) and therefore cannot be corporeal (*De An.* 3.4.429b10–22, 430a3–9; cf. Cherniss [above, note 10], 77, note 56).

18. The chief source is *SVF* 2.166. See B. Mates, *Stoic Logic* (Berkeley, 1953; reprint, 1961), 11–26. It should be noted that there is some question whether the λεκτά mentioned in a number of Stoic sources are identical with the σημαινόμενα. É. Bréhier, *La théorie des incorporels dans l'ancien stoicisme*[2] (Paris, 1928), 14–23, has attempted to show that they are different, whereas Mates (above) and Pohlenz, *Die Stoa: Geschichte einer geistigen Bewegung*[3] (Göttingen, 1964), 1.39, take the traditional view that they are identical. The question is irrelevant for our purposes.

19. Even the definition of φωνή as ἀὴρ πεπληγμένη (*SVF* 1.74; 2.139; 3.Diog.17) is based on Aristotle (cf. *De An.* 2.8.420b27–29, which is reminiscent of Plato *Tim.* 67b).

20. Cf. H. Siebeck, "Die Umbildung der peripatetischen Naturphilosophie in die der Stoiker," *Untersuchungen zur Philosophie der Griechen*[2] (Freiburg, 1888), 240–41.

21. *Metaph.* 4.2.1003b5–10; 5.7.1017a22–27; 6.2.1026a33–b2; 7.1.1028a10–13, 4.1030a18–27; 9.10.1051a34–35; 11.3.1061a7–10; 14.2.1089a7–9; *De An.* 1.5.410a13–15. cf. G. E. L. Owen, "Aristotle on the Snares of Ontology," in *New Essays on Plato and Aristotle,* ed. R. Bambrough (New York, 1965), 69–95.

22. *Phys.* 4.7.213b32; *Gen. Corr.* 1.3.318b18–27; and *Metaph.* 3.5.1002a8–12. In *Metaph.* 5.8.1017b10–26 bodies constitute only one of the four meanings of οὐσία.

23. *Metaph.* 12.1.1069a30–33, 6.1071b3–5. The prime mover is immaterial (ἄνευ ὕλης, *Metaph.* 12.6.1071b20–21), separate from perceptible things (κεχωρισμένη τῶν αἰσθητῶν, *Metaph.* 12.7.1073a3–5), and above all, partless, indivisible, and without magnitude (*Phys.* 8.10.266a10–267b26; *Metaph.*

12.7.1073a5–11). It is these last attributes that most of all rule out corporeality Cf. F Solmsen, *Aristotle's System of the Physical World: A Comparison with his Predecessors*, Cornell Studies in Classical Philology 33 (Ithaca, N.Y., 1960), 240, 248–49. See also Cicero's statement based on *On Philosophy:* "sine corpore idem vult esse deum" (*Nat. D.* 1.33 [=*De Phil.* fr. 26, Ross]).

24. Incorporeal entities, such as time, void, place, and λεκτά, though not called beings (ὄντα) are recognized as "somethings" (τινά, *SVF* 2.331, cf. 329). This sounds like a face-saving device to allow the Stoics to think and talk about things that have no substantial existence (cf. *SVF* 2.332).

25. Siebeck (above, note 20), 240–44, in trying to establish the Peripatetic influence on Stoic corporealism makes much of the process by which a materialistic doctrine of soul evolved in the Peripatetic school. His discussion is more relevant to the origin of the Stoic doctrines of soul and god than it is here. Its weak point in this context is that at the period in which Zeno was evolving the Stoic doctrine, the Peripatetics were making no positive contributions to a corporealistic world view. Theophrastus and Eudemus were criticizing certain aspects of Aristotle's doctrine of the first mover; and Aristoxenus and Dicaearchus were developing a radical, noncorporealistic doctrine of the soul along Pythagorean lines. It is only with Strato, who became head of the Peripatos more than a decade after Zeno began teaching, that the Peripatos came around to a corporealistic view of the world and of the soul.

26. Although the fragmentary nature of our sources makes certainty impossible, it is at least highly probable that the Stoics did not use this doctrine as a premise, for Alexander of Aphrodisias (*SVF* 2.792), in refuting the Stoic doctrine of the corporeality of the soul, gives what is presumably a complete list of Stoic proofs for the belief, and he does not mention any proof in which the corporeality of all things is used as a premise.

27. *Phys.* 3.5.204b20; *Cael.* 1.7.274b19–20; *Metaph.* 11.10.1066b32. Sometimes he varies the wording to τὸ πάντῃ (or τριχῇ) διαιρετόν (*Cael.* 1.1.268a6–10, cf. 24–25; *Metaph.* 5.6.1016b27–28; cf. 3.5.1002a18–20; 5.13.1020a11–14) or τὸ ἔχον τρεῖς διαστάσεις (*Top.* 6.5.142b24–25; cf. *Cael.* 2.2.284b21–25; *Phys.* 4.1.209a4–6). Euclid *Elem.* 11.Def.1 also defines solid as "that which has length, breadth, and depth."

28. Sext. Emp. *Math.* 1.21; 10.12 (=*SVF* 2.501) stresses the fact that ἀντιτυπία is what distinguishes corporeal matter from place or void.

29. On the process of mathematical abstraction, cf Arist. *Metaph.* 11.3.1061a28–b3; *Phys.* 2.2.193b22–35.

30. In *Theaet.* 155e–156a Plato calls the materialists who refuse to believe in anything intangible σκληροὺς καὶ ἀντιτύπους ἀνθρώπους. This characterization may reflect a current usage of the word ἀντίτυπος among contemporary materialists, whoever they may have been. E. Zeller, *Die Philosophie der Griechen*[5] (Leipzig, 1922), 2.1.297 and note 1, following the suggestion of earlier scholars, has speculated that Plato here refers to Antisthenes and his followers and that the Antisthenic materialism was then transmitted via the Cynic school to the Stoics; but he has no firm evidence that Antisthenes was a materialist, or that Plato is thinking specifically of him in this passage. On the fictitious connection of Antisthenes with the Cynics see below, Appendix 1, note 7.

31. This statement is found only in Plutarch *Comm. Not.* 1073e (=*SVF* 2.525), a hostile source, where von Arnim reads: ὄντα γὰρ μόνα τὰ σώματα καλοῦσιν.

ἐπειδὴ ὄντος τὸ ποιεῖν τι καὶ πάσχειν, etc. With this punctuation Plutarch appears to be stating an elliptical form of the syllogism we have reconstructed for the Stoics. The course of the argument, however, makes it clear that we must make a strong break after *καλοῦσιν* and understand the following clause as the premise to the following part of the argument. Plutarch is attempting to show the absurdities implied in the Stoic conception of the *πᾶν*. To do this he makes deductions from the Stoic admission that the *πᾶν*, the combination of cosmos and void, is neither body nor incorporeal. Plutarch argues that since the Stoics call only bodies beings (*ὄντα*), the *πᾶν* is a nonbeing. Then, since acting and being acted upon are essential characteristics of being, the *πᾶν*, a nonbeing, can neither act nor be acted upon. To give this sense M. Pohlenz in the Teubner edition of Plutarch conjectures *ἔπειτα δ'* for *ἐπειδή* and so reads ". . . *καλοῦσιν. ἔπειτα δ' ὄντος* . . ."

Although Plutarch is not giving an elliptical form of the Stoic proof that only bodies exist, he does state the major premise of this proof (acting and being acted upon are characteristic of being). Unfortunately, Plutarch does not expressly assign this premise to the Stoics with a word like *καλοῦσιν*, *λέγουσιν*, *ὁμολογοῦντες*, or *φασίν*, as he does other Stoic statements in this passage. Therefore, we cannot be certain whether he has actually derived the premise from a Stoic source or has merely used a commonly accepted idea, but we can be sure Plutarch believed the premise could not be rejected by the Stoics.

32. It should be noted that the Stoics were also in agreement with the Epicureans in using the premise that only body can act and be acted upon to prove the corporeality of the soul (Epicurus *Ep*. 1.67; cf. Lucr. 3.161–67).

33. Whether or not Plato himself accepted this as a mark (*ὅρος*) of being is irrelevant for our purposes. Cf. F. M. Cornford, *Plato's Theory of Knowledge* (London, 1935; reprinted, New York, 1957), 238–39.

34. See E. Hambruch, *Logische Regeln der platonischen Schule in der aristotelischen Topik* (Berlin, 1904); G. Ryle, "Dialectic in the Academy," in *New Essays on Plato and Aristotle*, ed. R. Bambrough (London and New York, 1965), 39–68; and P. Moraux, "La joute dialectique d'après le huitième livre des Topiques," in *Aristotle on Dialectic*, ed. G. E. L. Owen (Oxford, 1968), 277–311.

35. *Gen. Corr*. 1.6–10.322b1–328b22; 2.2.329b20–26, cf. 4.331a7–b2. See Solmsen (above, note 23), 353–67.

36. Aristotle adds parenthetically that the *μαθηματικά* also have the properties of contact, position, and place; but he does not infer further that they can act or suffer, or that they have weight or lightness. This is because the *μαθηματικά* are inseparable from material objects and are considered as separate by the mathematician in the process of abstraction, wherein he may leave behind any unnecessary qualities such as action or suffering and weight or lightness (*Metaph*. 11.3.1061a28–b3; cf. 13.3.1078a21–23; *Phys*. 2.2.193b22–35). Hence the presence of the *μαθηματικά* in this passage does not weaken the implication that action and suffering are limited to bodies.

37. *Gen. Corr* 1.6–7 and esp. 1.6.323a15–16, 7.324a24–b24. He points out that *κινεῖν* may be a wider term than *ποιεῖν*, if *πάσχειν*, the opposite of *ποιεῖν*, is limited to *πάθη*, and thus to changes in quality (*Gen. Corr*. 1.6.323a16–20). Note that Plato, *Theaet*. 156a, makes *ποιεῖν* and *πάσχειν* two *εἴδη* of motion.

38. E.g., see Plato, *Soph*. 247b–c (cf. *Theaet*. 155e); *Tim*. 28b, 31b; *Phaed*. 81b; Arist. *Phys*. 4.7.213b34–214a1; *Gen. Corr*. 2.2.329b7–8.

39. Cf. Solmsen (above, note 23), 350 and note 53.

40. *SVF* 2.365; cf. 1.65; 2.360; see also Bréhier (above, note 18), 7–8. Bréhier sees this as an explanation for Chrysippus's paradoxical solution of the problem of the equality or inequality of the sections of a cone (*SVF* 2.489), but other explanations of this difficult text are also possible. For a full discussion, see D. Hahm, "Chrysippus' Solution to the Democritean Dilemma of the Cone," *Isis* 63 (1972): 205–20.

41. The Epicureans may have held the same view as Chrysippus. At least Lucr. 3.166 uses contact as a mark of body. Chrysippus was probably not original, but merely expressing a common Stoic and Epicurean idea.

42. On Aristotle's dependence on Plato in this respect, see Solmsen (above, note 23), 187–90.

43. Chrysippus uses the compound ἐφάπτειν ("attach to" or "lay hold of," translated by Tertullian as *contingo*) rather than the simple form ἅπτειν The reason for the choice may be to recall Plato's belief that the soul is attached to the body with tight bonds (δεσμοί, *Tim.* 81d; cf. *Phaed.* 83d). At the same time, it is the word used by Plato to designate the corporeal contact that materialists regard as the criterion of reality (*Soph.* 246a).

44. Cf. G. Verbeke, *L'évolution de la doctrine du pneuma du stoïcisme à S. Augustin* (Paris and Louvain, 1945), 43; *Kleanthes van Assos*, Verhandelingen van de Vlaamse Academie voor Wetenschappen, Klasse der Letteren, vol. 11, no. 9 (Brussels, 1949), 152–54. Verbeke's explanation does not take into account the statements of Simplicius (*SVF* 2.388, 389). Less satisfactory is the explanation of Bréhier (above, note 18), 7–8.

45. *SVF* 3.306, 307, cf. 2.848. Two proofs that the soul is a living being (ζῷον) are recorded. In one the soul is a living being because it has the two marks of a living being, namely, life and perception (*SVF* 3.306). In the other the soul is called a living being because it is the cause of our being living beings (*SVF* 3.307).

46. See, for example, the treatise *De Qualitatibus Incorporeis*, found among the works of Galen, but of disputed authorship (cf. E. Orth, "Les oeuvres d'Albinos le Platonicien," *AC* 16 [1947]:113–14, who assigns it to Galen's teacher Albinus). A number of sections of this treatise are included in *SVF* (see index, *SVF* 4, page 201). Typical is *SVF* 2.385, in which the author marvels at the strange Stoic belief that the movements of bodies are corporeal.

47 In *Metaph.* 5.14.1020b12–13, 18–25, virtue and vice are explicitly mentioned as examples of qualities (ποιά).

48. See above, note 21.

49. See P M. Huby, "The Date of Aristotle's *Topics* and its Treatment of the Theory of Ideas," *CQ*, n.s. 12 (1962):72–80. (Huby, 72, note 1, gives further bibliography.) Cherniss (above, note 10), 18–19, points out that Aristotle did not necessarily approve of all the philosophical implications of the criticisms he voiced in the *Topics*. For an example, see below, note 50.

50. A nearly identical definition of snow as solidified water was criticized by Aristotle in *Topics* 4.5.127a3–17 for making the subject of the πάθος the genus of the definition. If Aristotle could ignore the criticism he had voiced in the *Topics*, so could the Stoics.

51. G. Verbeke, *L'évolution* (above, note 44), 42–46; *Kleanthes* (above, note 44), 156–60, emphasizes the relevance of Aristotle's statement to the Stoic proofs for the

corporeality of the soul, and especially to Cleanthes' proof from the intercommunication of the passions of body and soul; but since Stoic psychology as such is beyond the scope of our study, we cannot here explore all the connections between this passage and Stoic doctrines.

52. The expression *ἐχόντων πώς* is actually used by Aristotle in reference to this type of definition. He says a living being must be defined in terms of *τῶν μερῶν ἐχόντων πώς* (*Metaph.* 7.11.1036b28–30).

53. Even harmony (*συμφωνία*), a mixture of high and low, is corporeal, if high and low are construed as movers and causes of sound, as in *De An.* 2.8.420a26–b5. See also *Gen. An.* 5.7.786b21–22, where voice (*φωνή*) is called the matter (ὕλη) of speech.

54. Aristotle discusses this principle in *Cat.* 3.1b10–15; 5.2a19–27, 3a37–b5.

55. It is not necessary to suppose as does M. Pohlenz, "Stoa und Semitismus," *Neue Jahrbücher,* n.s. 2 (1926):261, that since no pre-Stoic philosopher held the view that the virtues and passions are corporeal, this doctrine must be part of Zeno's Phoenician heritage. The sources give every reason to believe that this doctrine did not enter Stoicism fully developed, but was deduced by the Stoics from premises found in Greek (mainly Aristotelian) thought. Against Pohlenz's theory of Semitic influences in general see the references cited below, Appendix 1, note 2.

Principles

The doctrine of the principles or *archai* is usually discussed at or near the beginning of an account of Stoic cosmology, presumably because the *archai* are felt to be logically, if not temporally, prior to the rest of the cosmological doctrines. This practice goes back to the Hellenistic doxographies, which conventionally began with a discussion of *archai*.[1] Diogenes Laertius, however, explicitly states that this doctrine was discussed by Chrysippus, not at the beginning, but near the end (πρὸς τῷ τέλει) of the first book of his *Physics (SVF* 2.300, cf. 316). Although this information need not make us hesitate to discuss the principles at this point, it ought to make us pause and consider very carefully what role the *archai* actually played in the Stoic physical system.

Diogenes Laertius in a brief summary says that Zeno, Cleanthes, Chrysippus, and Archedemus all recognized two *archai*, the active (τὸ ποιοῦν) and the passive (τὸ πάσχον). The passive is the unqualified substance (ἄποιος οὐσία), also called matter (ὕλη). The active is the *logos* in the matter and is also called god (*SVF* 1.85, 493, 2.300; 3.Arch.12; cf. 1.98; Calcid. *In Tim.* 289). Most frequently the *archai* are simply said to be god and matter (*SVF* 1.85, 98, 495; 2.301, 310, 312; Calcid. *In Tim.* 289).

The first book of Chrysippus's *Physics*, where the doctrine was apparently discussed at length, was devoted to cosmogony and cosmology.[2] Presumably the book contained an account of the origin of the cosmos in the early part. If the *archai* were discussed near the end, they were probably discussed after the account of the cosmogony. The precise context in which Chrysippus discussed the *archai* is not known, but a reasonable guess may be made on the basis of Diogenes Laertius's summary of Stoic cosmology, which is said to be based on

Zeno's *On the Universe,* Book One of Chrysippus's *Physics,* and Archedemus's *On Elements.*[3] This fragment, after describing the origin of the four elements, states that the four elements taken together (ὁμοῦ) are the unqualified substance, or the matter. Since Diogenes' source has already discussed the *archai,* there is no compelling reason to bring up the unqualified substance again, unless the original account of Zeno or Chrysippus discussed the subject after the origin of the elements. Moreover, the statement itself seems somewhat strange, for it is hard to see how the four elements can be called unqualified.[4] One is tempted to suspect that Diogenes is presenting in severely abridged form some Stoic book, such as the first book of Chrysippus's *Physics* or Zeno's *On the Universe;* and in the abridgement the Stoic doctrine of the *archai* has become somewhat distorted.

Fortunately, part of the account of unqualified substance given by Zeno and by Chrysippus in the first book of his *Physics* is preserved, and so we may test this hypothesis to some degree. Zeno and Chrysippus are said to have distinguished between substance (οὐσία) and matter (ὕλη). Matter is the material of anything that exists, as for example, the metal out of which a statue is made. Substance (οὐσία) is the prime matter (πρώτη ὕλη) of all things in general, the substrate in which all qualities inhere. As such it is itself entirely unqualified, but capable of receiving any quality (*SVF* 1.86, 87, 88; 2.316, 317). The point of view of this discussion seems to be the cosmos in its present, ordered state, analyzed in terms of substrate and quality. If after describing the origin of the elements and before going on to their cosmic arrangement, Zeno and Chrysippus had provided this analysis of the material of the cosmos in terms of substrate and quality, rather than in terms of the elements, Diogenes' source might understandably have condensed the discussion in such a way that the four elements that compose the cosmos are made to appear to be the unqualified substance or matter.[5] After the discussion of the unqualified matter Chrysippus may well have explained the cause of qualification, namely the active *archê.* He would thereby have produced a discussion of the *archai,* and this discussion would probably have come near the end of the book. For if Diogenes gives a fair summary of the book (*SVF* 2.580), only an account of the quality of each element and the arrangement of the elements within the cosmos would have followed.[6] The discussion of the active (ποιοῦν), the cause of qualification, would have made an appropriate preliminary to a description of the quality possessed by each element.[7]

Having tentatively reconstructed the context in which Zeno and Chrysippus may have discussed the *archai* at greatest length, we can go on to determine more precisely the role that the *archai* played in the Stoic system. The first question that comes to mind is whether the Stoics actually referred to the active god and the passive matter as *archai*. Aristotle in *Metaphysics I* and the Hellenistic doxographers assigned *archai* to Plato and the pre-Socratics, although it is improbable that all these earlier philosophers, without exception, explicitly called their first elements or principles by the name *archai*. We may well wonder whether a doxographer is also responsible for assigning the term *archai* to the Stoic active and passive. This is almost certainly not the case. When seeking *archai* in the pre-Socratics, Aristotle, followed by the later doxographers, always resorted to the first element (or elements) from which these early philosophers claimed things ultimately originated. The Stoic account of the origin of the cosmos, which, in Chrysippus at least, preceded the discussion of the active and the passive, makes it absolutely clear that the element from which all the other elements originated was fire. Chrysippus states: "The change of fire is this: It is changed through air into water; from the water, when earth has settled out, air is evaporated; then, when the air has thinned, *aether* is spread around in a circle" (*SVF* 2.579). Thus the four elements came into being. A doxographer, following the pattern that made water the *archê* of Thales, air, of Anaximenes, and fire, of Heraclitus, could only have said that fire is the *archê* of the Stoics. A doxographer could hardly have passed over this cosmogony to call the active god and passive matter *archai*, unless the Stoic sources themselves led the doxographer to believe that the active and the passive were *archai* in a more real sense than fire was. It is hard to avoid the conclusion that the early Stoics themselves used the term *archai* for the active god and the passive matter.

The function of the *archai* in the Stoic system was very simple. We have already referred to the fact that the passive matter is frequently called unqualified.[8] In addition, it is said to be in itself without shape or form and also unmoved.[9] On the other hand, the active principle is said to give to matter shape, form, and movement.[10] From this it is clear that the *archai* were called upon to explain two attributes found in all things, namely, movement and form (in the broad sense including every sort of qualification). The only other function assigned to the *archai* is the specific application of this activity to the cosmos; so the active cause is said to be the maker (δημιουργός) of the cosmos and all things in the cosmos.[11]

The fragmentary sources also record a few attributes of the *archai*. They are eternal, ungenerated, and imperishable (*SVF* 1.85 [=493=2.300], 87, 88; 2.299, 317, 323a; Calcid. *In Tim*. 289, 293; cf. *SVF* 2.311, 408, 599). Furthermore, each is a body.[12] Finally, since the two *archai* are in actuality inseparable from each other (*SVF* 2.306, 307, 308), god penetrates matter in a total mixture (*SVF* 1.155, 158; 2.310, 323a, 475, 1035, 1036, 1039, 1040, 1044, 1047, 1048).

Having determined the functions and attributes of the *archai*, we may go on to identify the role played by the *archai* in the Stoic system. The role seems to be twofold. The one role comes into view when we focus our attention on the Stoic description of matter, the passive principle. As we have seen, Zeno and Chrysippus probably discussed the *archai* after an account of the origin of the cosmos. Their approach seems to have been by way of the concept of material substrate. Matter, in general, is defined as that from which something comes to be (*SVF* 2.316; Calcid. *In Tim*. 289; cf. *SVF* 2.303, 318) or as the substrate of qualified things.[13] For example, the various metals are matter for the things made out of them. From here the Stoics proceeded by analogy. As a statue, being a shaped body, has bronze as its substrate, so bronze being shapeless, but still not without quality, has a more ultimate substance as its substrate, namely the unqualified passive principle.[14] Accordingly, they defined substance (οὐσία), the passive principle, as the ultimate or first matter (πρώτη ὕλη) of all things (*SVF* 1.86, 87; 2.316, 318, 323; Calcid. *In Tim*. 293). Apparently, the passive *archê*, matter, was reached by a process of logical abstraction, which started from the cosmos in its present state of organization and worked down to the ultimate substrate of everything in the cosmos.[15] That the cosmos as a whole, and not any given part of it, was the subject of this process of abstraction is suggested by the fact that the Stoics considered the material principle to be limited like the cosmos (*SVF* 1.88; 2.323; 3.Ant.32, Apollod. 4; Calcid. *In Tim*. 295; cf. *SVF* 2.524, 528, 534; 3.Ant.43, Apollod.9) and neither to increase nor decrease in amount.[16]

If we now step back somewhat from this close-up view, we may see in perspective one of the roles played by the *archai* in the Stoic system. Stripped of all qualifications, the cosmos is seen to be nothing but bare, corporeal material.[17] In the last analysis the nature of the cosmos is one.[18] Nevertheless, the multiplicity we see in the world around us is real, too, and can be explained by positing an active force, which, eternally inherent in the matter, produces the qualification and movement we observe. Thus one role of the *archai* is to provide a motive and a material cause for the qualified state of the cosmos as it appears today.

These two eternally coexistent principles could, if necessary, maintain the cosmos in its present state of organization for all time. In fact, one would expect to find them undergirding an eternal, ungenerated, and imperishable cosmos; but in the Stoic system we do not find this. The Stoics were firm believers in a cyclical cosmos, one that came to be and will eventually perish, only to be born again in an infinite cycle. The question that occurs immediately is whether the *archai* play any role in the other phases of the cosmic cycle. A priori one would suppose that since god and matter are eternal, they must somehow be operative in the part of the cycle in which only fire exists. Moreover, when fire changes to form the four elements, one could expect the active *archê* to play a role in causing this change.

A search of the fragments shows these inferences to be substantially correct. If Aristocles may be believed, god and matter were said to be the *archai* of fire.[19] Alexander of Aphrodisias simply assumes that the Stoics believed god and matter to be *archai* of the primal fire, for he argues that since in the conflagration fire is the only element existing, and since god and matter survive in the fire, god must be the form supervening on the matter of the fire (*SVF* 2.1047). Of course, since he is trying to translate the Stoic *archai* into Aristotelian terms, we do not have to take him seriously when he concludes that for the Stoics god is equivalent to form. We have ample evidence that god, as an *archê*, is not the form but the cause of form in matter. But it is significant that although Alexander feels he must prove that god is equivalent to form, he feels safe in assuming that in the conflagration god and matter survive along with the fire.

Although there is only this indirect hint that the Stoics applied their doctrine of the *archai* to explain the qualification of the primal fire, there is clear evidence that the *archai* were sometimes used to account for the change of fire into the other elements in the formation of the cosmos. We have Chrysippus's own words to tell us how the cosmos originated in terms of elemental change: "The transformation of fire is as follows: It is turned [τρέπεται] through air into water, etc." (*SVF* 2.579). This same account of the origin of the elements is found elsewhere in the words: "God . . . originally being by himself turns [τρέπειν] the entire substance (οὐσία) through air into water, etc."[20] Apparently at least some of the old Stoics viewed the active and passive, god and substance, as responsible for initiating the transformation that produced the four elements. The continuation of this same fragment shows by its choice of words that the *archai* were brought in also at the next stage in the origin of the cosmos: "This [scil. god] . . . is left behind in the wet, *making the matter* [ποιοῦντα τὴν ὕλην] adapted [εὐεργόν] to himself for the generation of the subsequent things [scil. the four elements]" (*SVF* 1.102[=2.580]). Thus the second role of the *archai* seems to be to provide a motive and a material cause for the origin of the cosmos.

The two roles are by no means incompatible. The *archai* serve as motive and material cause in both roles, in the second role causing the genesis of the cosmos, in the first causing the qualities, shapes, and changes in the existing cosmos. Yet the roles are different enough to merit separate mention; for besides the temporal difference, there is a difference in emphasis. In the first role, the concept of matter as substrate of all qualities is the prominent member; the active cause serves merely as correlative to the concept of matter to provide the quality that matter by itself lacks. In the second, the two *archai* are evenly balanced, and their active and passive properties seem to be the most essential aspect of their nature, inasmuch as one acts upon the other to bring the cosmos into existence. Moreover, the absence of quality in matter is irrelevant, if not actually embarrassing.

It is quite obvious that Aristotle influenced the Stoic doctrine of *archai*,[21] for it was Aristotle who popularized the term *archai* and the search for principles. Even more indicative of Aristotle's influence is the particular choice of *archai* made by the Stoics. Aristotle suggests that some of the pre-Socratics used the term *archê* for the first element, or cause, from which all things came to be.[22] Before Aristotle no one had ever put forth matter (ὕλη) as an *archê*.[23] Both the concept of matter and the use of the word ὕλη for this concept were Aristotle's own original contributions to philosophy.[24]

The suspicion that the Stoics derived their concept of matter from Aristotle can be confirmed by a detailed comparison of Aristotle's ideas on the subject. Aristotle's concept of matter was developed in connection with his doctrine of genesis and change. According to Aristotle all change occurs between opposites. Underlying such change between opposites there is a substrate (ὑποκείμενον), which may be called matter (ὕλη, *Phys.* 1.5–7; *Gen. Corr.* 1.4.319b6–320a7; *Metaph.* 8.1.1042a32–34; 11.12.1068b10–11; 12.1–2.1069b3–9 [cf. 9–26]). If matter is approached from the point of view of genesis, the result is slightly different. Genesis is, in one sense, a species of change, namely, change in the category of substance (*Gen. Corr.* 1.3.319a3–14; *Metaph.* 8.1.1042b1–3; 12.2.1069b9–11); but in another sense it embraces changes in several categories, namely, change of shape, growth, alteration, and so forth (*Phys.* 1.7.190a31–b10). What is common to all forms of genesis is the fact that everything that comes to be comes to be from something (ἔκ τινος), and that from which it comes to be is the matter (ὕλη).[25]

Thus Aristotle may speak of matter either as the substrate of change, or as that from which a thing comes to be, depending on his point of view. The particular opposites between which change occurs will, of course, depend on the type of change; but they will always fall under one of the general categories, form (εἶδος) and privation (στέρησις, *Metaph.* 12.2.1069b9–14, 32–34; cf. *Phys.* 3.1.201a3–9). If the process is viewed as one progressing from privation to form, matter must be the substrate of this process. On the other hand, if the process is viewed as one in which the matter acquires a form and becomes a formed object, matter must be that from which the formed object comes to be.

It is this second point of view that Aristotle takes in *Physics I*, where he seeks to identify the *archai* of nature and natural objects. He concludes that matter must be one of the *archai*, and all things that come to be must come to be from matter.[26] One of the examples he uses is that of the bronze statue. The matter out of which the statue is made, the bronze, is without form or shape; but if the bronze undergoes a change of shape (μετασχημάτισις), a statue is produced.[27] The bronze, shaped either as a statue or a sphere, is one of Aristotle's favorite examples of matter in the *Metaphysics*.[28] In *Metaphysics V* Aristotle points out that the ultimate matter (*πρώτη ὕλη*) of the statue is in the first place bronze; but since bronze can be melted into water, the ultimate matter is in the last analysis water (*Metaph.* 5.4.1015a7–11, 24.1023a26–29). This suggests that there are successive levels of matter that may be reached in analyzing any object, and that ultimately everything can be reduced to the four elements.[29] In *On Generation and Corruption* Aristotle carries the process to its conclusion. Since the elements may be observed to change into one another, there must be a substrate in which this change takes place. It is the qualification of this substrate by one of each of the two pairs of contraries, hot and cold, and wet and dry, that produces the four elements.[30]

Although Aristotle's account of matter is not found in connected form in any of his extant works, it is obvious that his approach is identical with that of the Stoics. Both begin with the formed objects of our cosmos and by logically stripping off successive layers of qualification arrive at the ultimate prime matter. Even the example the Stoics use, the bronze statue, is Aristotle's. Although no extant Stoic fragment specifically mentions the step in which the bronze is broken down to one of the four elements,[31] the similarity of approach and example leave no doubt that there was some connection between Aristotle and the Stoics.

The attributes that the Stoics assigned to their prime matter were also, to a large extent, anticipated by Aristotle. Aristotle does not actually call prime matter unqualified (*ἄποιος*), but he does imply this by making it the substrate of the qualities that constitute the four elements (e.g., *Gen. Corr.* 2.1.329a27–32) and by saying that none of the categories (including quality) applies to it (*Metaph.* 7.3.1029a20–25). Moreover, matter may be defined as that which underlies quality (*Metaph.* 5.28.1024b8–9) and therefore by definition must be unqualified. The absence of form and shape is asserted by Aristotle, particularly of the bronze out of which a statue is made, but Aristotle also generalizes and applies the term to the substrate of any formed object (*Phys.* 1.7.191a8–12; *Cael.* 3.8.306b16–17). Though Aristotle does not explicitly say prime matter is unmoved, as the Stoics do, he does incidentally speak of the matter that is the substrate of local motion, that is, change in the category of place (*Metaph.* 8.1.1042a32–35, b5–6, 4.1044b6–8; 9.8.1050b20–22; 12.1–

2.1069b3–15, 24–26). Such matter must in itself be unmoved, just as the substrate of quality or form must be unqualified and unformed. The Stoic assertion that matter is eternal, ungenerated, and imperishable can also be found in Aristotle. Since matter is the substrate of genesis and destruction and is that which persists (ὑπομένει) through these processes, it must preexist all genesis and survive all destruction. It is therefore ungenerated and imperishable and consequently eternal (*Phys.* 1.9.192a29–34; *Metaph.* 3.4.999b5–14, 7.7.1032b30–1033a1, 9.1034b12; 12.3.1069b35–1070a4). This is also implied by the fact that matter underlies the eternally revolving heavenly bodies, as well as the four changing elements of the eternal cosmos.[32]

The Stoics maintained that matter is corporeal. Aristotle's view on this point is more complex. As deeper layers of matter are stripped bare of qualification, the matter remains corporeal down to and including the four elements, but no farther. Aristotle makes special mention of the fact that there is no such thing as "body in general" (σῶμα κοινόν) or separable corporeal matter (ὕλην σωματικὴν καὶ χωριστήν), but corporeal matter always has some particular qualification that makes it perceptible body (*Gen. Corr.* 1.5.320b22–23; 2.1.329a8–13). By this he means that one cannot strip off all qualification from body until only bare, corporeal material is left. When the last perceptible qualities (hot, cold, wet, and dry) are removed, perceptible body is also removed. Therefore behind the four elements lies only imperceptible or potentially perceptible matter (*Gen. Corr.* 2.1.329a27–33, 5.332a26–27, a35–b1, cf. 2.329b7–20).

Although for Aristotle the ultimate prime matter is not corporeal, the Stoics could have pointed to texts in which Aristotle, referring to a partially qualified level of matter, says that matter is corporeal. A particularly pertinent statement is one made by Aristotle in *On the Heavens*. Referring to the fact that the cosmos comprises all the perceptible matter that exists (i.e., the sum total of the four elements), Aristotle remarks that "the physical and perceptible body is matter for the cosmos" (ὕλη γὰρ αὐτῷ τὸ φυσικὸν σῶμα καὶ αἰσθητόν, *Cael.* 1.9.279a8–9).

Although the Stoics might find only dubious support in Aristotle for their belief that prime matter is corporeal, they could point to clear statements supporting their belief that matter does not exist separable by itself. Aristotle repeatedly claimed that matter is inseparable except logically (*Gen. Corr.* 1.5.320b12–25; 2.1.329a24–26, 5.332a35–b1; *Phys.* 4.2.209b22–23, 4.211b36–212a2, 7.214a14–15, 9.217a24; cf. *Metaph.* 7.3.1029a26–30). The only difference between Aristotle and the Stoics is that Aristotle meant that matter is inseparable from form or qualities, whereas the Stoics said matter is inseparable from the active principle, which is the cause of form and qualities. Both agreed that prime matter is never found by itself in nature.

Another attribute of the Stoic matter was limitedness. The amount of matter in the cosmos was considered limited and able neither to increase nor decrease in amount. Aristotle did not directly consider the question of the amount of matter in the cosmos; but he did imply that it is limited when he explained how genesis and destruction could be eternal. He argued that if destruction means passing completely into nonexistence, the process of genesis and destruction will eventually come to an end, unless the amount of material is infinite. Since nothing can be actually infinite, the destruction of one thing must be the genesis of another, and the reciprocal process must be viewed as a change taking place in a persisting substrate (*Gen. Corr.* 1.3.318a13—27). It would not be hard to infer from this argument that matter is limited in amount, but matter's limitedness is more easily deduced from the fact that the cosmos is limited. Both the Stoics and Aristotle maintained that the cosmos is limited (*SVF* 2.524, 528, 534; 3.Ant.43, Apollod.9; Arist. *Cael.* 1.5–7, esp. 1.7.276a16–17), and so the Stoics may well have deduced directly from this fact that matter is limited.

Not only was there agreement between Aristotle and the Stoics that matter is limited, but there was also agreement that it does not increase or decrease in amount. Aristotle explained growth, or increase in size, by the addition of more matter from outside. Strictly speaking, it is the form that grows; the matter is merely supplemented and does not itself increase in size (*Gen. Corr.* 1.5, esp. 321b10–28). On this theory the sum total of matter in the cosmos cannot increase or decrease, because there is no matter outside the cosmos that may be added to it, nor is there any place or void outside the cosmos into which the matter of the cosmos can withdraw.[33] The Stoics apparently agreed not only with the cosmic application of this idea but also with the Aristotelian theory of growth, for Chrysippus said that the matter of a man does not increase or decrease in size, but the quality (i.e., form) does.[34]

Although the Stoics and Aristotle agreed on the basic concept of matter, and nearly all the attributes assigned to matter by the Stoics either can be traced to Aristotle, or at least conform to his theory, the Stoics cannot be considered Peripatetics in their concept of matter. There are two respects in which the Stoics diverged from Aristotle. First of all, Aristotle used the concept of matter to solve particular problems of change and genesis that he had encountered in his study of physics and biology. As a result his discussions of matter are found in various contexts scattered throughout his physical, biological, and metaphysical works. Matter for him was the substrate of a particular change, such as the transformation of elements; or it was the material from which a particular thing, such as a bronze statue, comes to be. The Stoics, on the other hand, used matter as a cosmic constituent; it is the material that underlies the cosmos as a whole as well as all that is in the cosmos. The Stoics thus universalized what for Aristotle was a concept of particularized application. What this reflects is a difference in personal outlook. Aristotle was a researcher seeking to understand natural phenomena; the Stoics were teachers of philosophy, appropriating scientific theories and forging from them a world view that would conform to the latest scientific researches. It is this change in emphasis that constitutes the Stoic originality.

The new Stoic point of view, however, was not entirely without precedent. It had a precedent in Plato, whose speculations on genesis perhaps supplied the impulse for Aristotle's discovery of the concept of matter. Plato realized that to account for the objects of experience something more than the form is needed. He concluded that "Being, Space, and Becoming—three distinct things—existed even before the heaven came into being" (*Tim.* 52d). This third thing, which exists alongside the Form and the object of Becoming, was given a cosmological application in the form of the receptacle (ὑποδοχή) in which the cosmos comes to be (*Tim.* 48e–52d). In developing his doctrine of genesis, Aristotle substituted matter for Plato's space as the third thing existing alongside form and the formed object, whereas Plato's space, with its cosmological application, the receptacle, entered Aristotle's system as place (τόπος).[35] The Stoics, we have seen, accepted Aristotle's concept of matter, but they gave it a cosmological application that resembles Plato's concept of the receptacle. Plato's receptacle is, of course, quite different from the Aristotelian and Stoic concept of matter, but does resemble matter insofar as it is without any form (μορφή, ἰδέα, εἶδος) whatsoever, and is moved and shaped (κινούμενον, διασχηματιζόμενον) by the things that come into it (*Tim.* 50a–51a). One cannot rule out the possibility that Plato's receptacle, which Aristotle cites as Plato's counterpart to his concept of matter (*Gen. Corr.* 2.1.329a13–24; cf. *Phys.* 4.2.209b11–13, 209b33–210a2), encouraged the Stoics to give matter the role of cosmic constituent, thereby returning the elements of genesis to their Platonic position in cosmology.[36]

There is also another difference between the Stoic doctrine and Aristotle's, namely the alternate name by which the Stoics referred to matter. The first matter was called "substance" (οὐσία). To limit the term "substance" to matter would have been unthinkable to Aristotle. Aristotle would have admitted that matter could be called "substance" (e.g., *Metaph.* 8.1.1042a32–b6; cf. Bonitz 545a27–32, 786a43–46), but he would have insisted that the primary meaning of "substance" is form (e.g., *Metaph.* 7.11.1037a29–30, 17.1041b7–9; cf. Bonitz 545a32–b45). His school followed him in calling the form "substance" (cf., e.g., Theophr. *Metaph.* 1.5a8, 2.6a7, 6.8a13, 8.8b21, 9a5, 10a11, 10a14). How then, did the Stoics come to apply the term "substance" exclusively to matter? This question may well never receive an answer. Nothing survives of any Stoic discussion of the applicability of the term "substance" to matter. In fact, there is no evidence that the Stoics ever raised the question. The common nonphilosophical meaning of "substance" (οὐσία) was "material possession," and even in philosophical usage it was frequently applied to the material nature of the cosmos and its parts.[37] The Stoic usage, thus, is not anomalous; but it is noteworthy in the context of a Stoic doctrine that owes much to Aristotle. Apparently here, as we have observed once before, the Stoics have seen fit to follow Aristotle up to a point, but no further.[38] We had best not even speculate on their reasons.[39]

That the Stoic passive principle, the first matter or unqualified substance, was taken from Aristotle's notion of matter is clear enough. The origin of the Stoic active principle is not so obvious. In *Physics I*, also called *On Principles*, Aristotle says the *archai* are matter and form; and to these he tentatively adds the negation of form, privation, as a third *archê*. The Hellenistic doxographers, following this book, popularized the idea that Aristotle's *archai* were matter and form, or matter, form, and privation (Stob. *Ecl.* 1.12[=*DG* 448]; Aët. 1.3.22; cf. Simplic. *Phys.* 25.18–19, Diels [=*DG* 477.16]). The Stoic active principle, though it produces form, is not form. It would appear that the Stoics have actually modified Aristotle's doctrine;[40] but such an inference is, at best, premature.

Further inquiry discloses that the Hellenistic doxographers, by relying on only one work have misrepresented Aristotle. In *Metaphysics XII* Aristotle repeats that the *archai* of nature are matter, form, and privation; but he goes on to maintain that by themselves these are not enough to explain genesis. Everything that comes to be comes to be by some agent (ὑπό τινος). This agent is the mover (τὸ κινοῦν) or the source of motion (ἀρχή τῆς κινήσεως). To be accurate we must say that there are four *archai:* form, privation, matter, and agent or motive cause (*Metaph.* 12.1–3.1069b3–1070a2, 4.1070b10–35, 5.1071a29–34). Also in *On Generation and Corruption* he insists that the matter and form are not sufficient (ἱκαναί) for causing genesis; there must be a third *archê*, a moving cause. This, he says, is the cause of which everyone dreams, but which no one puts into words (*Gen. Corr.* 2.9.335a24–336a12; cf. *Gen. An.* 2.6.742b33–35).

Aristotle does not restrict application of the motive cause to individual instances of genesis; he universalizes the concept so that it can account for all movement and change in the entire cosmos. According to Aristotle every movement is caused by a mover. With one exception every mover is itself in motion, moved by a prior mover. If there were no exception to this rule, the series of movers would be infinite. Since it cannot be infinite, there must at some point be an unmoved first mover, which initiates all movement (*Phys.* 7.1.241b24–243a2; 8.4–5 [esp. 4.256a2–3, 5.256b13–24, 257a25–27]; 8.10.267a21–b5; *Metaph.* 12.3.1069b36–1070a4, 7.1072a21–26). Aristotle even goes to the trouble of explaining precisely how the motion initiated by the prime mover is transferred through a series of movers until it causes such mundane changes as meteorological phenomena and biological genesis.[41]

Aristotle's prime mover bears a significant resemblance to the Stoic active principle in that it is a single principle that through a chain of causes is responsible for the movements and changes in the cosmos, but the resemblance does not end there. Aristotle's prime mover is actually god (θεός, *Metaph.* 12.7.1072b24–30, 9.1074b15–1075a10;

cf. 1.2.983a8–9); and, furthermore, its essence is mind (νοῦς, *Metaph.* 12.7.1072b18–24, 9.1074b15–1075a10). The Stoic active principle agrees in both respects; it is called both god (θεός) and reason (λόγος).[42] Moreover, we should notice that like the Stoic active principle, Aristotle's prime mover is eternal, ungenerated, and imperishable (*Phys.* 8.6.258b10–259a8, 13–15; *Gen. Corr.* 2.10.337a17–20; *Metaph.* 12.7.1072a21–26, 1073a3–5). Thus in its two alternate names, as well as in one of its basic functions, the Stoic active principle resembles Aristotle's universal moving principle, his divine prime mover.

Nevertheless, we must not fail to notice that the Stoics have not merely appropriated Aristotle's prime mover *in toto*. Aristotle's prime mover is unmoved, but the Stoics nowhere give the impression that their active principle shares this characteristic. In fact, Simplicius says the Stoic mover is in motion,[43] and Sextus records what appears to be a Stoic argument that the active principle is self-moved (*SVF* 2.311). Furthermore, Aristotle's prime mover exists beyond the cosmos and gives movement only to the outermost sphere of the heavens, from which the movement must be transmitted by a series of moved movers to the rest of the cosmos.[44] In contrast, the Stoic active principle lies within the cosmos, permeating every inch of its matter, causing movement directly throughout the cosmos.[45]

Both these characteristics have a precedent in the prototype of Aristotle's prime mover, namely Plato's world soul. Plato's world soul manifests the same complex of ideas—eternal source of movement, god, and psychic activity—that are shared by both the Stoic active principle and Aristotle's prime mover.[46] In addition, Plato's world soul is immanent in the cosmos, stretching from the center to the periphery (*Tim.* 34b, 36d–e), and is a self-mover, causing movement directly wherever it exists, be it in the heavenly bodies or in living things.[47] In these two respects the Stoics are closer to Plato than to Aristotle.

One other point should perhaps be added. Plato's source of movement is soul, which "takes mind to itself" in its activity, and so differs from Aristotle's prime mover who is pure mind.[48] Although the Stoic active principle is identified with *logos*, and therefore must be mind, the Stoics also identify god with the soul of the cosmos (*SVF* 1.158, 532; 2.1042, 1047) and thereby bring the active principle into connection with soul too. What the Stoics have done now becomes apparent. When Aristotle developed his idea of a transcendent, unmoved mover, devoid of all psychic functions except mind, he moved away somewhat from the Platonic position on the basis of which he had begun his analysis of the origin of movement.[49] The Stoics in their idea of god preserved precisely those Platonic associations which Aristotle had dropped.[50]

If we now take stock of our position, we find that the Stoic concept of matter owes a great deal to Aristotle's treatment of this concept; and furthermore, the Stoic active principle embodies some of the basic ideas of Plato's world soul and Aristotle's prime mover. These are valuable observations, to be sure; but as soon as we turn from the *archai*, as two individual concepts, to the doctrine of the *archai* as a whole, we realize that we are still far from an adequate understanding of the basis of the Stoic doctrine.

One of the basic functions of the Stoic *archai* is to account for the genesis of the cosmos. Plato's world soul does not do this; in fact, in the *Timaeus* it is itself fashioned by a higher power (*Tim.* 34a–36e). Since Aristotle denied that the cosmos is generated, naturally his prime mover does not bring the cosmos into existence. Then, too, the Stoics maintained that there were two and only two *archai*. There is nothing in Plato that would have led the Stoics to believe that the world soul and the receptacle (or Aristotle's refinement of it, matter) were principles in a more real sense than some other basic Platonic concepts, such as the demiurge or the Forms. A similar overabundance of principles confronted the Stoics in Aristotle, and Aristotle clearly labeled them as *archai*. We have already seen that Aristotle began with two positive *archai*, form and matter, but felt the need to add another, the active cause. The truth is that even these three were not enough *archai* for Aristotle. There had to be still another, the final cause, called the "end" (τέλος) or "for the sake of which" (οὗ ἕνεκα). In *Metaphysics I* Aristotle investigates his predecessors for traces of these four *archai*. He observes that all four have been anticipated indistinctly by his predecessors, but he for the first time is setting forth all four with clarity (esp. *Metaph.* 1.7, 10). It now becomes obvious that the *archai* for Aristotle are none other than his four causes: formal, material, motive, and final. In fact, Aristotle admits that causes are *archai*, and the words are virtually synonymous (*Metaph.*

4.2.1003b22–25, 5.1.1013a17; cf. Bonitz 112a49–56). In view of the abundance of causative principles in Plato and Aristotle any explanation of the origin of the Stoic doctrine of *archai* must account for the number and choice of *archai*.[51]

Moreover, accounting for the choice of *archai* is not as simple as it might appear at first sight. It will not do to view the Stoic doctrine as a simple selection of two of Aristotle's four causes and a rejection of the other two,[52] for the formal and final causes were also recognized by the Stoics. They maintained that when the active principle acts upon matter, it produces form. They also agreed with Plato and Aristotle that purpose exists in the cosmos.[53] The purpose manifested in the cosmos and in men, animals, and plants is spelled out as carefully by the Stoics, as it had been by Aristotle (*SVF* 2.1141–1167). This purpose (*πρόνοια*) is virtually identified with the active cause, so that purpose is said to penetrate all things (*SVF* 1.153[=2.1029]) and to serve as maker (*δημιουργός*) of the unqualified matter (*SVF* 2.1107, 1108, cf. 1157). Obviously, what the Stoics have done is not to recognize the existence of only two of Aristotle's four causes but to distribute his four causes between two entities, assigning the material cause to one entity, and the motive, formal, and final causes to the other. The Stoic *archai* are these entities, one of which (the active) is more than a simple Aristotelian cause or *archê* and embraces three causes in itself. So far, we have uncovered no basis for this distribution of causes.

Then, too, the basic function of the Stoic *archai* is to account for shape, form, and movement. Aristotle's discussions of matter stress its role in accounting for shape and form, but they make only incidental mention of the role of matter in movement. On the other hand, the prime mover causes all the movement in the cosmos, but it is not actually given credit for producing the shape and form of all things in the cosmos. Hence we must confess that we have not yet found in Aristotle the basis on which the Stoics asserted that the function of the *archai* is to produce form, shape, and movement.

Finally, the Stoic *archai* are characterized by the relation of active to passive. In fact, the first name given them by the doxographies is active and passive *archai*. Aristotle in his physical works occasionally refers to passivity (*τὸ πάσχειν*) as a characteristic of matter (e.g., *Gen. Corr.* 1.7.324a21, b18; 2.9.335b29–30; *Meteor.* 1.2.339a27–30; 2.8.368a33), but he does not generally reduce the difference between motive and material cause to a contrast between active and passive.

It is plain we must seek further if we wish to track down the basis of the Stoic *archai*. A further clue is given us by a passage in *On Generation and Corruption*. As a preliminary to a discussion of genesis, and in particular, the genesis of elements, Aristotle feels it is necessary to explain acting and being acted on (ποιεῖν καὶ πάσχειν). In his explanation he relates these concepts to his doctrine of causes and concludes that the active agency (ποιητικόν) is a cause in the sense of motive cause (ἡ ἀρχὴ τῆς κινήσεως), and that matter is passive (παθητικόν, *Gen. Corr.* 1.7.324b13–18). Here Aristotle does just what the Stoics like to do; he plainly pairs motive and material cause. What is of particular significance is the context in which he does this—a discussion of genesis.

If we keep searching, we will discover further clues. There are several passages in which Aristotle says that at times some of his four causes coalesce into a single entity. The most illuminating passage expressive of this view is found in the *Physics*: "Often three causes coincide. For the form and the purpose are one, and the first source of movement is the same as these in form. For example, a man generates a man" (*Phys.* 2.7.198a24–27, cf. 8.199a30–32). This gives us the clue we are looking for; it is in biological genesis that form, purpose, and motive cause coincide, as they do in the Stoic active principle.

The *Metaphysics* is full of references pointing in the same direction. Aristotle mentions the motive cause most frequently in connection with genesis, either artificial or natural. In art the form preexists in the soul of the maker; and when the maker acts, he imposes this form on matter and produces a formed object. In natural genesis, the form and the motive cause coincide in the father; and in begetting another man, the father reproduces his form in different matter (*Metaph.* 7.7.1032a12–b14, 9.1034a9–b19; 9.8.1049b17–29). The frequent references to genesis in the *Metaphysics* would allow us to deduce much more about Aristotle's theory, but this is unnecessary since Aristotle treats the subject much more fully in his biological works.

In *On the Generation of Animals* Aristotle gives a complete account of biological genesis. The male and the female are the principles of generation (ἀρχαὶ τῆς γενέσεως), the male by virtue of possessing the source of movement and generation (ἀρχὴ τῆς κινήσεως καὶ γενέσεως) and the female by virtue of possessing the source of matter (*Gen. An.* 1.2.716a4–7 [cf. 7–13], 21.730a24–28; 2.1.731b18–19, 732a7–9, 4.738b20–23; 4.1.763b21–24). When male and female come together in reproduction, the male through the semen gives movement and form to the matter supplied by the female, and thereby fashions (δημιουργεῖν) the offspring (*Gen. An* 1.20.729a9–11, 28–30, 21.729b18–21, 730a28–30, 22.730b8–23; 2.1.733b18–734a1, 734b4–735a29 [cf. 2.4.738b25–27], 3.737a18–22, 4.738b9–13; 4.1.765b10–13, 766a16–22, 3.767b15–18, 4.771b18–23).

Here, at last, we have discovered the central ideas of the Stoic doctrine of the *archai*. In Aristotle's theory of biological genesis we find two entities, called *archai*, whose interaction is expressly stated to be that of an active (ποιοῦν) upon a passive (πάσχον, *Gen. An.* 1.20.729a24–31, 21.729b12–14; 2.4.740b18–25; cf. 1.18.724b4–6; 4.3.768b15–25). It is clearly stated that the function of the active principle is to give both movement and form to the matter. Even the verb that is used of this process, δημιουργεῖν, agrees with the Stoic description of the function (cf. Bonitz 174b26–28). Moreover, since the form of man is the goal or purpose of genesis and the form in actuality is also the motive cause, all three causes (final, formal, and motive) are lined up on one side and contrasted with matter (*Part. An.* 1.1.639b11–21, 641a25–27; 2.1.646a30–35; *Gen. An.* 1.1.715a4–9; 2.1.732a3–5, 735a2–4); and finally, the matter supplied by the mother is identified with body (e.g., *Gen. An.* 1.20.729a9–11; 2.4.738b20–26, 35–36).

We have previously called attention to the fact that Platonic prototypes of Aristotle's matter and first mover bear a resemblance to the Stoic *archai*. Again Plato provides a parallel for the process of genesis, and, what is more, a precedent for genesis on the cosmic level. Plato's description of the genesis of the cosmos reveals a number of similarities to the Stoic doctrine of *archai*. Plato's creator is called demiurge, god, and even maker (ποιῶν, e.g., *Tim.* 29a, 30a,d, 31b, 41a, 53b, 55c, 76c). Moreover, Plato characterizes the genesis of the cosmos as the introduction of shape, form, and movement into the receptacle (*Tim.* 50c, 53b).

Since the Stoic description of the *archai* contains the same motifs, we must raise the question of the extent of Plato's influence on the

Stoic doctrine. To answer this question all we need to do is to examine the structural organization of these motifs in Plato's theory. There is a marked difference between the theory underlying Plato's cosmogony and Aristotle's theory of biological generation. The most significant difference is, as we might expect, in the role played by form. In Aristotle the motive cause and the form preexist in the same entity and subsequently produce form in the matter. In Plato the motive cause and the preexistent form are distinct. The preexistent form has its own motive power and introduces form (=quality) and movement into the receptacle (*Tim.* 50b–53a). Then, in another step, the motive cause, called god, overcomes the disorderly motion of the receptacle and introduces order and shape (*Tim.* 53a–b). Unlike the Stoic god, Plato's god works upon a receptacle already moved and having traces (ἴχνη) of the elements; and, unlike the Stoic matter, the Platonic receptacle receives its initial movement and form apart from god, the active force.[54] Nor does Plato give the active-passive contrast any significant place in this process. These differences make it clear that in the theoretical details the Stoics are much nearer to Aristotle, even though in their application of the general ideas to the cosmos they approach Plato.

We must now sum up what the Stoics have done in formulating their doctrine of *archai*. They seem to have begun with the widespread, venerable, ancient idea that the cosmos is a living being and that its origin was a birth exactly like the birth of living things.[55] For the details of the birth of the cosmos, they turned to one of the most recent authorities on the subject of reproduction. It was from Aristotle's biology that they derived the kernel of their doctrine of *archai* as well as the inspiration to give the *archai* the fundamental role of bringing the cosmos into existence. Aristotle's biological theory included the general concepts of matter and mover, which were interpreted by the Stoics along orthodox Peripatetic lines as far as this was possible. When Aristotle carried the origin of movement back to a prime mover who was at the same time divine mind, the Stoics eagerly followed. Similarly, when Aristotle carried the notion of matter to its ultimate conclusion as the substrate of the elements, the Stoics followed him.

At the same time the Stoics must have been conscious of the fact that their emerging doctrine of *archai* had significant points of contact with another influential philosopher, Plato. The Stoic matter could be viewed as an adaptation of Plato's receptacle; the Stoic active principle could absorb both Plato's demiurge and his world soul. Then, too, in Plato the Stoics could find an adherent of the popular idea that the cosmos had an origin.[56] In fact, even a few remnants of the biological character of its origin could be discovered in Plato.[57]

The Stoic doctrine of *archai* was actually only one result of a complex synthesis of ideas, a synthesis motivated undoubtedly by the desire to conform to the *consensus omnium*. In Stoicism the widespread notion of the biological character of the cosmos was interpreted according to the latest scientific theories of the biologists. The result was a synthesis of the current theories of cosmology and biology. In this synthesis the original elements, drawn largely from Plato and Aristotle, were so tightly welded that they lost most of their Academic and Peripatetic character, and resulted in a philosophical system with a soul of its own. The Stoic doctrine of *archai* shows resemblances to Aristotle's theory of reproduction, his four causes, and his prime mover, as well as to Plato's receptacle, demiurge, and world soul. Yet there was originality in the Stoic doctrine; for it was the Stoic achievement to combine these apparently disparate elements and to give them a new direction, so that they might serve as the foundation of a new cosmological system.

1. This is evident from the fact that most of the extant doxographies manifest this characteristic. See, e.g., the *Vetusta Placita* (cf. *DG* 181) and the three doxographies in Diog. Laert. 3.69 (assuming with A. Covotti, *SIFC* 5 [1897]:69, that 3.67–69 is misplaced and belongs later); 7.134; 8.25.

2. *SVF* 2.579, 580, 581 (The *περὶ φύσεως* and *τὰ φυσικά* are probably the same work; cf. É. Bréhier, *Chrysippe et l'ancien stoicisme*[2] [Paris, 1951], 32–36. Plutarch and Philodemus use the title *περὶ φύσεως*, whereas Diog. Laert. calls it *τὰ φυσικὰ*). Only cosmogony is expressly ascribed to Book One, but since Book Two went on to the subjects of sensation and the soul (*SVF* 2.105, 140, 741, 867), it is likely that Book One also gave the general facts about the cosmos. Hence the second part of *SVF* 2.580 (=Diog. Laert. 7.137) may well represent material from Book One of Chrysippus's *Physics*. For a reconstruction of the contents of Book One see Appendix 2.

3. *SVF* 2.580. Zeno, Chrysippus, and Archedemus are explicitly mentioned as witnesses only of the cosmogonal part of the fragment, but since the remainder, describing the arrangement of the elements in the cosmos, is closely connected and is stated by Diog. Laert. without mention of other witnesses, von Arnim is probably correct in making the whole description of cosmogony and cosmology a single fragment, found in essentially the same form in all three writers.

4. A parallel that should be compared is *SVF* 2.414, and perhaps also the view assigned by Plutarch (=*SVF* 2.380) to some unnamed Stoics who understood the term "unqualified substance" to mean that which possesses all qualities, rather than none (see below, note 5).

5. The Stoics referred to in *SVF* 2.380 (see above, note 4) perhaps had difficulty finding the denotation of the term "unqualified substance" in the sense-perceived world. Neglecting the logical distinction between substrate and quality, they may have rationalized the expression to mean the sum total of all qualified matter that exists in the sense-perceived world, thereby confusing the capability of receiving any quality with the actual possession of all qualities. Their interpretation thereby comes very near the statement in Diog. Laert. Cf. C. Baeumker, *Das Problem der Materie in der griechischen Philosophie* (Münster, 1890; reprinted, 1963), 333–34.

6. For a reconstruction of the contents, see Appendix 2.

7. Bréhier (above, note 2), 32, agrees that it was in connection with the four elements considered as matter that Chrysippus introduced the distinction between the two principles.

8. On the absence of quality in prime matter see *SVF* 1.85 (=1.493=2.300), 88; 2.301, 309, 313, 320, 321, 323a, 326, 380, 382, 1108, 1168; Calcid. *In Tim.* 289, 293, 297; cf. *SVF* 2.318, 449.

9. On the absence of shape (σχῆμα, *vultus, figura*), see *SVF* 1.86, 88; 2.1168; Calcid. *In Tim.* 297; cf. *SVF* 2.311, 318. On the absence of form (μορφή, *forma*), see *SVF* 1.86, 88; 2.321; cf. 299, 314. Matter is said to be unmoved in *SVF* 2.303, 449, 1168; cf. 311.

10. For shape, see *SVF* 2.1168; Calcid. *In Tim.* 311; cf. *SVF* 2.310, 311; form, *SVF* 2.303, 310, cf. 311, 1044; and movement, *SVF* 2.1168, cf. 311, 946. The double function of providing both movement and shape is brought out clearly by Plutarch (*SVF* 2.1168), and is supported by Sextus and Plotinus (*SVF* 2.311, 946), though these authors do not mention the Stoics by name.

11. *SVF* 1.85; 2.323a, 1108; cf. 1.160 (*artifex, factitator*); 2.310 (κοσμοποιεῖν), 599, 1044. *SVF* 2.526, 1032 also refer to god as δημιουργός, although not in connection with the *archai* of the cosmos.

12. Calcid. *In Tim.* 289; *SVF* 1.98; 2.299 (The MSS reading σώματα should be retained. Cf. A. Schmekel, *Die positive Philosophie in ihrer geschichtlichen Entwicklung* [Berlin, 1938], 1.245, note 4. G. Verbeke, *L'évolution de la doctrine du pneuma du stoïcisme à S. Augustin* [Paris and Louvain, 1945], 39–40; *Kleanthes van Assos*, Verhandelingen van de Vlaamse Academie voor Wetenschappen, Klasse der Letteren, vol. 11, no. 9 (Brussels, 1949), 122, defends ἀσώματος only on the mistaken assumption that it is in the MSS of Diog. Laert.). The active cause, god, is said to be body in *SVF* 2.310, 313; cf. also 1028–48. The passive principle is said to be body in *SVF* 2.305, 310, 315, 325, 326, 375, 533.

13. *SVF* 1.86; Calcid. *In Tim.* 289. Von Arnim gives the Calcidius passage at greater length under Zeno, and the Diog. Laert. account at greater length under Chrysippus; but each account is assigned by its author to both Zeno and Chrysippus. There seems to be no way of deciding in either account whether Zeno or Chrysippus was the predominant source.

14. Calcid. *In Tim.* 289–90. The somewhat unclear argumentation is clarified by J. C. M. van Winden, *Calcidius On Matter: His Doctrine and Sources*, Philosophia Antiqua 8 (Leiden, 1959), 94.

15. The logical character of the substrate matter is clearly brought out by Posidonius (Stob. *Ecl.* 1.11.5 [=*DG* 458]) and later by Galen (=*SVF* 2.409), but we have no evidence to show how clearly the early Stoics recognized this fact. Von Arnim's inclusion of the passage from Galen in *SVF* should not blind us to the fact that Galen neither attributes this statement to the Stoics nor sounds particularly Stoic at this point.

16. *SVF* 1.87; 2.316, 317, 762; cf. 2.597. One wonders why the Stoics bothered to stress the point that the matter of the cosmos is constant in amount. The explanation may be that the Epicureans promulgated the opposite view. The Epicureans held that atoms are constantly being added to or departing from this cosmos, and so the quantity of matter in the cosmos is not constant. The amount increases from birth to maturity and then begins to decrease until the cosmos is destroyed (Lucr. 2.1105–45; cf. C. Bailey, *The Greek Atomists and Epicurus* [Oxford, 1928], 351–52, 366–67). The Stoic belief that matter is limited is also opposed to the Epicurean view, for Epicurus held that the number of atoms is infinite (*Ep.* 1.41–42). Lucretius, 1.1008–51, even states that the amount of matter (*vis materiai*) is infinite.

17. The author of *De Qualitatibus Incorporeis* thought the Stoics did not go far enough in abstracting matter from its qualifications. He points out that by allowing it to be body and limited, they contradict the description of matter as unqualified (*SVF* 2.323).

18. According to Calcidius (*SVF* 1.88) Zeno said that substance is the one common substrate of all things (*unam communem omnium quae sunt substantiam*). Cf. Marc. Aur. 12.30. The matter of the cosmos was called ἁπλῆ or *simplex* (*SVF* 2.323, 346a); Calcid. *In Tim.* 293 and Sextus (=*SVF* 2.309) refer to it as one.

19. *SVF* 1.98. This statement is suspiciously schematic: the element of beings is fire; the *archai* of fire are god and matter. It could be the result of the author's attempt to harmonize the Stoic doctrine of the *archai* with the doctrine of the four elements, of which fire is primary.

20. Diog. Laert. in *SVF* 1.102 (=2.580). A little later Diogenes repeats this account omitting the agent: "The cosmos comes to be when the substance is turned [τραπῇ] through air into moisture" (*SVF* 1.102[=2.581]). This is probably a less precise rendition of the same source. Cf. also the account of Stobaeus is *SVF* 1.102.

21. An influence of Aristotle on the doctrine of *archai* is recognized by most writers on Stoicism, e.g., A. H. Armstrong, *An Introduction to Ancient Philosophy*[3] (London, 1957) 123; E. V. Arnold, *Roman Stoicism* (Cambridge, 1911), 165, 172; Baeumker (above, note 5), 326–27; Bréhier (above, note 2) 115–16; J. B. Gould, *The Philosophy of Chrysippus*, Philosophia Antiqua 17 (Leiden and Albany, N.Y., 1970), 96; R. D. Hicks, *Stoic and Epicurean* (New York, 1910), 28; A. C. Pearson, *The Fragments of Zeno and Cleanthes* (London, 1891), 12, 25, 98; M. Pohlenz, *Die Stoa: Geschichte einer geistigen Bewegung*[3] (Göttingen, 1964), 1.67; 2.38; H. Siebeck, "Die Umbildung der peripatetischen Naturphilosophie in die der Stoiker," *Untersuchungen zur Philosophie der Griechen*[2] (Freiburg, 1888), 183–84; Verbeke, *L'évolution* (above, note 12), 37–39, 78–79, 88; E. Zeller, *Stoics, Epicureans, and Sceptics*, trans. O. J. Reichel (London, 1880), 396. What has not been satisfactorily explained is the precise nature of the influence.

22. *Phys.* 1.5.188b28. The expression τὰς ὑπ' αὐτῶν καλουμένας ἀρχάς suggests that some pre-Socratics actually used the term *archē* of their originative elements. Plato *Tim.* 48b3–d1 also uses the term *archē* of the elements from which the pre-Socratics derived the cosmos, and his words give the impression that he

is not thereby giving the term *archê* a new meaning. Unfortunately, it is not known which of the pre-Socratics used the term. The name that first suggests itself is Anaximander on the basis of DK 12 A 9, 11.1 and Simplic. *Phys.* 150.23–24, Diels (cf. C. H. Kahn, *Anaximander and the Origins of Greek Cosmology* [New York, 1960], 29–32; W. K. C. Guthrie, *A History of Greek Philosophy* [Cambridge, 1962–69], 1.77), though J. Burnet, *Early Greek Philosophy*[4] (London, 1930; reprinted, New York, 1957), 54, note 2, followed by Kirk in G. S. Kirk and J. E. Raven, *The Presocratic Philosophers* (Cambridge, 1957), 107–8, doubts that these fragments ought to be given this interpretation. Although Plato uses the word of the pre-Socratic "beginnings" that he is criticizing, when he subsequently gives his own theory of the beginnings, he does not expressly give the title *archai* to the actors in the cosmogonal drama (Forms, imitations, receptacle, and god). It remained for Aristotle to make explicit that these "beginnings" (or at least his own counterparts of them) are to be called *archai*.

23. Hellenistic doxographies say that Plato's *archai* were god and matter (e.g., Diog. Laert. 3.69; Irenaeus *Adv. Haer* 2.14.2 [=*DG* 171]) or god, matter, and the Forms (Aët. 1.3.21; Hippolytus *Haer.* 19.1 [=*DG* 567]; Epiphanius [=*DG* 587.8, 591.17]; Hermias [=*DG* 653.27–28]). That Plato's receptacle is not identical with Aristotle's matter hardly needs to be stated (for discussion, see below, note 24). Although the statements in the doxographies might be due to a Stoic compiler, it must be recognized that the roots go back to pre-Stoic sources. Theophrastus *Phys. Dox.* fr. 9 (=*DG* 484–85) says Plato *δύο τὰς ἀρχὰς βούλεται ποιεῖν τὸ μὲν ὑποκείμενον ὡς ὕλην ὃ προσαγορεύει πανδεχές, τὸ δὲ ὡς αἴτιον καὶ κινοῦν ὃ περιάπτει τῇ τοῦ θεοῦ καὶ τῇ τοῦ αγαθοῦ δυνάμει.* (Cic. *Acad.* 2.118 [=*DG* 119] is perhaps dependent on Theophrastus.) Theophrastus's cautious wording (*βούλεται ποιεῖν . . . ὡς ὕλην . . . ὡς αἴτιον καὶ κινοῦν*) shows he is consciously interpreting Plato in terms of Peripatetic causes and does not wish to say Plato actually stated god and matter to be the *archai*. An uncritical doxographer, particularly one who was familiar with the Stoic *archai*, god and matter, could easily have summarized Theophrastus with less care and selected from Theophrastus the words *θεός* and *ὕλη* to represents Plato's *archai*. (Aristotle's analysis of Plato's *archai* was somewhat different and is unrelated to the development that led to the doxographical vulgate. Aristotle believed Plato recognized a material cause in the "great and small," and a formal cause, first in the Forms, but ultimately in the One [*Metaph.* 1.6.987b20–22, 7.988a23–26, a34–b6].)

24. On the Platonic origin of Aristotle's doctrine as well as his original contribution to the concept, see G. S. Claghorn, *Aristotle's Criticism of Plato's 'Timaeus'* (The Hague, 1954), 5–19; J. B. Skemp, "ΥΛΗ and ΥΠΟΔΟΧΗ," in *Aristotle and Plato in the Mid-Fourth Century,* ed. I. Düring and G. E. L. Owen (Göteborg, 1960), 201–12; and F. Solmsen, *Aristotle's System of the Physical World: A Comparison with his Predecessors,* Cornell Studies in Classical Philosophy 33 (Ithaca, N.Y., 1960), 118–26. The correctness of Aristotle's interpretation of Plato is discussed by Claghorn (above) and D. Keyt, "Aristotle on Plato's Receptacle," *AJP* 82 (1961): 291–300. On the choice of the word *ὕλη* for this concept, see F. Solmsen, "Aristotle's Word for Matter," in *Didascaliae: Studies in Honor of A. M. Albareda,* ed. S. Prete (New York, 1961), 393–408. The summary of Aristotle's notion of matter given by Baeumker (above, note 5), 212–47, is still useful.

25. *Phys.* 1.7.190a24–26; *Gen. Corr.* 1.5.320b17–18; *Gen. An.* 1.18.724a20–26, 2.1.733b24–26, 30–31; *Metaph.* 3.4.999b6–7; 4.5.1010a20–21; 7.7.1032a13–17, 8.1033a24–26; 9.8.1049b27–29; cf. 5.2.1013a24–26; Bonitz 785b8–17. Aristotle

reminds us that ὕλη in the strictest sense of the word refers to the substrate of genesis (τὸ ὑποκείμενον γενέσεως καὶ φθορᾶς δεκτικόν, *Gen. Corr.* 1.4.320a2–3). Sometimes Aristotle considers privation to be the ἐξ οὗ of genesis, e.g., in *Phys.* 1.7.190a21–23 (cf. 5–8), 8.191b13–16; cf. *Gen. Corr.* 1.3.317a32–b5; Bonitz 148a5–10. What this means is that the expression ἔκ τινος has two meanings and may be used to refer either to the matter or to one of the opposites of change (usually privation). We are concerned here only with the one sense, that of the matter.

26. *Phys.* 1.6–7 (see esp. 1.7.191a3–5). The same conclusion is reached in *Metaph.* 12.2.1069b32–34, 4.1070b18–19; cf. *Gen. Corr.* 2.9.335a24–30. Aristotle frequently states that all things that come to be have matter, e.g., *Metaph.* 7.7.1032a20, 8.1033b18–19; 8.5.1044b27–28; cf. 12.2.1069b24–25.

27. When a statue comes to be, the substrate is said to be bronze (or stone or gold), and the opposite from which it comes to be is ἀσχημοσύνη, ἀμορφία, and ἀταξία (*Phys.* 1.7.190b10–17; cf. 1.5.188b19–20, 7.191a1–3, 8–12; *Metaph.* 5.4.1014b26–30). One may thus infer that in itself the bronze is without shape, form, or arrangement. The process by which the statue comes to be is called μετασχημάτισις (*Phys.* 1.7.190b5–6; cf. *Cael.* 3.7.305b29–30). The verb σχηματίζειν is also used (e.g., *Phys.* 1.5.188b19–20.).

28. As a statue, e.g., in *Metaph.* 1.3.984a22–25; 5.2.1013a24–26, b6–8, 2.1014a11–12, 4.1014b26–32; 7.3.1029a3–5; cf. 7.10.1035a6–9; and as a sphere in 5.25.1023b19–22; 7.7.1033a2–4.

29. In *Metaph.* 8.4.1044a15–25 Aristotle further elaborates on his theory that different levels of matter will be reached in breaking up (ἀναλύεσθαι) an object, before the final πρώτη ὕλη is reached. For example, phlegm comes from the fatty and sweet, whereas bile comes from the bitter, but both come from the same matter, i.e., the πρώτη ὕλη underlying the sweet and the bitter. In another example (8.4.1044a34–b3), Aristotle gives as the immediate matter of man the menstrual blood, but as more distant matter the four elements. This example again alludes to his belief that all things in the sublunar world may be resolved into the four elements. This well-known theory is set forth in *Gen. Corr.* 2.8.

30. *Gen. Corr.* 2.1–5, esp. 2.1.329a24–b6. For a discussion of the evidence for Aristotle's notion of prime matter underlying the elements, see F. Solmsen, "Aristotle and Prime Matter: A Reply to Hugh R. King," *JHI* 19 (1958):243–52. Solmsen defends the notion of prime matter against H. R. King, "Aristotle without *Prima Materia*," *JHI* 17 (1956): 370–89, who contends that Aristotle never conceived a substrate to underlie the elements, but believed the elements change directly into one another, with one element playing the role of prime matter for the other. For a more recent, but no more convincing, denial of the notion of prime matter, see W. Charlton, *Aristotle's Physics, Books I and II*, Clarendon Aristotle Series (Oxford, 1970), 129–45.

31. This step might be concealed in the obscurely abridged statement "The four elements together are the unqualified substance, or the matter" (*SVF* 2.580).

32. That matter underlies the eternally revolving heavens can be deduced from *Metaph.* 12.2.1069b24–26. What this passage refers to is not immediately clear. The passage occurs in the paragraph discussing perceptible substance (cf. the first sentence in 12.1.1069b3), and so the passage must refer to that species of perceptible substance which is also eternal (cf. 12.1.1069a30–31). Since this eternal, perceptible substance is said to move (12.2.1069b25–26), 12.7.1072a21–23 and 12.8.1073a23–36 show that it must be the celestial bodies and especially the first heaven.

We have seen above that prime matter underlies the changing elements. The eternity of this matter may be inferred from the fact that the cosmos which the elements constitute is ungenerated, imperishable, and eternal (*Cael.* 1.10–12.279b4–283b22).

33. *Cael.* 1.9.278b8–279a18. Aristotle uses this very argument to prove that the celestial element is not subject to growth in *Cael.* 1.3.270a22–25.

34. *SVF* 2.762. The word for quality has fallen out. To fill the lacuna Zeller proposed ποιόν and Wyttenbach ποιότης (Von Arnim and Pohlenz follow Wyttenbach). A clue to the lost word is Plutarch's subsequent statement that he has actually oversimplified Chrysippus's doctrine (*Comm. Not.* 1083e). Chrysippus actually claimed that each of us consists of four corporeal substrata (ὑποκείμενα), but Plutarch has recorded only two, substance and the one now lost in the lacuna. From this we may conclude that the substrate mentioned in the lacuna is the second of a set of four entities that begins with οὐσία. The Stoic categories (ὑποκείμενον [or οὐσία], ποιόν, πὼς ἔχον, πρός τί πως ἔχον) are an attractive candidate for this set of substrata (for a parallel cf. *SVF* 2.374). This lends support to Zeller's emendation (ποιόν) and it certainly confirms the suspicion that a word for quality has fallen out.

35. Cf. Solmsen, *Aristotle's System* (above, note 24), 40–52, 118–35.

36. Gould (above, note 21), 96–97, has called attention to some of the similarities between Plato's receptacle and the Stoic matter.

37. We need cite only a few of the more memorable examples, such as Arist. *Cael.* 3.1.298a29–31 (λέγω οὐσίας τά τε ἁπλᾶ σώματα . . . καὶ ὅσα ἐκ τούτων); *Phys.* 4.7.214a12 and *Gen. Corr* 1.5.320b22 (οὐσία σωματική); and finally *Metaph.* 12.1–5, which discusses the two kinds of αἰσθητὴ or φυσικὴ οὐσία. Cf. also Bonitz 545a1–16. Plato frequently uses the word of property or wealth (see G. A. F Ast, *Lexicon Platonicum* [Leipzig, 1835–38], s.v. οὐσία).

38. See above, Chapter 1.

39. Baeumker (above, note 5), 329, 332, 337, holds the materialistic bias of the Stoics responsible for the identification of matter, body, and substance. It is not impossible that, once the Stoics came to believe only the corporeal is real, they might have asserted the corporeality of some real thing that had formerly been considered incorporeal; but there is no recorded example of a logical deduction of this nature. It is impossible to say when the specific examples of corporeal realities (god, soul, qualities, etc.) served to buttress the general contention that only bodies truly exist, or when, if ever, the general contention led the Stoics to assign a corporeal nature to some entity they considered real. See above, Chapter 1.

40. Bréhier (above, note 2), 115–16; Hicks (above, note 21), 28; Pearson (above, note 21), 25; Pohlenz (above, note 21), 1.67, 2.38; and Siebeck (above, note 21), 183–84, all view the Stoic doctrine as a modification of Aristotle's *archai*, form and matter. They consider the Stoic achievement to be the substitution of an active force for the Aristotelian formal cause. Baeumker (above, note 5), 346–54, gives a subtle explanation of the origin of the active principle. He believes the Stoics began with the Aristotelian concept of form, which they called quality. Then by interpreting quality as a tensional movement (κίνησις τονική) or a current of *pneuma*, that is, an activity, the Aristotelian formal cause fell together with the motive cause to produce the Stoic active principle. This ingenious theory perhaps deserves more than a passing reference in a note. Chrysippus does seem to give the qualities precisely the same role in forming matter as we have seen the active cause has. He says that the qualities are πνεύματα καὶ τόνους ἀερώδεις, which form and shape (εἰδοποιεῖν καὶ σχηματίζειν) the bare, unmoved matter underlying them (*SVF* 2.449). My reason for minimizing

Baeumker's line of thought is that it depends on concepts that were probably developed primarily by Chrysippus (e.g., pneumatic qualities and motions), whereas the *archai* go back to Zeno. Moreover, though the concepts of *pneuma* and qualities eventually made contact with the doctrine of the *archai*, these concepts have their own background and history in an area quite different from that of the *archai* (see below, Chapter 5). J. Moreau, *L'âme du monde de Platon aux Stoïciens* (Paris, 1939), 160, thinks that although Aristotle's matter supplied the Stoics with their conception of matter, Plato's active-passive dualism of *Soph.* 247d–e and the demiurgic activity of the *Timaeus* are the real sources of the dualistic Stoic *archai* and the Stoic conception of the active principle.

41. The first mover moves the first heaven in a uniform, circular motion (*Metaph.* 12.7.1072a21–24). The first heaven moves the planetary spheres, and so the movement is passed on down (*Metaph.* 12.8). By the time the movement gets to the sun, it is movement along an ecliptic. As the sun moves, it generates heat; and this heat varies as the sun approaches and recedes along its ecliptic (*Meteor.* 1.2–3). This movement is the cause of meteorological phenomena. For example, when the sun approaches the earth, it draws up moisture; and when it recedes, the moist vapor cools and turns to water, causing rain (*Meteor.* 1.9). The sun with its heat is also the efficient cause of biological genesis. As the sun approaches, it causes genesis; and as it recedes, it causes destruction (*Gen. Corr.* 2.10.336a15–b24, 11.338a17–b5; *Phys.* 2.2.194b13; *Metaph.* 12.5.1071a13–17; *Gen. An.* 2.3.737a3–5; 4.10.777b16–778a3). Even the local motion of men and animals is controlled by their environment and hence ultimately dependent on the prime mover (*Phys.* 8.2.253a7–21, 6.259b1–260a19). For a more detailed summary, see A. L. Peck, *Aristotle: Generation of Animals*, Loeb Classical Library (London, 1963), 567–76.

42. The Stoics generally use the word *logos* where other writers would use νοῦς (one exception is the *spermatikos logos*, on which see below Chapter 3). Where the word νοῦς does occur in the Stoic fragments, the word *logos* could also be substituted. It is especially significant for the point under consideration here that god is expressly said to be νοῦς, and the words are regarded as virtually synonymous (*SVF* 1.102 [=2.580], 146, 157, 158, 160, 530; 2.1027).

43. *SVF* 2.339. Simplicius may have deduced this from the texts that say god permeates or passes through (διαφοιτάω, διέρχομαι, διήκω) the matter of the cosmos. See index, *SVF* 4, pages 40–41, *sub vocibus*.

44. *Phys.* 8.10.267a21–b9; cf. *Mot. An.* 4.699b34–35. There is a possibility that in *On the Heavens* Aristotle considers the element of which the heavenly bodies are composed to be a self-mover (*Cael.* 1.9.279a30–35; 2.3.286a3–11). Unfortunately the crucial passage (279a30–35) does not state its subject clearly. H. Cherniss, *Aristotle's Criticism of Plato and the Academy* (Baltimore, 1944), 587–88, thinks the subject is a mover beyond the outermost heaven; Solmsen, *Aristotle's System* (above, note 24), 308, note 20, disagrees and defends the traditional view taken by von Arnim, Guthrie, Ross, and Moreau (for bibliography see Cherniss, 588, cf. 584) that this passage refers to the celestial element. If before Aristotle discovered the unmoved mover, he did indeed believe in a self-moving body at the periphery, the effect is still that the ultimate source of movement is at the periphery of the cosmos.

45. *SVF* 1.85, 155, 158; 2.300, 310, 311, 323a, 1044. At first sight this may seem to contradict the statement above that the Stoic first mover operates through a series of

intermediate movers. The fact is that the Stoics could look at the cause of movement from two points of view. God causes events through a series of movers, and this process is called fate. They derived εἱμαρμένη from εἴρω and loved punning definitions of εἱμαρμένη as an αἰτία εἰρομένη or an εἱρμὸς αἰτίων (*SVF* 1.175; 2.914, 915, 917, 918, 920). On the other hand, they also viewed the process itself as god (*SVF* 1.102[=2.580]; cf. 1.527; 2.528, 931, 1076), for the chain of causes is eternal and there never was a first cause (*SVF* 2.949). Hence god can only be he who is responsible for the continuing movement of the causal chain (The movement of the causal chain is emphasized in *SVF* 2.1000). Since unlike Aristotle's prime mover, the Stoic god is not locally removed from the movement he causes, it makes no difference whether one says that god operates through a chain of causes, or one says that god causes movement directly from within.

46. The connection between these three ideas is demonstrated in *Laws* 10.894b–896b, 899b. Although in the *Timaeus* Plato does not lay much stress on soul as a source of movement for other things (*Tim.* 58a is one exception; cf. Solmsen, *Aristotle's System* [above, note 24], 63–65), he does maintain an intimate connection between soul and god, for each part of the world soul (i.e., each heavenly body) is a god (*Tim.* 34a–40d). See F. Solmsen, *Plato's Theology*, Cornell Studies in Classical Philology 27 (Ithaca, N.Y., 1942), 75–97, 114–15, 136–41.

47. That soul is a self-mover is stated in *Phaedr.* 245c–246a; *Leg.* 10.895e–896a. As a self-mover it is the source of all movement and change in heaven, sea, and earth (*Leg.* 10.896a5–b1, 896d–897b). It manifests itself in the heavenly bodies (*Leg.* 10.896d–e, 898c–d; *Tim.* 34a–40d) and in living beings (*Tim.* 41c; cf. 41d–42e; *Leg.* 10.898d–e). It should be pointed out that although Plato believed the world soul to be dispersed throughout the cosmos, he felt it existed in greatest purity at the periphery; for the proper movement of soul is eternal, circular movement, the movement of reason, which is found primarily in the heavenly bodies (*Leg.* 10.897c–898c; *Tim.* 34a, 44d). That is why the souls of men were originally assigned to the stars (*Tim.* 41d8–e1) and why after death the souls of the good will again return to the region of the stars (*Tim.* 42b3–5). The Stoic active principle does not show any connection with circular motion or the revolution of the heavens, but these associations (which influenced Aristotle greatly) have left a definite impression on the Stoic concept of the world soul (see below, Chapter 5, noting especially the location of the ruling principle of the world soul in the heavens). The absence of association between the Stoic active principle and the heavens is probably due to the fact that the Stoic *archai* did not originate in a cosmological context; but this subject has yet to be discussed.

48. Plato *Leg.* 10.894b–897b. On the role of soul and mind in Plato's cosmology, see Solmsen, *Plato's Theology* (above, note 48), 110–17. Solmsen, *Aristotle's System* (above, note 24), 241–45, discusses the difference in viewpoint between Plato and Aristotle. Incidentally, Anaxagoras had already made νοῦς the first cause of movement in the cosmos (DK 59 B 12, 13).

49. On the origin of Aristotle's conception of the prime mover, see Solmsen, *Aristotle's System* (above, note 24), 222–49.

50. This point has been made by Solmsen, *Plato's Theology* (above, note 48), 179–83. Needless to say our present treatment does not do justice to the Stoic doctrine of god. The origin of Stoic theology is a separate subject, which cannot be dealt with here. For a preliminary treatment, see Solmsen, *Plato's Theology*, 179–85. We have dealt here only with points that have a bearing on the Stoic active principle.

51. Seneca *Ep.* 65.11 (=*SVF* 2.346a), disparages the *turba causarum* posited by Plato and Aristotle. He goes on to attack the *sine qua non* causes by a *reductio ad absurdum*, but he is probably thinking of Aristotle's four causes at the same time. To this *turba causarum* he contrasts the single Stoic cause, the active principle.

52. Verbeke, *Kleanthes* (above, note 12), 118–22, seems to make the Stoic achievement a selection from the causes distinguished by Plato and Aristotle, but he does recognize that the formal and final causes have become part of the Stoic active cause.

53. *SVF* 1.548; 2.634, 933, 937, 1140, cf. 1106–26. According to *SVF* 1.551(=2.933) there was disagreement between Cleanthes and Chrysippus over how many of the events were guided by providence; but even Cleanthes did not deny that some events at least were governed by providence.

54. This is made absolutely clear by *Tim.* 52d–53b. It is interesting to notice that when Plato speaks of the genesis of the cosmos in biological terms, the receptacle is the mother; but the father is identified with the Forms, not with the demiurge (*Tim.* 50d). However, he does on other occasions refer to the maker of the cosmos as father (*Tim.* 28c, 37c).

55. This idea is discussed below, Chapter 3.

56. It is irrelevant whether Plato meant the cosmogony of the *Timaeus* to be taken literally (cf. A. E. Taylor, *A Commentary on Plato's Timaeus* [Oxford 1928], 66–69, and R. Hackforth, "Plato's Cosmogony [*Timaeus* 27 D ff.]," *CQ*, n.s. 9 [1959]: 17–22). If even Aristotle (*Phys.* 8.1.251b17–19; *Cael.* 1.10.280a28–32) felt justified in classing Plato among those who believed the cosmos had a beginning, the Stoics, who were far less concerned with understanding the subtleties of their predecessors, would most likely have taken the *Timaeus* account literally.

57. Most important is *Tim.* 50d, where Plato says the receptacle is fittingly compared to a mother, the Forms to a father, and the things that come to be to the offspring. See also *Tim.* 28c and 37c, where the demiurge is called father. The creation of the cosmos by the demiurge or his agents is described by the verb *γεννάω* in *Tim.* 32c, 34a,b, 37c, 41a,d, 68e, 92a.

CHAPTER III

Cosmogony

One of the chief functions of the Stoic *archai* was to bring the cosmos into existence, and so the Stoic cosmogony must be considered next. Having arrived at the realization that the *archai* were in all probability partly biological in origin, we are in a better position not only to determine the origins of the Stoic cosmogony but even to achieve the preliminary task of reconstructing the doctrine itself. If the *archai* came out of a biological context, we may expect them to carry out the creation of the cosmos in a biological manner. With this hypothesis we may be able to make better sense of the difficult and obscure summaries of Stoic cosmogony than would otherwise be possible. If it should turn out that Stoic cosmogony does indeed show a distinct biological character, we shall have further confirmation that the *archai* were, in fact, a synthesis of biological and physical concepts.

In reconstructing the Stoic cosmogony and in analyzing its origins the safest course is to begin with the more intelligible physical aspect. Plutarch preserves a verbatim excerpt from the first book of Chrysippus's *Physics*:[1] "The change of fire is as follows: It is changed through air into water. And from this, when earth has settled down, air is evaporated. Then, when the air has been thinned, the *aether* is poured around in a circle" (*SVF* 2.579). Other fragments confirm this basic scheme. The initial condition is a mass of pure fire (*SVF* 2.605). This entire mass of fire changes to air, and then from air to water (*SVF* 1.102; 2.580, 581, 590). At this point nothing but a mass of water would be visible to an observer.[2] The four elements of which the present cosmos consists are produced from this water. First the heavier portion of the water (τὸ παχυμερές) settles down and masses together (ὑφίστασθαι, συνίστασθαι, συνίζεσθαι), thereby producing earth.[3] Of the remaining water, part continues on as water; but the lighter part of it (λεπτομερές) evaporates (ἀτμιζομένου, ἀναθυμιᾶται, ἐξαραιωθῇ, κατὰ ἀνάδοσιν) and forms air. Some of the air thins out still more (λεπτυνομένου, ἐπὶ πλέον λεπτυνθέν) and produces fire; or to put it another way, from some of the air, fire is ignited (ἐξάπτεσθαι, *SVF* 1.102, 104, 105; 2.579, 581, cf. 436, 527). This account is purely physical. Elemental change is the only process used to explain the origin of the cosmos, and the elemental change itself is explained in purely physical terms. According to Zeno the four elements come from water by such processes as settling and gathering (ὑφίστασθαι, συνίστασθαι), evaporation (ἀτμιζομένου), and ignition (ἐξάπτεσθαι, *SVF* 1.102 [page 28.15–19], 104). According to Chrysippus all elemental change can be reduced to a single physical process, solidification and dissolution or thinning.[4]

If the Stoic cosmogony amounted to no more than this, we should have no difficulty understanding it and little trouble seeing how the Stoics came to hold this view. The Ionian physicists before Parmenides had all sought the origin of the cosmos in the genesis of the many elements from a single substance.[5] Anaximenes had even anticipated Chrysippus's solidification and dissolution when he explained the process of elemental genesis by condensation and rarefaction of a single element (DK 13 A 5, 6, 7.3, 8; B 1). Above all, Heraclitus had asserted that fire is the primary element from which the others are derived.[6] Of course, Parmenides with his denial of the possibility of genesis and change (DK 28 B 7–8) had brought an end to such speculation for a time, and cosmogony had to circumvent the Eleatic ban by postulating a plurality of eternal elements, whose combination and mixture produced the cosmos.[7] But then Plato restored the process of genesis and elemental change to respectability, with the proviso that one element comes to be from another element and not from sheer nothing.[8] When Aristotle and his school continued to defend the notion of elemental change,[9] the stigma of Parmenides' interdict vanished completely; and the Stoics could use elemental change in their cosmogony without a word of apology.

If we knew only the Stoic physical explanation for the origin of the cosmos, we would be forced to conclude that, with elemental change back in fashion, the Stoics were, in effect, reviving the pre-Parmenidean cosmogonal speculation and, in particular, the forgotten ideas of Heraclitus. We could even ignore the probability that Heraclitus may not have written a cosmogonal account.[10] The fact that the well-known fragment 31 ("The changes [τροπαί] of fire: first sea, and of sea half earth and half fiery waterspout") has been preserved in a Stoic source and interpreted as being identical with the Stoic cosmogony (*SVF* 2.590) would suffice to assure us that the Stoics believed Heraclitus was in this passage describing the genesis of the cosmos. It would not be hard to see in Heraclitus the seed of the Stoic cosmogony.[11]

If Heraclitus provided the seed, later philosophers could have provided the nourishment. Archelaus is said to have believed that water, when melted by fire, insofar as it settles down, produces earth, and insofar as it overflows, generates air.[12] Plato enumerates the normal elemental changes in a way that comes even closer to the Stoic cosmogony: "Water when it has been solidified [πηγνύμενον], becomes stones and earth. When melted and dispersed [τηκόμενον καὶ διακρινόμενον], it becomes wind and air. And air, being ignited [συγκαυθέντα], becomes fire" (*Tim.* 49b–c). With only the slightest change of wording this could pass for a description of the second part of the Stoic cosmogony, the part following the stage in which the cosmos consists solely of water. Plato continues: "Then, again, combining and being quenched [συγκριθὲν καὶ κατασβεσθέν], fire passes into the form of air; and again, air coming together and becoming dense [συνιόντα καὶ πυκνούμενον] becomes cloud and mist; and from these, having been compressed [συμπιλουμένων] still more, water flows; and from water, earth and stones come again, thus transmitting genesis to one another in a cycle" (*Tim.* 49c). The processes of elemental transformation are the same processes as those used in the Stoic sources: solidification, gathering, quenching, becoming dense, melting, dispersion, and kindling. Only the addition of cloud and mist to the cycle of transformations sounds un-Stoic.

Thus, if the Stoic cosmogony amounted to no more than a physical account of the genesis of the elements, the explanation of its origin might easily be disposed of. But important as the influence of Heraclitus, Plato, and perhaps other physicists may have been, it is not the full explanation for the Stoic doctrine; for the Stoic cosmogony involves much more than a simple transformation of elements. Diogenes Laertius gives the following account: "In the beginning god, being by himself, turns the whole substance [οὐσία] through air into water" (*SVF* 1.102[=2.580]).[13] Here we do not find a simple element passively undergoing a change into another element; but there is an active cause, operating on some substance to initiate change. Of course, since god is fire, this account represents the same process as the physical account; but the point of view is different: the Stoic *archai* are now in play.

We have suggested that the *archai* are descended from biology, and now we see their inherited biological character in evidence. Diogenes Laertius continues: "As the seed [σπέρμα] is embraced [περιέχεται] in the seminal fluid [γονῇ], so also this [i.e., god], being a *spermatikos logos* of the cosmos, is left behind as such in the wet, making the matter adapted [εὐεργόν] to himself for the genesis of the next things; then he gave birth to [ἀπογεννᾶν] the four elements first of all, namely fire, water, air, earth" (*SVF* 1.102[=2.580]). Although not all of this account is immediately intelligible, it is obvious that a birth, and nothing else, is being described; for the account bristles with biological terms.[14]

A careful analysis, drawing on other fragments, will be necessary if we are to comprehend the birth process of the cosmos. The account begins with a simile: "As the seed is embraced in the seminal fluid, so god is left behind in the wet." The wet, or water, which constitutes the cosmos at this stage, is compared to the seminal fluid; and god is compared to the seed in the seminal fluid. In fact, he is called a *spermatikos logos*, literally, a "*logos* pertaining to a seed." This difficult expression is best left untranslated in the hope that its meaning will eventually emerge. For the present it is enough to notice that it describes that function of god which is analogous to the function of the seed in reproduction.

The connection of seed (σπέρμα) with the origin of the cosmos is seen clearly in other fragments. The early Stoics called the fire of the conflagration (which is the same as the fire from which the cosmos originates) the seed (σπέρμα) of the future cosmos (*SVF* 2.596, 618, cf. 619). Zeno reportedly said fire is "as it were a seed, possessing the *logoi* of all things and the causes of events, past, present, and future" (*SVF* 1.98). Thus the primary fire, which is actually identical with god, has the same cosmogonal function as did god in the account of Diogenes Laertius; fire is the seed and, as seed, is associated with what Zeno calls the *logoi* of all things.

In addition to conceptualizing the origin of the cosmos as a function of the *archai* and as an act of biological reproduction, the Stoics brought in another set of ideas, which appears in Chrysippus's description of the birth of the cosmos: "The cosmos, being fiery throughout, is directly its own soul and *hegemonikon* [i.e., principal part of soul]. But when, having changed into the wet and the soul left enclosed in it [ἐναπολειφθεῖσαν], it changed in a way into body and soul, so that it consists of these; then it has something else as *logos*" (*SVF* 2.605). Here the process is seen in terms of body and soul (or *logos*). Fire is soul; and so during the conflagration, before a cosmos is born, only soul exists. Therefore we may say that at this time the world and the world soul are identical (cf. also *SVF* 2.604, 1032, 1052). But when the primeval fire has changed into water, soul is left behind in the water; and so the cosmos consists of body and soul as two distinct entities. Clearly the water is body and fire is soul.

All these motifs are drawn together in a passage of Dio Chrysostom, where the Stoic cosmogony is translated into an allegorized myth: "Zeus, remembering Aphrodite and genesis, softened himself and, having quenched much of his light, changed [τρέπεται] into fiery air of less intense fire. Then having had intercourse with Hera . . . , he ejected the entire seminal fluid [γονήν] of the All. . . . Thus he made the whole substance wet, one seed [σπέρμα] of the All, he himself running through in it, just as the forming and fashioning [τὸ πλάττον καὶ δημιουργοῦν] *pneuma* in seminal fluid [γονῇ]. At this time he most resembled the other living things, inasmuch as he would properly be said to consist of soul and body. Then he easily formed and molded [πλάττει καὶ τυποῖ] the remaining things, having poured around himself the substance in a smooth, soft, and easily yielding state" (*SVF* 2.622).

Here we find most of the motifs we have seen clustering around the birth of the cosmos. God is fire and soul. He passes by way of air (= Hera) into water. This water is conceived as seminal fluid (γονή), through which god himself, being both fire and soul, passes. There in the water he is a formative and creative power, just as the *pneuma* is in the seminal fluid. This account seems to use the term σπέρμα of the water and therefore of the seminal fluid (γονή, cf. 2.590), using *pneuma* for the analogue of the divine fire in the water. Therein it differs slightly from Diogenes Laertius's account (*SVF* 2.580), which uses σπέρμα of the creative power in the seminal fluid. But basically it sets forth the same conception of the fluid from which the elements are born.

In these accounts, however, there is one motif that is difficult to place, and that is matter (ὕλη). The motif is important because it is one of the *archai* and ought to find a place in the cosmogony. In Diogenes Laertius's account the divine fire in the water makes the matter workable (εὐεργόν) for the generation of the elements (*SVF* 2.580). With this the mythological account agrees. When Zeus has made wet the entire substance (οὐσία), he is said to have easy work forming the remaining things (scil. the elements), because he has made the material (οὐσία) surrounding himself pliable and easily yielding (λείαν καὶ μαλακὴν καὶ πᾶσαν εἴκουσαν εὐπετῶς, *SVF* 2.622). Clearly the wet is considered matter. In biological terms Zeus's seminal emission supplies both the creative power and the matter out of which the cosmos is made. Hera, the female, has the function of inducing the emission of seed, but contributes nothing to the offspring. Hence Hera, through whom Zeus produces seminal fluid, is identified with the air through which fire changes on the way to becoming water. Origen, however, states that Chrysippus interpreted an erotic painting of Zeus and Hera as a mythical representation of the fact that matter has received and now possesses in itself the *spermatikoi logoi* of god for the ordering of everything. Origen expressly states that Hera is the matter and Zeus is god.[15] Here the female functions as matter. This is plainly a different assessment of the female's role in reproduction and also of the source of matter in reproduction. It is hard to decide whether these two approaches represent different theories or whether the attempt to allegorize a variety of myths has distorted a single theory. If we leave the female out of account, the role of matter in the birth of the cosmos is the same in all reports. God acts on matter, introducing *spermatikoi logoi*, with the result that the present cosmos comes to birth. It is true that this is not very specific, but we shall soon see that it is specific enough to help us track down the origins of the Stoic cosmogony.

By now it should be apparent that the Stoic cosmogony involves much more than a mere transformation of elements. Before we set out to track down the individual ingredients that went into the Stoic cosmogony, we must consider the basic model for the conceptualization of the cosmogony, namely, the embryological model. Without the basic presupposition that the origin of the cosmos was a biological process, the Stoics could never have promulgated the cosmogony we have described.

The analogy between living beings and parts of the cosmos is extremely ancient in Greece and antedates all written records.[16] From earliest times Greek mythology contained stories that equated the earth with a mother. According to these myths gods and men were born from the earth. Ovid's version of the Flood of Deucalion carries the analogy so far that stones are called "bones of our mother."[17] The idea that the earth is capable of producing life was taken over by the Ionian philosophers and so entered the body of Greek philosophy.[18] Early in the history of Greek philosophy the idea became popular that the cosmos as a whole is a single living being, and its parts correspond to the parts of living animals. The analogy between microcosm and macrocosm can be traced back as far as the sixth century.[19] If the fragment be genuine, Anaximenes saw an analogy between the human soul, which is air, and the air of the cosmos (DK 13 B 2). For the Pythagoreans the cosmos was a living animal that breathes in the void outside it (DK 58 B 30; Aët. 2.9.1). By the fifth century the analogy between man and the cosmos was being spelled out in greater detail.[20] Empedocles referred to the parts of the cosmos as limbs (μέλη, γυῖα, DK 31 B 27.1, 27a, 30.1, 31, 35.11). Aristophanes portrayed Euripides describing the eye as an imitation of the sun (*Thesm.* 16–17). Leucippus called the outer shell of the cosmos ὑμήν, a word that generally is used as a technical term for the amnion enclosing the fetus in the womb (DK 67 A 1.32). If the Armenian philosopher David can be believed, Democritus said man is actually a little cosmos (μικρὸς κόσμος, DK 68 B 34). Aristotle gives a lucid summary of this fifth-century point of view: "If something can occur in a living animal, what prevents the same thing from happening also in the universe? For if it happens in a microcosmos, why not in a macrocosmos?"[21]

In the fourth century this point of view was no less prevalent than in the fifth. According to Plato (*Phil.* 29a–30a) and Xenophon (*Mem.* 1.4.8), Socrates maintained that the four elements in our bodies are derived from the four elements in the body of the cosmos, and our soul is derived from the world soul. Plato deduced from this that man is a derivative and imperfect form of the universe. Accordingly, in the *Timaeus* he reversed the relationship between man and cosmos and deduced facts about man from the cosmos. For example, he explained biological functions and activities, such as nutrition and exercise, by analogy to cosmic processes, such as movement of like to like and the eternal shaking of the receptacle (*Tim.* 81a–b, 88c–e). Even though Plato preferred to use the analogy from cosmos to microcosmos, he did firmly believe that the cosmos is a living, ensouled, intelligent animal (*Tim.* 30b and passim).

To a certain extent Aristotle agreed with Plato that the cosmos is alive, but Aristotle made little use of this idea in his cosmological researches, preferring an exclusively physical approach.[22] Nevertheless, he could not completely escape the traditional point of view, and so he constantly used the analogy of living animals to explain his cosmological theories. For example, both Aristotle and his successor, Theophrastus, referred to the eternal revolution of the heavenly bodies as a kind of life (ζωή τις, Arist. *Phys.* 8.1.250b11–15; Theophr. *Metaph.* 8.10a15–16). Aristotle also argued that as in an animal the center of the animal (i.e., the heart) is not necessarily in the center of the body, so in the cosmos the principal part is not at the mathematical center but at the periphery (*Cael.* 2.13.293b6–15). In the *Meteorology* he made extensive use of biological analogies to explain cosmological phenomena, such as the location of the sea and changes in its location, the salt in the sea, drought and rain, and finally earthquakes (*Meteor.* 1.14.351a19–31; 2.2.355a32–b20, 356a33–b3, 3.358a3–20, 4.360b22–26 [cf. also *Part. An.* 2.7.653a2–8], 8.366b14–30, cf. 367a33–b4). The reason these analogies are useful, he admitted, is that "the greater is similar to the smaller" (*Meteor.* 2.8.366b29–30; *Part. An.* 2.7.653a3). With this powerful tradition behind them, it is no wonder the Stoics believed the cosmos to be a living thing and saw validity in using biological analogies to describe the cosmos.

When the Stoics conceived the origin of the cosmos to be a birth, they were merely conforming to one phase of this old tradition. Already among the Egyptians and Babylonians, there existed a belief that the parts of the cosmos came to be through a biological process.[23] The early Greek cosmogonies manifested the same character. Hesiod's *Theogony*, 116–33, described the birth of the various deities that represent the parts of the cosmos, such as Earth, Tartaros, Night, Day, Aether, Heaven, Mountains, Sea, and Ocean. Some of the so-called Orphic cosmogonies gave similar accounts of the birth of deities representing parts of the cosmos.[24] Another type of Greek cosmogony described the birth of the cosmos as the hatching of an enormous egg.[25] Pherecydes of Syros (sixth century B.C.) wrote a cosmogony in which the semen of Chronos played a part (DK 7 A 8), and earth and ocean were produced by Zas (=Zeus) in connection with his marriage to Chthonie, possibly in an erotic situation.[26]

When we get to the pre-Socratic philosophers, we find small, but distinct, traces of a biological conception of the origin of the cosmos. In Anaximander's cosmogony the first thing "to be separated off" (*ἀποκριθῆναι*) from the infinite was "the generative [*τὸ γόνιμον*] of hot and cold" (DK 12 A 10). The word *γόνιμον* is obviously biological; and *ἀποκριθῆναι* is frequently biological, since it is the word used of the separation of the seed from the parent. This suggests that Anaximander held some kind of embryological conception of the origin of the cosmos.[27] The Pythagoreans seem to have thought the cosmos grew from the unit as a seed. This unit-seed began to inhale the infinite void surrounding it, and by imposing limit on it produced the cosmos.[28] Empedocles, who called the four elements the roots (*ῥιζώματα*) from which all things grow (DK 31 B 6) and said that the mingling of these is what men mean by the word "birth" (*φύσις*, DK 31 B 8), described the origin of the cosmos in a way that is strikingly similar to contemporary descriptions of the growth of an embroyo.[29] Anaxagoras called his ultimate particles "seeds" (*σπέρματα*, DK 59 B 4), and so all things must have grown from the initial condition in which all the seeds were together.[30] Aristotle refers to the atomic elements of Leucippus and Democritus collectively as a *πανσπερμία* (DK 59 A 45; 67 A 15, 28). Even if the word is Aristotle's, the idea that the elements are seeds may go back to the early atomists, for the Epicureans also called the atoms seeds or generative bodies (*semina*, *genitalia corpora*, Lucr. 1.58–60), and Epicurus said a cosmos comes to be when "seeds of the right kind" (*ἐπιτηδείων σπερμάτων*) come together (*Ep*. 2.89).[31] Moreover, Democritus spoke of the cosmos as coming to maturity (*ἀκμάζειν*, DK 68 A 40). The fact that even the atomists used biological language to describe their cosmogony is a good indication that the embryological analogy was firmly embedded in the Greek mind.

In the fourth century Plato continued to use biological language to describe the origin of the cosmos. The demiurge begets (*γεννάω*) the cosmos;[32] the Forms are like a father, and the receptacle is like a mother to the cosmos, which itself resembles an offspring (*Tim.* 50d). The receptacle is also a nurse (τιθήνη) for things that come to be in it (*Tim.* 49a). Only Aristotle, who insisted the cosmos had no beginning, did not make use of embryological analogies to describe the origin of the cosmos. Nevertheless, even he manifests the power of the old tradition; for he asserted the eternity of the cosmos by denying to it any predicates of change, declaring the cosmos as a whole to be unborn (ἀγένητος) and undying (cf. ἀθανασία) and the celestial element to be, in addition, unaging (ἀγήρατος, *Cael.* 1.12.281a28–283b22; 2.1.283b26–284a2; 1.3.270b1–3). Moreover, he spoke of the eternal motion of the cosmos as "undying," serving as "a kind of life" (ζωή τις) for all natural things (*Phys.* 8.1.250b11–15, 6.259b25–26). Even if for Aristotle the term γένεσις no longer had any biological connotations, the terms "unaging" and "undying" show that he had before his mind the biological analogy that saw the origin of the cosmos in terms of a birth.

In the light of this long tradition the Stoic achievement becomes clear. The idea that the origin of the cosmos was a birth in the literal sense of the word had disappeared, at least among the philosophers. The biological language, once expressive of a real conviction, had deteriorated into mere metaphor. It was the Stoic achievement to rejuvenate the ancient idea by taking literally again the metaphorical language.

The early Greek tradition that provided the basic idea also provided the Stoics with a precedent for two of the prominent details of their cosmogony, namely that the cosmos was born out of water and that heat played an active role in the origin of the cosmos. The ancient Egyptian and Babylonian cosmogonies generally made the cosmos come into existence from water. This primeval sea, called Nun by the Egyptians and Nammu by the earliest Babylonians, was the first goddess; she brought forth other deities who represented other parts of the cosmos.[33] The same idea seems to lie behind Homer's statement that Ocean is the genesis of gods and all things (*Il.* 14.201, 246); and if Thales actually maintained that the earth came from the sea, he too may be reflecting this originally Near Eastern idea.[34] After Thales Greek cosmogonal speculation immediately moved away from this primitive idea in search of a more serviceable primeval substance from which the rest of the materials in the cosmos might come. Nevertheless, the basic feeling for the importance of water survived in the very widespread popular idea that the material of life is actually a fluid of the body.[35] From this idea the Milesian philosophers deduced a theory of the origin of living things. They seem to have thought that if life is a fluid, life must originate from a fluid; and consequently living things must have originated from something wet. Anaximander maintained that the first animals arose from the moisture on the earth's surface (DK 12 A 30). Anaxagoras (DK 59 A 1.9, 42.12), Democritus (DK 68 A 139), and, in a sense, Xenophanes (DK 21 B 29, 33) agreed.[36] The popular view that life resides in a fluid also developed along another line, giving rise both to myths such as those of Zeus impregnating earth with rain to bring forth crops,[37] and to the later scientific theories of the nature of the seed and the development of the embryo. But since this line of thought takes us out of the realm of ultimate origins into the realm of biology, we shall have to dismiss it for a moment and pick up another, related development.

It was obvious to the Greeks that dry earth could not bring forth crops; water is necessary for life. It also became apparent that even earth and water are not sufficient for life and growth; the warmth produced by the sun's rays is also necessary. Consequently, the Greeks began to see the importance of heat as an agent that cooperates with moisture to produce life. Anaximander and Anaxagoras gave the sun's heat a role in the production of living things from the moisture (DK 12 A 11.6, 30; 59 A 1.9). The zoogonies of Epicurus (fr. 333, Usener), Lucretius (5.805–806); and Diodorus (1.7.3–4[=DK 2, page 135]) all give heat an active role in producing life in the wet element. These zoogonies may well go back to the fifth century B.C.,[38] to the time at which Archelaus was saying the earth produced animals when it was warmed (DK 60 A 1, 4.5).

More important than the role of heat in zoogony is the role of heat in cosmogony. In the cosmogony of Anaximander the first step is the separation of "the generative of hot and cold." From this a sphere of fire forms around the air, and this fire produces the heavenly bodies (DK 12 A 10). The remainder of the cosmogony is accomplished by the agency of the heat from the newly formed sun. This heat dries up some of the water in the region of the earth and thereby produces dry land and seas (DK 12 A 27). It then produces wind and rain[39] and eventually, as we have already noted, animals and all living things.

Empedocles, too, gives fire the key role in his cosmogony. Fire initiates the original "whirl" (DK 31 A 30). Fire congeals some of the air at the periphery of the cosmos to make the solid dome of the heavens (DK 31 A 51). Fire is involved in the formation of rocks (DK 31 A 69), and fire is active in the production of living things (DK 31 B 62, 73).[40] Finally, the hot is the cosmogonal agent in Archelaus (DK 60 A 1.17, 4.2).

In viewing the origin of the cosmos as a birth and in giving water and fire important roles in this birth the Stoics were, in a sense, reviving the popular theories of a bygone era. They were bringing to life an idea that was too deeply embedded in the Greek consciousness to die out completely. To make these outmoded theories again respectable, they had to adapt and update them. This they did by explaining the cosmic birth in terms of a specific biological theory that had never before been given cosmic application. Fortunately, the Stoic accounts of the birth of the cosmos contain enough details to allow us to identify the biological theory behind their cosmogony.

The clearest detail that may be abstracted from the Stoic accounts is the precise nature of the seed. The Stoics clearly stated that the cosmic seed is more than mere fluid. They maintained that the wet is only the vehicle for the actual reproductive force. In the seminal fluid is something called variously seed (σπέρμα), *pneuma*, or soul, whose elemental character is hot.[41] One can infer that the Stoics believed male semen to consist of two components, water and an active seminal substance. The biological theory of their cosmogony is thus seen to be identical with their actual biological theory, for both Zeno and Chrysippus asserted that human semen (σπέρμα) is *pneuma* with moisture (πνεῦμα μεθ' ὑγροῦ, *SVF* 1.128; 2.741, 742). Properly speaking, the seed (σπέρμα) is the *pneuma* in the moisture; and according to Zeno's definition, this seed or *pneuma* is a fragment of the father's soul (*SVF* 1.128; 2.742; cf. 2.741). As in the cosmogony, the active force in the seminal fluid is seed (σπέρμα), *pneuma*, or soul.

Speculation about the nature and source of the semen was popular among the philosophers of the fifth century B.C.[42] The fluid nature of semen was, of course, obvious. In the Periclean Age the Pythagorean Hippon seems to have remarked on the wet nature of the semen (DK 38 A 3; cf. Arist. *De An.* 1.2.405b1–5[=DK 31 A 4]), and a late fifth-century Hippocratic writer deduced from this that semen is derived from the fluids of the body.[43] This same period also brought the recognition that the production of semen involves more than fluid. Sometime during the second half of the fifth century a theory was put forth that breath (*pneuma*) is the agent that causes the ejection of semen.[44] This theory, described briefly by Aristotle (*Gen. An.* 2.4.737b28–35), is referred to in a Hippocratic treatise, which probably comes from the latter part of the fifth century.[45] Diogenes of Apollonia gives the *pneuma* a much more sophisticated function in the production of semen. According to Diogenes the inhaled breath lightens or thins the blood to produce semen, which is the froth (ἀφρός) of blood joined with *pneuma*.[46] According to another version, Diogenes gives the innate heat of the male the function of producing the froth that is semen (DK 64 A 24). Both versions are probably authentic, for the soul-air that travels in the veins with the blood (cf. Simplic. *Phys.* 153.13–16, Diels[=DK 64 B 6]) is warmer than the inhaled air (DK 64 B 5). When a child is born, it contains innate heat; but it is not ensouled until it breathes. The inhaled breath tempers the innate heat, and the heat warms the breath.[47] Thus the soul-air that permeates the blood to form froth is warm air. That is why Diogenes can describe the semen as light, warm, and frothy (DK 64 B 6). Clearly in the view of Diogenes semen is more than mere moisture; it is also warm and contains air or breath.

There is a trace of a similar point of view in the Hippocratic author who was quoted earlier as saying the semen comes from the wet. This writer states that when the wet semen enters the warm womb, *pneuma* is produced (presumably by evaporation); and this *pneuma* forces its way out, making channels in the semen by which the cold, respired air of the mother may enter and nourish it (*De Nat. Puer.*[=*De Genit.*] 12 [7.487–88, Littré]). This *pneuma* does not seem to come from the father but to be generated by the heat of the mother. Nevertheless, the *pneuma* is connected with heat and is thought to be warmer than the outer air and tempered (or nourished) by the outer air. Thus in many respects it resembles Diogenes' idea of *pneuma* in the semen.

The theory of Diogenes of Apollonia had a decided influence on Aristotle.[48] Aristotle says: "Semen is a compound [κοινόν] of *pneuma* and water; and *pneuma*, in turn, is hot air. Semen is wet in nature, because it is made of water."[49] He explains the origin of the heat in the semen by saying that semen "has much hot *pneuma* because of the animal's internal heat."[50] Moreover, Aristotle makes it plain that the heat of the seminal *pneuma* is the most important constituent of the semen and is of a unique kind; for he says: "There is present in the semen [σπέρμα] . . . the substance called the 'hot.' This is not fire or some such power, but *pneuma* . . . and the natural substance [φύσις] which is in this *pneuma*, a substance analogous to the element of the stars" (*Gen. An.* 2.3.736b33–737a1).

It is obvious that the Stoic conception of semen is derived from Aristotle. Both consider semen to consist of *pneuma* mixed with moisture. In maintaining that *pneuma* consists of fire and air (*SVF* 2.310, 442, 841) the Stoics have converted Aristotle's description of *pneuma* (hot air) to one that spells out its elemental composition, but they certainly concur with Aristotle on its basic nature. Moreover, both of them may view the generative constituent of the semen either as this *pneuma*, or, alternatively, as heat. Finally both connect the heat of the semen with the element of the heavenly bodies. Aristotle does this by saying the semen's heat is analogous to the element of the stars; the Stoics not only admit that the *pneuma* is analogous to the *aether* (*SVF* 2.471), but when speaking of the cosmic seed, actually identify the divine fire with the semen's heat.

A second motif found in the Stoic cosmogony is the identification of the generative power, the heat or *pneuma*, with soul. This belief is in complete harmony with the general Stoic doctrine that the heat or *pneuma* of the body is its soul (*SVF* 1.134–41, 521; 2.773–87, 796, 879, 885). We cannot here go into the entire background of the Stoic doctrine of soul, but it is instructive to look at Aristotle's discussion of the relation of soul to the generative power in the seed. Aristotle devotes a long discussion to the question whether the seed contains soul. The discussion comes in the context of another question: By what is the embryo formed? He states the following alternatives: either the parts are formed by something external or by something present in the seed; and this is either some part of soul, soul itself, or something possessing soul (*Gen. An.* 2.1.733b31–734a1). After a lengthy discussion leading to an impasse and a new attack based on the potentiality-actuality distinction, Aristotle comes to the conclusion that semen possesses and is soul potentially (*Gen. An.* 2.1.735a4–9; cf. 2.3.737a16–18). Then after having discussed the nature and composition of the semen, he tackles the question whether the semen or any part of it enters physically into the embryo. Since he maintains that no part of the semen enters into the composition of the embryo, he must explain how the embryo comes to possess soul. In explaining how soul is transmitted from father to child through the seed he states: "Now the faculty [δύναμις] of every type of soul seems to participate in [κεκοινωνηκέναι] some material substance different from and more divine than the so-called elements; and as the types of soul differ in value, so also the nature of the associated material substance differs. For in every case there is present in the semen [σπέρμα] that which makes seeds in general [σπέρματα] fertile, namely the substance called 'the hot.' This is not fire or some such power, but the *pneuma* which is enclosed in the semen and froth, and the natural substance [φύσις] which is in this *pneuma*, a substance analogous to the element of the stars" (*Gen. An.* 2.3.736b29–737a1). Thus Aristotle brings the soul that exists potentially in the seed into connection with the *pneuma* or heat of the semen.[51] Here he says soul participates in (κεκοινωνηκέναι) the *pneuma*. On other occasions Aristotle brings soul into close connection with *pneuma* and the heat of the body, suggesting that these physical substances are tools of the soul.[52] It is only a short step to the Stoic view that completely identifies soul with the *pneuma* or heat in the seed.[53]

Another detail of the biological theory behind the Stoic cosmogony is the role of agent and matter, the Stoic *archai*. The fire or soul is related to the water as agent to matter. God acts upon the matter and makes it suitable (εὔεργον) for generation (*SVF* 2.580). This detail clearly reveals the Stoics to be in the shadow of Aristotle's biology. In Aristotle's theory the female supplies the matter for the embryo. This matter is the menstrual blood and so is considered wet. The male supplies a power that resides in the semen and that acts upon the wet matter supplied by the female, cooking it and thereby preparing it to be a new animal.[54] The Stoic statement could easily be a summary of the Aristotelian view. The most serious discrepancy is the role assigned to the female by the Stoics. In the cosmogonal passages (*SVF* 2.580, 622) the wet material upon which the generative agent works is the fluid vehicle of the male semen; it is not, as in Aristotle, supplied by the female. In the Stoic cosmogony, the female (Hera) is merely an agent inducing the production of the seed. At first sight this would appear to reflect the older biological theory that the female supplies only the place in which the embryo grows; but before drawing this conclusion, we must remember Chrysippus's interpretation of the erotic painting of Zeus and Hera. Chrysippus claims that Zeus represents god, and Hera, matter; so the painting represents the fact that matter receives the *spermatikoi logoi* of god (*SVF* 2.1074). This is obviously a variation of the theory of the cosmogony, where Zeus is the *spermatikos logos* left behind in the wet matter (*SVF* 2.580). Apparently the Stoics tried to incorporate into their cosmogony, not only the Zeus-Hera myths and artistic portrayals, but also the assumed etymological connection between Hera (ἥρα) and air (ἀήρ), a connection mentioned already by Plato (*Crat.* 404c). The result was that Hera received an inconsistent interpretation by the Stoics. In the cosmogonal testimonies Hera's position is determined more by the assumed etymology than by the biological theory, but Chrysippus's interpretation of the Zeus-Hera myths in a noncosmogonal context manifests the Aristotelian theory that the female supplies the matter. Therefore, even the role of the female does not argue against an Aristotelian influence on the biological theory behind the Stoic cosmogony.

If Aristotle's biology influenced Stoic cosmogony, it ought to be possible to find traces of Aristotle's theory of conception. This, after all, is the core of his theory of reproduction. Reduced to its simplest form, his theory maintains that the father through the semen gives movement and form to the matter supplied by the mother.[55] We have earlier observed that giving movement and form is the essential function of the *archai*. Now we must see whether the *archai* have this function in producing the cosmos. If we examine the cosmogonal accounts, we find no statement that god (the fire) moves the matter (the water); but the mythological version of the cosmogony states that god molds and models (πλάττει καὶ τυποῖ) the matter, just as the molding and fashioning (πλάττον καὶ δημιουργοῦν) *pneuma* in the semen does (*SVF* 2.622). Here, indeed, we find god giving form to the matter. Although the vocabulary of this late source cannot be pressed, we may at least observe that one of the words used of the *pneuma* is δημιουργοῦν, the very word that Aristotle uses of the male and his seed in reproduction (*Gen. An.* 2.4.738b9–21; 4.1.766a15, 4.771b18–23, cf. 772b31).

This single late source is rather weak evidence of an Aristotelian influence, so we must look a little deeper into the Aristotelian theory of reproduction. It is through the semen that the father gives form and movement to the female matter. Now the moisture of the material of the semen contributes nothing to conception; it is rather the power (δύναμις) in the semen that gives the movement and form to the matter (*Gen. An.* 1.21–22.729a34–730b32; cf. 2.3.737a7–22). Nature behaves as a craftsman and uses the seed as a tool that has movement and may through its movement bring form to the matter at hand (*Gen. An.* 1.22.730b5–32; cf. 2.4.738b11–13). The seed is set in motion by the father and continues in motion until it comes into contact with the matter. Then this movement causes the parts of the embryo to come to be and to become ensouled (*Gen. An.* 2.1.734b4–24).

Before comparing Aristotle's theory of reproduction with the Stoic theory, it is necessary to determine more precisely what Aristotle meant by movement and by form. The movement in question in these passages is certainly not local movement. Aristotle defines movement in general as the actualization of a potentiality (*ἡ τοῦ δυνάμει ὄντος ἐντελέχεια, ᾗ τοιοῦτον*, *Phys.* 3.1.201a10–11; cf. Bonitz 391a36–38). Accordingly the movement initiated by the father through the agency of the semen is the progressive actualization of the potentiality of the matter, i.e., the form of man. Thus when Aristotle says that the father through the semen moves and forms the matter of the mother, he does not mean that the father performs two distinct operations on the matter. Moving actually means producing form. This is why Aristotle can explain heredity on the basis of movement and can say that if the movement from the male gains the mastery completely, the child will be a male resembling his father; but if this movement fails to gain the mastery in some respect, the child will either be a female, resemble the mother, resemble an ancester, or show a combination of these characteristics (*Gen. An.* 4.3.767b15–769a6). Aristotle's entire theory of heredity is dependent on this principle, and this is possible only because movement means the actualization of form.

When we turn to Aristotle's notion of the form that is produced in matter in the process of reproduction, we again encounter a term whose meaning is fuller than one might at first think. Aristotle frequently calls form the formula or definition of a thing's essence (ὁ λόγος τῆς οὐσίας, e.g., *Gen. Corr.* 2.9.335b6–7; *Gen. An.* 1.1.715a4–7; cf. Bonitz 219a49–54, 434b13–53). The form of a living being involves much more than the sum total of the physical qualities of its parts. That is why Aristotle says that the movement causes the parts to come to be and to become ensouled. If they did not come to have soul, they would be like the face and flesh of a corpse (*Gen. An.* 2.1.734b22–27; cf. *Gen. An.* 1.19.726b22–24; *De An.* 2.1.412b10–413a3). Aristotle then explains: "Heat or cold alone can produce qualities such as hardness, softness, toughness, and brittleness in the ensouled parts, but it cannot produce the *logos* by which one thing is flesh and another bone; this is produced by the movement which comes from the father, who is in actuality what the material from which the embryo comes is potentially" (*Gen. An.* 2.1.734b31–36). What the power or movement of the semen gives to the matter is more than physical qualities; it is a formula that includes the life and activity that each part must have to deserve its name. This formula of the living body is the soul (*De An.* 2.1.412b10–413a3). Aristotle has many names for the soul, all expressing the same conception. He calls it "the form of a physical body which potentially has life," "the actuality [ἐντελέχεια] of the body," "the substance according to the definition" (ἡ οὐσία ἡ κατὰ τὸν λόγον), "the essence" (τὸ τί ἦν εἶναι), or simply "the *logos*" of a body (*De. An.* 2.1.412a19–b17, cf. 2.414a12–14, 27–28, 4.415b12–15). Since the seminal movement carries with it the form, *logos,* or soul for the matter, Aristotle goes on to say that potentially the semen both possesses soul and is soul (*Gen. An.* 2.1.735a4–9).

Thus Aristotle's theory of reproduction involves a complex interplay of many concepts: movement, form, potentiality, actuality, essence, *logos*, soul, and, as we saw earlier, also heat, *pneuma,* and the substance analogous to the element of the heavens. The nuances of meaning accompanying all these concepts were carefully distinguished by Aristotle, but even he had to admit that there is a degree of overlapping among them. Referring to the factor of the male that gives form to the matter of the female, Aristotle says: "It makes no difference whether we say 'semen' or 'movement which causes each of the parts to grow,' nor whether we say this movement is one 'which causes to grow' or 'which constitutes from the beginning.' The *logos* of the movement is the same" (*Gen. An.* 4.3.767b18–20).

Returning to the Stoic cosmogony, we find it contains many of the concepts that Aristotle used in his theory of reproduction; but instead of being differentiated, they are virtually identified. We have already observed that the Stoics identified the generative factor in the semen with soul, heat, and *pneuma*. Now we must examine still another concept associated with the generative factor, namely the *spermatikos logos;* for in the cosmogony god is left behind in the water as the *spermatikos logos* of the cosmos (*SVF* 2.580), and the Zeus-Hera painting represents the matter receiving the *spermatikoi logoi* of god in itself for the ordering of everything (*SVF* 2.1074).

Stobaeus's summary of Cleanthes' account of the cosmogony makes the nature of the *spermatikoi logoi* slightly clearer. After describing the cosmogony, the account states: "As all the parts of a thing grow from seeds at the proper times, so also the parts of the universe . . . grow at the proper times; and as certain *logoi* of the parts come together and are mixed in seed and then again are separated, and the parts come into existence, so also all things [i.e., the cosmos] come from one [i.e., the primeval fire]" (*SVF* 1.497). According to Aëtius, one Stoic definition of god is "a creative fire, proceeding along the road toward generating a cosmos, embracing all the *spermatikoi logoi* according to which individual things come to be by fate" (*SVF* 2.1027). The nature of the *spermatikoi logoi* becomes still clearer when we turn to Stoic biology. The Stoics recognized that "seed is that which is capable of generating things of the same sort as that from which it is separated" (*SVF* 2.741, cf. 742). Zeno explained the phenomenon of heredity by saying that "the seed is a part or fragment of the soul . . . and contains the same *logoi* as the whole [i.e., the living being from which it came]" (*SVF* 1.128). Finally *physis*, which means both nature and growth, is said to have been described by the Stoics as "an inflation [ἐμφύσησις] and expansion [διάχυσις] of the *logoi* and numbers which are opened and loosed by nature" (*SVF* 2.744). All these descriptions make it clear that the *spermatikos logos* is a formula in the seed, according to which the emergent offspring takes its shape. In addition to guiding the embryological development of the living being, it also controls the form and activities of the fully developed animal. The soul is moved according to *spermatikoi logoi* (*SVF* 2.780); and the physical soundness of a hand, health, perception, and strength are examples of "shapes and movements according to the *spermatikoi* *logoi*" (*SVF* 3.141). Thus the *spermatikoi logoi* in the cosmos or any other living thing are the formulas or principles contained in the seed of any thing that determine what it shall be and how it shall behave during its life.

The concept of a formula (or formulas) governing the development, form, and activity of the cosmos and all living things in the cosmos is surely a Stoic appropriation of the Aristotelian concept of the same name, the *logos*.[56] As we have seen, Aristotle viewed the seed and its movement as an agent in transmitting the formula or *logos* of the offspring, the formula that defines also the nature, life, and activity of the body and is, in fact, the soul of the body. This formula, which comes through the seed and, in a sense, is present in the seed, the Stoics gave the name *spermatikos logos* or "seminal formula." In Aristotle they found it in the circle of ideas that clustered around the generative factor of the semen, including soul, heat, and *pneuma*. This context made it easy for the Stoics to identify the *spermatikos logos* with the active principle, god, in one account of the cosmogony (*SVF* 2.580). On the other hand, its Aristotelian function as the form imposed on matter by the father made possible the Stoic statement that god introduces *spermatikoi logoi* into matter to order all things (*SVF* 2.1074) and that god embraces the *spermatikoi logoi* according to which all things come to be (*SVF* 2.1027). Thus the Stoics not only have incorporated into their cosmogony a few details from Aristotle's theory of generation, but they have in their idea of the *spermatikos logos* taken over an important part of Aristotle's explanation of conception (the moving and forming of matter by the father), which is actually the core of his entire theory of reproduction.

There is still another aspect of the Stoic cosmogony that can be pressed for biological precedents. When the matter of the cosmos has reached the water or semen stage, the embryo of the cosmos comes into existence. Presumably under the action of the fire left behind in the wet matter, the heavier material settles together and produces earth. The words used to describe the process by which earth comes from the fluid are ὑφίστασθαι, συνίστασθαι, συνίζεσθαι, πήγνυσθαι, and στερεμνιοῦσθαι. These words sound like descriptions of physical processes; but when we look at the ancient descriptions of the formation of an embryo, we find this same vocabulary; and what is even more important, we find that the first stage in development is the production of solid material from fluid under the action of heat.

Accounts of embryogony are found in Aristotle and the Hippocratics. Aristotle's simple account comes closest to the Stoic cosmogony. Aristotle says that semen containing vital heat leads the similar into one and "sets" (συνίστησι) it.[57] When the corporeal matter (σωματώδους) has collected together (συνιόντος), the wet separates off around it; and when the earthy (γεηρῶν) has dried, a membrane encircles it.[58] The Hippocratic treatise *On Regimen* says that fire moving in the wet dries out the water and causes solidification on the outside. The imprisoned fire then uses up the moisture in the inside, and the remaining dry matter becomes bones and sinews. The account adds that the water in the belly comes together (συνισταμένου), becomes compacted (πήγνυται), and is called flesh (*De Victu* 1.9 [6.482–84, Littré]). The Hippocratic treatise *On The Nature of the Child* contains a lengthy description of the development of the embryo. The seed of the mother and father are mixed together; this seed collects and, when heated, is thickened (*De Nat. Puer.*[=*De Genit.*] 12 [7.486, Littré]). The material is then increased by the mother's blood; and when this blood is compacted (πηγνυμένου), it becomes flesh (*De Genit.* 15 [7.492, Littré]). When the flesh has increased, it is differentiated and each part takes on a homogeneous character, part dense, part light, and part wet. Then each comes to its own proper place corresponding to the part from which it originated. So whatever came to be from dense is dense, and that from wet is wet, and so on. Then the bones, being compacted (πηγνύμενα) are hardened (σκληρύνεται) by the heat (*De Genit.* 17 [7.496–98, Littré]). Thus the first stage in the Stoic differentiation of elements is parallel to the first stage in the formation of the embryo. The solid material solidifies from the wet under the action of the heat. In Aristotle some water remains to surround the solid material, as it does in the Stoic cosmogony.

The second stage in the Stoic cosmogony, the evaporation of air from the wet, finds less clear parallels in embryogonal accounts; but the account in *On the Nature of the Child* does say that after the heated seed has been thickened, the heat causes *pneuma* to be given off (*De Nat. Puer.*[=*De Genit.*] 12 [7.486, Littré]). Aristotle does not mention vaporization as a process in the formation of the embryo of viviparous animals, but he does mention it as a process that occurs in the growth of fish eggs. Fish eggs are said to grow in the same manner as insect larvae or yeast; the solid becomes wet and the wet becomes *pneuma* (πνευματουμένου, *Gen. An.* 3.4.755a14–21). Even though the parallel between Stoic cosmogony and traditional embryogony weakens in the second stage and breaks down completely in the third stage of the Stoic cosmogony, the stage in which air is changed to fire, the strength of the parallel in the first stage (the formation of earth) is not diminished. It was inevitable that the Stoics would be forced to abandon the analogy between cosmogony and embryogony at some point. What is remarkable is that they maintained it as extensively as they did.

The parallels that we have traced between the Stoic cosmogony and Greek biological theories, in particular those of Aristotle, are too great to be coincidental. They can only be due to a deliberate attempt on the part of Zeno and his followers to portray the origin of the cosmos as the birth of a living animal, and to make this birth conform to Aristotle's biological theories in as many details as possible. Apparently the Stoics viewed the origin of the cosmos under two aspects, the physical and the biological, both of which had precedents. Their originality lay in combining a particular physical theory (the theory of four mutually convertible elements) with a particular biological theory (the Aristotelian) to produce an original cosmogony.

The originator of this synthesis was most likely Zeno. The physical theory of the origin of the cosmos is unambiguously attributed to him by Stobaeus, and Diogenes Laertius cites Zeno along with other Stoics as exponents of this view (*SVF* 1.102, cf. 104, 105). Although the biological aspect of the cosmogony is embedded in a summary that Diogenes assigns in common to a number of Stoics (*SVF* 1.102) and therefore may or may not go back to Zeno, the biological theory behind the cosmogony conforms in detail to the biological theory of the seed explicitly assigned to Zeno (*SVF* 1.128). What is more important, the doctrine of the *archai* of the cosmos, which we have seen had its roots in Aristotle's theory of reproduction,[59] was certainly originated by Zeno (*SVF* 1.85). Therefore, we can feel fairly safe in assigning the biological aspect as well as the physical aspect of the cosmogony to Zeno himself. So it must have been Zeno who integrated the two aspects into a coherent account and thereby gave birth to the Stoic theory of the origin of the cosmos.

If synthesis of physical and biological theories is the fundamental principle that determined the genesis of Stoic cosmology, hardly less important is the principle of harmonization of predecessors. Even the little we have seen of the origins of Stoic cosmology suggests that Zeno's aim was not to blaze new trails, but to give his assent to established beliefs.[60] To support his belief that he was following the *consensus omnium,* he had to do a considerable amount of harmonization. One way in which he harmonized the cosmogonies of his predecessors was by allegorization. For example, Zeno allegorized Hesiod's *Theogony* 116–20 to correspond to his own cosmogony. For this purpose Hesiod's cosmogony was fairly convenient: "First of all Chaos came to be, and then broad-breasted earth . . . and airy [ἠερόεντα] Tartaros . . . and also Eros." Zeno derived the word χάος from χέεσθαι and hence understood it to mean water (*SVF* 1.103, 104). Eros he allegorized as fire, since love is a fiery passion (*SVF* 1.104). If then "airy Tartaros" is interpreted as air (cf. *SVF* 2.430, 563), Hesiod presents the cosmogonal sequence as water, earth, air, and fire.[61] This is precisely the sequence found in the Stoic cosmogony, if we overlook the preliminary transformation of fire into water. Zeno could argue that even so revered a sage as Hesiod supported the Stoic cosmogony.

When Cleanthes took over the leadership of the Stoa from Zeno, he also took over Zeno's doctrine to a large extent. The reconstruction of Cleanthes' cosmogony involves immense problems, for we must rely on a single obscure fragment in Stobaeus (*SVF* 1.497). But this fragment in Stobaeus makes it sufficiently clear that Cleanthes carried on Zeno's biological conception of the origin of the cosmos. According to Stobaeus, Cleanthes reasoned that "just as all the parts of a thing grow from seeds at the fitting times, so the parts of the universe [τὸ ὅλον] grow at the fitting times; and as *logoi* of the parts collect together into a seed . . . and are again separated when the parts come into existence, so from one all things come to be, and from all one is combined."

The physical aspect of Cleanthes' cosmogony is lost under the unintelligible and probably mistaken account of Stobaeus. Only by a speculative reconstruction can any statements be made about Cleanthes' cosmogony.[62] According to my own hypothetical reconstruction Cleanthes followed Zeno's basic cosmogonal scheme, but he elaborated on it to introduce a number of new motifs, the principle of which was symmetry. One of the symmetries he found in the cosmogony was the biological contrast between seed and mature animal. Another symmetry was between the one and the many. Cleanthes maintained that the primeval fire is the seed and is one in substance; the world is the mature offspring of the seed and is many in that it contains four elements.[63] Not only did he see contrasts between the initial and the final state of the cosmogony, but he seems to have viewed the cosmogony as a cyclical process in which one half balances the other. The process begins with all cosmic matter in the form of fire. This fire is transformed into air, the air into water, and finally the water into earth, in a process proceeding from the peripheral to the central element. In the second half of the cosmogony the process is reversed, and there is a transformation from earth up to fire. Cleanthes may have used much of the language of Zeno's asymmetrical cosmogonal transformation, but in it he saw a new symmetrical process, a process in which a single element, fire, through a series of transformations moves quasi-locally in a downward direction to earth and then, changing direction, moves upward toward fire.[64] In conformity with the notion of quasi-local elemental movement, Cleanthes probably introduced also the motif of contraction and expansion. As the fire is transformed in the direction of earth, it contracts in size and increases in density; then when it has reversed its direction and is proceeding up again toward fire, it expands. This cyclical process of contraction and expansion, of condensation and rarefaction, seems to have been called "tension" (*tonos*) by Cleanthes. If this reconstruction is trustworthy, we may say that in cosmogony Cleanthes was, at heart, a faithful, but not slavish, follower of Zeno. Keeping the basic framework, he could still find fresh approaches to the theory of the origin of the cosmos.

Cleanthes seems also to have pushed forward Zeno's search for predecessors. Whether at Zeno's suggestion or on his own initiative, Cleanthes called attention to the remarkable support that Heraclitus could give to Stoicism. He wrote four books of *Interpretations of Heraclitus* (*SVF* 1.481) and his well-known *Hymm to Zeus* is saturated with Heraclitean phrases.[65] One fragment of Cleanthes survives in which he cites Heraclitus as the inspiration for Zeno's doctrine of soul.[66] The reason for mentioning Cleanthes' interest in Heraclitus is that there may be a connection between Cleanthes' interest and the well-known passage from Clement of Alexandria (*SVF* 2.590). This passage, obviously taken from a Stoic book, has preserved two fragments of Heraclitus pertaining to the transformation of fire (DK 22 B 30, 31); and these two fragments are interpreted in such a way that they seem to conform to the Stoic cosmogony. It is quite possible that the inspiration for interpreting these statements of Heraclitus as support for the Stoic cosmogony originally came from Cleanthes' *Interpretations of Heraclitus;* and so Cleanthes may have added Heraclitus's name to the growing list of ancient sages who purportedly supported the Stoic cosmogony.

Since Cleanthes found in Heraclitus support for the Stoic cosmogony, it is possible, and even probable, that his own version of the cosmogony was influenced by Heraclitus. Heraclitus's stress on the balance between opposites[67] may have been what prompted Cleanthes to introduce the many symmetries that seem to be present in his cosmogony. Heraclitus's statement about "the way up and down" (DK 22 B 60), which regardless of its meaning to Heraclitus himself was taken by Theophrastus and sometimes by others in antiquity to refer to elemental change,[68] may have inspired Cleanthes to view the elemental changes of the cosmogony as quasi-local movements of fire. Thus Cleanthes, in addition to quoting Heraclitus as a forerunner of Stoicism, may actually have introduced some Heraclitean elements directly into his own philosophy.

Chrysippus, coming after Cleanthes, had both Zeno and Cleanthes to draw upon; and in cosmogony he seems to have done just that. In his *Physics* he followed Zeno's asymmetrical version of cosmogony (*SVF* 2.579, 580, 581), and Stobaeus preserves a summary of Chrysippus that indicates he also made use of Cleanthes' symmetrical approach. In this fragment Chrysippus considers fire the basic element, which by transformation produces all the other elements. Like Cleanthes, he sees contraction and expansion as the process behind elemental change: "The first change is from fire to air by contraction, the second from air into water, and the third when water contracts still more into earth. Then again, from earth, dissolved and liquefied, there is first a pouring [χύσις] into water; then a second pouring from water into air and a third and last into fire." Although it is not clear from this whether Chrysippus is referring to cosmogony or ordinary elemental transformation, a subsequent sentence suggests he is referring to cosmogony, since he calls the fire "the eternal power which has such a nature so that it moves itself down toward the turning point [τροπή] and from the turning point up in a complete cycle, absorbing all things into itself and reestablishing all things again from itself in an appointed order."[69] If our hypothetical reconstruction of Cleanthes is correct, Chrysippus must here be following Cleanthes closely. Cleanthes' influence is seen not only in the motif of contraction and expansion but in the symmetrical transformation from fire to earth and back to fire again, and in the description of the changes of fire in terms of local motion, so that fire moves down to a turning point and then moves up again. Thus on the physical side of the cosmogony Chrysippus seems to have carried on the formulations of both Zeno and Cleanthes.

Chrysippus also continued to see cosmogony in biological terms. The fragment that displays the biological side of the Stoic cosmogony (*SVF* 2.580) is assigned by Diogenes to Chrysippus as well as to Zeno. We have also mentioned that Chrysippus allegorized the Zeus-Hera myths in terms reminiscent of the biological view of cosmogony (*SVF* 2.1074). Finally, Chrysippus spoke of the fire of the conflagration as the seed of the future cosmos (*SVF* 2.618, cf. 596). Whether the biological side of the Stoic cosmogony underwent any modifications during the third century, as the physical side seems to have done, is not known because of the meagerness of the fragments. Then, too, Chrysippus carried forward the search for precedents by allegorizing large numbers of myths (cf. *SVF* 2.1067, 1069, 1077, 1078), including the Zeus-Hera myths to which we have so frequently referred (*SVF* 2.1071–1074).

When Zeno formulated the Stoic cosmogony, he was guided by the fundamental conviction that the cosmos is a living animal and was born in the manner of living animals. This idea was not original with him; in fact, it was very ancient; but recent philosophical thought had tended to minimize it, preferring a mechanistic (pre-Socratic) or a technological (Plato) model to explain the origin of the cosmos, or else denying that the cosmos had an origin at all (Aristotle). It was Zeno who gave the idea of a cosmic birth a new lease on life. He accomplished this by synthesizing what he considered the most reasonable cosmological theory of the day with the latest theory of reproduction, namely, that of Aristotle. Though Zeno's successors may have modified some of the details of Zeno's doctrine, the basic synthesis survived to become the orthodox Stoic doctrine of the origin of the cosmos.

1. *SVF* 2.579. All MSS except one say that this fragment is from the third book (*τρίτῳ*), but modern editors seem to agree in reading *πρώτῳ* (cf., e.g., M. Pohlenz, ed., *Plutarchi Moralia*² [Leipzig, 1959], vol. 6.2, page 48). The reason for reading *πρώτῳ* is that Diogenes Laertius gives an account found in the first book of Chrysippus's *Physics* that is nearly the same as this (*SVF* 2.580). Moreover, the fragments suggest that the third book had an ethical orientation (*SVF* 2.636; 3.153, 526, 760). The reading *πρώτῳ* may well be correct, but we must at least be aware that this summary sentence may actually have been found in the third book. The first book probably contained a more detailed cosmogonal account, and it is possible that Chrysippus included in Book Three a summary of the conclusions he reached in Book One. Aristotle could furnish many parallels for the practice of giving brief summaries of results reached in other books. We should note that Book Three included at least one mention of a physical subject, for *SVF* 2.479 informs us that Chrysippus talked about the doctrine of mixture in Book Three.

2. That all the fire has been transformed and only water can now be seen may be inferred from Diog. Laert. 7.136 (=*SVF* 1.102=2.580), who says that *τὴν πᾶσαν οὐσίαν* becomes water (cf. also *SVF* 2.590, 622). Even more conclusive is Seneca *QNat* 3.13.1: "For we say that it is fire which lays hold of the cosmos and turns all things into itself; this, slackening, settles together and nothing else is left in the nature of things, when fire has been extinquished, but water; in this lies the hope of the future cosmos." See also *SVF* 2.565 (cf. 436), where it is stated that the elements come from water. Plutarch preserves a verbatim fragment of Chrysippus that states, "The cosmos being fiery throughout . . . changes into water" (*SVF* 2.605). This fragment actually expresses a much more complex idea (see below); but it also implies that if an observer existed, he would *see* only water.

3. *SVF* 2.582, which states that the genesis of the cosmos began at the center with earth, perhaps refers to the fact that the actual differentiation of elements began at the center with earth.

4. *κατὰ σύστασιν* and *διαλυομένης καὶ διαχεομένης*, or *χύσις* in *SVF* 2.413; *λεπτυνομένου*, *SVF* 2.579. The process of elemental change is referred to several times in the Stoic sources, but there is no agreement about its precise nature. Plutarch refers to it as change in density (*παχυνόμενον*, *SVF* 2.605); Philo as contraction (*στέλλεσθαι*, *συνάγεσθαι*) or increase in density (*παχύνεσθαι*, cf. *πυκνότατον*) and the opposite process as dissolution (*ἀναλύεσθαι*, *διαλύεσθαι*, *χεῖσθαι*, *SVF* 2.619); Athanasius as contraction and expansion (*συστέλλεσθαι* and *ἐκτείνεσθαι*, *SVF* 2.615); and finally, Galen as *χύσις* and *πίλησις* (*SVF* 2.406). This may indicate that the Stoics never spelled out the precise nature of elemental change.

5. Thales, from water (DK 11 A 1.27, 12, 13); Anaximander, from the Infinite (DK 12 A 9, 10, 11.1–2, 14, cf. 1.1); Anaximenes, from air (DK 13 A 5, 7, 8); and Heraclitus, from fire (DK 22 B 90, cf. 30, 31).

6. DK 22 B 30, 31, 90. The unsolved question is whether fire was the primary element only in importance (G. S. Kirk, *Heraclitus: The Cosmic Fragments* [Cambridge, 1954], 307–38; W. K. C. Guthrie, *History of Greek Philosophy* [Cambridge, 1962–69], 1.454–59; M. Marcovich, *Heraclitus: Greek Text with a Short Commentary* [Merida, 1967], 259–304), or also in time (C. H. Kahn, *Anaximander and the Origins of Greek Cosmology* [New York, 1960], 225–26; R. Mondolfo, "The Evidence of Plato and Aristotle relating to the Ekpyrosis in Heraclitus," *Phronesis* 3 [1958]:75–82). (These are only some of the most recent proponents of each view; Kirk, 335–36, cites the more important earlier discussions.)

7. Empedocles, DK 31 B 8, 9; Anaxagoras, DK 59 B 17; Democritus, DK 68 A 1.44, 37, 57. Cf. F. M. Cornford, *Plato and Parmenides* (London, 1935; reprinted, New York, 1957), 53–56.

8. *Tim.* 53d–e, 54b–d, 56c–57c, cf. 49b–d. See F. Solmsen, *Aristotle's System of the Physical World: A Comparison with his Predecessors*, Cornell Studies in Classical Philology 33 (Ithaca, N.Y., 1960), 20–24, 52–57.

9. *Gen. Corr.* 2.1.329a35–b1, 4.331a12–23; cf. *Cael.* 3.2.302a3–4, 6.304b23–305a32; *Meteor.* 1.3.339a36–b2. See also Solmsen, *Aristotle's System* (above, note 8), 327–30, 336–42.

10. The problem has been much discussed, but not yet settled. Kahn (above, note 6), 225, note 2, makes the significant point that "there is no good evidence that Heraclitus denied the most fundamental tenet in all early Greek thought: that the universe undergoes a process of generation and growth comparable to that of living things." Aristotle, who sought precedents for his doctrine that the cosmos is eternal, did not feel justified in assigning eternity to Heraclitus's cosmos except in an unusual sense (*Cael.* 1.10.279b14–17, 280a11–23; see below, Chapter 6). On the other hand, when the Stoics wished to cite Heraclitus as a forerunner of their own doctrine, the best testimony they could find was B 30 and 31. B 31 does not sound at all like a cosmogony, and B 30 is so worded that opposite conclusions can be drawn from it (cf., e.g., Kirk, *Heraclitus* [above, note 6], 307–24, and Kahn [above, note 6], 225). Even in antiquity opinion was divided, for though Aristotle and the Stoics thought Heraclitus believed in a generated cosmos, Aëtius 2.4.3(= DK 22 A 10) and Plutarch *Def. Or.* 12 (415f–416a) seem to have held the opposite view. The applicability of Plato *Soph.* 242d–e is disputed (cf. Kahn, 226), though, if applicable, it suggests Plato thought Heraclitus's cosmos to be eternal (cf. Kirk, 321, 336–37). One is inclined to suspect that Heraclitus wrote no clear cosmogonal account, nor clearly denied that the cosmos is generated, but rather stressed the nature of the present-day cosmos and man's proper relationship to it.

11. This observation has been made by many, e.g., É. Bréhier, *Chrysippe et l'ancien stoïcisme*[2] (Paris, 1951), 142–44; R. D. Hicks, *Stoic and Epicurean* (New York, 1910), 30–31; A. C. Pearson, *The Fragments of Zeno and Cleanthes* (London, 1891), 102; M. Pohlenz, *Die Stoa: Geschichte einer geistigen Bewegung*[3] (Göttingen, 1964), 1.78; E. Zeller, *Stoics, Epicureans, and Sceptics*, trans. O. J. Reichel (London, 1880), 161.

12. DK 60 A 1.17; cf. A 4.2. This presumably pertains to the cosmogony, but the text is corrupt and involves some difficulties. See Guthrie, *HGP* (above, note 6), 2.342 and note 1.

13. *SVF* 2.581 states that "from fire the substance is turned [τροπῇ] through air into moisture." This may reflect the same point of view as *SVF* 2.580 but with the motive cause, god, removed, and the original elemental condition of the substance (fire) spelled out. Notice that the verb has been changed from active to passive.

14. J. Moreau, *L'âme du monde de Platon aux Stoïciens* (Paris, 1939), 166–70, discusses briefly the embryological point of view of the Stoic cosmogony.

15. *SVF* 2.1074. The allegorization of Zeus-Hera myths seems to have been a favorite subject of Chrysippus. We are told he allegorized not only this episode depicted in a painting in Samos but also another depicted in a statue group at Argos

(*SVF* 2.1072, 1073). Moreover, his allegorizations were found in at least two works, *On the Ancient Natural Scientists* and *Erotic Epistles* (*SVF* 2.1071, 1072).

16. A thorough survey of this view down to the time of Aristotle can be found in G. E. R. Lloyd, *Polarity and Analogy: Two Types of Argumentation in Early Greek Thought* (Cambridge, 1966), 232–72.

17. Ovid *Met.* 1.381–394. Many of the myths dealing with Mother Earth and earth-born peoples are recounted by W. K. C. Guthrie, *In the Beginning* (London, 1957), 21–28.

18. Anaximander was the first we know to express himself on the origin of life. He states that life arose in the moist places of the earth (DK 12 A 30, cf. Kahn [above, note 6], 110–11). He seems to have been followed by Xenophanes (DK 21 B 29, 33). Empedocles says that the whole-natured forms that produced men arose from earth (DK 31 B 62.4, 73; cf. A 75), and Archelaus too maintained that the first living things came from earth (DK 60 A 1.17, 4.5). The cosmogony of Diodorus Siculus 1.7.3–4 (= DK 2, page 135), which probably goes back to the fifth century (cf. Guthrie, *In the Beginning*, 35–38; 122, note 10; *HGP* [above, note 6], 2.210, note 1, for discussion and bibliography), says that the first living things came into existence in membranes out of the primeval mud. This idea, which came from Anaximander and is found also in Hipp. *De Carn.* 3 (8.586, Littré), was carried on by the Epicureans, who concluded from this that the earth is rightly called mother (Lucr. 5.793–820). Plato says that the seed for the first Athenians came from earth and Hephaestus (*Tim.* 23d–e; cf. *Critias* 109c–d) and the first animals were born of earth (*Polit.* 271a–c, 274a). He also states that woman in her ability to reproduce imitates earth (*Menex.* 238a). Aristotle admits that earth is rightly called mother (*Gen. An.* 1.2.716a15–17) and uses his theory of spontaneous generation to show how men could have been born from the earth (*Gen. An.* 3.11.762b28–763a24), though he does not commit himself to the theory that men actually were earth-born. The Stoics said that the first men were born from the earth with the aid of the divine fire (*SVF* 1.124). In general cf. Guthrie, *In the Beginning*, 29–45.

19. W. Kranz, "Kosmos und Mensch in der Vorstellung frühen Griechentums," *NGG*, Phil.-hist. Kl., Fachgruppe I, vol. 2 (1938), 121–61, attempts to trace the origin of this view to sixth-century Persia, but questionable assumptions vitiate much of his argument. Cf. J. Mansfeld, *The Pseudo-Hippocratic Tract* ΠΕΡΙ ἙΒΔΟΜΑΔΩΝ *Ch. 1–11 and Greek Philosophy*, Philosophical Texts and Studies 20 (Assen, 1971), 25–26, 56–65.

20. At some time two Hippocratic works named earth, water, air, moon, sun, stars, and the outer firmament as the cosmic analogues of flesh and bones, blood and bodily fluids, breath, the diaphragm, internal heat, hypodermic heat, and the skin respectively. See esp. *De Hebd.* 6 (Greek text in Kranz [above, note 19], 122–24) and *De Vict.* 1.10; cf. 4.89 (6.484–86, cf. 644–646, Littré). Kranz, 121–35, dates these works shortly after 500 B.C., but various dates down to Hellenistic times have been proposed; see Mansfeld (above, note 19), 16–31, 229–31, and 25, note 116.

21. *Phys.* 8.2.252b24–27. Aristotle attributes this use of analogy specifically to Empedocles, saying that Empedocles saw Love and Strife in operation among men and extrapolated these forces to the cosmos (*Phys.* 8.1.252a27–31).

22. In *Cael.* 2.2.285a29–30 he says that the *οὔρανος* is *ἔμψυχος* and in *Cael.* 2.12.292a20–21 he adds that the stars partake of life. Aëtius 2.3.4 says that Aristotle

believed only the celestial region of the cosmos to be ensouled. This suggests that even the doxographers, who had access to Aristotle's published works, did not know of a discussion in which Aristotle emphasized the presence or activity of soul throughout the cosmos. However, we cannot rule out the possibility that the doxographers may have missed something. Cf. the warning of Solmsen, *Aristotle's System* (above, note 8), 244, note 73, against overworking the unique statement of *Cael.* 2.2.285a29–30. Vitalist conceptions in Aristotle's cosmology are discussed at greater length by Lloyd (above, note 16), 257–65.

23. Some of the Egyptian cosmogonies describe how the god Atum-Re generated the parts of the cosmos from his own seed; cf., e.g., J. B. Pritchard, *Ancient Near Eastern Texts Relating to the Old Testament*² (Princeton, 1955), 5, 6; and *Pyramid Text 1248*. Egyptian cosmogonal accounts are summarized by J. A. Wilson in *The Intellectual Adventure of Ancient Man*, ed. H. Frankfort (Chicago, 1946), 50–61 (=*Before Philosophy* [London, 1949], 59–70). In Sumerian mythology the goddess Nammu (the primeval sea) gave birth to An (sky-god) and Ki (earth-goddess); An and Ki gave birth to Enlil (air-god), and so forth (S. N. Kramer, *Sumerian Mythology* [Philadelphia, 1944], 73–75). *Enuma elish*, a later Babylonian cosmogony, describes the parts of the cosmos as deities begotten of the three primeval water deities, Apsu, Mummu, and Ti'amat. Cf. T. Jacobsen in Frankfort (above), 184–87. On the earliest Egyptian and Babylonian cosmogonies in general, see S. A. B. Mercer, *Earliest Intellectual Man's Idea of the Cosmos* (London, 1957), 88–90.

24. DK 1 B 12, 13. The age of these so-called Orphic cosmogonies is disputed. W. K. C. Guthrie, *The Greeks and Their Gods* (London, 1950), 307–19, thinks they go back to the sixth century B.C.; I. M. Linforth, *The Arts of Orpheus* (Berkeley, 1941), thinks most Orphic writings were composed after 300 B.C.

25. DK 1 B 13. The egg motif may be traced back as far as the cosmogony of Aristophanes *Av.* 693–703. Its origin is uncertain. Cf. G. S. Kirk and J. E. Raven, *The Presocratic Philosophers* (Cambridge, 1957), 42–48.

26. DK 7 B 1, 2, 3; A 9–11 are the relevant texts, but their meaning is by no means clear. Cf. the attempts at interpretation by Kirk (above, note 25), 60–62, and M. L. West, "Three Presocratic Cosmogonies," *CQ*, n.s. 13 (1963): 157–72.

27. Cf. Kahn (above, note 6), 57, 86–87, 156 (and note 1), and Lloyd (above, note 16), 234–35. The embryological terms in this fragment are also discussed by H. C. Baldry, "Embryological Analogies in Pre-Socratic Cosmogony," *CQ* 26 (1932):29–30. As Kahn, 57, says, even if the wording of this fragment is more recent, the basic ideas, including the embryological viewpoint, go back to the Milesians (Guthrie, *HGP* [above, note 6], 1.90–91, agrees). Kirk (above, note 25), 132–33, is more sceptical of the value of this fragment for proving that Anaximander had the embryological analogy in mind, but even he admits that he would not be surprised "to find that Anaximander resorted to the old mythological medium of sexual generation" in his cosmogony.

28. DK 58 B 26, 30. Cf. Theon of Smyrna 97.17–20, Hiller. The passages are translated and discussed in Guthrie, *HGP* (above, note 6), 1.276–81. Guthrie argues that this idea must be early, because what is inhaled in respiration is still thought to be "void."

29. F. A. Wilford, "Embryological Analogies in Empedocles' Cosmogony," *Phronesis* 13 (1968):108–18. On the translation of φύσις as birth in DK 31 B 8, see Guthrie, *HGP* (above, note 6), 2.140, note 1.

30. Cf. G. Vlastos, "The Physical Theory of Anaxagoras," *PhilosRev* 59 (1950):32–41.

31. Lucr. 1.58–60; cf. C. Bailey, *The Greek Atomists and Epicurus* (Oxford, 1928), 343–44. Bailey thinks that Epicurus himself used the word "seed," not of an individual atom but of a nucleus of atoms so constituted as to be specially adapted for the creation of a particular thing, be it organic or inorganic.

32. See above, Chapter 2, note 57.

33. See references in note 23.

34. Cf. U. Hölscher, "Anaximander und die Anfänge der Philosophie," *Hermes* 81 (1953):385–89, and Guthrie, *HGP* (above, note 6), 1.58–61. The Orphic view described by Athenagoras should also be compared: "For water was the origin for all things" (DK 1 B 13).

35. Cf. R. B. Onians, *The Origins of European Thought* (Cambridge, 1951), 200–228.

36. Xenophanes actually says we all come from earth and water. This seems to imply that moisture is necessary for life (on these passages, see Guthrie, *HGP* [above, note 6], 1.383–87). Kahn (above, note 6), 110–12, has reconstructed a general Milesian view that water is the source of life. Compare the zoogony in Diod. 1.7.3–4 (=DK 2, page 135) and in Epicurus, fr. 333, Usener; Lucr. 5.805–815.

37. Cf. W. K. C. Guthrie, *The Greeks and Their Gods* (London, 1950), 53–55. Aeschylus, fr. 44, Nauck (= fr. 125, Mette), and Euripides, frs. 839, 898, Nauck, both make use of this motif. Cf. A. B. Cook, *Zeus: A Study in Ancient Religion* (Cambridge, 1940), 3.452–54.

38. The Epicurean accounts probably go back to Democritus, and Diodorus may go back even earlier. Cf. W. K. C. Guthrie, *In the Beginning* (London, 1957), 35–38; 122, note 10.

39. DK 12 A 24, cf. 27. DK 12 A 11.7 is further evidence, if Kahn (above, note 6), 63–64, is correct in reading ἐκ γῆς ὑφ' ἡλίου ἀναδιδομένης.

40. Cf. Guthrie, *HGP* (above, note 6), 2.185–90.

41. *SVF* 1.102(=2.580); 2.605, 622; cf. 1.98; 2.596, 618.

42. For an overview of all the ancient theories of both reproduction and embryology, see H. Balss, "Die Zeugungslehre und Embryologie in der Antike," *Quellen u. Studien z. Gesch. d. Naturwiss. u. d. Medizin* 5 (1936), 193–274. Erna Lesky, "Die Zeugungs- und Vererbungslehren der Antike und ihr Nachwirken," *AbhMainz*, Geist.-soz. Kl. (1950), number 19, pages 1225–1425, distinguishes three different theories of reproduction and analyzes the origin and development of each. She does not treat the ancient views of embryology.

43. *De Genit.* 1, 11, cf. 3 (7.470.1–3, 484.16–17, cf. 474.5–7, Littré); *De Morb.* 4.32 (7.542.6–11, Littré); cf. Lesky (above, note 42), 1301–3.

44. Onians (above, note 35), 119–20, believes that the association of breath with reproduction is a very primitive conception. If so, the views we are beginning to discuss here are sophisticated rationalizations of the primitive conception.

45. *Aph.* 5.63 (4.556, Littré), dated between 450 and 400 B.C. by W. H. S. Jones, *Hippocrates*, Loeb Classical Library (London, 1923), 2.xx–xxix. Aristotle agrees, in part, with this view, for he says that holding the breath produces the strength necessary for the ejection of semen; but he denies *pneuma* any other role in producing or moving

the semen (cf. *Gen. An.* 1.6.718a2–4, 20.728a9–11; 2.4.737b35–738a9; *Hist. An.* 7.7.586a15–17).

46. Vindicianus 3 (= DK 64 B 6). The word for "lightens" is *suspendit*, which probably translates κουφίζῃ (cf. DK 64 A 19.43). Simplic. *Phys.* 153.13–14, Diels (= DK 64 B 6) says that according to Diogenes of Apollonia semen is πνευματῶδες.

47. Cf. H. Diller, "Die philosophiegeschichtliche Stellung des Diogenes von Apollonia," *Hermes* 76 (1941):373.

48. The influence of Diogenes on Aristotle in this respect is discussed by E. Lesky (above, note 42), 1345–49. The bibliography discussing his influence in general is collected by Guthrie, *HGP* (above, note 6), 2.381, note 1.

49. *Gen. An.* 2.2.735b37–736a2. Aristotle states that semen is wet also in *Part. An.* 2.2.647b10–14; 4.10.689a9; *Gen. An.* 1.13.720a7–8; 2.3.737a7–12; 7.747a18–19.

50. *Gen. An.* 2.2.735b33–34. Elsewhere Aristotle says that the semen possesses psychic heat (θερμότης ψυχική) or vital heat (θερμότης ζωτική), i.e., *Gen. An.* 2.4.739a9–12, b20–26, 6.743a26–29, cf. 7.747a18–19.

51. See F. Solmsen, "The Vital Heat, the Inborn Pneuma and the Aether," *JHS* 77 (1957):119–23, for a discussion of this passage as well as of the background and influence of Aristotle's association of heat, *pneuma*, and the celestial element with soul.

52. All physical bodies are tools (ὄργανα) of the soul (*De An.* 2.4.415b18–20). The *pneuma* is the soul's instrument for causing movement and apparently also for sensation (*Mot. An.* 10.703a4–b2; *Gen. An.* 2.6.744a1–5; cf. *Part. An.* 2.16.659b17–18; see F. Solmsen, "Greek Philosophy and the Discovery of the Nerves," *MusHelv* 18 [1961]:175–76); and, in spontaneous generation at least, the ψυχικὴ ἀρχή is enclosed in the *pneuma* (*Gen. An.* 3.11.762b16–18). Moreover, nature does most of her work with *pneuma* as instrument (*Gen. An.* 5.8.789b8–12). On the other hand, the functions of the soul cannot occur without φυσικὸν πῦρ, and nature kindles (ἐμπεπύρευκεν) the soul in this fire (*De Juv.* 14.474b10–12, cf. 6.470a19–20). One can even say that the soul subsists (συνεστάναι) in some hot body (*Part. An.* 2.7.652b7–15), and that the soul commonly uses hot and cold as its instruments (*Gen. An.* 2.4.740b29–32). Cf. also *De Juv.* 4.469a28–b20. In general see F. Solmsen, "Cleanthes or Posidonius? The Basis of Stoic Physics," *MNAW*, n.r. 24 (1961):277–79.

53. We cannot here discuss the question whether the Stoics were or were not the first to take this step to identify soul with the *pneuma* or heat of the body. That there is only a single step (though a very distinct and significant one) between the Aristotelian and Stoic views has been observed, e.g., by W. Jaeger, *Diokles von Karystos* (Berlin, 1938), 203, and Solmsen, "Vital Heat" (above, note 51), 123; "Cleanthes" (above, note 52), 274–77.

54. These ideas lie behind the entire *On the Generation of Animals*. The respective contributions of male and female are succinctly stated in *Gen. An.* 1.2.716a4–7, 19.727b31–33, 20.729a9–33; 2.4.738b11–13, 20–26. In *Gen. An.* 1.20.728a26–30, Aristotle states that the menstrual blood is impure seed and still needs to be acted upon (δεόμενον ἐργασίας) by the male. That this action by the male takes the form of a cooking (πέψις) is implied in *Gen. An.* 4.1.765b6–766b26, 2.767a13–23; cf.

1.21.730a14–17; 2.4.739b20–26; 4.4.772a10–30. Aristotle's statement that the menstrual blood requires ἐργασία by the male should be compared to the Stoic statement that god makes the matter εὐεργόν (*SVF* 2.580).

55. *Gen. An.* 1.20.729a9–11, 28–30, 21.729b18–21, 730a28–30, 22.730b8–23; 2.1.733b18–733a1, 734b4–735a29, 3.737a18–22, 4.738b9–13; 4.1.765b10–13; 766a16–22, 3.767b15–18, 4.771b18–23. For further discussion, see Chapter 2.

56. Lesky (above, note 42), 1393–94; H. Meyer, *Geschichte der Lehre von den Keimkräften* (Bonn, 1914), 18–24, cf. 199–205; J. Moreau (above, note 14), 168–69; and Pohlenz (above, note 11), 1.78–79, have discussed the relationship between Aristotle's form and the Stoic *spermatikos logos*. Though Lesky, Meyer, and Moreau will admit an influence of Aristotle on the Stoics, Pohlenz merely says that the Stoic *spermatikos logos* assumes the function of the Aristotelian form. Moreau emphasizes the direct line of descent from Plato's Form through Aristotle's *logos* to the Stoic *spermatikos logos*. Meyer clearly stresses the biological origin of the Stoic idea.

57. συνιστάναι is Aristotle's favorite word for the action of the male seed on the female matter. Cf. Bonitz 730b60–731a8; A. L. Peck, *Aristotle: Generation of Animals*, Loeb Classical Library (London, 1963), lxi–xii, and index, s.v., "set" fetation.

58. *Gen. An.* 2.4.739b20–27. I have paraphrased the text to eliminate the analogy with the action of rennet on milk.

59. See above, Chapter 2.

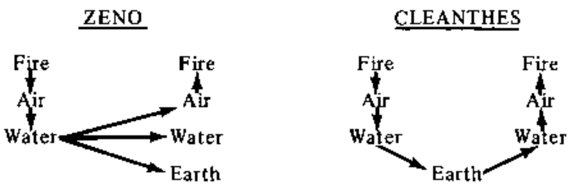
60. For an interesting sketch of the history of the idea of consensus as a criterion of truth, see K. Oehler, "Der Consensus omnium als Kriterium der Wahrheit in der antiken Philosophie und der Patristik," *Antike und Abendland* 10 (1961):103–9. Oehler emphasizes Aristotle's role in elevating this idea to a formal principal of dialectic.

61. Zeno's allegorization raises a problem because according to the scholiasts on Hesiod and Apollonius, Zeno asserted that Eros came to be in the *third* place (*SVF* 1.104, 105). This has led many, beginning with the scholiasts, to speculate that lines 118–19 of the *Theogony* are an interpolation, and that the text which Zeno accepted and allegorized mentioned only chaos, earth, and Eros. This is not the place to discuss the knotty textual question involved here (for a recent discussion, see M. L. West, ed., *Hesiod: Theogony* [Oxford 1966], 193–94). But it should be noted that the scholiasts' words need not mean that Eros was the third *element* to come into existence; the words could equally well refer to a discussion of Zeno's cosmogony, which began with water (equivalent to Hesiod's *chaos*) and went on to say that three elemental *transformations* subsequently occurred: the first to produce earth, the second to produce air (= Tartaros), and the third to produce fire (= Eros). Some scholiast, then, may have abridged this in a misleading way.

62. For a hypothetical reconstruction of the cosmogonal account that lies behind Stobaeus's summary (*SVF* 1.497), see Appendix 3. Here also will be found all references for the present summary of Cleanthes' cosmogony.

63. The one-many symmetry had a long history before Cleanthes. The formula, "From all one and from one all," was clearly ennunciated by Heraclitus (DK 22 B 10) and was given an explicit cosmological application by Empedocles (DK 31 B 17.1–20; cf. D. O'Brien, *Empedocles' Cosmic Cycle: A Reconstruction from the Fragments and Secondary Sources* [Cambridge, 1969], 237–49).

64. The difference between the two cosmogonies may be expressed diagramatically:



65. *SVF* 1.537. The echoes of Heraclitus can be seen by comparing line 2 with Heraclitus DK 22 B 41; line 10 with B 30 and B 64; lines 17 and 26 with B 1; line 20 with B 50, 51, 54; line 21 with B 1, 10, 50; lines 24–25 with B 34, 114, cf. B 2; line 33 (ἀπειροσύνης) with B 1; line 35 with B 41; the three regions of lines 15–16 with the three elements of B 31, 36; and finally the unification of opposites in lines 18–20 with the doctrine of Heraclitus B 10, 50, 60, 61, 67, 88, 111. Cf. E. Neustadt, "Der Zeushymnos des Kleanthes," *Hermes* 66 (1931):396–98.

66. Von Arnim, *SVF* 1, page 137, attributes this fragment (*SVF* 1.519) to Cleanthes' *Interpretations of Heraclitus*, but according to Eusebius the work from which this fragment was taken compared Zeno's doctrine with more predecessors than merely Heraclitus (cf. πρὸς τοὺς ἄλλους φυσικούς). This, of course, may be an exaggeration; but it is also possible that Cleanthes made comparisons between Zeno's doctrine and that of his predecessors in *On Zeno's Natural Science*.

67. For several references, see above, note 65. Cf. also Kirk, *Heraclitus* (above, note 6), 72–262.

68. Theophrastus's interpretation is reflected in Diog. Laert. 9.8 = DK 22 A 1.8–9 (cf. *DG* 163). One of the other ancient accounts that Kirk, *Heraclitus* (above, note 6), 107–8, cites for this interpretation of Heraclitus contains some Stoic vocabulary (Cleom. *Mot. Circ.* 1.11 [112, Ziegler] = *SVF* 2.572; cf. Cic. *Nat.* D. 2.84); and another, though used against the Stoics, has a Stoic ring (Philo *Aet. Mund.* 110). This suggests that the Stoics themselves may have given Heraclitus's statement a cosmological interpretation. For a discussion of Heraclitus's intent see Kirk, 105–12.

69 *SVF* 2.413. For parallels that show that the vocabulary is that of the Stoic conflagration and restoration, see Appendix 3, notes 9 and 10.

CHAPTER IV

Cosmology

The Stoic conception of the cosmos, like the Stoic conception of its origin, has both a physical and a biological side. It is commonly acknowledged that the physical side follows, in general, the Platonic-Aristotelian conception.[1] The Stoics believed that the cosmos is one, limited, spherical body, situated in an infinite expanse of void. It consists of four elements: earth, water, air, and fire, arranged in concentric spheres around the center. That is to say, the main mass of earth is a stationary sphere in the center of the cosmos. Surrounding this are spheres of water and air; and finally rotating at the periphery is the sphere of fire or *aether*. Situated in the sphere of fire are the fixed stars and seven wandering stars—Saturn, Jupiter, Mars, Mercury, Venus, the sun, and the moon, in that order. All four elements are mutually transformable, and each possesses one primary tactile quality; that is, fire is hot, air cold, water wet, and earth dry. Within the periphery of the cosmos matter is continuous with no void space whatsoever, but beyond the periphery there extends an infinite expanse of void.[2]

This view of the cosmos is identical with that of Plato and Aristotle with two significant exceptions.[3] First of all, there is not complete agreement between Plato, Aristotle, and the Stoics on all details concerning the number, location, and nature of the elements. Second, the Stoics do not agree with Plato and Aristotle in rejecting the idea of an infinite void outside the periphery of the cosmos. There is no need to dwell on the similarities, but the exceptions merit further investigation for the light they shed on the relationship between the cosmology of the Stoics and the ideas of their predecessors.

In the Stoic system the cosmos consists of four, and only four, elements, of which the one found at the periphery is called either fire or *aether*.[4] To see how this differs from the Platonic and Aristotelian views of the cosmos, we must look a little more closely at their views; for Plato and Aristotle themselves did not agree in every respect. Plato believed that the element at the periphery of the cosmos is fire, and below this element lies air (*Tim.* 62d–63e). This air, in turn, consists of two layers, essentially the same, but differing in purity and brightness. The pure, upper air is called *aether;* the lower, atmospheric air is called darkness, fog, or simply air (ἀήρ, *Tim.* 58d; *Phaed.* 109b–c, 111a–b). Aristotle recognized the same five-fold stratification, but altered the names and status of the layers. In *On the Heavens* he declared that the element at the periphery is a fifth element, distinct from the familiar four elements: fire, air, water, and earth (*Cael.* 1.2–3.268b14–270b25). Though he himself gave it no name, he admitted that the ancients were justified in calling it *aether* (αἰθήρ), a word that he derived from "eternally running" (ἀεί θεῖν); and he chided Anaxagoras for using the name *aether* for the ordinary element, fire (*Cael.* 1.3.270b20–25; cf. *Meteor.* 1.3.339b16–30). Fire he placed immediately below the celestial element, and air below the fire (*Cael.* 2.4.287a30–b3; cf. *Meteor.* 1.3.339b30–341a12). The effect of Aristotle's change was to bring the number of elements to five,[5] and to disassociate the celestial element from the ordinary type of fire kindled by men.

It is quite apparent that the Stoics side with Plato in this respect and have not seen fit to accept Aristotle's addition of a fifth element. This is probably not because the Stoics were ignorant of Aristotle's innovation. They seem to have known a great deal about Aristotle's physical and biological theories, and it would be hard to imagine how this important idea could have escaped their knowledge, especially if Theophrastus was still promulgating it.[6] In addition, the fact that the Stoics called the element of the stars *aether* indicates that they knew of Aristotle's doctrine. Plato had used the word *aether* for a species of air; it was Aristotle who affirmed that the title *aether* is most fittingly applied to the element of the stars. Ignorance, then, is not a satisfactory explanation for the absence of the fifth element from the Stoic system.

In fact, the Stoics may actually have derived some ideas from Aristotle's notion of a fifth element. Xenophon tells us that Socrates called attention to some of the crucial differences between the heat of the sun and ordinary fire. One such difference is that sunlight makes vegetation grow, whereas ordinary fire destroys it (*Mem.* 4.7.7). Aristotle made much of this distinction between destructive and creative heat, and carried it to its ultimate conclusion. In Aristotle's view there is a vast chasm separating the substance of the heavens and the ordinary fire that burns on earth; these are two entirely different elements that should never be confused as Anaxagoras had done. The celestial element is much more honorable and divine than ordinary fire (*Cael.* 1.2.269a18–32, b13–17). Whereas ordinary fire cannot generate a living thing, the heat of the sun can. For this reason Aristotle concluded that the heat in living things, and particularly the generative heat in the seed, is more akin to the element of the stars and the heat of the sun than to ordinary fire (*Gen. An.* 2.3.736b33–737a7). Theophrastus followed Aristotle in connecting the generative heat of living things with the sun and in distinguishing the heat of these from ordinary fire, which is generally destructive and generative only of itself (*De Igne* 5–6, 44). The Stoics were quite willing to accept the distinction between creative heat and the basically destructive ordinary fire, though they were not willing to make them two separate elements.[7] Zeno said that there are two kinds of fire, the uncreative (ἄτεχνον) fire, which changes its fuel into itself, and the creative (τεχνικόν) fire, which causes growth and preservation, and which is found in plants, animals, and the heavenly bodies (*SVF* 1.120). Similarly Cleanthes said the sun is not like the ordinary fire that destroys all things but is similar to that "vital and beneficial kind in the body" which "preserves, nourishes, increases, sustains, and gives sensation" (*SVF* 1.504).

There is also another idea for which the Stoics may be indebted to Aristotle's concept of a fifth element. In *On the Heavens* the observation that the celestial element moves in a circle, whereas ordinary fire moves in a straight line toward its natural place above air, is made to serve as a proof that the element of the celestial bodies is different from fire (*Cael.* 1.2.268b11–269b17). Zeno, or at least some Stoic, was willing to accept this Aristotelian distinction and asserted that earthly light moves in a straight line, whereas ethereal light (τὸ αἰθέριον φῶς) moves in a circle (*SVF* 1.101); but again the Stoics were not willing to follow Aristotle in positing two separate elements. Thus the Stoics most likely were aware of Aristotle's introduction of a fifth element but were unwilling to accept it.

Their rejection might be accounted for as a conservative devotion to the tradition of four elements and an unwillingness to depart from the *consensus omnium*, but such an explanation is unsatisfactory. Though it is widely held that it was Empedocles who made the four elements canonical (cf. DK 31 B 6, 17.18), the evidence does not suggest the existence of any consensus on the subject before the Stoics entered the scene. At least Anaxagoras (DK 59 B16), Melissus (DK 30 B 8), Diogenes of Apollonia (DK 64 B 2), and the Atomists (DK 67 A 1.31; 9; 68 A 38) remained unconvinced.[8] In the fourth century, though Plato accepted it, the number four was still not canonical enough even in Plato's own Academy to prevent Aristotle, the author of the *Epinomis* (981b–c), and perhaps also Speusippus[9] from raising the number to five. When Zeno arrived in Athens, one can hardly think an overpowering tradition pressured him into accepting the four elements of Empedocles and Plato.

This is not to say there was no Greek tradition against Aristotle's innovation. Aristotle definitely upset one old tradition; for before him not a single philosopher had explicitly denied that the sun, planets, and stars consist of fire, at least in part. Even Anaxagoras, who maintained that the sun is a stone, nevertheless admitted it is a fiery stone (DK 59 A 42.6, 71). Thus there was one important respect in which Zeno would have had to break with the consensus to accept Aristotle's fifth element, and Zeno could not be expected to take this step without weighing the consequences carefully.

Aristotle postulated his theory of one celestial element rotating around the four sublunar elements to explain the movement of the heavenly bodies. Maintaining that an element can have only one natural movement, and that fire's natural movement is lineally upward, he argued that the element moving in a circle at the periphery cannot be fire, but must be a separate element whose natural movement is in a circle (*Cael.* 1.2.268b14–269b17). This left Aristotle with five elements—four naturally moving in a straight line each to its natural place and one moving eternally in a circle around the periphery.

Though this theory sufficed to explain the movement of the elements, it did entail certain difficulties. One of the most obvious natural phenomena is the warmth produced by the sun. Since Aristotle denied that the celestial element is warm or possesses any of the four basic qualities, he encountered serious difficulty explaining the sun's heat. He tried to get out of this dilemma by offering two possible explanations. The sun as it moves produces heat by friction, as projectiles flying through the air may be observed to do; and the sun's motion scatters the fire that lies between it and the atmospheric air and forces this fire down to earth (*Meteor.* 1.3.341a12–36; *Cael.* 2.7.289a11–35). Both of these explanations are forced, and together they are no more convincing than either one is separately.

It was not only the substance of the celestial bodies that caused problems in explaining the observed phenomena. In Aristotle's cosmology the sublunar region of the cosmos consists of the four elements inherited from Plato. Plato had found the four Empedoclean elements to be suitable for explaining all the observed phenomena. In the *Timaeus* he used them to construct a cosmological and a biological theory. In the *Phaedo* he found them useful for explaining "meteorological" phenomena, such as rivers and wind (*Phaedo* 111c–112e). Under Aristotle's hand these four elements were worked into an admirably symmetrical cosmology in *On the Heavens.* Even when Aristotle in *On Generation and Corruption* substituted a physical explanation for Plato's mathematical explanation of their transformation, he encountered no difficulties, although he was compelled to define the elements in terms of a substrate and the four basic physical qualities (hot, cold, wet, and dry) that he had reintroduced into philosophy.[10] But when he tried to bring meteorological and geological phenomena under the same comprehensive scheme, he ran into serious difficulty. The theory of a sublunar atmosphere consisting of a layer of fire above a layer of air proved useless for explaining meteorological phenomena. To produce a unified theory Aristotle had to admit air and fire are not the ultimate constituents of the sublunar atmosphere; rather he had to posit two exhalations: a hot, dry, smoky exhalation from earth, and a cold, wet, vaporous exhalation from water. He maintained that the upper atmosphere actually consists of the hot exhalation, which is inflammable and potentially fire, but not actually fire; and the lower atmosphere consists of a mixture of the two exhalations (*Meteor.* 1.3.340b14–29, 4.341b6–24; 2.4.359b27–34, 360a21–27). Thus in the *Meteorology* fire and air had to be dismissed as unscientific approximations, and the four qualities had to be called upon to constitute some new substances that would be better able to explain the phenomena.[11]

The effect of this was that the five-strata universe of *On the Heavens* was virtually abandoned. Aristotle no longer called the element immediately below the moon "fire" in an unequivocal sense, but rather "what we are accustomed to call fire" (*Meteor.* 1.3.340b22) or "a sort of fire" (οἷον πῦρ, *Meteor.* 1.3.340b29, 32; cf. *Gen. Corr.* 2.3.330b21–30) or "the so-called sphere of fire" (*Meteor.* 2.2.354b25).[12] Moreover, he could now refer to the whole region from the moon down to the region in which we live as "air" or "what is called air."[13] In a sense, then, Aristotle had returned to a four-strata universe, consisting of spheres of earth, water, a mixture of two exhalations, and a unique celestial element.

The theory of five elements, which Aristotle put forth in *On the Heavens,* was minimized even further in the biological writings, where the elements were overshadowed by the qualities or powers operating on their own. In the physical treatise *On Generation and Corruption* Aristotle had grappled with the problem of the respective roles of elements and powers in the formation of compounds, among which he included flesh and bones. He had decided that when the elements are mixed to form tissues, the powers neutralize each other to form an intermediate at the mean between hot and cold or wet and dry; yet the elements exist in the compound insofar as the qualities still exist potentially (*Gen. Corr.* 2.7.334a15–b30). In *On the Parts of Animals,* however, when Aristotle came to deal with biological matters directly, he conceded: "The first type of composition is from what people call elements, namely, earth, air, water, and fire; or perhaps it would be better to say from the powers . . . for wet, dry, hot, and cold are the matter of compound bodies" (*Part. An.* 2.1.646a12–17; cf. 2.2.648b8–10; *De Long. et Brev.* 5.466a20–22). Although he admitted the elements are the material of tissues (*Part. An.* 2.1.646b5–6), he devoted all his attention to determining the precise meaning of hot, cold, wet, and dry in biological contexts (*Part. An.* 2.2–3.648a19–649b35), on the grounds that these four qualities are the *archai* of the elements and therefore the real cause of all vital processes (*Part. An.* 2.2.648b1–10). Throughout the biological works Aristotle operated primarily with the powers. In short, Aristotle's theory of elements as stated in *On the Heavens* was by no means an all-pervasive theory. It was useful for explaining the natural movement of elementary bodies, but it could not serve to explain every natural phenomenon. Aristotle also had to call on other explanatory principles besides elements, and these other principles often competed with his theory of elements.

A glance at the role of fire as an explanatory principle reveals this competition in its intensest form. Whereas fire had always played a large role in the theories of the natural philosophers, in Aristotle it found itself pushed into the background in one treatise after another. In *On the Heavens* fire lost the celestial bodies to a very powerful newcomer called "the first body." Then having been pushed down a level to a position between the heavens and air, fire was eventually in the *Meteorology* reduced to a mere figurehead with only nominal control over this region. Fire was also fighting a losing battle with its rival "the hot" for a position in living things. Although in *On Youth and Old Age* it shared with "the hot" the role of vital principle,[14] nevertheless, in *On the Generation of Animals* it was driven out of the reproductive process by "the hot," which had made an alliance with the powerful newcomer from the stars (*Gen. An.* 2.3.736b33–737a7). Even its most sacrosanct realm, "flame" (φλόξ) was no longer indisputably its possession, for flame is only "burning smoke" (*Gen. Corr.* 2.4.331b25–26; cf. *Part. An.* 2.2.649a20–23). In fact, fire came to be defined as an "excess of the hot" (*Gen. Corr.* 2.3.330b21–29; *Meteor.* 1.3.340b23) and was reduced to complete dependence on "the hot." When Aristotle finished with it, fire was left in a most precarious position with its very existence under suspicion.

Theophrastus, too, was at an utter loss about what to do with fire. The first chapter of his treatise *On Fire* states the problems connected with the nature of fire and despairs of a solution. Fire did not seem to Theophrastus to be in the same class as air, water, and earth; for whereas the latter change into each other, fire changes into no element, but rather generates and destroys itself. Moreover, fire in all its forms is always found in some kind of substrate. Light exists in air or water; flame is burning smoke; and burning coal (*ἄνθραξ*) is something hard and earthy. Fire is always some material in a burning state. If this is true, however, fire is neither simple nor prior to its substrate; how then can it be an *archê*? One possibility is that the celestial sphere is made of a very pure, unmixed heat; but then it cannot be called burning and this is an essential characteristic of fire. The only solution is to assume there are several types of fire, a pure type in the heavens and a mixed type in the earthly region; but then what should be assigned as the *archê* of earthly fire? The unmixed fire of the periphery, the substrate in which the earthly fire inheres, or both? Moreover, to assume that the celestial spheres consist of a species of fire leads to a perplexing problem. The sun produces heat in the earthly regions. Both the generative heat of animals and ordinary fire come from the sun, yet the two are entirely different. How can the sun produce both? On the other hand, if the rays of the sun have no connection with fire, and heat is not produced through them, fire and the sun must be heat inhering in a substrate. This brings us back to the dilemma we started from—heat, which is certainly an *archê* since it causes changes and genesis, is found in a substrate (*De Igne* 1–6). Like Aristotle, Theophrastus could not find a consistent role for fire.

The heart of the problem for both Aristotle and Theophrastus is the relationship between fire and heat, and this problem is only a part of a larger problem, the relationship between the elements and the powers. It is quite obvious that there is in Aristotle an unresolved conflict between the elements and the powers, with each striving for the honor of being the basic explanatory scheme. If we wish to understand the Stoic attitude toward Aristotle's theory of elements, we must first understand how this conflict between elements and powers arose, and why Aristotle failed to solve it.[15]

From prephilosophical times the substances that were later to become the four elements were associated with certain qualities; so, for instance, no one ever doubted that water is, among other things, wet, and fire hot. The substances of the atmosphere, however, presented problems. In the epic language *aether* denoted the bright, clear sky, and "air" (ἀήρ) a mistiness that impedes vision.[16] When the Ionian philosophers applied these terms to portions of the cosmos, they added new qualities: *aether* became the name of the fiery heavenly bodies and so acquired the quality hot; "air" became applied to the atmosphere and was associated with cold.[17] So the elements played their roles in Ionian physics in association with certain qualities.

Alongside the elements were the powers existing in their own right. According to Anaximander it was the powers that separated off from the infinite to constitute the cosmos (DK 12 A 9, 10, 16, 17a, cf. 27). The opposites were no less important in Anaxagoras; for it is actually the opposites that constitute the *aether* and the air, the first substances to separate off (DK 59 B 12; A 42.2; cf. B 4).

Empedocles was the first philosopher clearly to subordinate the powers to the elements. For him, fire, air, water, and earth are the eternal realities (DK 31 B 6, cf. 17.18), whereas hot and bright are the qualities that fire possesses and that distinguish fire from the cold and dark earth.[18] With Empedocles the powers lost their dominance over the philosophical theories. Democritus relegated them to the area of sensations with no physical reality (DK 68 A 135.63–67; cf. B 117, 125); and Plato did much the same thing.[19]

Nevertheless the powers lived on among the medical writers; in fact, they came to occupy the chief position in explaining physiology and disease. Some of the Hippocratic writers attempted to define the relationship between elements and powers. One described earth as cold and dry, air as hot and wet, and water as wettest and thickest (παχύτατον, *De Carn.* 2 [8.584, Littré]). Another defined fire as hot and dry and water as cold and wet (*De Victu* 1.4 [6.474, Littré = 4.232, Jones]). The Sicilian physician, Philistion of Locri, a contemporary of Plato and a follower of Empedocles, took the easiest course of all and simply identified fire with the hot, air with the cold, water with the wet, and earth with the dry.[20] One of the few occasions on which Plato did make use of the powers was a physiological explanation of respiration. Here he identified the hot with fire (*Tim.* 79d–e). This is undoubtedly an influence of the medical theories with which he was acquainted, and it is possible that it is an influence of his contemporary, Philistion.[21]

This brings us to Aristotle again. When he entered the scene, the powers were dominating the field in medical theory, and the elements were triumphing in the philosophy of the Academy. Aristotle, with Plato as his starting point in physical philosophy, and the medical theories as his starting point in biology, had to face the problem of bringing the powers and elements into harmony. He made a virtue of necessity in *On Generation and Corruption* and devised a remarkably ingenious explanation for the transformation of elements. Since each element consists of a substrate qualified by two powers (fire, hot and dry; air, hot and moist; water, cold and moist; and earth, cold and dry) the change of one quality to its opposite causes the transformation of one element into the next in the series (*Gen. Corr.* 2.1–5). This theory not only brought powers and elements into harmony but fit his general theory of genesis and change, a theory that made typical use of the concepts of matter, form, and privation. What is more, it allowed him to retain the elements to explain movement in *On The Heavens* and the powers to explain biological phenomena.

Unfortunately, this beautiful theory did not work out in practice, as we have noted. In meteorology other principles, the two exhalations, were required, and these took over the region and the qualities formerly associated with air and fire. In biology, where traditionally the powers had dominated, Aristotle's neat correlation between powers and elements had to be ignored completely. Even though in *On Generation and Corruption* he had attempted to make the elements and powers more easily interchangeable by characterizing earth as dry more than cold, water as cold more than wet, air as wet more than hot, and fire as hot more than dry,[22] he had to yield in the biological field to Philistion's conflicting theory that fire is hot, air cold, water wet, and earth dry. Accordingly, the innate heat of an animal is referred to as the "internal fire."[23] The wet is constantly associated with water or the watery (ὑδατώδης), and the dry with earth or the earthy (γεηρός).[24] Finally, the function of the inhaled air is to cool the innate heat (*De Juv.* 14–27.474a25–480b20; *Part An.* 1.1.642a31–b4).

It is this function of air as refrigerant that most of all suggests a different point of view from that of *On Generation and Corruption*. If pressed, Aristotle could have argued that air is indeed warm, but less warm than fire, and therefore capable of cooling a more intense heat. But when Aristotle in *On Generation and Corruption* had explained how elements mix to produce tissues he had said the qualities hot and cold (and wet and dry as well) neutralize each other to produce a mean (*Gen. Corr.* 2.7.334b8–30). Aristotle's explanation of respiration suggests that air cools the internal heat for this very purpose, to maintain a mean.[25] Moreover, the cooling process is called "quenching" (σβεννύναι, *De Juv.* 27.480b1), which Aristotle expressly defines as "destruction by the opposite" (*De Juv.* 5.469b21–23; 20.474b13–15). In fact, Aristotle specifically states that air is cold when it enters the body, and is warm when exhaled only because it comes into contact with the internal heat (*De Juv.* 27.480a28–b6; cf. 22.478b15–19). It is impossible to avoid the conclusion that for Aristotle's theory of respiration the basic property of air is coldness; air's heat, so essential for the theory of the transformation of elements, is forgotten.

Belief in the cooling properties of inhaled air was shared by Aristotle's contemporary, the physician Diocles of Carystus (fr. 15, Wellman) and by Plato (*Tim.* 70c–d). All of them seem to have derived it from Sicilian medicine, since it is the view attested for Philistion.[26] When Philistion asserted that inhaled air cools the innate heat, he was propounding a thoroughly consistent theory, because in his view air is basically cold (fr. 4, Wellman). But when Aristotle adopted the Sicilian medical theory of respiration, he introduced into his biology a theory whose presuppositions were in direct conflict with one of his own carefully contrived physical theories, and so he was forced to ignore his basic theory of elements.

We can now begin to understand why the Stoics adopted the theory of elements they did. There was nothing to be gained by adopting the fifth element of *On the Heavens* simply to explain the movement of the heavenly bodies. If the heavenly bodies are living beings made of fire, as the Stoics maintained, their movement could easily be explained as due to the initiative of their souls. This was the theory of Plato (*Tim.* 39e–40b; *Leg.* 10.898c–899b) and probably also of Aristotle's youthful, published work *On Philosophy.*[27] The Stoics may have seen no need to abandon it for the later Aristotelian theory that appeared to cause more problems than it solved. Aristotle's theory of elements and elemental change in *On Generation and Corruption* might have been more attractive to the Stoics since their own theory that each element has one primary quality (*SVF* 2.580) contributes nothing to an explanation of the transformation of elements,[28] but the Stoics passed up this Aristotelian theory to obtain what must have impressed them as a more significant gain—a consistent, unified point of view.

Aristotle was a seeker after truth, exploring first one science and then another. For him each science was a self-contained study, based on its own *archai.*[29] Since he was not necessarily trying to set up a comprehensive philosophical system, it did not matter that elemental movement was explained in terms of five elements, meteorology in terms of two exhalations, and biology in terms of four powers. But Zeno had an entirely different personality and aim. He too was seeking the truth, but his aim was a comprehensive, unified system. If he was to produce a unified system on the basis of Aristotle's legacy, he obviously had to make some modifications in Aristotle's theory of elements. He had to refrain from following Aristotle in positing a fifth element for the heavenly bodies and could only posit two different types of fire to account for the differences between ordinary fire and the revolving, creative element of the heavens.[30] Moreover, since Aristotle's theory of the qualities and transformation of the elements conflicted with the premises on which his biological theories were based, Zeno had to reject one or the other; he chose to reject the theory of *On Generation and Corruption*.

His choice is indicative of another intellectual characteristic—the biological bent. To Zeno, with his deep conviction that the cosmos is a living animal, it would have seemed foolish to adopt a theory of elements that conflicted with the presuppositions of biology. It must have seemed far more reasonable to adopt the theory made explicit by the great Sicilian physician Philistion, but implicit also in the biological theories of Aristotle and his school—the theory that fire is hot, air cold, water wet, and earth dry. Medical theory may also have contributed to some of the other modifications that the Stoics made on Aristotle's cosmology. Aristotle had said that the wet, dry, hot, and cold are the matter of composite bodies (*Part. An.* 2.1.646a16–17; *De Long. et Brev.* 5.466a20–22; cf. *Top.* 3.1.116b18–20), and the whole of Aristotle's biological work rested on this assumption. This opinion, which was shared by Aristotle's colleague, Diocles of Carystus (fr. 7, Wellmann), presumably came from the medical theories of men like Philistion, who held that living things consist of the four qualities, which are identical with the four elements. Plato adopted the other side of this theory and maintained that men consist of the four elements (esp. *Tim.* 42e–43a, 82a; *Phil.* 29a). Since the Stoics regarded the cosmos as a living being, it was only natural that they would regard it as consisting of the four powers or the four elements, and that they would reject Aristotle's addition of a fifth element.

By a long and circuitous route we have come to see how the details of Aristotle's cosmology and theory of elements, not only involved him in minor dilemmas and serious inconsistencies, but conflicted with the presuppositions of his biology and the medical theories on which his biology depended. Although no amount of conflict between the principles of the separate sciences could invalidate the conclusions for Aristotle, the Stoics sought a unified theory of cosmology and so were compelled to eliminate all obvious sources of incongruity. Their characteristic notion that the cosmos is a living animal compelled them to eliminate even the incongruities between the seemingly unrelated sciences of cosmology and biology. By a few, simple modifications the Stoics cleared Aristotle's cosmological scheme not only of its inconsistencies with other physical sciences but also of its incompatibility with the fundamental tenets of biology.[31] Thereby the Stoics produced a cosmology worthy of the divine living being that the cosmos actually is and prepared the way for a synthesis of the physical and biological sides of the nature of the cosmos.

The other important difference between the Stoic cosmology and the Platonic-Aristotelian view of the world is that the Stoics believed the cosmos to be surrounded by an infinite void. This difference is, on the face of it, merely one of definition. Both the Stoics and Aristotle agreed that there is nothing outside the cosmos (Arist. *Cael.* 1.9.278b21–279a7). Whereas Aristotle refused to apply the name "void" to this condition (*Cael.* 1.9.279a11–18), the Stoics from Zeno on called this region of nothing "void" (*SVF* 1.94, 95, 96, 99; 2.503, 535, 542, 543). Why did the Stoics refuse to follow Aristotle's terminology, if they agreed with him in principle?

Aristotle's refusal to call the nothingness outside the cosmos "void" was a result of his definition of void. Void is "that in which there is no body, but in which it is possible for body to come to be" (*Cael.* 1.9.279a13–14). Since he had previously proven that it is impossible for a body to come to be outside the cosmos (*Cael.* 1.9.278b21–279a7), it followed that there is no void outside the cosmos (*Cael.* 1.9.279a11–18). The argument is very closely reasoned. If the definition is to be fulfilled, the *possibility* of the presence of body must be established. In Aristotle's view a proposition is possible if, and only if, it is actually, or may be imagined to be, true at some time.[32] But there never was and never will be a body outside the cosmos. To put it another way, the cosmos is eternal; and the absence of body outside the cosmos is also an eternal condition. In the case of eternal realities potentiality becomes actuality.[33] If an infinite void, defined as place potentially filled with body, is assumed to exist beyond an eternal cosmos, the absurd consequence is that an infinite body actually extends beyond the cosmos (*Phys.* 3.4.203b28–30).

"Void" is disqualified as a name for the nothingness beyond the cosmos precisely because it is defined in terms that presuppose that the absence of body is *temporary*. We cannot go into the complete background of Aristotle's definition of void,[34] but it will be helpful to see why Aristotle conceived of void as a temporary absence of body rather than as a simple absence regardless of duration. His limitation of the term "void" to a place *temporarily* deprived of body is due to his consideration of void in the context of place. He defined place as the immediate envelope or continent of a body (*τὸ πρῶτον περιέχον τῶν σωμάτων ἕκαστον*, *Phys.* 4.2.209b1–2, 4.210b34–211a1). Place is the surface or limit of a body, yet not the limit of the body contained in place, but rather the inner limit of the containing body (*Phys.* 4.4.211a23–34, cf. 211b9–14, 212a5–6). Thus two bodies are required to define place, the container and the contained. Without a container a body cannot be in place; so the outermost heaven is not in place, because no body embraces it (*Phys.* 4.5.212b13–22). On the other hand, if the contained body is absent, the definition of place is technically not met; and the result is a misconception of place as a dimension between the boundaries.[35] The container without the contained is precisely Aristotle's conception of void, which he defines as "place deprived of body."[36] Thus a contained body is required to define the place that when deprived of body, becomes void. As a result, void can be no more than a temporary absence of body from a place, and consequently the term "void" is not applicable to the permanent absence of body beyond the cosmos.

The relationship of the Stoic view to Aristotle's discussion of void can be determined only by looking more closely at the Stoic conception of the void. Unfortunately, we know nothing of Zeno's view of the void except the bare fact that he believed a void to exist beyond the cosmos.[37] A few years earlier Epicurus had revived the notion of the void as the unfilled space through which the atoms move and in which the cosmos exists.[38] We may speculate that to Zeno the Epicurean idea that any emptiness is void may have seemed more reasonable than the subtle argument by which Aristotle rejected the name "void" for the emptiness beyond the cosmos, but we cannot say anything definite about his reasons, if he had any.

Chrysippus's conception of the void, on the other hand, is known in some detail; and he at once shows himself to be in Aristotle's debt by considering void in the context of place.[39] Chrysippus defines place as "that which is totally occupied by being," or "that which is capable of being occupied by being and is, in fact, occupied completely by one or more things." Place is compared to a full vessel, void to an empty vessel; and finally Chrysippus distinguishes an unnamed entity, different from void or place, that is capable of being occupied by being, but is only partly occupied (*SVF* 2.503). The definition of void that may be inferred from this passage, and which other fragments assign to the Stoics in general, is "that which is capable of being occupied by being, but is not so occupied" (*SVF* 2.505, 535, 543 [reading κενόν for ἀσώματον in lines 16–17]). This definition is essentially the same as that accepted by Aristotle (*Cael.* 1.9.279a13–14). The analogy of a full and empty vessel is also used by Aristotle (*Phys.* 4.2.209b28–30, 4.212a14–16, 28–29, 6.213a15–19; cf. 4.3.210a24). The only significant difference is that Chrysippus ignores Aristotle's technical definition of place as "the immediate continent of a body" or the inner surface of the container, and instead emphasizes the other side of Aristotle's notion, namely, that place is "something occupied by body."[40] This change signals a shift in point of view. Aristotle viewed void as a species of place, that is, that place which is temporarily devoid of body; Chrysippus views place and void as coordinate species of a third thing, "that which is capable of being occupied by body." Chrysippus's point of view was already implicit in Aristotle's analogy of a vessel and in the definitions used in his denial of void and place outside the cosmos in *On the Heavens* (1.9.279a11–18). Chrysippus has merely made it explicit, unless Aristotle himself or one of his school did so before Chrysippus.[41] This change in point of view makes the term "void" slightly more applicable to the nothingness beyond the cosmos. Since void is no longer defined in terms of place, which, in turn, is defined in terms of a containing and a contained body, one of the obstacles preventing Aristotle from calling the nothingness "void" has been removed. Nevertheless, the removal of this obstacle alone is not enough; for the Stoic definition of void as that which is capable of being occupied, but is not actually occupied, is just the definition that disqualified the extracosmic nothingness from being called "void" in *On the Heavens*. Something must have happened to close the gap.

The fact is that several things have happened. We remember that one of the obstacles to the application of the term "void" to the condition outside the cosmos was the eternity of the cosmos. The eternal organization of Aristotle's cosmos precluded the possibility of matter beyond its periphery. The organization of the Stoic cosmos, however, is not eternal. During the conflagration the whole cosmos is changed to fire; and since elements changing to fire increase in volume, the whole volume of the cosmos increases at this time. Because the cosmos does at times expand beyond its present periphery, there has to be a void into which it can expand (*SVF* 2.609, 610, 618, 619; cf. 537, 597). The fact that in the Stoic system body sometimes occupies the space beyond the periphery makes the definition applicable even according to Aristotle's logic.

The conflagration, however, can prove only a limited void since the cosmos does not expand to infinity.[42] Something else must have happened between Aristotle and Chrysippus, and we may discover it in a change in the principles of logic. According to Aristotle's logic a proposition is possible only if it becomes actual at some time. According to the Stoics this condition is not necessary; a proposition is possible if nothing external prevents it from being true.[43] Consequently, the condition beyond the periphery of the cosmos satisfies the definition of void, even if body *never* comes to occupy it. In this way an infinite void not only becomes possible; but if there is any void at all beyond the cosmos, it is necessarily infinite, for there is nothing that can bound it.

To prove that the void exists and probably also to prove that it is infinite the Stoics (which Stoics we do not know) used an old thought experiment derived from the Pythagorean Archytas of Tarentum and quoted by Aristotle's pupil, Eudemus of Rhodes (DK 47 A 24). According to Simplicius the Stoic asked: If a man stands at the periphery of the cosmos and extends his arm outward, what will happen? If he can extend it, there is something beyond the cosmos into which he is extending it, and this must be void. If he cannot, there is something preventing him; and he must go beyond this obstacle or limit and repeat the experiment until he does come to the void (*SVF* 2.535, cf. 536). By continuing the experiment in the void beyond the periphery of the cosmos it is possible to prove that the void is infinite. Archytas (DK 47 A 24) seems to have used the experiment to prove infinite extension, and Lucretius records an Epicurean adaptation of this experiment to prove the infinity of the universe, with the infinity of the void implied.[44] A quotation of Simplicius from Alexander of Aphrodisias suggests that the Stoics also used this experiment to prove the infinity of the void beyond the cosmos (Simplic. *Cael*. 285.27–286.2, Heiberg).

With respect to the void beyond the cosmos the Stoic divergence from Aristotle is more apparent than real. The Stoics have taken over Aristotle's conception of the cosmos with nothing beyond it, but have applied the name "void" to this nothingness. Zeno may have done this without giving much consideration to the technical reasons for which Aristotle refused to use the term; but Chrysippus paid careful attention to Aristotle's discussions about the void and even adopted Aristotle's basic conception of void. By merely changing the point of view slightly and presupposing a different logical doctrine of possibility, Chrysippus discovered that the term "void" is actually quite applicable to the region beyond the cosmos.

However, what began as a mere difference in terminology turned out to have far reaching consequences for Stoic cosmology. The existence of an infinite void beyond the cosmos raised a frightening question: What prevents the matter of our cosmos from dispersing and distributing itself equally throughout the void? Epicurus, whose cosmology included an infinite void, readily admitted that matter does distribute itself equally in the void, and a cosmos is only a temporary concentration of atoms that will eventually be dispersed again.[45] When the Stoics placed the Aristotelian cosmos in an infinite void, they were asking for trouble. Aristotle's cosmos was not designed to live in such an environment, and Epicurus's cosmology displayed the inevitable consequences. The Stoics now were faced with the problem: How can the cosmos remain intact though situated in an infinite void? As usual, the Stoic explanation seems to have had both a physical and a biological side, though for the present we shall concentrate on the physical side.[46]

As luck would have it, Stobaeus has preserved Arius Didymus's summary of Zeno's attempt to explain the cosmos's immobility in the void, a subject intimately connected with the cohesion of the cosmos: "Of everything in the cosmos held together with its own *hexis* [literally, "holding"] the parts move toward the middle of the whole, similarly also of the cosmos itself. Therefore it is correct to say that all the parts of the cosmos move toward the middle of the cosmos, especially those having weight. The same cause serves both for the immobility of the cosmos in an infinite void and likewise for the immobility of the earth in the cosmos, since it is situated in equilibrium around the center of this [the cosmos]. Moreover, body does not entirely have weight, but air and fire are weightless. These, too, somehow tend toward the middle of the whole sphere of the cosmos; but they collect at the periphery of it [the cosmos], because they are by nature upward moving, since they possess no weight. Likewise the cosmos itself has no weight, because its whole composition is of the elements which have weight and of the weightless ones. The earth as a whole in itself has weight; but by its position, since it occupies the middle space and since for bodies of that kind [i.e., heavy] motion is to the middle, it remains in this place'' (*SVF* 1.99).

This account has been abbreviated almost to the point of unintelligibility, and it is only by very careful analysis and the support of parallel accounts that Zeno's theory can be recovered and understood. Even a superficial reading of the summary reveals that analogy played an important role in the argument. The account begins with the statement that the parts of all unified objects in the cosmos have a motion toward the middle of the object. Then it continues, ''And similarly [the parts] of the cosmos itself; therefore it is correct to say that all the parts of the cosmos move to the middle of the cosmos.'' Finally the argument takes a third step: ''The same cause serves both for the immobility of the cosmos in the infinite void and likewise for the immobility of the earth in the cosmos, since it is situated in equilibrium around the center of this [the cosmos].'' The account thus begins with a triple analogy—natural objects:cosmos:earth (*SVF* 1.99, page 27.25–31). After this it turns to explain why fire and air remain at the periphery of the cosmos and subsequently goes on to say, ''Similarly to these [elements] the cosmos itself does not have weight.'' Finally there is a return to the subject of the earth and its immobility at the center of the cosmos. This is not introduced with any word like ''similarly''—in fact, its immobility is explained in a slightly different way from that of the cosmos—but it operates with the same concepts as the earlier parts. Hence it is not hard to see in the second half of Zeno's account an argument proceeding in parallel fashion to the first—light elements:cosmos:earth (*SVF* 1.99, page 27.31–28.4).

This structure provides some indispensible clues to understanding Zeno's argument, which may now be divided into two obvious components. The first component, which we might call the theory of centripetal force, explains the immobility (μονή) of the cosmos by the fact that all parts of the cosmos move toward the middle of the cosmos. Exactly how this theory works is not immediately apparent. In fact, it seems to be illogical. A movement toward the middle *of the cosmos* can account very well for the cohesion of the cosmos in the void, but it is hard to see how it can explain why the cosmos will not move as a whole in the void. What we would expect in an explanation of the immobility of the cosmos is movement to the center *of the void;* for if every part of the cosmos moves toward the center of the void, the cosmos as a whole would naturally come to rest at this point and would remain intact without dispersing. But Stobaeus's summary states explicitly that the parts of the cosmos move toward the center *of the cosmos.*

We might consider the possibility that Stobaeus or his source, Arius Didymus, has made an error in excerpting Zeno's text and has either substituted the center of the cosmos for the center of the void or has mistakenly used the term "immobility" (μονή) in what was actually Zeno's proof only for the cohesion of the cosmos.[47] But the analogy with "all objects in the cosmos held together by their own 'holding' or *hexis*" supports the notion of movement toward the center *of the cosmos,* for in each of the objects held together by a *hexis* the parts move toward the middle *of the whole* (i.e., the object itself), not toward the middle *of the cosmos.*[48] An example of such an object might be a stone (cf. *SVF* 2.449, 716). A centripetal force holds the parts of the stone together, but this force does not affect the movement of the stone as a whole. It will still fall if dropped. We can also rule out the possibility that Zeno's argument was intended only to prove the cohesion of the cosmos, because other witnesses confirm the accuracy of Stobaeus's summary. Achilles the grammarian in his *Introduction to Aratus's Phaenomena* records several Stoic proofs that the cosmos remains at rest in the void. He begins with an empirical proof: "If the cosmos were moving down in an infinite void, rain would not overtake the earth. But it does. Therefore the cosmos does not move, but stands still." Then after a lacunose proof from the fact that winds move both up and down, Achilles gives the theoretical argument: "The cosmos remains in an infinite void because of the motion toward the middle, since all its parts incline toward the middle. And the parts of it are earth, water, air, and fire, which all incline toward the middle. Therefore the cosmos in no way sinks'' (*SVF* 2.554). This is identical with Zeno's argument, showing that centripetal movement was used by the Stoics to prove the immobility of the cosmos in the void. It is true that Achilles does not expressly say whether the movement is toward the middle *of the cosmos* or the middle *of the void,* but it is more natural to understand his words to mean the middle *of the cosmos.* If any doubt still remains, it is removed by the Aristotelian commentator, Alexander of Aphrodisias, who attacks the Stoic belief in an infinite void by asking what holds the cosmos in its place and prevents it from moving to every part of the void. Then he adds, ''If they say that it remains [in its place] because the same *hexis* holds it together, the *hexis* might perhaps prevent its parts from scattering, dispersing, and moving in different directions; but the *hexis* still does nothing to make the cosmos as a whole with its binding *hexis* rest and not move'' (*SVF* 2.552 [quoted at greater length in Simplic. *Cael.* 286.6–23, Heiberg], cf. 553). Apparently the Peripatetic commentators saw in the Stoic *hexis* an attempt to explain the cosmos's immobility. Finally, Cleomedes explicitly states that the centripetal force of the parts of the cosmos refutes the suggestion that the cosmos will move, if there is a void outside it: ''It is impossible for it to move through the void, for it inclines toward its own middle and has this as its 'down' '' (*Mot. Circ.* 1.1 [10, Ziegler]).

We are thus confronted with the problem of figuring out how the motion toward the center of the cosmos kept the cosmos at rest in the void. The analogy with other objects, as we have seen, does not help us understand this problem; but the analogy with the earth ought to help, since the earth must be shown to be immobile in the cosmos. However, Stobaeus's account is disappointingly concise, adding only the statement that the earth is situated in equilibrium (καθιδρυμένης ἰσοκρατῶς) around the center of the cosmos. Since the words, ''being seated around the center of the cosmos,'' are essentially a restatement of the thesis to be proven, the immobility of the earth in the cosmos,[49] only the idea of equilibrium or equal force (ἰσοκρατῶς) is new; and this single word is not particularly illuminating at this point.

To understand Zeno's argument we must turn to a parallel account in Cicero, *On the Nature of the Gods.* The Stoic speaker in Book 2 uses

Zeno's triple analogy to prove the stability and cohesion of the cosmos: "For all its parts everywhere striving for the middle press on uniformly [*aequaliter*]. Moreover interlinked bodies endure best when they are bound together by a kind of encompassing bond. This is accomplished by that substance which, performing all things by mind and reason, pervades the whole cosmos and draws and gathers the outermost parts toward the center. Consequently, if the cosmos is spherical and all its parts are therefore held together everywhere uniformly [*aequabiles*] by and with each other, the same thing must happen to the earth, so that with all its parts converging toward the middle, which in a sphere is the lowest point, nothing may break through and so cause its great coherence of weight and heavy things to collapse [*labefactari*]" (*Nat. D.* 2.115–16). This account, so similar to Stobaeus's summary of Zeno as to suggest a common source,[50] confirms the existence of a close analogy between objects held together by a *hexis*, the cosmos, and the earth. It also shows that the parts of the earth are viewed as pressing inward toward the earth's center.[51] In addition it emphasizes the uniformity of the movement toward the interior, thus shedding light on the meaning of equilibrium (ἰσοκρατῶς) in Stobaeus's account of Zeno. Though the account in Cicero does not clarify completely the logic of this theory, it does point the direction in which the Stoics sought an answer to the problem of the stability of the cosmos in the void. Somehow or other the Stoics saw in the uniformity of the centripetal pressure within a sphere a source of rest. With all parts (whether of the cosmos or of the earth) exerting equal pressure and balancing each other, there was no reason to expect movement in any direction. To oversimplify, if the top pushes down and the bottom pushes up with equal pressure, the two halves will balance each other and so remain at rest. Only if one pushes harder than the other, will the two together move. Among parts arranged spherically around a center, none will be able to dominate and set the object in motion.

The second component of Zeno's argument, which we may call the theory of counteracting forces, is easier to understand (*SVF* 1.99, page 27.31–28.4). Here the threefold analogy begins with the elements of air and fire. Whereas the previous theory held that all parts of the cosmos move toward the center, Zeno now points out that we must not infer as a consequence that all parts have weight. He says: "Body does not entirely have weight, but air and fire are weightless. These, too, somehow tend toward the middle of the whole sphere, but they collect at the periphery of it [i.e., the cosmos], because they are by nature upward moving, since they possess no weight." The logic seems to be that air and fire are weightless (ἀβαρῆ),[52] a condition that causes them to move upward and away from the center. At the same time they share with all other parts of the cosmos a tendency to move toward the center of the cosmos. The two forces acting in opposite directions presumably counteract each other and cause fire and air to rest at the periphery. We might conjecture that Zeno would have considered the ratio of the centrifugal force to the centripetal force slightly higher for fire than for air, and thus could explain why fire rises above air. The important point is that rest is the result of two counteracting forces, one centripetal and the other centrifugal.

The immobility of the cosmos is explained in an analogous way: "Similarly to these [elements] the cosmos itself has no weight because its whole composition is of the elements which have weight and of the weightless ones." This argument is presented in expanded form by Achilles and there attributed to Chrysippus: "One might well believe Chrysippus, when he says the composition of all things is from the four elements, and equal weight [τὸ ἰσοβαρές] is responsible for the immobility [μονή] of these; for since two are heavy, earth and water, and two light, fire and air, the mixture of these is the cause of the position of the universe; for as the cosmos would move down, if it were heavy, so it would move up, if light. It remains immobile, because it has the heavy equal to the light" (*SVF* 2.555). On this theory the weight and weightlessness of the elements cause movement down and up respectively. Since the two forces counteract each other, the cosmos as a whole moves in neither direction.[53]

The third stage of the argument explains the immobility of the earth. The earth's immobility, however, is not explained by the tension of two counteracting forces. Instead, Zeno says, "The earth as a whole in itself has weight; but by its position, since it occupies the middle space and since for bodies of that kind [i.e., heavy] motion is to the middle, it remains in this place."[54] It is not another force that counteracts the earth's weight, but its position in the cosmos; and Zeno sets up a contrast between the earth in itself (καθ' ἑαυτὴν μέν) and the earth in its central position (παρὰ δὲ τὴν θέσιν). Thus the analogy with the cosmos and light elements is somewhat forced, but still follows the same basic principle that a tendency to move down is counteracted by some other factor.

Zeno's explanation for the immobility of the cosmos and the earth raises several questions. First of all, why did he need two different theories to explain the same thing? Our perplexity is increased when we compare the two theories for the immobility of the earth. In the second theory Zeno has a good, clear explanation for the immobility of the earth in its position at the center of the cosmos; but Zeno's first theory, which seems to make no use of the earth's position at the center of the cosmos, is open to an obvious criticism. If the earth's immobility is due solely to the uniformity of the movement of its parts in their spherical arrangement, why should not any other sphere of a hard material be equally immobile, regardless of its position? It would seem that the first theory of the earth's immobility cannot even stand. Why does he then retain it alongside the more cogent second theory? Second, in Zeno's eyes which way is down? Fire and air are weightless and therefore move upward and collect at the periphery. This idea implies that up and down are defined as movement away from and movement toward the center respectively. But when Zeno says the cosmos is without weight, because it is made of a mixture of heavy, downward-moving elements and weightless, upward-moving elements, he implies that as a whole the cosmos will move neither up nor down in the void, thereby suggesting that up and down are absolute directions in the void without reference to any middle or periphery. It looks as if Zeno is guilty of inconsistency.

Now that we have analyzed Zeno's argument and noted some of the problems it raises, we may turn to his predecessors in an attempt to see how he arrived at his position and why he failed to produce a single, consistent theory. It is surely obvious that the fundamental concepts used in Zeno's argument, namely weight and weightlessness, natural movement, and cosmic places are derived from Aristotle.[55] The briefest summary of Aristotle's use of these ideas will suffice to supply the background for Zeno's solution. Aristotle maintained that the movement and rest of elements is due to nature, for nature is the principle of rest and movement (ἡ ἀρχὴ κινήσεως καὶ στάσεως [or ἠρεμίας], *Phys.* 2.1.192b8–14, 20–23; 3.1.200b12–13; 8.3.253b5–6, 7–9; *Cael.* 1.2.268b16; 3.2.301b17–18). When an element is in its natural place, it remains at rest; when it is not in its place, it moves by nature toward its natural place, unless some obstacle prevents it. Any movement away from its natural place must be by force and not by nature. The four concentric spheres of earth, water, air, and fire are the natural places of these elements and the places to which they move by nature.[56] Since "up" is to be defined as the direction from the center to the periphery and "down" as the direction from the periphery to the center (e.g., *Phys.* 4.4.212a21–28; *Cael.* 1.2.268b21–22, 3.269b23–24; 4.1.308a14–29), the direction of movement of each element may be calculated from the particular dislocation from which it begins to move. Weight and lightness are defined as the properties of elements whose natural movements are down and up respectively (*Cael.* 1.3.269b23–29; 2.13.295b3–9; 4.1.308a29–31; 4.311b14–16; *Phys.* 4.4.212a24–28). Consequently, earth may be called absolutely heavy and fire absolutely light, because earth will always move down and fire up. Water and air are relatively heavy and light, for in returning to their natural places they will move either up or down, depending on the position from which they start. So water is heavy with respect to air and fire, but light with respect to earth; and air is light with respect to earth and water, but heavy with respect to fire (*Cael.* 1.3.269b26–29; 4.4.311a15–29, 311b13–312a12, 5.312a22–b2). Theophrastus probably agreed with Aristotle's theory. At least he maintained that the elements have a natural movement; for example, fire moves up by nature (*De Vent.* 22), and this natural movement is responsible for an element's weight or lightness.[57]

Although Zeno uses the same basic ideas, he seems to put them together in a different way. In the Peripatetic scheme the natural movement and the natural place are the two sides of each element's nature. There is no cause for them but nature itself. Weight and lightness are also natural qualities of the elements, but they are dependent on and, in a sense, the result of the natural movement of the elements.[58] Since place, movement, and weight or lightness are natural to an element and due to one and the same cause, nature, Aristotle may use any one to deduce the other two.[59] Zeno, however, seems to give weight and weightlessness priority, making them natural properties of the elements.[60] They, in turn, cause, or at least determine, the natural movement of each element; and the natural movement seems to be responsible for the position each element occupies in the cosmos.[61] Thus for Zeno movement and position seem to be due ultimately to weight or weightlessness. This modification of Aristotle's theory necessitates another. If weight and weightlessness are permanent properties of elements and are the cause of the natural movements, each element must be either heavy or light. No element can be intermediate, for it will then be unable to move naturally, a result contradicted by experience.[62] Nor can an element be sometimes heavy and sometimes light, as are air and water in Aristotle's theory, for then weight and lightness become relative to some other factor, such as the particular unnatural location in which they find themselves. Accordingly, Zeno makes earth and water heavy and air and fire weightless. This change, though not a major one, makes the theory less comprehensive, for whereas Aristotle's theory explained all possible dislocations of the elements, Zeno's does not apply to the relatively uncommon dislocations of air into the place of fire and water into the place of earth.[63] This loss in comprehensiveness was necessary if Zeno was going to make natural movement dependent on weight and weightlessness. Why Zeno wished to make this change is difficult to say. A major reason may have been the fact that he was trying to prove that the elements remain in their places. Since place was to be the conclusion, weight and weightlessness, or the movements produced by weight and weightlessness, had to serve as premises. Since Aristotle, as we shall see presently, was content to do the same thing, the difference between Zeno and Aristotle may be more apparent than real.

The precise nature of Zeno's relationship to Aristotle becomes clearer from an examination of Zeno's proofs for the stability of the earth and of the cosmos. Zeno's second proof for the immobility of the earth is taken directly from Aristotle. Aristotle proves the stability of the earth in two separate places. The most detailed proof is found in *On the Heavens*. After discussing the previous theories on the subject (*Cael.* 2.13), he offers three proofs. Two are directed specifically against the theories that the earth revolves around the center or rotates on its axis at the center (*Cael.* 2.14.296a24–b6); the third gives the positive proof that the cosmos rests at the center: "The natural movement of the parts of the earth and of the whole earth is toward the center of the universe; for this reason it is now lying at the center" (*Cael.* 2.14.296b6–9). Then restating his argument more fully, he reasons essentially as follows: The natural movement of the earth is toward the center. A simple body can have only one simple movement.

Therefore, earth cannot have the contrary movement (i.e., away from center) naturally, but only by force. There is no force great enough to move the whole earth. Therefore it must rest at the center (*Cael.* 2.14.296b25–297a2). To put it another way, "to whatever place the parts move by nature, there the whole exists by nature" (*Cael.* 2.14.296b34–35). Here the basic premise is natural movement; weight does not even enter the argument.[64] As a matter of fact, Aristotle's proof does not amount to much more than a restatement of his doctrine of natural movements and places. In the *Physics* Aristotle offers a slightly different proof that the earth rests at the center: "The earth is heavy. The heavy remains at the center. The earth is now at the center" (*Phys.* 3.5.205b15–16). Therefore the earth will remain at the center naturally. This proof is almost identical to Zeno's second proof, which may be paraphrased as follows: The earth in itself has weight. Things that have weight move toward the center. The earth already occupies the center. Therefore the earth remains in the center. Zeno has merely substituted the natural movement of the heavy for the natural rest of the heavy in Aristotle's argument.

Zeno also owes much to Aristotle for his first proof, which is based on the equilibrium of the centripetal force acting on all parts of the earth; but the origin of this theory is somewhat more complex. Its roots extend back to Anaximander, who was the first to maintain that the earth remains in place because it is symmetrically related to the center and periphery of a spherical cosmos (DK 12 A 26). This theory found its most forceful expression in Plato: "I am persuaded . . . that if the earth, being round, is in the center of the heaven, it does not need air or any such force to prevent it from falling; but the uniformity [ὁμοιότης] of the heaven itself to itself in every direction and the equilibrium [ἰσορροπία] of the earth itself is sufficient to hold it fast. For any thing possessing equilibrium [ἰσόρροπον], placed in the middle of something uniform, will not be moved more or less in any direction, but, being uniform, will remain without inclining" (*Phaedo* 108e–109a; cf. *Tim.* 62d–63a). This theory certainly lurks behind Zeno's explanation for the immobility of the earth; yet Zeno's version incorporates the idea of movement toward the center, an idea not found in Plato. We can conclude that Zeno has not merely taken over the pure version of this theory as found in Plato, but is following Aristotle's discussion of it. In a description and criticism of this theory in *On the*

Heavens Aristotle grants that the theory is accidentally true, but not a sufficient explanation, because it fails to explain (1) why any other body (say, fire) will not remain at the center if placed there; (2) why earth and other bodies move; (3) why fire remains at the periphery; and (4) why the earth does not scatter toward the periphery (*Cael.* 2.14.295b10–296a21). As Aristotle goes through these unexplained phenomena, he repeatedly suggests that his own theory of natural places and natural movements will supply a sufficient answer; and in the next chapter he definitely states that the natural movement of earth toward the center is the explanation for its immobility. Zeno apparently has taken Aristotle's criticism into account and has united the theory of equilibrium with the Aristotelian theory of natural movement to produce his own theory of uniform, centripetal force as an explanation for the earth's immobility.

One question we must still ask is why he retained the equilibrium theory at all, if he was so committed to Aristotle. An answer might be that his fondness for consensus compelled him to keep as many theories as he could reasonably synthesize; but there is a deeper reason that we must still discover. A second question we must raise is why he modified Aristotle's theory in synthesizing it with the theory of equilibrium. Aristotle's theory for the immobility of the earth held that all earthy bodies move toward the center. Though this point, toward which earth moves, is both the center of the earth and the center of the cosmos, Aristotle makes it amply clear that earth moves toward it insofar as it is the center *of the cosmos*, not the center *of the earth* (*Cael.* 2.14.296b9–18). Zeno in his first proof disagreed with Aristotle on this very point and held that the earth moves toward the center *of the earth*.

Before we can answer these questions, we must consider the use Zeno was to make of these theories of the earth's stability. Their context suggests that his main concern was the immobility of the cosmos, and these proofs for the immobility of the earth were analogies or models for his first theory of the immobility of the cosmos. The use of the earth's immobility as a model for that of the cosmos may have been suggested by Aristotle. In the *Physics* Aristotle's proof for the immobility of the earth occurs as an illustration of the kind of proof Anaxagoras ought to have used to prove that the infinite is stationary. Aristotle rejects Anaxagoras's own proof on the grounds that it misses the point. Even if it is true that the whole is not moved, Anaxagoras must explain why this absence of motion is natural. As an example of the type of explanation needed, Aristotle proves the stability of the earth, using the very proof Zeno adopted as his second proof for the immobility of the earth. Then he announces that some comparable cause is needed to explain the immobility of the infinite (*Phys*. 3.5.205b1–24). Here Aristotle suggests that Anaxagoras ought to find an explanation for the stability of the whole on the order of the explanation Aristotle has given for the stability of the earth. It looks as if Zeno were trying to follow Aristotle's directive.

In trying to create a proof on the model of Aristotle's proof for the immobility of the earth Zeno encountered a serious difficulty. He could not simply extrapolate to the cosmos and claim that all parts of the cosmos move toward the center of its environment, the void, for Aristotle had insisted that there are no directions in that which is void and infinite: "For insofar as it is infinite, there is no up nor down nor middle; and insofar as it is void, up cannot be differentiated from down" (*Phys*. 4.8.215a8–9). Zeno had to contrive a proof that did not depend on movement toward the center of the thing's natural environment. Again Aristotle conveniently pointed the way. Aristotle maintained that because a void possesses no differentiation, there is also no possibility of movement in a void. To prove this point Aristotle used the equilibrium theory of the earth's immobility as an analogy: "Nothing at all can move, if there is a void [surrounding it]; for as they say that the earth is at rest on account of uniformity, so also in the void a thing must necessarily be at rest; for there is no place where it will be moved more or less, since a void, as such, possesses no differentiation" (*Phys*. 4.8.214b30–215a1). Since Aristotle could use the equilibrium theory of the earth's immobility as an analogy to explain the impossibility of movement in a void, Zeno may have felt this same theory could serve to explain the cosmos's immobility in the void; but he could not apply it in a similar way to the earth and to the cosmos as long as it retained the shortcomings Aristotle had found in it (*Cael*. 2.14.295b10–296a21). Therefore, he modified it just enough to reconcile it with Aristotle's own theory that earth naturally moves toward the center.

Now we can understand more fully why Zeno retained some aspects of the equilibrium theory of the earth's immobility and why he modified Aristotle's theory of the immobility of the earth so that earth moves toward its own center, not the center of its environment, the cosmos. In general, Zeno was willing to follow Aristotle in the theory of elemental movement and in the explanation of the earth's immobility in the cosmos; but he refused to follow as soon as Aristotle's theories failed to solve Zeno's real problem, the immobility of the cosmos in the void. To solve this problem he wished to use the equilibrium theory; but to reconcile the equilibrium theory with Aristotle's theory, he had to modify Aristotle's theory of natural movement to make earth's natural movement a movement toward its own center, not toward the center of the cosmos. Then he could develop his theory of the cosmos's immobility on the basis of this model. The result was a new, characteristically Stoic theory, that all parts of the cosmos move naturally toward the center of the cosmos. Though based on Aristotle, it turned out to be most un-Aristotelian, at odds with the whole Aristotelian theory of natural movements and places. Zeno apparently felt this was necessary if he was to solve the objection that an infinite void beyond the cosmos would cause the cosmos to float around and eventually disintegrate and disperse.

One rather puzzling question is who raised this objection against the Stoics. We would not expect it to come from an Aristotelian, since Aristotle denied that movement was possible in a void (*Phys.* 4.8.214b28–215a14); yet Cleomedes records Zeno's theory of centripetal force and of the binding *hexis* as a direct reply to "Aristotle and those of his sect" who deny the existence of an extracosmic void (*Mot. Circ.* 1.1.5–6 [10, Ziegler]). If he is reporting these theories in the correct polemical context, we may infer that Zeno's theory was framed expressly to support the Stoic belief in the existence of an extracosmic void against Peripatetic attacks. Later the Aristotelian commentators, Alexander, Simplicius, and Themistius repeat the objection and bring the Aristotelian rebuttal that the Stoic theory may explain why the cosmos does not disperse, but not why it does not move as a whole (*SVF* 2.552, 553; Simplic. *Cael.* 286.6–23, Heiberg). Thus it would seem that Zeno's theory of centripetal force was called forth by a confrontation with Aristotelianism, though we cannot identify the opponent by name.

However, not all of Zeno's theory comes out of Aristotle and confrontation with the Peripatetics. One aspect of Zeno's second theory, the theory of counteracting forces, seems to have an entirely different background. When Zeno suggests the cosmos will not move because its two heavy elements are balanced by two weightless elements, he presupposes absolute directions in the void. He seems to be attempting to meet the objection that the cosmos will fall down through the infinite void. Such an objection could hardly have come from the side of Aristotle, who denied there were any directions in a void. Zeno's opponents or potential opponents must, therefore, have been atomists, like the Epicureans, who worked out in detail the behavior of matter in a void. Faced with the Epicurean dictum that in a void everything, even a uniform thing, naturally moves down, Zeno had to devise another theory, the theory of counteracting forces. Agreeing with Epicurus that weight is a natural property of heavy bodies and the cause of a downward movement through the void,[65] Zeno added the un-Epicurean idea that weightlessness is likewise a property of some bodies and the cause of an upward movement through the void. He then argued that if a body is made of both falling and rising elements, it will remain fixed in the void. Thus in addition to a proof based on Aristotelian premises and probably directed against actual or potential Aristotelian critics, Zeno puts forth a second proof based on Epicurean premises and presumably directed against Epicurean criticism.

Further light is shed on the origin of Zeno's proofs by a passage in Lucretius that attacks the theory that the cosmos's immobility and coherence is due to the tendency of everything to strive for the center of the universe (*in medium summae,* Lucr. 1.1052–82). The Epicurean attack, unfortunately marred by lacunae in the crucial section, refutes the idea that an infinite can have a center, and then goes on to argue that even if the void does have a center, nothing will stop there, for every void will make way for a weight, whether this weight is at the center or not (Lucr. 1.1070–76). The import of the latter argument is that things do not move toward a center, even if it exists; things naturally move down.[66] After disposing of the theory that the cosmos remains immobile in the void by movement toward the middle, Lucretius goes on to say that this foolish theory also holds that not all bodies tend toward the middle; but air and fire move away from the center, and fire ultimately collects in the heavens. From this notion Lucretius concludes there is a danger that these upward-moving elements will continue moving upward until they escape the cosmos and the entire cosmos disintegrates (Lucr. 1.1083–1113). This passage is usually taken to be an attack on the Stoics and particularly on the theory of Zeno, which we have been discussing. This assumption is questionable, for Zeno's theory seems to contain answers to Lucretius's attack.[67] For example, Lucretius attacks the idea that all things move toward the center of the void; Zeno scrupulously avoids positing a center in the void.[68] Lucretius assumes the rising elements might continue rising right out of the cosmos; Zeno's centripetal force is a force that Cleomedes (*Mot. Circ.* 1.1.6 [10, Ziegler]) and the Aristotelian commentators (*SVF* 2.552, 553; Simplic. *Cael.* 286.15–23, Heiberg) consider an adequate safeguard against the dissolution of the cosmos in the void. In fact, Zeno expressly mentions the rising of fire and air and shows how this is counteracted by a concurrent centripetal tendency to make them collect near the periphery. Finally, Zeno discusses the theory that the heavy elements balance the weightless elements in the cosmos, a theory that Lucretius ignores entirely. It is tempting to speculate that Lucretius's polemic comes from an early Epicurean treatise, perhaps by the hand of Epicurus himself, and that Zeno's theory is, in part at least, contrived to meet these Epicurean objections.

If Lucretius's polemic is not directed against Zeno's theory, we may well wonder against whom it is directed. Aristotle is a most unlikely candidate, because he is never known to have worried about proving the immobility or the coherence of the cosmos, and because the notion of all things moving toward the center contradicts his theory of natural movements and places.[69] On the other hand, Zeno, the first Stoic, already shows signs of meeting the Epicurean objections; and his successors down to Cicero follow his lead. Hence we shall probably never know the original target of Lucretius's attack, but we should not ignore the possibility that Lucretius's target was an early theory of Zeno's. It seems entirely possible that Zeno's first attempts to explain the behavior of the cosmos in the void might have included the concept of a motion toward the middle of the void, based on a simple analogy with the behavior of earth in the cosmos. It would naturally have included the seemingly contradictory notion that light elements move up by nature, for this is also found in the extant theory. Epicurus could have gotten wind of his theory and written a polemic against it, forcing Zeno to revise it on the Aristotelian basis we have already discovered.

It would be this revised theory that we possess today. Regardless of whether Zeno did once subscribe to this particular theory that all parts of the cosmos move toward the middle of the void, the surviving texts show that Zeno's inconsistent theories most likely evolved from a serious, many-sided debate over the issue and may have undergone several modifications during his lifetime in an attempt to meet objections both from the side of the Peripatetics and from the side of the Epicureans.

When Chrysippus undertook the defense of Stoic doctrine, he inherited this vexatious problem along with Zeno's inconsistent discussion of it. Chrysippus's fidelity to the founder of the Stoa shows up in the fact that he retained much of Zeno's solution, at least for a while. As we have seen, Achilles refers to Chrysippus for his exposition of the theory of counteracting forces,[70] and it is not impossible that Achilles' account of the theory of centripetal force goes back to Chrysippus as well.[71] More significant is the fact that Chrysippus also sought a new way to answer critics who maintained the cosmos must fall in an infinite void.

According to Plutarch, Chrysippus frequently stated that the void beyond the cosmos is infinite, unbounded (ἄπειρον) in the literal sense of the word; it has neither beginning nor middle nor end. What is more, the downward motion asserted by Epicurus is a fiction, because the void possesses no differentation according to which one direction may be considered up and another down (*SVF* 2.539). Although Chrysippus's criticism is directed against the Epicurean theory of atomic movement, the basic idea has wide significance in that it sweeps aside in one blow the Epicurean criticism of Zeno, Zeno's theories for the immobility of the cosmos in the void, and even the need for any theory at all. The cosmos cannot fall down through the void; and it is actually meaningless to talk of change of place in the void, since "there is no difference in the void which leads bodies to one place rather than another."[72] Accordingly, Chrysippus seems to have put forth no new theories why the cosmos does not move through the void. The basis for Chrysippus's sweeping solution to the problem of the immobility of the cosmos seems to have been Aristotle. Aristotle maintained that an infinite void has no up or down (*Phys.* 4.8.215a8–9) and that motion is impossible in a void. "For as they say that the earth is at rest on account of uniformity, so also in the void a thing must necessarily be at rest; for there is no place where it will be moved more or less, since a void, as such, possesses no differentiation" (*Phys.* 4.8.214b31–215a1). This is, of course, the same passage that may have led Zeno to use the uniformity of the centripetal force as an explanation for the immobility of the cosmos. Chrysippus follows Aristotle's logic to the conclusion Aristotle intended, that is, that motion in an infinite void is absolutely unthinkable. This is a conclusion that utterly overthrows the Epicurean notion of falling atoms and a falling cosmos and allows Chrysippus to ignore completely the problem of the immobility of the cosmos.

He could not, however, ignore the related problems of the cohesion of the cosmos in the void and of the movement of the elements. These two problems he solved with a single theory, expounded chiefly, it seems, in Book Two of his treatise *On Motion*. Since directions in the void cannot determine movement, Chrysippus held that "the arrangement (σύνταξις) of this cosmos is the cause of movement" (*SVF* 2.550). "The cosmos is a perfect body, but the parts of the cosmos are not perfect in that they have a relationship to the whole and do not exist by themselves" (*SVF* 2.550). This fact has implications for the movement of the cosmos as a whole and for the movement of its parts. Chrysippus says, "The natural movement of the cosmos, as a whole, is for permanence and self-maintenance, and not for dissolution and dispersion." Consequently "since the whole tends and moves to the same place, and the parts have this movement inasmuch as it is a natural characteristic of bodies, it is plausible that the first natural movement for all bodies is toward the middle of the cosmos, for the cosmos, insofar as it moves into itself, and for the parts, insofar as they are parts of the whole" (*SVF* 2.550). This first natural movement toward the center is the same movement on which Zeno relied so heavily, but Chrysippus now seems to refer it back to the permanent, natural arrangement of the cosmos and to use it to account for the coherence of the cosmos in the void. The movement of the individual elements is also presumably due to the arrangement of the cosmos and the fact that the parts do not exist by themselves but have a relationship to the whole (cf. *SVF* 2.550, page 173.21–22, 25–26). The extant fragments do not explain Chrysippus's theory of natural movements as clearly as we could wish, but they do suggest that, just as in Aristotle's theory, each element has an appointed place to which the element, if displaced, must move. Chrysippus says that "fire is weightless and moves upward, and air behaves in the same way as fire, because water is appointed (προσνεμομένου) more to earth and air to fire" (*SVF* 2.434). He thus seems to admit that air, like fire, may be considered light and upward-moving; but this is because air is appointed to hold a position in the same direction from us as fire, that is, above us. Water, on the other hand, is appointed to a vicinity more in the region of earth and so moves down. Hence the lightness and movement of air is dependent on its appointed place. In a passage from the *Physical Arts* Chrysippus says that "of itself [ἐξ αὑτοῦ] air has neither weight nor lightness" (*SVF* 2.435). The meaning of this statement out of context is not absolutely clear. It may mean that weight or lightness is not inherent in air, but is due to its appointed position in the arrangement of the whole. It could thus confirm our suspicion that the appointed position is responsible for movement. We still do not know whether Chrysippus held this view only for air or also for the absolutely light element, fire. A report in Aëtius defines light and heavy in terms of movement away from the middle and toward the middle respectively (*SVF* 2.571). This, too, removes weight and lightness from the primary position as cause of movement.

All these fragments suggest a theory of elemental movement very much like Aristotle's, yet Chrysippus still seems to accept Zeno's idea that the immediate cause of movement is weight or lightness. He says (if Plutarch's statement is an accurate reflection of his view), "Fire, being weightless, is upward-moving" (ἀνωφερές, *SVF* 2.434), and, according to Alexander of Aphrodisias, he thought that "if nothing prevents it, a stone lifted up is unable not to fall down, for the fact that it possesses weight is the cause of such movement according to nature" (*SVF* 2.979). The apparent contradiction with the view reconstructed above is cleared up somewhat when Chrysippus explains that behind weight and lightness, as well as behind the arrangement of the cosmos, stands nature. Movement comes about of necessity, yet not by the necessity of force, but rather because the nature of the moved object requires it (*SVF* 2.979). Thus Chrysippus, like Aristotle, makes nature responsible for all three: arrangement, movement, and weight or lightness. In fact, Chrysippus is so much under the sway of Aristotle that in stating that heavy things fall he adds the qualification so typical of Aristotle, "if nothing prevents it" (μηδενὸς ἐμποδίζοντος, *SVF*

2.979; cf. Arist. *Cael.* 4.3.311a6–8, 4.311a19–21, b14–16). To emphasize that the movement of an element is natural and not due to any external force Chrysippus says: "In whatever manner each of the parts moves when it is joined with [συμφυές] the remaining parts, in the same manner it is reasonable for the part to move by itself, even if, for the sake of argument, we should imagine and assume it to be in a void space of this cosmos. For example, if being held together it were moving from everywhere toward the middle, it remains in this motion, even if for the sake of argument void were suddenly surrounding it" (*SVF* 2.550). If this idea were also applied to the upward movement of light things, Chrysippus's statement could serve as a rebuttal of the Epicurean theory of *ekthlipsis,* in which all bodies are heavy, but light ones rise because they are squeezed out by heavier ones.[73] Chrysippus's elements move entirely of their own nature to their naturally appointed places in the cosmos.

Chrysippus brings Stoic cosmology back to the theory of Aristotle from which the Stoic doctrine took its origin. Nature is again in control, keeping the elements in their appointed places and moving them back to their places when they are forced out. Weight and lightness again take their position with movement and place as consequences of nature, sometimes being defined in terms of movement, and sometimes considered as the cause of movement. Moreover, the natural arrangement of the parts of the cosmos with respect to the whole is again given the decisive role in the movement of elements.

The problems entailed by placing a void around the cosmos are finally solved for Chrysippus and the Stoics. The Epicureans, who had been harrassing the Stoics with threats that their cosmos would fall down, have been refuted for good, along with any Aristotelian critics who may have claimed the Stoic cosmos might move. Moreover, since Aristotle's confidence in nature's ability both to move elements and hold them fast has been vindicated, nature is given the additional responsibility of holding the cosmos together and preventing its disintegration in the void. Under Chrysippus's guidance the Aristotelian cosmos of elements, each moving by nature to its own concentric sphere, is finally given a comfortable home in the infinite void.

This narrow problem, which involves only the movement of the elements and the relationship between cosmos and void, has turned out to have had a very complex history. If Arius Didymus had not preserved a summary of Zeno's view, or if Plutarch had not quoted so much from Chrysippus's allegedly contradictory accounts, or if Lucretius, Cicero, Cleomedes, and Achilles had not reported opinions on this subject, we could never have reconstructed even a bare outline of this complex history. Fortunately, a relatively rich amount of material has been preserved on this problem; but for the problems on which we possess less, or only the views of Chrysippus, and these not in his own words, we shall never know how grossly we have oversimplified the origin of the Stoic doctrine, or how often we have misunderstood it entirely.

1. Cf., e.g., É. Bréhier, *Chrysippe et l'ancien stoicisme*[2] (Paris, 1951), 149–50; J. B. Gould, *The Philosophy of Chrysippus*, Philosophia Antiqua 17 (Leiden and Albany, N. Y., 1970), 119–23; R. D. Hicks, *Stoic and Epicurean* (New York, 1910), 32; M. Pohlenz, *Die Stoa: Geschichte einer geistigen Bewegung*[3] (Göttingen, 1964), 1.81; and E. Zeller, *Stoics, Epicureans, and Sceptics*, trans. O. J. Reichel (London, 1880), 197–204.

2. The references are abundant. The cosmos is one (*SVF* 1.97; 2.528, 530, 531, 542, 620) limited (*SVF* 2.524, 528), spherical (*SVF* 2.547, 555, 654, 681), and consists of four elements in concentric spheres (*SVF* 2.413, 527, 555, 580, cf. 434, 558). Earth is stationary (*SVF* 2.527, 555) and fire rotates (*SVF* 2.527, cf. 642) with the fixed stars and seven wandering stars fixed in it (*SVF* 2.527). The elements change into one another (*SVF* 1.102; 2.406, 413, cf. 309, 579, 580, 581), and each possesses a single quality (*SVF* 2.580, cf. 429, 430). There is continuous matter within the cosmos (*SVF* 1.95, 96; 2.433[=545], 502, 528, 542, 543, cf. 424, 425), and infinite void outside (*SVF* 1.94, 95, 96; 2.503, 509, 535, 539, 542, 543).

3. For Plato and Aristotle, too, the cosmos is one (*Tim*. 30d–31b, 33a, 34b, 55d, 69c, 92c; *Cael*. 1.8–9), limited (*Cael*. 1.5–7), spherical (*Tim*. 33b, 62d, 63a; *Cael*. 2.2.285a31–32, 4.286b10–287b21), and consists of the four elements (or five according to Aristotle) arranged in concentric spheres around the center (Plato *Tim*. 62d–63e; cf. F. M. Cornford, *Plato's Cosmology* [London, 1937; reprinted, New York, 1957], 264–66; see also *Phaedo* 108e–109c, 111a–b; *Phil*. 29a–e; Arist. *Phys*. 4.5.212b20–22; *Cael*. 2.4.287a30–b14; *Meteor*. 1.3.339b9–341a12; 2.2.354b4–13, 23–26; cf. *De Phil*. fr. 19b Ross). At the center the earth is stationary according to Aristotle (*Cael*. 2.14.296a24–297a8), and Plato probably held essentially the same view (*Tim*. 40b–c; cf. D. R. Dicks, *Early Greek Astronomy to Aristotle* [London and Ithaca, N.Y., 1970], 132–36). Plato appears to have maintained that the earth is spherical (*Phaed*. 108e, cf. 110b; but cf. T. G. Rosenmeyer, "Phaedo 111c4ff.," *CQ* 50 [1956]:193, and the subsequent debate on the shape of Plato's earth in *Phronesis* 3 [1958]:121–25; 4 [1959]:71–72, 101–19). Aristotle certainly did (*Cael*. 2.14.297a8–298b20; *Meteor*. 2.7.365a26–31). The order of the celestial bodies can be reconstructed from Plato *Rep*. 616d–617b, *Tim*. 38d–e, *Epin*. 986e–987d (cf. Dicks, 111–13, 126, 145–47) and Arist. *Metaph*. 12.8.1073b17–1074a14. Both Plato and Aristotle banished void from the cosmos (*Tim*. 58a, 79b–c; *Phys*. 4.6–9; cf. F.

Solmsen, *Aristotle's System of the Physical World,* Cornell Studies in Classical Philology 33 [Ithaca, N.Y., 1960], 135–43), although Plato, by imposing a geometrical form on each of his elements, is forced to allow a small amount of void back in (*Tim.* 58b, 60e–61b; cf. A. E. Taylor, *A Commentary on Plato's Timaeus* [Oxford, 1928], 399, 427).

4. *SVF* 2.580. It seems proabale that all three old Stoics called the peripheral fire *aether* Zeno, Cleanthes, and Chrysippus all spoke of the *aether* and identified it with god (*SVF* 1.154, 530 [=534]; 2.1077, cf. 634). Chrysippus certainly used the term *aether* of the peripheral fire of the cosmos (*SVF* 2.527, 579, 634, 642), and Cleanthes appears to have used it in the same way (*SVF* 1.504). If Zeno used the term, it would be difficult to think of any meaning he could have attached to it other than the peripheral fire.

5. Without going into the question of authorship we might point out that the *Epinomis* (981b–d, 984b–c) stands somewhere between the views of Plato and Aristotle; while keeping the Platonic names for the layers (fire, *aether*, air, water, earth), the *Epinomis*, like Aristotle, gives elemental status to each of the five.

6. Theophrastus *Phys. Dox.* fr. 21 (=*DG* 493=Philoponus *Aet. Mund.* 13.15 [520, Rabe]). P. Steinmetz, *Die Physik des Theophrastos von Eresos,* Palingenesia 1 (Bad Homburg, Berlin and Zurich, 1964), 162–66, argues on the basis of *De Igne* 1–6 and other statements about the effect of the sun that Theophrastus rejected Aristotle's fifth element. He is answered by H. B. Gottschalk, *Gnomon* 39 (1967):23–24, who defends the traditional view. P. Moraux, "Quinta Essentia," *RE* 47 (1963):1231–32, cautiously suspends judgment.

7. The Stoic debt to Aristotle in this regard is acknowledged by Moraux (above, note 6), 1234.

8. Philolaos, DK 44 B 12, is of doubtful value as evidence either for or against the acceptance of Empedocles' four elements in the fifth century B.C. Neither its authenticity nor its interpretation is agreed upon (see above, Chapter 1, note 8). The author of the Hippocratic treatise *De Carnibus* 2 (8.584, Littré) seems to have accepted the four elements. For a good discussion of the evolution of the four-element theory in the pre-Socratic period, see C. H. Kahn, *Anaximander and the Origins of Greek Cosmology* (New York, 1960), 134–54.

9. Iambl. *Theol. Arith.* 61. Cf. E. Zeller, *Plato and the Older Academy,* trans. S. F. Alleyne and A. Goodwin (London, 1888; reprinted, New York, 1962), 578 and note 57 In his *Life of Plato* Xenocrates attributes a belief in five elementary bodies to Plato (fr. 53, Heinze), and it is possible that Plato himself also accepted the *aether* as a fifth element after writing the *Timaeus.* This same fragment has been used by R. Heinze, *Xenokrates: Darstellung der Lehre und Sammlung der Fragmente* (Leipzig, 1892), 68, as evidence that Xenocrates too accepted *aether* as a fifth element; but the fragment itself says nothing about Xenocrates' own belief, and it is hard to square a belief in five elements with Aët. 1.7.30 (=fr. 15, Heinze), which speaks only of the fiery celestial bodies (cf. also fr. 56), air, water, and earth (unless the lacuna in the part on air should be filled with a mention of both *aether* and air, something that Heinze attempts neither in his discussion [page 92] nor in his text of the fragment). Zeller, 594–95, also assigns a belief in five elements to Xenocrates, but he does not make clear his evidence.

10. On Aristotle's achievement in the theory of the transformation of the elements, as well as for the previous history and fate of the basic qualities, see Solmsen, *Aristotle's System* (above, note 3), 339–48.

11. Solmsen, *Aristotle's System* (above, note 3), 393–400, discusses the significance of the new approach taken in the *Meteorology* and also comments on its implications for the chronology of Aristotle's development.

12. The only exception is *Meteor.* 1.3.341a3–9, but this is so unusual that commentators feel compelled to explain that he really means "what is called fire" or "the potential fire" (cf. Alexander *In Meteor.* 16.16–18, Hayduck, and H. D. P. Lee, *Aristotle: Meteorologica*, Loeb Classical Library [London and Cambridge, Mass., 1952], 21, note c).

13. E. g., the celestial element borders on "the *air* and the terrestrial region" (*Meteor.* 1.3.340b9–10); "of what is called *air* the part near the earth is wet and hot . . . , and the part above this is hot and dry [i.e., potential fire]" (*Meteor.* 1.3.340b24–27); clouds do not form in the higher parts of the region between us and the moon because "not only is *air* present, but rather a kind of fire" (οἷον πῦρ, *Meteor.* 1.3.340b29–32); the celestial bodies cause heat and light by friction between themselves and the *air* below them (*Cael.* 2.7.289a19–21, 28–32).

14. In few passages, i.e., *De Juv.* 12.473a4, 14.474b12, 21.478a16–17 (cf. *De An.* 2.4.416a9–10), Aristotle refers to the innate heat as innate fire.

15. The following summary owes much to Kahn (above, note 8), 126–33, 140–54, 159–63, and Solmsen, *Aristotle's System* (above, note 3), 342–48.

16. Kahn (above, note 8), 140–46, cites and discusses the evidence of Homer and Hesiod.

17. Anaxagoras (DK 59 B 1, 2, 15; cf. A 42.2, 70) is the best evidence for the Ionian association of *aether* with hot and air with cold. Parmenides (DK 28 B 11, cf. 8.56, 9, 10, 12) also seems to regard *aether* as hot; and Anaximander (DK 12 A 10, cf. 11.4, 18, 17a) seems to regard air as cold (cf. Kahn [above, note 8], 87; Arist. *Phys.* 3.5.204b26–28 [= DK 12 A 16] would be the best evidence of all, if only we could be sure Aristotle is quoting Anaximander and not stating this on his own).

18. DK 31 B 21. This is not to say that the powers cannot act at all on their own (cf. DK 31 B 65, 67, 75, 90, 104). By mentioning Empedocles after Anaxagoras I do not mean to prejudge the disputed question of priority. Anaxagoras is mentioned first because his point of view is more akin to that of the earlier Ionian philosophers.

19. *Tim.* 61d–62b. For discussion, see Solmsen, *Aristotle's System* (above, note 3), 344–45. Solmsen points out that there are some situations in which Plato does make use of the powers, e.g., *Tim.* 50a, 58d, 59d, 79d–e, and 82a–b.

20. Philistion, fr. 4, cf. 5, in M. Wellmann, *Die Fragmente der sikelischen Ärzte* (Berlin, 1901).

21. For Philistion's influence on Plato, see C. Fredrich, *Hippokratische Untersuchungen*, Philologische Untersuchungen 15 (Berlin, 1899), 46–48; Wellman, (above, note 20), 10, 69, 74, 81–85; and W. Jaeger, *Diokles von Karystos* (Berlin, 1938), 8–11, 211–13.

22. *Gen. Corr.* 2.3.331a3–6. His choice of a basic quality for each element seems strange, for why should water be basically cold rather than wet? A little thought supplies the reason for his choices. Hot obviously characterizes no element but fire. If water had been characterized as wet, as would seem natural, Aristotle would have had cold and dry to distribute between air and earth; but according to Aristotle's theory air is hot and wet, and so neither cold nor dry could be its basic characteristic. His only alternative was to make water cold, thereby conveniently retaining the opposition between fire and water (*Gen. Corr.* 2.3.331a1–2).

23. See above, note 14.

24. E.g., *Gen. An.* 2.3.737a12 (ὑγρὰν καὶ ὑδατώδη), 4.739b27 (ξηραινομένων τῶν γεηρῶν); *Part. An.* 2.2–9. In this latter passage Aristotle does not use the expression "dry" very frequently (*Part An.* 2.5.651a33 [ξηρὰ καὶ γεηρά] is a revealing exception; cf. also 2.7.653a22–24). For the contrary of ὑγρὸν he prefers to use words meaning "hard" (esp. στερεόν; cf. *Part. An.* 2.2.647b10–11). Another passage clearly revealing the correspondence of dry with earth and wet with water is *De Juv.* 20.477b24–32; cf. 19.477a27–31. It should, in all fairness, be pointed out that the coldness of water and earth is not totally ignored, for the cold brain consists of water and earth (*Part. An.* 2.7.652a24–b23).

25. Cf. esp. *De Juv.* 5.469b21–470a18; 14.474b10–24; 21.478a11–25; 27.480a27–b6. In *De Juv.* 20.478a1–4 Aristotle generalizes on the equalization of hot and cold and says, "the environment equalizes the excess of a state to the mean."

26. Fr. 6, Wellmann. See above, note 21. This theory is also found in Hipp. *De Corde* 5 (9.84, Littré) and *De Sacr. Morb.* 4 (6.368, Littré=2.154, Jones).

27 Cic. *Nat. D.* 2.44 (=*De Phil.* fr. 21, Ross), where the voluntary movement of the stars can only be due to the fact that they are alive and have souls (cf. *Nat. D.* 2.42 [=*De Phil.* fr. 21, Ross]). It is commonly maintained that Aristotle already introduced the theory of the fifth element in *On Philosophy* (cf., e.g., W. Jaeger, *Aristotle: Fundamentals of the History of His Development*², trans. R. Robinson [Oxford, 1948], 138–54), but I suspect, with W. D. Ross, *Aristotle's Physics* (Oxford, 1936), 96–97, and D. J. Furley, "Lucretius and the Stoics," *BICS* 13 (1966): 22–23, that this was not the case. If Aristotle still believed the stars to be made of fire, the parallel with Stoicism is exact.

28. As far as we can tell from the extant remains, the Stoics never attempted to explain elemental transformation in terms of a generalized theory of genesis as Aristotle had done. If they had, they might have run into a serious dilemma. How does the wet (i.e., water) become the cold (i.e., air)? This problem could be further complicated by asking how it comes about that in the process of evaporation it is the hot (i.e., fire) that is responsible for making the wet (i.e., water) become cold (i.e., air). Cic. *Nat. D.* 2.26–27, which deals with this problem, uses the fact that air originates by vaporization of water under the action of heat as proof that air, though the coldest of the elements, contains a considerable admixture of heat. This explanation seems to betray the theory that each element possesses only one quality and suggests that the Stoics did not adhere rigidly to their theory under all circumstances.

29. Cf. especially *Anal. Post.* 1.7–9, 28. See Solmsen, *Aristotle's System* (above, note 3), 262–65.

30. Theophrastus had explored this possibility but had found that it still left some unanswered questions, such as how the sun can produce both generative heat and ordinary fire. The Stoics seem to have ignored this problem, if they knew it; but they did make use of Theophrastus's suggestion about mixed and unmixed heat. One illustration of this is the Stoic explanation of *pneuma*. Aristotle had defined *pneuma* as hot air (*Gen. An.* 2.2.736a1), but the Stoics called it a mixture of air and fire (*SVF* 2.310, 442, 841). This is in keeping with Theophrastus's problematic suggestion that the heat in earthly things might be a mixed form of the heat that exists in purity at the periphery (*De Igne* 4–5).

31. This is not to say that the Stoic system is without problems and inconsistencies. For one problem, see above, note 28.

32. What will never be cannot be called possible, but must be called impossible (*Metaph.* 9.4.1047b3–30). In *Int.* 13.23a25–26 Aristotle refers to potentialities that will never be. Here he must be referring to things like the infinite in number or divisibility, which can never exist in acutality, but can exist in thought (*Metaph.* 9.6.1048b14–17; cf. *Phys.* 3.6). See J. L. Ackrill, *Aristotle's Categories and De Interpretatione* (Oxford, 1963), 153.

33. In *Cael.* 1.12.281a28–b25 he makes use of this principle to prove that the eternal cosmos cannot be called destructible (*φθαρτός*), i.e., capable of destruction.

34. Cf. Solmsen, *Aristotle's System* (above, note 3), 135–43, for a little more discussion of the background.

35. *Phys.* 4.4.211b14–29. Cf. also *Phys.* 4.1.209a26–27; 4.4.211b8–9, 212a5–7, all of which suggest that place requires a contained body.

36. *Phys.* 4.1.208b26–27, 7.214a16–17, b17–18, cf. 213b31–34. When he wishes to refute opponents who believe in the existence of void, he puts the definition in terms of one of his refuted definitions of place and claims they define void as "extension [*διάστημα*] in which there is no body" (*Phys.* 4.6.213a27–29, 7.214a4–6, cf. 19–20), though there is no evidence that his opponents actually used such a definition (cf. Solmsen, *Aristotle's System* [above, note 3], 140–41).

37. *SVF* 1.99. *SVF* 1.94, 95, and 96 are of no value for Zeno's doctrine. *SVF* 1.94 and 96 are both attributed to Zeno's school ("those around Zeno"), and not specifically to Zeno. Moreover, *SVF* 1.96 is from Philoponus, who, in general, shows little knowledge of Stoicism; and in *SVF* 1.94 Themistius includes "those around Zeno" in a large group of "ancients" who believed in a void beyound the cosmos. Stobaeus's version of Aëtius 1.18.5; 1.20.1 (=*SVF* 1.95) does indeed speak of Zeno and his followers, but Pseudo-Plutarch's version (=*SVF* 2.504) assigns this *placitum* to "the Stoics" in general. Moreover, this fragment may postdate even Chrysippus. For it defines space (*χώρα*) as a place "partially occupied by body," whereas Chrysippus defined space as "the larger [or "relatively large"] thing capable of being occupied by being" and "a kind of larger vessel of a body" or else as "that which makes room for a larger body." He said that "a place partially occupied by body" is the description of some nameless entity, different from both void and place (*SVF* 503, cf. 505). Thus Chrysippus seems closer to Aristotle and Epicurus who considered place to be synonymous with space (see Bonitz 767a25–28, 859a35; Lucr. 1.426, 472, 955, 1002, 1074; 2.163, 219, etc.; cf. Epicurus *Ep.* 1.39–40 [*τόπος* is conjectural; cf. C. Bailey, *The Greek Atomists and Epicurus* (Oxford, 1928), 279, note 1. H. S. Long, in the Oxford text of Diogenes proposes *κενόν*]; 2.89. See Bailey, 294–99). The definition of void, place, and space in *SVF* 1.95; 2.504, 505 would therefore seem to be later than Chrysippus.

38. Cf. Bailey, *Atomists* (above, note 37), 359, cf. 293–99.

39 On the originality of Aristotle's approach see Solmsen, *Aristotle's System* (above, note 3), 140–42.

40. In *Cael.* 1.9.279a12–13 Aristotle states that "in every place body is capable of coming to be." To be accurate he should have added "and acutally is"; but since he was not defining place, but merely stating one property of it that the region outside the cosmos could not meet, we need not fault him for being incomplete. Nevertheless, his statement points the way to Chrysippus's definition of place; whether Aristotle himself ever defined place in the way the Stoics did we cannot say.

The Aristotelian commentators, Themistius and Simplicius, in commenting on Aristotle's four tentative suggestions for the meaning of place, put down the Stoics, together with the Atomists, as subscribers to Aristotle's rejected suggestion that place might be the interval between the limits of the container (*SVF* 2.506, 508). It would be rash to think Aristotle's rejected suggestion represents the Stoic view precisely Simplicius does admit that for the Stoics place is eternally occupied by body (*SVF* 2.508), and this sounds like the view we have found attested for Chrysippus. Hence the commentators cannot be pressed to yield more than is already known from other fragments.

41 *SVF* 2.505, which seems to be later than Chrysippus (see above, note 37), shows some interesting reminiscences of Aristotle. Void is not only said to be that which is capable of being occupied, yet is not occupied, but is also called "an interval devoid [ἔρημον] of body" or "unoccupied [ἀκαθεκτούμενον] by body." An interval in which there is no body is the description of void given by Aristotle *Phys.* 4.6.213a27–29, 7.214a5–6, 19–20. The idea "devoid of body" is also Aristotle's, though he prefers words derived from στερεῖν to express the idea of "devoid" (cf. *Phys.* 4.1.208b26, 6.213a18, 7.214a16–17, b17–18, 8.215a11). Place is said to be not only "occupied by body" but "coextensive with the containing body" (ἐξισαζόμενον τῷ κατέχοντι αὐτόν). Introducing a containing body into the definition of place is another mark of Aristotle.

42. Cf. Achilles' statement alleging that the Stoics believed the void to be only large enough to hold the fire of the conflagration (*SVF* 2.610). Whether some later Stoics actually held this view or whether Achilles is mistaken, we do not know.

43. *SVF* 2.201, cf. 202. See B. Mates, *Stoic Logic* (Berkeley, 1953; reprinted, 1961), 40–41.

44. Lucr. 1.968–983. C. Bailey in his commentary, *Lucretius: De Rerum Natura* (Oxford, 1947), 2.763, thinks that the experiment is Lucretius's own addition to the Epicurean proofs for the infinity of the void, but there is no proof that Epicurus did not himself use it at some time.

45. Epicurus *Ep.* 2.89–90; Lucr. 5.416–508; 2.1105–74. Cf. Bailey, *Atomists* (above, note 37), 364–67. The assumption of equal distribution of matter in the void led Aristotle to argue that the hypothesis of an infinite void implies an infinity of *cosmoi*, for there cannot be more void in one place than in another (*Phys.* 3.4.203b25–27). The Stoics, to judge from the extant remains, seem not to have worried about this implication of an infinite void; they simply assert dogmatically that the cosmos is unique (*SVF* 1.97; 2.528, 530, 531, 542, 620).

46. For the biological side of the solution to this problem, see below, Chapter 5.

47. Though the words μονή and μένειν are normally used in Stoic contexts to refer to the immobility of the cosmos, Chrysippus pointed out that μονή sometimes means the absence of local motion and sometimes the retention of shape (*SVF* 2.492). Thus it is not inconceivable that Zeno may have had both the immobility and the cohesion of the cosmos in mind, when he used the word μονή. In fact, he may not have recognized that the two problems might be different and require separate treatment, since we have no record that he discussed the cohesion of the cosmos separately.

48. The traditional Stoic theory of the *hexis* actually seems to have originated with Chrysippus (see below, Chapter 5), and the use of the word here may possibly be due to the epitomist. I have retained the use of the word in this discussion of Zeno, because

it does occur in this text, and because it is useful to describe the doubtlessly Zenonian theory that all parts of an object move toward the middle of the object. The difference between this idea and Chrysippus's theory of the *hexis* will become clear in the next chapter.

49. If it is not taken as a restatement of the thesis to be proven but as an explanation of the earth's immobility, the analogy between the earth's immobility and that of the cosmos becomes difficult to maintain; for then the earth's immobility is explained in terms of rest (*καθιδρυμένης*), instead of motion (*φορά*), and in terms of the center of the earth's environment (i.e., the cosmos), instead of its own center.

50. For the relationship of the various accounts of this subject, see Appendix 4.

51. Plutarch *Fac. Lun.* 924d–e (=*SVF* 2.646) also seems to represent the Stoic theory as one in which the movement of the parts of the earth are toward the center of the earth, not toward the center of the cosmos.

52. Furley (above, note 27), 20, points out that the Stoics prefer to call air and fire weightless (*ἀβαρής*) rather than light (*κοῦφος*). He believes this is the Stoic attempt to meet the objection that absolutely light elements would rise forever, leave the cosmos, and disperse through the void; and he conjectures that in the Stoic view weightless elements, in contrast to light elements, were believed to rise only in the presence of heavy elements and so would not leave the cosmos. He is probably right in thinking there is a deliberate avoidance of the word *κοῦφος*. As Furley points out, when Plutarch attempts to juxtapose Chrysippus's statement, "Air of itself has neither weight nor lightness," with the contradictory belief that air is *κοῦφος*, he can only find a quotation in which Chrysippus says fire is *ἀβαρές* and air similar (*Stoic. Repug.* 1053e [=*SVF* 2.434, 435]). Moreover, Achilles can be trusted no more than Plutarch when he attributes to Chrysippus the belief that air and fire are *κοῦφος* (*SVF* 2.555). Nevertheless, I am reluctant to follow Furley in conjecturing that the choice of terms means Chrysippus and Zeno consider air and fire to be only *relatively* light and rising. Neither actually says anything like this, and both feel safe in inferring motion upward directly from a state of weightlessness, with no *proviso* concerning the presence of heavy elements. Chrysippus even says, "In whatever manner each of the parts moves when it is joined with [*συμφυές*] the remaining parts, in the same manner it is reasonable for the part to move by itself, even if, for the sake of argument, we should imagine and assume it to be in a void space of this cosmos" (*SVF* 2.550). Though he chooses motion toward the middle as his example of this, I see no reason why it should not apply to the motion of fire and air as well. Furthermore, the fact that Zeno is going to make the weightless elements balance the heavy and constitute a cosmos with "no weight" suggests that he regards the weightlessness of air and fire as an absolute, active force. Finally, Zeno's explanation of the position of fire and air at the periphery, I feel, also demands that weightlessness be an absolute, active force.

53. Plutarch *Fac. Lun.* 943f also alludes to this theory. Achilles appends to his account of the theory of Chrysippus an interesting analogy adduced by the Archimedeans to illustrate the theory. The Archimedeans pointed out that if a piece of lead (the heaviest of bodies) and a piece of cork (the lightest of bodies) are bound together and placed in the sea, the combination will neither sink to the bottom nor rise to the surface, but will remain immobile (Achilles *Isagoge* 4 [32–33, Maass]).

54. The same theory is attributed to the Stoics by Plutarch *Fac. Lun.* 923e–f (=*SVF* 2.646).

55. For Aristotle's originality in bringing these concepts into mutual relation for application to cosmology, see Solmsen, *Aristotle's System* (above, note 3), 253–86.

56. *Cael.* passim, e.g., 1.2.268b13–269a2, 8.276a22–30; 3.2.300a20–b1. Note also the argument underlying *Phys.* 2.1.192b35–193a1; 4.8.214b14–15; 5.6.230b10–21.

57. *De Sens.* 88: "Fire and air appear to be and actually are light by virtue of their movements to their own places." In general, in this passage Theophrastus is more interested in the relative weight of different quantities of material and so is not as clear as he might be on his agreement with Aristotle's basic theory.

58. Though Aristotle repeatedly defines weight and lightness in terms of movement down and up respectively, he occasionally makes statements that give the impression that weight and lightness logically precede or even cause movement, e.g., *Phys.* 3.5.205b26–28; but Aristotle is absolutely clear that both movement and weight or lightness are caused by a third thing. When he actually investigates the mover and moved in elemental motion, he says "the gravator and levator are what cause upward and downward movement [*εἰς τὸ ἄνω καὶ τὸ κάτω κινητικὸν μὲν τὸ βαρυντικὸν καὶ τό κουφιστικόν*] and the potentially heavy and light are what moves" (*Cael.* 4.3.310a31–33). What this "gravator and lèvator" is Aristotle explains a little later when he says that the reason for light moving up and heavy moving down is that light and heavy have within themselves "a principle of change," by which he means nature (*Cael.* 4.3.310b23–25). *Cael.* 3.2.301a20–b30 also makes it clear that nature is the cause of the "inclination [*ῥοπή*] of weight and lightness" (301a22–23).

We should notice that in the one passage in which Aristotle speaks of elements having weight in their own places, he infers it from the fact that these elements, even when they are in their natural places, will move down if the element below them is removed (*Cael.* 4.5.312b2–19). He must be attempting to explain the fact that air replaces the water drained out of a pond or the earth dug out of a pit, and the fact that water and earth will fall to the bottom of a pit. His explanation confirms our contention that weight and lightness are determined by movement.

59. Aristotle most commonly uses natural place or natural movement as the basic premise, but *Phys.* 3.5.205b15–16, 26–28 are two examples in which weight and lightness seem to serve as premise.

60. Aristotle's definition of weight and lightness had made these qualities natural to the elements and independent of an observer, thereby giving them an objective status they never had before (cf. Solmsen, *Aristotle's System* [above, note 3], 280–81, and D. Hahm, "Weight and Lightness in Aristotle and His Predecessors," in *Motion and Time, Space and Matter: Interrelations in the History of Philosophy and Science*, ed. Peter Machamer and Robert Turnbull (Columbus, Oh., 1976). This may have been the reason that Zeno felt no reluctance to make weight and weightlessness inherent natural qualities of things, as Epicurus was also doing with weight (cf. J. Burnet, *Early Greek Philosophy*[4] [London, 1930; reprinted, New York, 1957], 341–44). Before Aristotle, Plato had made heavy and light relative to the observer; weight, Plato said, is the pressure an observer feels as like attempts to return to like (*Tim.* 62c–63e). Before Plato philosophers merely mentioned heavy and light without defining the nature of these qualities (for estimates of pre-Socratic opinion, see Burnet, 342–43; and Solmsen, *Aristotle's System* [above, note 3], 276–78).

61. The sequence of priority can be inferred from an analysis of the logic behind *SVF* 1.99. Particularly instructive are the following arguments: "Air and fire collect at

the periphery [τὴν σύστασιν πρὸς τὴν περιφέρειαν ποιεῖσθαι], for these travel up by nature since they have no weight"; and "the whole earth in itself has weight, but because it holds the middle position, and such [i.e., heavy] bodies have movement toward the center, it remains in this place."

62. Aristotle discusses the consequences of assuming a moving body that has neither weight nor lightness and concludes that, on the one hand, natural movement is impossible for such a body, but, on the other hand, force movement will carry it to infinity (*Cael.* 3.2.301a22–b17).

63. We might notice that when precision is not necessary, even Aristotle can oversimplify: "If the natural movement is upward, the body is fire or air; if downward, water or earth" (*Cael.* 1.2.269a17–18).

64. Cf. *Cael.* 2.13.294b32–295a2. In *Cael.* 2.14.296b9–25 heavy and light are used, but do not enter the argument; they merely serve as synonyms for earth and fire when Aristotle requires a plural noun ("heavy things" or "light things").

65. Epicurus *Ep.* 1.61; fr. 275, Usener; Lucr. 2.190, 205, 217–18; Cic. *De Fato* 46. See Bailey, *Atomists* (above, note 37), 289–90.

66. The Epicureans explained the immobility of the earth and of the cosmos by the pressure or blows of atoms of air. On the Epicurean theory that the earth rests on air, see Lucr. 5.534–563; Epicurus, fr. 348, Usener; and the papyrus fragments of Epicurus's *On Nature*, Book Eleven (discussed by Bailey, *Lucretius* [above, note 44], 3.1756). The Epicurean theory that atoms of air in the spaces between the worlds hold up our world is recorded by Achilles as a counterpart to the Stoic theory of centripetal force (Achilles *Isagoge* 9 [39, Maass] = Epicurus, fr. 301b [page 353, Usener]).

67. Furley (above, note 27), 20, comes to this same conclusion, but on the grounds of an interpretation of Zeno's theory that I cannot accept.

68. There is, of course, always the possibility that Lucretius's refutation unknowingly or deliberately misrepresents the opponents.

69. Furley (above, note 27), 21–23, argues for the young Aristotle of *On Philosophy* and has some points in his favor; but he never considers the question whether Aristotle ever maintained that all things strive for the center or why a man who denied the existence of an extracosmic void would hold such a belief. Furley, 17–18, gets around Lucretius's assumption of a void in his refutation by pointing out that Lucretius never expressly attributes it to his opponent and therefore is simply using his own assumptions to refute his antagonist. If Lucretius did not know this theory of centripetal force as a serious explanation for the stability of the cosmos in the void, it is strange that he would bother refuting it at all.

70. *SVF* 2.555. After his exposition of Chrysippus's theory and of the opinions of the Archimedeans and Orphics on the composition of the cosmos, Achilles records a proof that the earth stands still and then closes with the opinions of Xenophanes, Aristophanes, and Empedocles on this subject (*Isagoge* 9 [34, Maass]). Von Arnim assigns Achilles' proof that the earth stands still to Chrysippus and so prints it in large type (*SVF* 2.555). Presumably the structure of the chapter (i.e., Chrysippus on the immobility of the cosmos, followed by other opinions on the immobility or composition of the cosmos; then an unknown source on the immobility of the earth, followed by other opinions on the location or immobility of the earth) suggested that Chrysippus was the source also of this theory, especially since the theory contains some elements that accord well with Stoicism. If we could be sure it came from Chrysippus, we would

have to consider it along with all the other Stoic attempts to solve this problem; but since we cannot be sure of its source, it seems best to leave it to the side of our discussion.

This does not mean it is of no interest at all. Achilles' account claims that if a seed is dropped into a sausage skin and the skin is inflated, the seed will come to rest in the middle of the skin. Then the analogy is drawn: "The earth, under equal pressure [ὠθουμένην ἰσορρόπως] from the air on all sides, is at rest in the middle." The account concludes by comparing the earth to an object bound with ropes pulled equally taut in every direction. Though we may be amused at the alleged results of the experiment with the seed and the sausage skin, the analogies clarify somewhat the principle believed to be involved in the earth's stability. The earth is supported by air pressure, and its immobility does not depend on the natural movement of any element. If it is a Stoic theory, it would seem to be a remodeling of Zeno's equilibrium theory, and one that could stand up even to Epicurean criticism.

71. *SVF* 2.554. Themistius attributes the theory that the *hexis* gives the cosmos coherence and immobility to "those around Chrysippus," and von Arnim by his large type indicates he believes this goes back to Chrysippus himself (*SVF* 2.553). The expression "those around Chrysippus" cannot be pressed. It may be nothing more than a synonym for "Stoics," especially in this case, since Simplicius attributes the same theory to the Stoics in general (*SVF* 2.552).

72. *SVF* 2.550. Plutarch preserves these accounts in an attempt to show that they are contradicted by another statement by Chrysippus which suggests that the cosmos is located at the center *of the void* and for this reason is incorruptible (*SVF* 2.551). However, Plutarch here seems to have found a theory that Chrysippus mentioned, but rejected; and so we cannot use the quotation to shed light on Chrysippus's own cosmology. For a full discussion of this passage see Appendix 5.

73. Lucr. 2.191–205. Though Aristotle attempted to disprove the theory in *Cael.* 1.8.277b1–9, it seems to have been accepted by Strato (frs. 50–53, Wehrli).

CHAPTER V

Cosmobiology

For the biological side of Stoic cosmology we are in the fortunate position of possessing enough fragments to reconstruct the view of each of the three heads of the old Stoa.[1] Only a little is known of Zeno's cosmobiology. He believed the cosmos to be a living being (ζῷον), ensouled (ἔμψυχος), intelligent (νοερός, *sapiens*), and endowed with both the power of sensation (*sentiens*) and the power of reason (λογικός, *SVF* 1.111, 112, 113, 114). To prove that the cosmos is ensouled, capable of sensation, and intelligent Zeno used three basic arguments, one of which was teleological: "Whatever possesses reason is better than that which does not possess reason. Nothing is better than the cosmos. Therefore the cosmos possesses reason." He used the same argument for the other attributes (*SVF* 1.111). The second argument was based on the fact that the parent has the same attributes as the offspring: "Nothing devoid of soul or reason can generate that which has soul or reason. Now the cosmos generates ensouled and reasoning beings. Therefore the cosmos is ensouled and has reason" (*SVF* 1.113). He seems to have given the same argument also in more picturesque language: "If melodiously singing flutes were born on an olive tree, surely you would not doubt that some knowledge of flute playing is in the olive tree. If plane trees bore harmoniously sounding lyres, you would again suppose a knowledge of music is in the plane trees. Why, then, should not the cosmos be judged ensouled and intelligent, since it begets ensouled and intelligent creatures?" (*SVF* 1.112). Finally he argued: "Nothing devoid of sensation can have sentient parts. The cosmos has sentient parts. Therefore the cosmos is not devoid of sensation" (*SVF* 1.114). This last argument allows us to infer one more fact. Since living things are parts of the cosmos, Zeno must have conceived the cosmos to be not merely the physical structure in which men live but the totality of the physical structure and the living creatures in it.

Sextus Empiricus already observed that Plato's view is virtually the same as Zeno's (*SVF* 1.110). Plato, too, said the cosmos is a living animal, ensouled and possessing mind (*Tim.* 30b and passim; *Polit.* 269c–d; *Phil.* 30a–d). Closer examination shows that this observation has even more truth than Sextus suspected, for everything known about Zeno's cosmobiology is found also in Plato. Plato's world soul performs all the activities of a human soul; it has an intelligent (ἔμφρων) life and makes use of calculation (λογισμός). This reasoning activity is called a discourse or *logos* in the soul and occurs when the soul is moved by coming into contact either with the dispersed world of perceptible things or the indivisible world of Forms. When the discourse is about perceptible things, opinions and beliefs are produced; when it is about rational things, mind (νοῦς) and knowledge (ἐπιστήμη) are the result (*Tim.* 36d–37c). The reasoning power of the world soul, described as *logos,* is plainly stressed by Plato; and the power of sensation may be inferred, even though it is not plainly stated.[2] The same ideas are also found in Zeno's cosmobiology. Zeno's cosmos possesses both sensation (*SVF* 1.114) and reasoning power, for which he uses the same word Plato had used to describe the activity of his world soul, namely *logos* (*SVF* 1.111, 113). Zeno elsewhere is reported to have said *logos* is the nature of the cosmic mind (*animus Jovis, SVF* 1.160, cf. 161).

Even Zeno's proofs are based on Plato. His teleological proof seems to be based on a passage in Plato's *Timaeus:* "It neither was nor is right for the supremely good to do anything but the best. After thinking about it, he [scil. the demiurge] found that among naturally visible things no work that is without mind will be better than one with mind, when each is considered as a whole; and it is impossible for mind to be present in anything without soul. On the basis of this reasoning in fashioning the Universe he placed mind in soul, and soul in body, so that the finished work might be by nature the most beautiful and best possible" (*Tim.* 30a–b). Zeno has modified Plato's argument only so far as to eliminate Plato's genetic point of view.

Zeno's second type of proof is based on the argument attributed to Socrates in Plato's *Philebus* and Xenophon's *Memorabilia.*[3] In Plato, Socrates argues that the elements in our bodies are derived from the elements in the body of the cosmos. Socrates then goes on to say that our bodies also have soul and asks: "Whence can a human body have received its soul, if the body of the universe does not possess soul?" (*Phil.* 29a–30a). In Xenophon, Socrates uses the same argument in a briefer form to prove that mind (νοῦς) is in the cosmos (*Mem.* 1.4.8). Socrates' argument presupposes that all components of a living thing are derived from the components of the cosmos, and this is reason to believe that the cosmos must, like a man, have a soul and reason. In the *Timaeus* Plato gives a "likely" explanation of the way in which a man derives his components from the cosmos. The demiurge fashions human souls out of the ingredients left over from making the world soul (*Tim.* 41d). Then his children, the celestial gods, borrow a quantity of each of the four elements from the cosmos, rivet it together, and enclose a human soul within each body (*Tim.* 42e–43a). Zeno's only contribution to the Platonic argument is claiming the process by which man is derived from the cosmos to be biological generation. This is a simple natural step, since both man and his source are living beings.

Zeno's third argument is not found as such in Plato, but its underlying premise is Platonic. Zeno's argument assumes that individual living things are organic parts of the cosmos. This unusual idea resembles Plato's statement that the cosmos was created in imitation of "that living being of which the other living beings individually and generically are parts" (*Tim.* 30c). Thus for Plato, as for Zeno, our cosmos is a living being, and the individual living things in it are parts of the whole cosmic animal.

The similarity between Zeno's conception of the cosmos as a living, intelligent animal and Plato's discussions of this subject makes it probable that Zeno was directly influenced by Plato.[4] Although the conception of an ensouled cosmos lived on in the Academy,[5] as far as we can tell from the fragmentary remains, no philosopher set forth anything as close to Zeno's view as did Plato himself. We might well ask, then, why Zeno chose to follow Plato so closely on this point. We have found that, in general, Zeno's cosmology has taken its start from Aristotle, so this leap back over Aristotle to Plato seems somewhat anomalous. But we must remember that the Stoic conception of the cosmos as a living, ensouled animal was a very deep one. Since Aristotle did not provide much material on the soul of the cosmos, it is not too surprising that Zeno would turn to someone who did.

Moreover, if we look a little deeper, we shall find that Zeno has not necessarily ignored the Peripatetic developments in this area.

Plato had made a self-moving world soul responsible for all movement in the cosmos (*Leg.* 10.895e–897b). Aristotle, however, had rejected this view and had pointed out that a self-mover can actually be resolved into an active and a passive part, an unmoved mover and a first moved (*Phys.* 8.5.257a31–258b9). Thus all movement in the cosmos can ultimately be traced back to an unmoved first mover outside the cosmos. Since there can be no contact with the partless, incorporeal unmoved mover, the first moved, the sphere of the fixed stars, is caused to move by desire (ὄρεξις) for the unmoved mover (*Phys.* 7.1; 8.4–10 [esp. 8.10.267a21–b26]; *Metaph.* 12.7.1072a21–b4). With this explanation Aristotle had satisfied himself that soul is not the ultimate cause of all movement.

Theophrastus took issue with Aristotle's theory and argued that if the heavenly bodies are capable of desire (ὄρεξις), they must also possess soul and therefore psychic movement or change. Both desire and the perception that leads to desire have their origin in soul and the psychic movements of the body. Accordingly, the thing desired cannot be considered the first cause of movement, because the perception of the thing desired and the subsequent desire for it presuppose the existence of movement.[6] Instead, the soul of the first moved body must be reckoned the first cause of movement. Thus Aristotle's theory actually leads to the conclusion that the soul possessed by the stars is the real first mover. In effect, then, Theophrastus has shown that Aristotle's theory, if followed out logically, comes back to the position of Plato.[7] If Zeno knew Theophrastus's examination of Aristotle's theory of the first mover, it is understandable that he conceived of the cosmos as a living thing, owing its movement to soul; and it is not so strange that he turned to Plato for elaboration of this idea.

Whether Zeno went beyond Plato at all is hard to say. He probably went beyond Plato at least so far as to identify the world soul with fire, so that it might have a material substance (*SVF* 1.157, cf. 154). But we have no idea whether or not he made use of this identification to introduce strictly biological doctrines into his cosmology. The only biological motif we know he introduced is the idea that living things are derived from the cosmos by a reproductive process (*SVF* 1.112, 113). So it seems quite possible that in his one book on cosmology, *On* *the Universe,* Zeno did not go much beyond the Platonic conception of the world soul.

When we turn to the cosmobiology attested for Cleanthes, we find the picture quite different. With Cleanthes the predominant motifs are physiological, though fitted into the Platonic structure of Zeno's cosmobiology. We do not know whether this new look was original with Cleanthes, or was developed already by Zeno later in life, after he had published the doctrines just reconstructed, or even whether it was part of Zeno's original cosmobiology and has merely been lost. All we can do is discuss this new approach in connection with Cleanthes and leave the question of its original proponent open.

For Cleanthes, as for Zeno, the cosmos has a soul. "The soul permeates the whole cosmos, and we share a part of it and are consequently ensouled" (*SVF* 1.495, cf. 532). Fortunately, Cicero in *On the Nature of the Gods* preserves a long discussion of the world soul that seems to go back to Cleanthes.[8] This fragment is particularly valuable because it displays the Stoic ideas in context. If we collect the conclusions of each section of this account, we can deduce Cleanthes' aim. The account aims to prove that the cosmos is preserved by the fiery world soul as an intelligent (*sapiens*), sensitive (*non sine sensu*), ensouled animal (*animans*).[9] It would, therefore, seem that Cleanthes is faithfully following Zeno and attempting to prove Zeno's contention that the cosmos is a rational, intelligent, sensitive ensouled animal. What is new is Cleanthes' proof for this doctrine.

Zeno's proofs were taken directly from Plato and by themselves gave not the slightest indication that the world soul is a material entity; Cleanthes rests his proof on the assumption that the heat of the cosmos is the world soul. To determine his basis for this assumption and for his proof in general, we must look at his arguments in detail. The first part of Cleanthes' proof is devoted to proving that the cosmos is preserved in a long life by the heat (*in tanta diuturnitate servari, Nat. D.* 2.28). In the previous chapter we examined one of the problems that plagued Zeno, namely the survival of the cosmos in the void. The fact that Chrysippus was still working on this problem proves that Zeno's attempts had not settled the issue. Hence the survival of the cosmos must have been one of the crucial problems facing Cleanthes during his leadership of the Stoa. How Cleanthes answered the charges that the cosmos would disintegrate in the void, we are not explicitly told; but in this fragment Cleanthes is obviously concerned with the preservation of the cosmos in its present state of organization. This may be part of Cleanthes' attempt to solve the problem he had inherited from Zeno.

Cicero's summary of Cleanthes shows how Cleanthes proved that the ethereal heat preserves the cosmos. His entire proof rests on an analogy with a living animal. Every living thing contains heat without which it cannot be nourished or grow; for the heat is a self-mover, and everything that is nourished and grows uses a definite and uniform movement. As long as this movement remains in us, sensation and life remain; but as soon as the heat is extinguished, we die. Cleanthes uses several proofs to show that heat is involved in the digestive process and in the uniform movement of the pulse, which supplies nutrients for growth. Consequently he concludes that everything which has life, plant or animal, lives on account of the heat within it (*Nat. D.* 2.23–24).

From this Cleanthes infers that heat possesses a vital force that extends throughout the cosmos. This inference he supports by a proof that appears to resemble his proof that heat supplies the vital force in men but that is quite different in form, since the key to his microcosmic proof, the contrast between the presence and absence of heat, is not applicable to the cosmos. First he demonstrates the importance of heat in all the major parts of the cosmos, just as he had demonstrated its importance in the vital processes of nutrition and growth. He gives proofs for the presence of heat in earth, water, and air, pointing out that water is fluid only because heat is mixed in, and that air, though the coldest of the elements, is generated from water by heat and hence contains at least a little heat. The fourth element is heat itself, the source of all the other vital, health-giving heat in the cosmos. His conclusion is that since all the major parts of the cosmos are sustained by heat, the cosmos itself is preserved in such a long life by the same or a similar substance (*Nat. D.* 2.24–28).

The form of this proof is recognizable as Zeno's. Zeno had argued: "Nothing devoid of sensation can have sentient parts. The cosmos has sentient parts. Therefore the cosmos is not devoid of sensation" (*SVF* 1.114). Cleanthes has merely changed the content; if the parts are sustained by heat, then the whole is also sustained by heat. If we may trust Cicero's account, Cleanthes did not rest this proof only on the argument from parts to whole, but added that the conclusion is all the more true because the heat is interfused with nature in such a way that it is the generative power by which plants and animals are born and grow (*Nat. D.* 2.28). Cleanthes seems to be arguing that since the heat in living things is the sustaining vital force, the cosmic heat from which these living things are derived must therefore be the sustaining vital force in the cosmos. In form this looks like an adaptation of Zeno's argument that since the cosmos generates ensouled and rational creatures, it too must be ensouled and rational (*SVF* 1.112, 113). Formally, Zeno's argument is that the source must have the same qualities as the derivatives of the source; Cleanthes argument is that the heat in the source must have the same function as the heat in the derivatives of the source. Thus by adopting certain logical forms from Zeno, Cleanthes has proved that the ethereal heat preserves the cosmos. We shall return later to the general significance of Cleanthes' physiological conception of the world soul, but first we may ask what importance his point of view had for the question why the cosmos endures.

In the next section of Cicero's summary the sustaining vital heat is described as a substance that holds together (*contineat*) and preserves (*tueatur*) the whole cosmos (*Nat. D.* 2.29), and as a substance that holds all things in its embrace (*res omnes conplexa teneat*), with the result that the cosmos is held together (*contineri*) by a divine nature (*Nat. D.* 2.30). According to Cicero, Cleanthes also describes the celestial heat as "poured around on all sides, binding (*cingentem*) and embracing (*conplexum*) all things" (*Nat. D.* 1.37[=*SVF* 1.534]). The idea contained in the word *tueatur* is the preservation that dominates the text we have been discussing, but the idea expressed in *contineat* and *contineri* is new. This word seems to translate συνέχειν, a term that we shall see had great importance later as a technical term for the function of the *pneuma* in holding things together and giving them unity. In fact, this is the term used for the coherence of the cosmos in the void (*SVF* 2.540, 551, 552, 553). The occurrence of this term in Cleanthes' discussion of the heat is a strong indication that Cleanthes used the heat to explain the cohesion of the cosmos in the void, considering the cohesion of the cosmos an essential part of its "preservation in a long life."

It is hard to tell how Cleanthes meant the term to be taken. The expression "heat which binds together" (*cingentem ardorem*, Cic.

Nat. D. 1.37[=*SVF* 1.534]) could suggest that the celestial fire has a binding force that is due to its encircling nature, but need not necessarily have this meaning. On the one hand, Plato, attempting to explain why the elements do not separate from each other, says, "The circumference [περίοδος] of the universe . . . being circular and naturally wishing to come together upon itself, binds all things together [σφίγγει] and allows no empty space to be left" (*Tim.* 58a). Plato seems to take literally the binding function of the outermost heaven.[10] On the other hand, the idea that the *aether* binds the cosmos together is an old poetic idea. Empedocles speaks of the "*aether* which binds together [σφίγγων] all things in a circle" (DK 31 B 38.4); so we cannot really draw any inferences from Cleanthes' language, especially since he was also a poet.[11] It is well to remember that the Epicurean poet Lucretius described the *aether* in terms very similar to those of Cleanthes, for he says the *aether,* "set around on all sides, binds[12] and, spreading wide in every direction, fences in all other things in its greedy embrace" (5.467–470: *circumdatus undique* ⟨*flexit*⟩ / *et late diffusus in omnis undique partis / omnia sic avido complexu cetera saepsit*).

Whether Cleanthes also saw in the poetic description of the all-embracing heavens a force literally binding by encirclement, or whether he believed the heat to hold the cosmos together only from the inside in the manner in which it sustains living things, he has made a significant advance over Zeno's theory. In Cleanthes' theory the cosmos no longer has to rely on the natural movements of its elements if it hopes to remain intact. This natural movement, which was vulnerable to Epicurean attack, is now superfluous;[13] one of the elements provides the force that preserves the cosmos.[14] The troublesome question what keeps the cosmos from disintegrating in the void and perishing has been answered by Cleanthes on the basis of a biological analogy.[15] As the vital force of the heat sustains us, so it preserves and holds together the cosmos, which is a living being as much as any man. Cleanthes has simply extended the use of the biological analogy that Zeno introduced, to an area and problem to which Zeno had not yet applied it.[16]

Having proved that the cosmos is sustained and maintained by the vital heat, Cleanthes now turns to the proof that the cosmos is intelligent. The argument (*Nat. D.* 2.29–30) is difficult to interpret in its context; it seems likely that a section has been omitted. Possibly *Nat. D.* 2.40–44 was originally composed to fit between *Nat. D.* 2.29 (*dominatuque dignissimum*) and *Nat. D.* 2.30 (*Videmus*).[17] If so, Cleanthes argues that the sun is composed of the kind of fire that is in living things, namely, the vital fire; and so it and the other celestial bodies must be living animals. Cleanthes then sets out to prove that the celestial bodies possess sensation and intelligence. His proof is interesting because it borrows material from Plato and Aristotle. Aristotle is mentioned by name on two occasions; and since the quotations from Aristotle do not come from any extant treatise, it seems reasonable to assume that Cleanthes is quoting the now lost *On Philosophy*.[18] Cleanthes' assertion that the regularity of the heavenly movements rules out nature or chance as cause and indicates rather that the heavenly bodies are moved of their own accord by sensation and divinity (*Nat. D.* 2.43) seems to be reminiscent of Plato (*Leg.* 10.888e–898c). Plato distinguishes nature (φύσις), chance (τύχη), and art, also called mind or god (τέχνη, νοῦς, θεός) as sources of movement (*Leg.* 10.888e, 889c). He rejects the theory of the physicists who say the movement in the cosmos is due, in the first place, to nature or chance (*Leg.* 10.888e–891d); and he demonstrates that it is due rather to a self-moving soul, which moves the cosmos with the movement of reason, namely, uniform, circular movement.[19]

Having proven with arguments derived from Plato and Aristotle that the celestial bodies are sentient and rational, Cleanthes again makes use of Zeno's argument from parts to whole to prove that the celestial heat is sentient and rational. Since the celestial bodies, consisting of vital heat and therefore parts of the vital heat, are sentient and rational, the whole of the vital heat that holds the cosmos together and preserves it must possess sensation and reason. Therefore the cosmos itself must be intelligent (*sapiens*) and, in fact, a god.[20] Thus, once again, Cleanthes has taken the doctrine and the formal syllogistic structure from Zeno and filled the form with new content to prove the doctrine. The content again includes a physiological view of the soul of the cosmos and draws on the writings of Plato and Aristotle without embarrassment.

The next section (*Nat. D.* 2.30–31, *atque etiam . . . ardore teneatur*) proves that the cosmos possesses sensation. Here the initial assumption is that the heat of the cosmos is the same as the heat in us.

This belief was first stated in Cleanthes' proof that the cosmos is sustained by heat. There he said the heat of the cosmos is infused in nature so as to be the generative principle and that by which plants and animals are caused to be born and grow (*Nat. D.* 2.28). Then in the proof that the cosmos is intelligent Cleanthes demonstrated that the heat in the sun and in living things is of the same nature (*Nat. D.* 2.40–41). Now he simply assumes that the heat of the cosmos is identical with the vital heat in us. His argument is that since the cosmic heat is purer, brighter, and more mobile than our heat, it must be more suited for producing sensation. If even our inferior heat produces sensation in us, the superior cosmic heat must produce sensation in the cosmos; so the cosmos must be sentient. This *a fortiori* argument, which, as far as we can tell, has not, as the previous arguments, obtained its form from Zeno, resembles Cleanthes' other arguments in being built around a physiological conception of the cosmos.

Finally Cleanthes approaches the world soul directly. The heat of the cosmos is not moved by another force—for what stronger force exists? It must therefore be self-moved (*per se ipse ac sua sponte moveatur*). Plato, "that god of philosophers as it were," says that self-movement is more divine than movement caused from without, and self-movement exists only in soul. Therefore, since the heat of the cosmos is self-moved, it must be soul; and the cosmos must be a living, ensouled creature (*Nat. D.* 2.31–32, *praesertim cum . . . esse mundum*). This time to prove Zeno's doctrine Cleanthes has helped himself to the ideas of Plato's *Laws* (*Leg.* 10.895b–899b; cf. *Phaedr.* 245c–246a, *Tim.* 89a). But Cleanthes has made some changes, for Plato's self-moving soul was an incorporeal source of movement, acting in some obscure way upon the heavenly bodies, whereas Cleanthes' self-moving soul is the corporeal cosmic heat. Once again, Cleanthes' physiological conception of the world soul is the basis on which he constructs a proof for Zeno's doctrine out of this Platonic material.

This lengthy passage clearly reveals how Cleanthes worked. He accepted Zeno's doctrine that the cosmos is a sentient, intelligent, ensouled animal. Then he took Zeno's syllogisms and appropriate ideas and arguments from Plato and Aristotle, and transformed them into a proof for Zeno's doctrine. Underlying this transformation of the borrowed arguments was a single, powerful idea, the idea that the heat of the cosmos is its soul and consequently the cause of its survival, life, sensation, and intelligence. This is the new idea that transforms Zeno's general idea of a world soul into a *physiological* theory. Cleanthes thus brings out the full import of Zeno's belief that the cosmos is a living animal and that its vital processes are accordingly physiological. Whereas Zeno developed the implications of this idea for cosmogony, Cleanthes applies it consistently to the continued existence of the cosmos.[21]

From Cleanthes' discussion it is possible to deduce his theory of cosmic physiology. The cosmic heat, as soul of the cosmos, performs several functions. First of all, it sustains and preserves the cosmos and gives it life.[22] The analogy with the heat of the body suggests that the function of preservation is allied with, and perhaps equivalent to, the heat's function of causing nutrition and growth (*Nat. D.* 2.23–24, cf. 40–41). In addition to the nutritive function, the cosmic heat has the function of producing sensation, just as the vital heat produces sensation in animals (*Nat. D.* 2.30–31; cf. 23, 41). Finally, since this heat, possessing sensation and reason, enables the cosmos to be called intelligent, it seems to function as the mind of the cosmos.[23]

The most striking thing about the three functions of the heat in Cleanthes is that they correspond exactly to the three functions of the soul, or the three kinds of soul, in Aristotle. For Aristotle recognized as distinct the nutritive (*θρεπτικόν*), perceptive (*αἰσθητικόν*), and rational (*διανοητικόν, λογιστικόν*) faculties of the soul.[24] The resemblance becomes all the more striking when we compare the details of each function. Aristotle considered nutrition and growth to be the basic prerequisite of all life. Plants, for example, are living things, though they possess only this one aspect of soul. Thus both plants and animals possess the nutritive soul (*De An.* 2.2.413a20–b10, 3.414a29–b1, 4.415a23–25, b26–28; 3.9.432a29–30, 12.434a22–27; cf. *Part An.* 2.10.655b28–34; *Gen. An.* 2.1.735a15–21; *Eth. Nic.* 1.7.12.1097b33–1098a1). Cleanthes, too, moves from nutrition and growth to life, as if the terms were coextensive; and when he speaks of nutrition, growth, and life, he mentions both plants and animals (*Nat. D.* 2.24, 28), though plants are not mentioned in his later discussion of the perceptive and rational functions of the heat.

Moreover, we took note that part of the heat's sustaining function is to hold the organism together (*continere* = *συνέχειν*). Aristotle in discussing the nutritive function of the soul said Empedocles attributed the growth of plants to the natural movement of the elements. Earth moves down and causes the roots to spread downward; fire moves up and so causes the plant to grow upward. One of Aristotle's arguments against Empedocles' theory was that if fire and earth move in opposite directions, they will be torn apart unless something prevents them. There must be something holding them together (τὸ σύνεχον), and this will be the soul and the cause of growth and nourishment (*De An.* 2.4.415b28–416a9; cf. 1.5.411b5–19). So even the function of holding the organism together was found in Aristotle's doctrine of the nutritive soul. As Aristotle continued his discussion of the function of the nutritive soul, he explained the difference between the terms "nourishment" and "growth." Food is a promoter of growth for a living body *qua* quantitative, whereas food is nourishment for a body *qua* individual and substance; for food preserves (σώζει) substance. Consequently this soul principle is a power that preserves (δύναμις οἷα σώζειν) its possessor; and food prepares it to do this (*De An.* 2.4.416b11–19). Here Aristotle specifically gave the nutritive soul a preservative function, the very function that looms so large in Cleanthes' discussion of the first function of heat in the cosmos (cf. *servari, tueatur, Nat. D.* 2.28, 29).

There is still one essential difference between Aristotle and Cleanthes. Aristotle assigned this nutritive, preservative function to the soul, which, as "the first realization of a natural body potentially possessing life" (*De An.* 2.1.412a27–28), is incorporeal. Cleanthes, on the other hand, assigns this function to the vital heat. The gap between them is vast, but not unbridgeable. In his discussion of the nutritive soul Aristotle raised the question whether it would be correct to call fire the cause of nutrition and growth. He asserted this would not be correct; rather we should say fire is the contributing cause (συναίτιον) and soul is the real cause (ἁπλῶς αἴτιον, *De An.* 2.4.416a9–18). To be more specific, he said, the agent of nourishment (τὸ τρέφον) is the soul; the means of nourishment (ᾧ τρέφεται) is the food, though actually "means of nourishment" has a double meaning, since every food must be cooked, and cooking is accomplished by heat. He concluded from this that every ensouled body possesses heat (*De An.* 2.4.416b20–29). Aristotle then dismissed the subject with the excuse that this process must be explained more clearly elsewhere.

Although there is no specific discussion of nutrition extant, there are many incidental statements in which Aristotle reiterated his position on the relation between the nutritive soul and heat. In *On Youth and Old Age* he said, "The other faculties of soul cannot exist without the nutritive; and this not without natural fire, for nature has kindled [ἐμπεπύρευκεν] the soul in this fire" (*De Juv.* 14.474b10–13, cf. 27.480a16–19; *Gen. An.* 2.4.740b29–34). Again he said, "Life and the possession of soul are accomplished by heat, for the cooking through which food comes to living things cannot occur without soul and heat" (*De Juv.* 14.474a25–28; cf. 4.469b11–12; 6.470a19–20; *Part. An.* 2.3.650a2–7). Finally, in *On the Parts of Animals* he faced the crucial question whether the soul is actually the fire of the body. Without outrightly rejecting the idea he said: "Perhaps it would be better to say that the soul subsists [συνεστάναι] in some such material [i.e., fire]. The reason for this is that of the corporeal substances the hot is the most serviceable for the activities of the body; for to nourish and cause movement are activities of the soul, and these come about primarily through the hot power" (*Part. An.* 2.7.652b8–13). He concluded that saying the soul is fire is like saying that the craftsman and his tool are the same thing (*Part. An.* 2.7.652b13–15). Clearly Aristotle's position was that soul and fire are closely connected but not identical. Since, as Aristotle admitted, the soul had been identified with fire in the past, and since Aristotle himself still recognized a close connection between heat and the soul in its nutritive function, it was no difficult matter for Cleanthes to identify them again.[25] Then having taken this step, he could easily extend the identification to the other functions of the soul. This he had to do on his own, because Aristotle did not connect heat very closely with sensation or reason. Sensation he connected with *pneuma*,[26] and reason he associated with no material substance at all (*De An.* 2.2.413b24–27; *Gen. An.* 2.3.736b27–29).

Cleanthes does not go into detail on the heat's role in the production of sensation (*Nat. D.* 2.30–31), so we cannot compare his theory with Aristotle's; but he does have something to say on the rational aspect of the soul. Cleanthes concludes that the cosmos is intelligent because it possesses a part that is sentient and rational. In physical terms this part is the heat of the cosmos and, in particular, the heat of the heavenly bodies; in psychological terms this part is the soul. If our hypothesis that *Nat. D.* 2.40–44 was written to come between *Nat. D.* 2.29 and

30 is correct, Cleanthes proved that the heat has sensation and reason by means of two arguments. The first of these, based on the fact that the environment of the stars produces sensation and reason, may have connections with the cosmology and theology of Aristotle's *On Philosophy*, but not with his psychological doctrine per se.[27] The second argument merits closer examination. The movement of the heavenly bodies that embody the heat is the initial datum on which Cleanthes' inference is based. The path by which he goes from this movement to the conclusion that the heavenly bodies (and therefore the heat of which they are composed) possess sensation and reason is by no means clear from Cicero's summary, but it becomes amply clear against the background supplied by Aristotle's theory of animal movement.

Cleanthes infers from the regularity of the celestial movements that these movements cannot be due to chance or nature, but must be self-moved. Up to this point the argument is Platonic and proves only that the movements are due to soul.[28] Then the argument goes on to infer that the heavenly bodies are moved "by their sensation and divinity" (*suo sensu ac divinitate, Nat. D.* 2.43). Plato does link god with the mind, which he contrasts to nature and chance (*Leg.* 10.889c); but it is not clear how Cleanthes goes from self-induced movement of soul to movement based on sensation, unless Cleanthes is assuming with Aristotle that in ensouled animals local movement is a product of sensation. Aristotle does not say movement is produced directly by the faculty of sensation, nor any other faculty for that matter; but the process that leads to local movement presupposes and, in fact, is initiated by perception (*De An.* 3.9–11 [esp. 3.10.433b27–30]; 3.12.434a22–b8, cf. 3.3.428b10–429a9). If Cleanthes made this same assumption, local movement in ensouled animals is an adequate indication that the moving animal has sensation.[29]

Cleanthes goes on to approve Aristotle's inference from the circularity of the heavenly movements that the celestial bodies are moved neither by nature nor by force, but by will (*Nat. D.* 2.44). Again it is not clear how this leads to the conclusion that the heavenly bodies possess sensation or reason. However, it is possible to reconstruct a path on the basis of the Stoic premise that will is a "desire with reason" and can occur only in the wise.[30] Now a comparison with Aristotle's theory of movement reveals that this reconstruction is in substantial agreement with Aristotle. According to Aristotle the cause of local movement is appetite (ὄρεξις). When mind produces movement, it, of course, does this with appetite, but with a specific kind of appetite called will (βούλησις); for will is appetite with reasoning (λογισμός). There is also appetite without reasoning; this is called desire (ἐπιθυμία, *De An.* 3.10.433a22–27). If Cleanthes had Aristotle's theory in mind—and this is quite possible, since the Stoics obviously took over much of his theory into their ethics[31]—the voluntary movement of the stars is adequate proof that they also possess reason.

It seems more than coincidence that Aristotle's theory of movement contains ideas that can transform the loosely reasoned argument of Cicero, *Nat. D.* 2.43–44 into a strictly reasoned piece of writing. It is tempting to conjecture that Cicero has abridged the original argument and that this argument is as close to Aristotle as Cleanthes' discussion of the sustaining function of the soul. If Cleanthes actually wrote this section, the similarities between Cleanthes' conception of the world soul and Aristotle's doctrine of the human soul are even more remarkable—so remarkable, in fact, as to suggest that Cleanthes devised his doctrine under the influence of Aristotle's psychology.

There are two aspects of Cleanthes' conception of the world soul on which we have not yet touched. Cleanthes considered the sun to be the ruling principle or *hegemonikon* of the cosmos (*SVF* 1.499). *Hegemonikon* in the Stoic vocabulary is the technical term for the chief part of the soul. Zeno and most of the Stoics after him divided the soul into eight parts: the *hegemonikon*, the five senses, the vocal part, and the generative part.[32] There is no evidence that Zeno himself identified the parts of the world soul or applied the term *hegemonikon* to a part of the cosmos; and Cleanthes' justification of his use of this word for the sun gives the impression that he was innovating at this point.[33] If this was his own innovation, it was in keeping with the Stoic assumption that analogy from the microcosm is a valid means of explaining the macrocosm. The eight parts or spheres in the heavens (sun, moon, five planets, and the sphere of the fixed stars) may have reminded Cleanthes of the eight parts of the soul and suggested that one of these heavenly bodies must be the *hegemonikon*. At any rate, Cleanthes, in making the sun the ruling part, was expanding Zeno's conception of the world soul, in this case not on the basis of Aristotle's psychology but on the basis of the existing Stoic doctrine of the human soul.[34]

Though Cleanthes' identification of the sun as the principal part of the world soul is based primarily on the Stoic doctrine of the soul, we must not forget that it had a partial precedent in Aristotle's cosmology. In *On the Heavens* Aristotle maintained that just as the true center (μέσον) of an animal (i.e., the heart) is not at the center of the body, so in the cosmos the true center and *archê* is not at the geometrical center but at the periphery (*Cael.* 2.13.293b6–15). The parallel with Aristotle would be closer if Cleanthes, like Chrysippus (*SVF* 2.642, 644), had considered the *aether* as a whole to be the principal part of the world soul. As it is, Aristotle provides a precedent both for the use of the zoological analogy to determine the true center or "heart" of the cosmos and also for placing the "heart" of the cosmos in the heavenly region.

Another example of Cleanthes' expansion of the concept of the world soul on the basis of the Stoic doctrine of the human soul can be seen in Cleanthes' statement that the sun and other heavenly bodies, being fire, cannot exist without nourishment (*Nat. D.* 2.40). Therefore the sun is nourished by exhalations from the ocean and the rest of the heavenly bodies by exhalations from the rest of the water on the earth's surface (*Nat. D.* 2.40 [=*SVF* 1.504], 43; *SVF* 1.501). Cleanthes uses this theory to explain the solstices. The sun, requiring a tremendous amount of moisture to feed on, has to remain over the ocean that girdles the globe; therefore it turns back when it reaches the edge of the ocean (*SVF* 1.501). Cleanthes' theory is obviously patterned on Zeno's theory of the soul, which Cleanthes quotes with approval (*SVF* 1.519). Zeno held that the soul is a perceptive exhalation (ἀναθυμίασις) and that souls are continually renewed (νεαραί)[35] by being exhaled (ἀναθυμιώμεναι, *SVF* 1.139[=520], 141[in part=519]). The exhalation for the human soul comes from the blood (*SVF* 1.140[=521]; cf. 2.778, 781, 782, 847). Cleanthes has merely extended this theory to the world soul and has concluded that the heavenly bodies are sustained by exhalations from the liquids of the world's body.

However, by making this extension he has brought his astronomical theory into harmony with the theory of Heraclitus. Heraclitus held that the heavenly bodies are fire, and in fact, fire consuming an exhalation from the sea; so like the Stoics, he maintained that the heavenly bodies are sustained by exhalations (DK 22 A 1.9–10; 11; 12). This theory was not limited to Heraclitus. Anaximenes seems to have held that the heavenly bodies came into existence when moisture rising from the earth was rarefied so far as to become fire.[36] Xenophanes also believed that the sun draws up moisture (DK 21 A 46; B 30) and is itself a collection of fiery particles gathered from the wet exhalation (DK 21 A 33.3; 40). In fact, it is not impossible that this was the general Milesian theory.[37] This theory, and particularly Heraclitus's version of it, ought to be compared in detail with the Stoic theory. Unfortunately the nature of our sources makes this virtually impossible,[38] and so only a few details may be compared. The notion that the heavenly bodies use water as food (τροφή) may have been held by Heraclitus, though this is not certain.[39] The idea was certainly put forth by someone before the Stoic era, because Aristotle refutes it.[40] That the sun's search for food is responsible for the solstices is also mentioned by Aristotle in the same context. If Aristotle is referring to Heraclitus, this idea of Cleanthes, too, might be able to be traced back to Heraclitus; but in this whole area we are on shaky ground in claiming a Heraclitean influence on Cleanthes, as long as we do not know to whom Aristotle is referring.

When we compare some of the well-attested details of Heraclitus's astronomical theory with Cleanthes' theory, we find both differences and similarities. For example, Heraclitus believed the sun is new every day (DK 22 B 6), and he said the heavenly bodies are bowls in which the exhalation is burning (DK 22 A 1.9–10; cf. A 12). Neither of these ideas is found in Cleanthes' theory. On the other hand, there is one respect in which Cleanthes may have been directly influenced by Heraclitus. Cleanthes, unlike the rest of the Stoics, held that the celestial bodies are conical in shape (*SVF* 1.508, cf. 506). This idea he may have derived from Heraclitus's notion that the heavenly bodies burn in bowl-shaped containers (DK 22 A 1.9–10; cf. A 12). Conceivably Cleanthes used this idea to explain eclipses, just as Heraclitus had done.[41] Therefore, all we can say is that Cleanthes, by conceiving the world soul on the pattern of the human soul, found that he could bring his cosmology into line with an old theory described by Aristotle, possibly going back to Heraclitus, and that he may have adjusted his astronomical theory slightly to conform to Heraclitus. We cannot say that he made Heraclitus's astronomical theory the basis of his entire conception of the heavens.

We should now be able to see Cleanthes' role in the evolution of Stoic cosmobiology in its proper perspective. The doctrine that he upheld, namely, that the cosmos is a living, intelligent, ensouled being, was the doctrine that Zeno had taught him; but Cleanthes forged new arguments to prove Zeno's doctrine. It is this achievement that gives meaning to Cleanthes' boast that if he deserves to be called an ass, it is because he is the only one able to carry Zeno's load (*SVF* 1.463). It is this achievement, too, that constitutes Cleanthes' claim to originality. Cleanthes' new proof retained, in addition to Zeno's conclusions, the syllogistic forms that Zeno had used to prove his doctrine; but the content of the forms was totally new. Yet this content was not out of keeping with the course Zeno had set for Stoic philosophy; the Zenonian principle that analogy from the microcosm yields valid conclusions for the macrocosm was merely applied to the world soul. In this application Cleanthes turned to Aristotle's psychology to obtain the basic structure for his world soul. Aristotle's functional division of the soul provided in Cleanthes' new proof the functions of the cosmic heat; and Aristotle's close connection of the soul's functions, especially the nutritive, with heat seems to have been conducive to Cleanthes' transferral of these functions to the cosmic heat and to Cleanthes' complete identification of soul and heat. Moreover, Cleanthes probably borrowed a few arguments from Plato's *Laws* and Aristotle's *On Philosophy* to help his own argument along and to give it the benefit of the prestige of these philosophers. Where he borrowed arguments intact, Cleanthes was willing to give credit by mentioning the names of his sources; but where he was performing a radical synthesis he was discreetly silent on his sources. Thus Cleanthes' cosmobiology, in the last analysis, seems to be a synthesis of physical cosmology with Aristotelian biology and psychology. In addition, this synthesis is made to converge, where possible, with an older pre-Socratic, possibly Heraclitean, notion about the heavenly bodies.

Before leaving Cleanthes we ought to look briefly at his notion of the *tonos*, a notion that takes on more importance in Chrysippus's cosmobiology. Cleanthes defines the *tonos* as "a blow of fire" (πληγὴ πυρός). In the human soul this blow may vary in intensity; when it is sufficient to ward off attacks, it is called strength and might (ἰσχὺς καὶ κρατὸς) and seems to be the physical cause of the virtues in men (*SVF* 1.563). The *tonos* also plays a cosmological role. First of all the origin of the cosmos is due to the *tonos* in the matter of the universe. Here the word may allude to the downward and upward transformation of elements, which in a sphere is an inward and outward motion. Perhaps it alludes at the same time to the contraction and expansion that fire undergoes in elemental transformation.[42] Moreover, the activity of the *tonos* in the normal life of the cosmos may be referred to in the fragment in which Cleanthes calls the sun "the pick" (πλῆκτρον), because "in rising it implants its rays and, as if plucking [πλήσσων] the cosmos, leads it into its harmonious course" (τὴν ἐναρμόνιον πορείαν, *SVF* 1.502, cf. 503). The words for pick (πλῆκτρον) and pluck (πλήσσων) are from the same Greek root as the word for blow (πληγή) that Cleanthes uses in his definition of *tonos* as "a blow of fire." Through the use of a metaphor Cleanthes shows that he considers the action of the fire of the sun on the cosmos to be analogous to the action of a pick on a lyre; the effect is harmony. Finally, there is an allegorical treatment of the myth of Heracles, which may go back to Cleanthes (*SVF* 1.514). According to this account Heracles represents "the *tonos* in things" according to which nature is strong and mighty (ἰσχυρὰ καὶ κραταία). Here the *tonos* performs the same function in natural things that it performs in the soul (cf. *SVF* 1.563). Heracles is pictured as an archer to signify the fact that the *tonos* penetrates everywhere, like arrows, and makes things "taut" (ἔντονος). This reminds us of Cleanthes' statement that the rays of the sun penetrate the cosmos and make it harmonious (*SVF* 1.502). The only new information in this allegorization is that the *tonos* is subject to the *logos* and obeys its commands, just as Heracles was subject to Omphale.

Cleanthes' conception of *tonos* is transmitted to us in too fragmentary a state to allow either a firm reconstruction or a certain determination of its background. Nevertheless, the images associated with *tonos* in the few preserved fragments allow us to make a few conjectures. Most obviously, the musical meaning of the word "*tonos*" must have suggested to Cleanthes the image of the sun plucking the cosmos, as the pick plucks the lyre to produce beautiful harmony. This seems to be a poetic elaboration of a more basic idea, namely, that the heat of the sun produces *tonos*, and *tonos* is a "blow of fire."

We may come a step closer to the basis for this idea in Cleanthes' association of *tonos* with strength. This association may be traceable to Zeno, who seems to have believed that symmetry in the sinews or *neura* is strength (ἰσχύς) and *eutonia*, whereas lack of symmetry is weakness and *atonia*.[43] The basic meaning of *tonos*, as well as of the verb τείνω, is the stretching of a cord; and this meaning is well attested from Homer through the fourth century B.C.[44] The musical meaning of *tonos* is derived from this basic meaning because a stretched cord makes a musical sound when plucked. The word "*tonos*" is also applied to other kinds of stretched cords, such as the cords or sinews of the body. In the Hippocratic writing *On Joints*, "*tonoi*" are mentioned several times. Here the term seems to be virtually synonymous with "*neura*."[45] In the Hippocratic writers, writing before the nerves were distinguished from other cords, the word "*neura*" most often refers to tendons or ligaments, and the idea of a strong, stretched cord is frequently prominent. For instance, they are said to be stretched against (προστεταμένα) the bones and to serve as a bond (σύνδεσμος) for the joints (*De Arte* 10 [6.18, Littré = 2.208, Jones]). Their general purpose is to give the body flexibility and the ability to contract (ξύντασις) and stretch out (ἔκτασις, *Oss.* 11 [9.182, Littré]). Furthermore, in their capacity as fasteners of joints they are stretched along (παρατεταμένα) the whole body; but their strength, which in general is intermediate between flesh and bone, is said to be greatest where the flesh is least (*Loc. Hom.* 4–5 [6.284, Littré]).

The close connection between *neura*, the *tonos* or stretching of a cord, and strength can also be seen in Plato and Aristotle, where muscles are clearly included among the *neura*. Plato says the *neura* are a more taut (συντονωτέρα) power than flesh (*Tim.* 74d); and Aristotle says the strength (ἰσχύς) is in the *neura* (*Gen. An.* 5.7.787b10–11; cf. *Part. An.* 3.4.666b13–16) and the sinewy (νευρώδης) heart of bulls is taut (σύντονος) like a sinewy string stretched tight (ὥσπερ χορδὴν τεταμένην νευρίνην, *Gen. An.* 5.7.787b15–17). Moreover, he claims that the *neura* that provide strength in living beings acquire tautness or *syntonia* as the body matures, and lose it again with age (*Gen. An.* 5.7.787b10–15). The fact that Greek biology associated the idea of a stretched cord with the ligaments that bind the bones and with the muscles that produce strength in the body, may help to explain Cleanthes' association of *tonos* with strength, though a clear connection between Cleanthes and Greek biology in this idea is by no means obvious.

Cleanthes' concept of *tonos* also included another idea that may have biological affinities, namely the idea that the strength-producing tension is a result of fire. According to Aristotle's theory bodily movement comes about by expansion and contraction (ἕλκειν καὶ ἀνιέναι, αὐξάνεσθαι καὶ συστέλλεσθαι, ἐκτείνεσθαι καὶ συνάγεσθαι) of the sinews or *neura*. The origin of movement is in the heart; a small change in the heart will produce great changes in the extremities. What causes the expansion and contraction, first of all in the heart, but also eventually in the rest of the body, is heat and cold, heat causing expansion and cold contraction (*Part. An.* 3.4.666b14–15; *Mot. An.* 7.701b1–32; 9.702b20–25; 11.703b3–16; cf. 10.703a19–21). This is not the whole of Aristotle's theory of movement, and we shall return to it later; but this part of it is enough to suggest that biological thought connected heat with the expansion of the muscles of the heart and body.[46] It is this idea that may lie behind Cleanthes' notion that fire produces the muscular tension that results in strength. These tenuous links between Cleanthes' concept of *tonos* and antecedent biological ideas are hardly sufficient to clarify the relation of Cleanthes' thought to the ideas of his predecessors. More evidence will be needed if we are to solve the puzzle, and so we must postpone further consideration of the question until we have discussed Chrysippus and his concept of *tonos*.

Chrysippus's cosmobiology had its conservative and its original elements. Chrysippus, like Zeno and Cleanthes, believed that the cosmos is a sentient, rational, intelligent, ensouled, living animal (*SVF* 2.618, 633, 634, 636, 1076; cf. 92, 528, 1209). According to Diogenes Laertius he defended this belief with arguments reminiscent of Zeno's: "The animal is better than the non-animal. Nothing is better than the cosmos. Therefore the cosmos is an animal" (*SVF* 2.633). In addition to the teleological argument, Diogenes Laertius suggests he used the argument from derivative to source, an argument used by both Zeno and Cleanthes; since our soul is a fragment (ἀπόσπασμα) from the cosmos, the cosmos too must have a soul (*SVF* 2.633, cf. 774, 821, 1015). This argument also includes Cleanthes' idea that we become ensouled by partaking of the world soul (*SVF* 1.495).

Cicero preserves Chrysippus's argumentation in fuller form.[47] Chrysippus argues that everything except the cosmos exists for the sake of something else and consequently lacks something and is imperfect. Plants exist for animals, animals for man, and man for contemplating and imitating the cosmos. Even man is not perfect, but is only a fragment (*particula* = ἀπόσπασμα?) of what is perfect. Only the cosmos, since it embraces all things and nothing exists that is not in it, is perfect. How, then, can it lack the best thing? Since nothing is better than mind and reason, the cosmos must possess these. Chrysippus then adduces examples to show that in the perfect and mature everything is better than in the imperfect; for example, in the horse than in the colt, in the dog than in the puppy, and in the man than in the boy. Consequently, the perfect thing ought to possess the best thing in the cosmos. Since nothing is more perfect than the cosmos and nothing is better than virtue, virtue is an attribute of the cosmos. Moreover, since virtue may be realized in man, who is imperfect, virtue certainly must be in the cosmos; so the cosmos must be wise and divine. This argument reveals clearly the Platonic teleological argument that Zeno had adopted. It also manifests the characteristic Platonic motifs of the all-inclusiveness and perfection of the cosmos (cf. *Tim.* 29a–31b, 32c–33b).

In another fragment Chrysippus deduces self-sufficiency from the all-inclusiveness of the cosmos: "The cosmos alone is said to be self-sufficient because it alone contains in itself everything that it needs. It is nourished and increased from itself when the various parts change into one another" (*SVF* 2.604). Chrysippus's thought is very close to Plato's description of the self-sufficiency of the cosmos, which he too deduces from its all-inclusiveness: "[The cosmos] was in need of no organ by which it might receive food into itself. . . . For nothing went out or came into it from anywhere, because there was nothing. It was designed to offer its own waste as food for itself and to act and be acted upon entirely in and by itself. For the creator thought it would be better self-sufficient than needing other things" (*Tim.* 33c–d).

Apparently Chrysippus could, when it seemed appropriate, be a conservative student of the Platonic concept of the world soul that we found already in Zeno.[48] Yet he also adopted the physiological point of view of Cleanthes, for Chrysippus regarded the functions of the world soul as functions specifically of the material manifestation of the world soul. Nevertheless, it is precisely in the material manifestation of the world soul that Chrysippus also diverged from Cleanthes. To Cleanthes the world soul was the heat that permeates the cosmos, and the ruling part or *hegemonikon* of the world soul was the sun. Chrysippus, for his part, believed the world soul is the *pneuma* permeating the cosmos and the ruling part of the soul is the celestial *aether*. Chrysippus seems to have thought out his conception of the world soul in great detail: "When the cosmos is fiery, it is its own soul and *hegemonikon;* but when it has changed into water with soul left behind in it, it has changed in a way into body and soul, so that it consists of both of these; at this time it has something else as *logos*" (*SVF* 2.605). During the conflagration the fire is body, soul, and *hegemonikon* of the cosmos; but after the fluid stage is reached, and for all time until the next conflagration, body and soul are separate. Water and earth are the body of the cosmos, and fire and air are its soul (cf. also *SVF* 2.821). The *hegemonikon* of the world soul Chrysippus places in the *aether,* which is the name he gives to the fire at the periphery of the cosmos. This, he claims, is the purest and most unmixed substance, and also the most mobile. In it are situated the heavenly bodies, ensouled and divine (*SVF* 2.527, 634, 642, 644, cf. 1032).

This pure substance is localized at the periphery; the substance that penetrates the entire body of the cosmos is the *pneuma* (*SVF* 2.473, cf. 416, 442, 1027). Chrysippus accepts the common definition of *pneuma* (literally, wind) as moved air; he also accepts Aristotle's idea that it is analogous to the substance of the heavens (cf. Arist. *Gen. An.* 2.3.736b33–737a1), so that both *aether* and *pneuma* "come under the same definition" (*SVF* 2.471). This dual nature of the *pneuma* must be kept in mind to understand Chrysippus's doctrine. To account for the dual nature of the *pneuma* Chrysippus resorts to Aristotle's definition of *pneuma* as hot air (*Gen. An.* 2.2.736a1), but Chrysippus interprets this to mean that *pneuma* is actually a mixture of air and fire (*SVF* 2.841, cf. 310, 442, 786). Consequently, the *pneuma* may function either as fire or as air; and its function is determined, in part at least, by the proportion of its components (cf. *SVF* 2.715, 787). Finally, the world soul, which the mixture of air and fire constitutes, is believed to be exhaled (ἀναθυμιαθεῖσαν) from the earth and sea (*SVF* 2.821).

Chrysippus's conception of the material of the world soul is quite different from that of Cleanthes. Whereas for Cleanthes fire alone is the world soul, Chrysippus believes both air and fire go into its composition. This difference is accompanied by a difference in the identification of the *hegemonikon*. Since Cleanthes' world soul consists of fire alone, one localized portion of that fire must be the *hegemonikon;* and so the sun, the most intense part of it, receives the honor. Chrysippus does not have to make only part of the heat the *hegemonikon*. Since the soul consists of fire and air both, the *hegemonikon* can be the entire region in which fire exists in absolute purity, namely, the heavens; and so either the heavens or the *aether* may be called the *hegemonikon*.

As Cleanthes' theory of the world soul is deduced from biology, so Chrysippus's revision is based on biology. The *pneuma* seems to have been part of Stoic biology from the beginning. Zeno defined the soul as a warm or innate *pneuma* (*πνεῦμα ἔνθερμον*, *consitus spiritus*, *naturalis spiritus*), a portion of which is emitted in the semen (*SVF* 1.128, 135–38). In Zeno this *pneuma* seems to provide the breath of life and movement for a man (*SVF* 1.135, 137, 138), though the mind is furnished by fire (*SVF* 1.126, 134). Whether Zeno tried to integrate the notions of fire and *pneuma* we do not know,[49] nor have we any evidence that Zeno applied the *pneuma* to cosmology.[50] Cleanthes may have retained Zeno's definition of the soul as *pneuma* (*SVF* 1.521, 525); but he seems to have placed more emphasis on the soul as heat, perhaps assigning all psychic functions to the heat.[51] Yet it is Cleanthes who is said to have ascribed to the *pneuma* which permeates the cosmos the role of creative force in the cosmos (*SVF* 1.533). This seems to conflict with the long account of Cicero (*Nat. D.* 2.23–32, cf. 40–44) in which the heat of the cosmos is credited with all the functions of the world soul; but knowing what Chrysippus was going to make of the *pneuma*, we might conjecture that Cleanthes himself took the first steps in this direction, perhaps after Chrysippus had already joined the school.[52]

For Chrysippus the human soul is *pneuma*, pure and simple. He introduces his work *On the Soul* by defining the soul as "the *pneuma* innate in us, continuous, and penetrating the entire body, as long as the breath of life is in the body" (*ἡ ψυχὴ πνεῦμά ἐστι σύμφυτον ἡμῖν συνεχὲς παντὶ τῷ σώματι διῆκον, ἔστ' ἂν ἡ τῆς ζωῆς ⟨εὔπνοια⟩ παρῇ ἐν τῷ σώματι*, *SVF* 2.885). Chrysippus agrees with Zeno that the soul has eight parts, of which the chief part or *hegemonikon* is in the heart (*On the Soul*, reconstructed as *SVF* 2.911; esp. 2.885). The *hegemonikon* is not the heart itself, but rather the *pneuma* located in the heart (*SVF* 2.885, cf. 96, 838, 848, 879, 886; 3. Diog.30). The *pneuma* of the human soul is a mixture of fire and air, with a slight admixture of moisture from the body in which it lives (*SVF* 2.841; cf. 310, 442, 786, 787).

Chrysippus's conception of the world soul is nothing but his theory of the human soul extrapolated to the cosmos, so that the *pneuma* (air-fire mixture) permeating the cosmos is soul, and the very pure part, the fire at the periphery, called *aether*, is the ruling principle or *hegemonikon*. The question we must ask is what made Chrysippus revise Cleanthes' theory that the heat of the cosmos is its soul. The answer is not hard to find. Zeno's biology had included both the *pneuma* and the heat as competing bearers of the psychic functions, much as Aristotle's biology had made both *pneuma* and heat competing tools of the soul.[53] The difficulty of integrating the *pneuma* with the four-element theory, whether in biology or cosmology, weighted the balance in favor of heat, whose biological importance was unquestioned and whose reputation was generally high;[54] so Zeno made heat serve as the material of the world soul and god. Cleanthes thought he could settle the issue by ascribing all the psychic functions to the heat, but his solution set the Stoics in conflict with contemporary medical thought, which had meanwhile been moving in the other direction.

The key figure in the new movement of medical thought seems to have been Praxagoras of Cos (fl. ca. 300 B.C.).[55] For Praxagoras the *pneuma* was the main agent of psychic activity. The blood, which flows through the veins, he thought, produces nutrition and growth (fr. 79, Steckerl), whereas the *pneuma*, with which the arteries are filled, transfers movement from the heart to the sinews that move the body (frs. 9, 11, 75, 85, Steckerl). Whether Praxagoras believed this *pneuma* to be responsible also for sensation, we cannot tell from the extant fragments. We do know that he believed breathing nourishes the soul or psychic *pneuma* (fr. 32, Steckerl), apparently identifying the *pneuma* with soul. Since he thought the soul to be situated in the heart (fr. 30, Steckerl) and thinking to be a function of the heart (fr. 62, 72; cf. Phylotimus, fr. 1, Steckerl), it is probable that he assigned to the *pneuma* thought as well as the production of movement. In Praxagoras's view the heat took a lowly place. Though some heat is necessary for digestion, this heat is not innate but acquired, probably coming in with the food itself,[56] so that digestion is perhaps nothing more than ordinary decomposition (cf. Plistonicus, fr. 1, Steckerl).

In the third century the stature of the *pneuma* increased, whereas that of the heat decreased. Heat seems to have had no role in the physiology of Herophilos of Chalcedon and Erasistratus of Ceos, the two chief physicians working in Alexandria. They both assigned perception and movement to the *pneuma*.[57] Erasistratus expressly deprived the heat even of its small role in digestion. Instead, he said the food is mechanically ground up in the stomach (Galen *De Nat. Fac.* 2.8, 3.4, 3.7 [2.110–11, 118–19, 157, 166, Kühn]; *In Hipp. de Aliment.* 2.7 [15.247–48, Kühn]; *Def. Med.* 99 [19.372–73, Kühn]). In fact, Galen complains that Erasistratus completely ignored the four qualities without even deigning to refute those who base their biology on the four qualities and give heat the chief role in the body (Galen *De Nat. Fac.* 2.8 [2.110–11, cf. 112–13, Kühn]).

Chrysippus thus found the *pneuma* entrenched in scientific medical thought, and spreading even to some of the philosophical schools, namely the Epicureans and Peripatetics,[58] whereas he found Cleanthes and his own school trying to keep alive the already antiquated psychic heat. Chrysippus was not one to run after every new scientific theory. When Herophilus and Erasistratus emphasized the importance of the brain for psychic functions,[59] Chrysippus in *On the Soul* vigorously defended the old-fashioned idea that the heart is the seat of the soul. He even called to witness Praxagoras, who more than half a century earlier had held the old theory (*SVF* 2.897). But this particular theory had jeopardized the venerable old Stoic idea that the *hegemonikon* is in the heart. The theory that the soul is *pneuma*, not only was not opposed to the Stoic theory but was actually part of Zeno's original doctrine. Chrysippus did not have to feel that by revising Cleanthes' doctrine he was betraying Stoicism. He could view his updating of Stoic doctrine as a rehabilitation of Zeno's original doctrine. Of course, he was still faced with the problem of integrating the *pneuma* with the four-element theory; but he solved this by defining *pneuma* as a mixture of fire and air, though this solution turned out to be exceptionally vulnerable to criticism (e.g., *SVF* 2.389, 442).

To decide how much the new trend in medical thought actually influenced Chrysippus would require a detailed comparison of Chrysippus's biological doctrine with the medical theories of the day. This is beyond the scope of our study, but a brief comparison of two key ideas will give us a preliminary clue.[60] Chrysippus defined the soul as innate *pneuma* (πνεῦμα σύμφυτον, *SVF* 2.885). The concept of *pneuma* innate in the body was characteristic of Aristotle.[61] Praxagoras, Herophilus, and Erasistratus, on the other hand, seem to have believed the *pneuma* to be acquired, not innate.[62] Chrysippus's definition of the soul, then, is in terms of the older Aristotelian *pneuma*, not the contemporary medical *pneuma*. The concept of innate *pneuma* was not taken over by Chrysippus directly from Aristotle. Zeno had already defined the soul as innate *pneuma* (*consitus spiritus*, *naturalis spiritus*, *concretus corpori spiritus*, *SVF* 1.137, 138), and so Chrysippus was just perpetuating the definition he had inherited.

On the other hand, Chrysippus's debt to the medical theory of the *pneuma* is just as obvious. Erasistratus believed the *pneuma* to be acquired through respiration (Galen *De Usu Resp.* 1, 2 [4.471, 473–74, Kühn]; *An in Arter. Nat. Sang. Cont.* 2 [4.706–7, Kühn]), and Praxagoras believed the *pneuma* to be nourished by respiration and therefore partly acquired from the outer air (fr. 32, Steckerl). The purpose of respiration among these medical writers is to sustain the *pneuma*. This stands in sharp contrast to the view of Aristotle and Diocles, who held that respiration exists to cool the innate heat (Arist. *De Juv.* 14–27; *Part. An.* 1.1.642a31–b4; Diocles, fr. 15, Wellmann).

Chrysippus's view of the purpose of respiration is not explicitly recorded but may be inferred. Cicero records a detailed description of a Stoic theory of respiration (*Nat. D.* 2.138, cf. 136). According to this account the respired air is warmed in the lungs and from the lungs passes into a ventricle of the heart; from the heart it is pumped through the arteries to the whole body as the vital and health-giving *pneuma* (*vitalis et salutaris spiritus*, *Nat. D.* 2.117, cf. 83). Cicero's account is widely believed to come from Panaetius or Posidonius,[63] but this does not necessarily mean that his immediate source was the first to adopt this physiological theory. Plutarch knows this theory as part of the general Stoic theory,[64] and a search of the fragments reveals that no other theory was known to be held in the Stoa.[65] Moreover, what we know of Chrysippus's doctrine fits the theory perfectly. As in Cicero's account, Chrysippus believed one ventricle of the heart to be filled with psychic *pneuma* (*SVF* 2.897). Moreover, he believed this *pneuma* is sent out from the heart as vital *pneuma* (*vitalis spiritus*) to all parts of the body (*SVF* 2.879). He also believed that there is a direct connection between the *pneuma* in the heart and the *pneuma* in the nostrils and the windpipe (*SVF* 2.885). In speech the voice, which is "struck air" (cf. *SVF* 2.139–41), is sent out through the throat (*SVF*

2.879, 894, 898). It is reasonable that he would have believed air can come into the heart through the same channel by which the voice leaves. Finally the *pneuma* is conceived as the breath of life and associated with breathing. For Chrysippus defined the soul as a *pneuma* penetrating the body as long as the breath of life is present,[66] and he reasoned: "We breathe and live by one and the same thing. We breathe by the natural *pneuma* [*naturalis spiritus*]; therefore we live by the same *pneuma*. Moreover, we live by the soul. Therefore the natural *pneuma* is the soul" (*SVF* 2.879, cf. 792). The close association of breathing with the psychic *pneuma* and the exact correspondence between the few attested physiological ideas of Chrysippus and the complete theory of Cicero's account makes it almost certain that Chrysippus, too, believed respiration nourishes the soul.[67] If so, it is obvious that he has been influenced by the medical writers, and especially Paraxagoras.[68]

Thus it seems that Chrysippus was influenced by both the Aristotelian and the medical theory of the *pneuma*. The fact that the medical writers influenced his theory of the *pneuma* suggests that Chrysippus was, indeed, cognizant of the recent trend of medical research and was eager to update the Stoic philosophy, as long as no crucial doctrines were jeopardized. Similarly, he updated Stoic cosmobiology on the same basis, discarding Cleanthes' theory of the cosmic heat, and substituting the vital *pneuma* as the agent of all the psychic functions in the cosmos.

According to Chrysippus the cosmos is permeated and given life by *pneuma*, the same substance that permeates a living thing and makes it alive. Just as this *pneuma* makes a man a living, organic whole, so the cosmic *pneuma* makes the cosmos a living, organic whole, with each single part grown together (συμφυές, cf. *SVF* 2.550) in living sympathy (σύμπνοια, συμπάθεια) with all the rest (*SVF* 2.473, 912; cf. 475, 546). In the cosmos the function of the *pneuma* is fourfold. In the form of "holding" or *hexis* it provides unity and quality; in the form of nature (φύσις), nutrition and growth; in the form of soul (ψυχή), sensation and movement; and in the form of mind (νοῦς) or *logos* it provides rationality. Inanimate objects possess only the simplest form of *pneuma*, namely *hexis*; plants (φυτά) possess, in addition, nature (φύσις); irrational animals possess soul; and man and the cosmos possess also reason (*SVF* 2.473, 634, cf. 458, 459, 460, 714, 715, 716, 804, 1013). Each form of the *pneuma* includes all of the forms below it, but adds an additional psychic function. The result is a scale of beings; and it is obvious that this scale is indebted to Aristotle's scale, in which plants possess only the nutritive soul, animals possess also the perceptive soul, and man possesses mind in addition to the two lower forms of soul.[69] We are interested in this scale of beings not only for itself but chiefly for what it implies about the function of the world soul or cosmic *pneuma*. Diogenes Laertius preserves a summary of an important idea found in Chrysippus's *On Providence*.[70] According to this summary Chrysippus stated that mind (νοῦς) permeates the cosmos, as soul does in us, but it differs in degree.[71] Through some parts of us it passes as *hexis*, namely, through the bones and sinews; through others as mind, namely, through the *hegemonikon*. Similarly, the whole cosmos, being an ensouled, reasoning animal, has the *aether* as its *hegemonikon*. Through the *aether* it passes as mind; through the things in the air, such as animals and man, it passes as sensation; through the things in the earth, namely, plants, it passes as nature; and, finally, through the earth itself it passes as *hexis*. Thus the cosmic *pneuma* lies behind the four psychic functions that the *pneuma* performs in the various parts of the cosmos.

Chrysippus's conception of the function of the cosmic *pneuma* is grounded in his Stoic predecessors, yet shows some important new developments. Chrysippus has preserved the idea of Zeno and Cleanthes that individual living things are parts of the cosmos and derive their psychic capacities from the psychic material of the whole. On the other hand, Chrysippus has altered the number of psychic functions and the parts chosen as manifestations of these psychic functions. It is the grounds for these alterations that we must now examine. Let us begin with the second alteration. As we have seen, Cleanthes found the four elements to be the cosmic parts that manifest the nutritive or preservative function of heat, but he did not carry out the search for parts systematically for the other psychic functions. If our reconstruction of Chrysippus's argument is correct, Chrysippus did systematically seek parts that manifest each psychic function; and he did this on a different basis, at least in part. Cleanthes' parts had been the four elements; Chrysippus's parts are not wholly clear, but the four elements are not ignored. The *aether* and the earth are definitely mentioned, and this suggests that Chrysippus intended to make some use of the four elements in his scheme. But what manifests the perceptive function is not the air itself, but "the things in the air." This, together with the text's explanatory phrase, "both animals and plants," suggests that Chrysippus also intended to use the scale of beings as an example of the parts that manifest the functions of the soul. Chrysippus apparently wished to free himself of Cleanthes' self-imposed limitation of seeking manifestations of the world soul only in the elements, the major parts of the cosmos. Instead he preferred to follow Zeno (cf. *SVF* 1.112, 113, 114), in using also animals and men, the minor parts of the cosmos, as manifestations of the world soul. Though the fragmentary text does not allow us to judge how Chrysippus put this argument together,[72] we can see that he did not hope to find every soul function in every part of the cosmos, as Cleanthes had done with the nutritive function; but he sought a different soul function in each part. Second, we can see that the scale of beings serves as a partial basis for his demonstration that the cosmic *pneuma* functions in the parts of the cosmos. Since this scale of beings was derived from Aristotle, the same source from which Cleanthes obtained the functions of the cosmic soul, we may conclude that it was on the basis of Aristotle's psychological theory that Chrysippus has modified the parts chosen to manifest the psychic functions.[73]

A much more important change is the addition of a fourth psychic function. Whereas Cleanthes had followed Aristotle in distinguishing three psychic functions, Chrysippus has added a fourth, the "holding" or *hexis*. If we look through the Stoic fragments, we see that this new psychic function comes to overshadow the three Aristotelian functions to which it was added. In fact, the fragments mention this function of the *pneuma* almost to the exclusion of any other, presumably because it was so important and so characteristic of the Stoa after Chrysippus. The addition of this fourth psychic function ranks with the transferral of the cosmic psychic functions from heat to *pneuma* as one of Chrysippus's major contributions to the evolution of Stoic cosmobiology.

Simply stated, the *pneuma* holds everything together (*συνέχειν*).[74] Since the *pneuma* consists of fire and air, it is frequently said that fire and air hold everything together. In specific, fire and air (the active elements) hold together earth and water (the passive elements) (*SVF* 2.439, 440, 444, 473 [page 155.32–36]). The *pneuma* accomplishes this activity by means of a motion sometimes called pneumatic motion (κίνησις πνευματική, *SVF* 2.442, 454, cf. 458). This motion has two phases, a movement into itself (πρὸς or εἰς ἑαυτό) and a movement out of itself (ἐξ αὐτοῦ); or these can be called movements back and forth (πρόσω καὶ ὀπίσω, *SVF* 2.442, 471, cf. 551 [page 174.27–29]). The state of the *pneuma* in this activity is sometimes called tension (*tonos*), and the pneumatic movement in and out may be called tonic or tensional movement (τονικὴ κίνησις, *SVF* 2.441, 444, 448, 451). Each phase of the pneumatic or tensional movement produces it own result. The inward movement or movement toward the center holds the body together and produces cohesion (συνέχεια), unity (ἕνωσις), and being (οὐσία); the outward movement or movement toward the periphery causes dimensions and qualities (*SVF* 2.451, 452, 551). The new psychic function of Chrysippus, the *hexis*, then, is responsible not only for cohesion but for qualities in all things.[75] In particular, the *hexis* operates in inanimate things, the lowest step in the scale of beings. In his *On Hexeis* Chrysippus explains that a *hexis* is really air; and air is responsible for holding inanimate things together and giving them their shapes and qualities, for example, hardness in iron, density in stone, and brightness in silver (*SVF* 2.449). The *hexis* not only operates in inanimate objects, such as wood and stones; it also operates in parts of animals, such as the bones and sinews (*SVF* 2.634, cf. 458). But its most important function for our purposes is its function in the cosmos as a whole, for it is the *hexis* that holds the cosmos together and prevents its disintegration in the void (*SVF* 2.540, 552, 553, cf. 551 [page 174.27–29]). Thus Chrysippus's new psychic function was put to good use on an old and elusive problem.

The question we must now ask is from what source Chrysippus derived this fourth psychic function. If we look back to Cleanthes and to Aristotle, on whom Cleanthes depends, Chrysippus's source becomes apparent. Both Cleanthes and Aristotle included cohesion among the products of the nutritive soul. Cleanthes may have already applied this function to the cohesion of the cosmos in the void. Chrysippus has merely detached it from the nutritive soul and given it independent status.[76] By so doing, he has been able to lengthen Aristotle's scale of beings to include inanimate objects, without divesting them of psychic activity. Thus the favorite Stoic device of biological analogy has found another application, namely to extend the sphere of psychic activity down to inanimate objects, thereby bringing everything in the cosmos under the influence of the psychic *pneuma*.

Having gained independence from the nutritive function of the soul, the *hexis* was free to develop its own personality. As the active cause of cohesion and the continued existence of inanimate objects, it immediately came into the company of the *archai*; for everything in the cosmos consists of matter and an active cause that provides form, quality, and movement to the matter. The *hexis*, therefore, became identified with the active cause, the source of qualities. Thus the quality (ποιότης) that gives form and shape could be called "*pneuma* and an airy tension" (τόνος ἀερώδης, *SVF* 2.449; cf. 379, 389). The identification of this pneumatic function with the active principle was made easy by the fact that *pneuma* consists of air and fire, the two active elements; so the Stoics could say that air and fire, the active elements, hold together (συνέχειν), whereas water and earth, the passive elements, are held together (συνέχεσθαι, *SVF* 2.439, 440, 444, 473 [page 155.32–36]).

The movement by which the *pneuma* effects the *hexis* is another independent development and is probably the result of a synthesis of several ideas. The basic idea that the *pneuma* accomplishes its work by movement may have been suggested by the fact that *pneuma* is literally wind or air in motion (*SVF* 2.471, cf. 697). But fluid flow is certainly not the primary idea of pneumatic motion, for the inward and outward movements are said to occur simultaneously.[77] What is more, the movement is called tonic motion or a *tonos*, two names connoting tension. This points to an entirely different image, namely, the image of air pressed into a confined space, such as a skin. The image of compressed air gives, on the whole, the most satisfactory explanation of the pneumatic motion and its effects.[78] Such pressure has no local motion and the fact that it acts simultaneously in opposite directions could have given rise to the notion that it comprises a simultaneous motion toward the center and toward the periphery (i.e., the wall of the container). From the notion of compressed air one may readily discern a path to the Stoic idea that motion toward the outside produces dimensions and qualities. The Stoics may well have had in mind the picture of an inflated skin, in which the shape and dimension are revealed only because of the pressure of the enclosed air. At least we know the Stoics claimed that stretching (τάσις) produces shape, and they defined a straight line as one stretched to the utmost (*SVF* 2.456). Moreover, Cleomedes, the astronomer whose Stoic influence has already been noted, argued that the unconfined air and fire of the cosmos will always assume the spherical shape that is natural to these elements, because they are braced up (τετονωμέναι) and stretched out (ἀποτεινόμεναι) equally from the middle in every direction (*SVF* 2.455). The concommitant notion that confined air exerts a pressure toward its own center that accounts for unity and cohesion is somewhat less comprehensible, since there is no empirical evidence for it. Yet we know from Achilles that there were people, probably Stoics, who maintained that if one places a piece of grain in a bladder and inflates it with air, the grain will remain standing at the center of the skin, because the air pushes it with equal pressure from all sides (*SVF* 2.555). Moreover, Achilles tells us this example was used to illustrate and help explain the stability of the earth at the center of the cosmos.

If the image of compressed air is the basis for Chrysippus's concept of the pneumatic *hexis*, it is not the only factor that shaped this concept. The movement of the *pneuma* toward the center was credited with producing cohesion and unity. When this pneumatic function was applied to the cosmos as a whole, it came into contact with another Stoic theory. Zeno had said that the cosmos remains intact in the void because all the elements naturally tend (τείνεσθαι) toward the center (*SVF* 1.99). The crucial elements, of course, are air and fire, because these are light and therefore move away from the center; but it is to these elements that Zeno specifically assigned a tending toward the center as an explanation of cohesion. Chrysippus's *pneuma* consists of fire and air and produces cohesion in similar fashion by a kind of centripetal movement, which even bears the same name as Zeno's elemental movement, for "tension" (τόνος) is the noun form of "tend" (τείνω).[79] In Chrysippus's *hexis* Zeno's purely physical explanation of cohesion coalesces with the physiological explanation that may have originated with Cleanthes. Thus a single phenomenon, the cohesion of the cosmos in the void, may be visualized by Chrysippus in purely physical terms as the result of the natural centripetal movement of all its parts, or in biological terms as the product of the cohesive *hexis* (ἡ συνέχουσα ἕξις).[80]

In this context it may be well to return to the question that we left unanswered in our discussion of Cleanthes, the origin of the Stoic concept of the *tonos*. Chrysippus retained Cleanthes' idea that *tonos* is equivalent to strength in body and soul (*SVF* 3.471, 473, cf. 278). Moreover, in *On Passions* he says: "The *tonoi* of the body are said to be poorly or well toned [ἄτονοι καὶ εὔτονοι] in respect to the muscular substance [τὸ νευρῶδες], in that we possess or lack power in the activities that are accomplished through these [i.e.,*tonoi*]; and the *tonos* in the soul is also spoken of as a good or poor tone [εὐτονία καὶ ἀτονία]. . . . As in running, clinging to something, and similar activities, which are accomplished through the muscles, there is a certain effective state and an ineffective state, depending on whether the muscles are tensed or relaxed, so also analogously in the soul there is a sort of 'muscle' according to which we speak metaphorically of people being either with or without 'muscle' " (*SVF* 3.473). This quotation confirms the conjecture made in connection with Cleanthes that behind the Stoic idea of *tonos* lies a biological conception of muscular movement and strength; for Chrysippus regards *tonoi* as *neura*, that is, as sinews and muscles, and sees strength and movement as a product of the contraction and relaxation of the muscles. This, of course, is the same conception of movement described in Aristotle's biological works, as we have already noted, but it is hard to see how this biological theory of movement should have led to the elaborate concept of the pneumatic *tonos* that we have found in Chrysippus's cosmology.

We abandoned our quest for the connection between Cleanthes' *tonos* and Greek biology because we could not find enough specific points of contact. Chrysippus's *tonos*, however, is not completely identical with that of Cleanthes. As far as we can tell from the extant references, Chrysippus has given up the imagery of the plucked lyre and the harmonious course of the universe, which Cleanthes had associated with the word "*tonos*," and instead has filled the term with new content, derived from his new psychic function, the pneumatic *hexis*.[81] This new content, including the idea of pneumatic motion, production of unity, cohesion, dimensions, and qualities, is quite foreign to Cleanthes' *tonos*. One can imagine a path from Cleanthes' idea that the *tonos* is strength to Chrysippus's notion that it produces cohesion and certain qualities, like hardness and solidity (*SVF* 2.449).

Likewise there may be a path from Cleanthes' definition of *tonos* as a blow of fire and his conception of the *tonos* as the pressure produced by the contraction and expansion of the cosmogonal fire to Chrysippus's conception of the *tonos* as air pressure.[82] But to dismiss Chrysippus's *tonos* as a logical development from Cleanthes' *tonos* may make us miss its additional points of contact with antecedent and contemporary thought; for whether Chrysippus's concept of the pneumatic *tonos* is entirely his own or has borrowed more from Cleanthes than the evidence reveals, it does have several antecedents that we have not yet noted.

Tonos is derived from the verb "to stretch" and is especially connected with cords stretched tight. We have already mentioned its association with a cord stretched and plucked to provide a musical sound. Now we must observe that the word *tonos* is also used of a cord stretched to hold an object together. *Tonoi* is the technical term for part of the system of ropes that was used to hold a ship together.[83] Plato takes note of this nautical term and points out that in preventing disintegration the ropes on a ship (*ἔντονοι, ὑποζώματα*) and the taut *epitonoi* or cords of sinews (*νεύρων ἐπίτονοι*)[84] in a living creature are essentially the same, differing only in name (*Leg*. 12.945c). Obviously Plato regards the *neura* as the bonds that hold the body together. The bonding function of the *neura* is also recognized by Aristotle (*Hist. An*. 3.5.515b11–13). This function of the *neura* does not, of course, exclude their other function, namely, the performance of feats of strength. In fact, in the same discussion in which Aristotle refers to the role of *neura* in binding the skeleton together he mentions specific *neura* that are important in running and in other feats of strength (*Hist. An*. 3.5.515b3–10). What is important is that the *neura* are clearly regarded as a most important element in holding the body together, and that Plato regarded the term *epitonoi*, a compound form of *tonoi*, particularly appropriate for the *neura* in their function as bonds.

It is, therefore, quite possible that the Stoics adopted the word *tonos*, because it had the connotation of bond and that this connotation is what suggested its extrapolation to the cosmos. For this extrapolation they even had a precedent in Plato, who had seen not only an analogy between the *neura* of the body and the ropes of a ship but also an analogy between the light that binds the cosmos together and the same ropes of a ship (*Rep*. 10.616b–c). This time, however, Plato did not use the word *tonoi*, but *hypozômata*. Yet nothing was to prevent the Stoics from applying the word *tonos* to the bond of the cosmos and from seeing a similarity between this cosmic bond and the function of the *neura* in the human body. The biological analogy had served Stoic cosmology before, and so it could be pressed to serve again. To the Stoic mind accustomed to thinking in biological terms, it must have seemed eminently logical that cords, such as those which preserve the body, should also preserve the cosmos, and that what is known about the cords of the body could help explain the coherence of the cosmos and other things.

By the time Cleanthes and Chrysippus were formulating their ideas about *tonos* and about the coherence of the cosmos, medical researchers had come a long way in understanding the ligature of bones and the process of movement. In the beginning of the third century B.C. Herophilus, the Alexandrian physician, laid the foundation for differentiating the nerves, or *neura* properly so-called, from the tendons and ligaments, which up to that time also went under the name of *neura*.[85] The nerves proper, he found, come from the brain and are of two types, motor (προαιρετικά) and sensory (αἰσθητικά). The sensory nerves convey sensations to the brain, whereas the motor nerves convey the impulse to move from the brain to the parts that move. His discovery came in the course of intensive speculation about the mechanism by which sensations are carried to the seat of the soul and voluntary motions are carried from the principles of movement to the extremities. Aristotle, having dismissed the old theory that the blood carries the psychic activities, proposed a new carrier, namely the *pneuma*, though for movement heat was equally important.[86] Praxagoras located this *pneuma* in the arteries, which he believed collapsed at their extremities to form the *neura*.[87] Then Herophilus discovered that the *neura* form a network of vessels independent of the arteries and are, in fact, connected to the brain. Accordingly Herophilus and his younger associate Erasistratus seem to have maintained that *pneuma* flowing in the nerves, or *neura*, carries sensations from the sense organs to the brain and motor impulses from the brain to the extremities.[88]

All of this seems to have taken us a long way from the *tonoi* and the Stoic *tonos*. If *tonos* was at one time associated with the *neura* that hold the body together, we must certainly wonder what happened too this term when the term *neura* became applied to the nerves, the vessels that communicate sensations and voluntary movement. Unfortunately we cannot answer this question. In two tantalizing passages Rufus of Ephesus informs us that "*tonoi*" is a name for the nerves proper, used of the large nerves extending along the esophagus and trachea, and also more generally of all sensory and motor nerves (*De Nom. Part.* 158, 211). This proves the term was by no means dead in the first century A.D., but there is no way to tell whether Rufus is reporting a widespread, living usage or merely the usage of Hippocrates to which Galen also refers.[89] In particular, we would like to know whether Herophilus and Erasistratus used the word in the third century B.C. In the absence of any testimony concerning their vocabulary all we can say is that insofar as the word survived in the medical vocabulary, it survived in reference to the nerves proper, not to the ligaments and tendons that bind the bones together and fasten the muscles to the bone. This obscure piece of information must surely whet our appetites to know what connection Hellenistic medical thought presupposed between *tonos* or *tonoi* and the psychic *pneuma*. Since we have already discovered that Hellenistic medical theory had a significant influence on Chrysippus's doctrine of the *pneuma*, we must at least keep open the possibility that it had some influence also on the idea of the *tonos*.

There is still another set of medical theories that may lie behind the Stoic doctrine of the *tonos*, but again we can do no more than raise the question. According to the Stoic biological theory the *pneuma* flows in the arteries of the body. This idea goes back to Praxagoras of Cos and was probably the commonly accepted view of the Alexandrian physicians.[90] The medical writers who subscribed to this theory were also intensely interested in the arterial pulse and its qualities.[91] One frequently discussed quality of the pulse was its intensity (σφοδρότης), and Galen summarizes a number of views on this subject (*De Puls. Diff.* 3.1–2 [8.643–46, Kühn]). According to Galen, Herophilus said the intensity of the pulse depends on "the strength [ῥώμη] of the vital power in the arteries." Asclepiades of Prusa in the first century B.C. said it depends on "the abundance and lightness of the *pneuma*," Athenaeus of Attaleia about the same time or somewhat later on "the strength of the vital *tonos*," and Archigenes of Apamea in the early second century A.D. on "the *tonos* of the movement of the arteries." The last two introduce *tonos* into their explanation of a strong pulse, and in fact Archigenes seems to have considered *tonos* to be one of the categories according to which pulses can be classified.[92] Since both Athenaeus and Archigenes are generally assumed to be under the influence of Stoicism,[93] one might think they have picked up a Stoic term to describe a medical concept. It is equally possible that the word is medical in origin and was originally associated with the *pneuma* of the arteries. Again we would like to know whether Praxagoras, Herophilus, or Erasistratus, all of whom discussed the pulse and the movement of the *pneuma* in the arteries, used this term. In the present state of our knowledge of Hellenistic medical theories and terminology, we cannot answer this question either. Our ignorance, however, should not induce us to dismiss the possibility that somewhere behind the Stoic doctrine of the *tonos* may lie Hellenistic discussions of the pulsation of the vital *pneuma* in the arteries as well as theories of the transmission of sensations and motor-impulses through the *pneuma* of the nerves. A medical influence on the Stoic concept of the *pneuma* and its activity seems clear; the question still remaining is where the medical influence leaves off and Stoic elaboration begins.

Our investigation into the origin of the Stoic concept of the *tonos* has yielded relatively few firm conclusions. It has shown that the Stoic concept includes a number of ideas already associated with the word in non-Stoic contexts. It has also revealed that the word entered the biological vocabulary rather early and that Stoicism may well have adopted the term from this context. But the incompleteness of our knowledge both of the Stoic use of the term and of the medical use precludes definite conclusions at this point. Yet we may take comfort in the fact that the Stoic concept of the *tonos* is not an isolated doctrine but merely one aspect of the concept of the psychic *pneuma*, and this exceedingly important concept can be understood in some detail and its origin determined with a fair degree of probability. Thus Chrysippus's major contribution to Stoic cosmobiology can be clearly identified and appreciated, even if the Stoic *tonos* remains incompletely explained.

In conclusion, it appears that the origin and development of Stoic cosmobiology was no simple process. The fundamental idea that the cosmos is a living, sentient, intelligent animal was firmly enunciated by Zeno and perpetuated by his successors. This idea, rooted deeply in the mind of the ancient world, Greek and non-Greek alike, was first stated by Zeno in Platonic terms, after Theophrastus had shown that

Aristotle's attempt to eliminate the world soul had left it as firmly implanted in the cosmos as Plato had believed it to be. Cleanthes continued to support Zeno's doctrine and to buttress it with new arguments. In so doing, he expanded the concept of the world soul to embrace Aristotle's three psychic functions; and he identified the world soul with the heat of the cosmos, an identification that Zeno must also have made, but to which Aristotle's physiology now seemed to give further support. Chrysippus, noticing that medical theory had left his school behind, updated Stoic cosmobiology by identifying the world soul with the *pneuma* (air-fire mixture) that permeates the cosmos. To this *pneuma* he assigned the three psychic functions that Cleanthes had taken from Aristotle, but he broke up the nutritive function into growth and a new function called *hexis* or cohesion (συνέχεια). This last function he used, probably following the precedent of Cleanthes, to explain the cosmological problem of the survival of the cosmos in the void. The ultimate result was that the Stoic cosmos had a biological as well as physical side. Though each side owed its existence to the ideas of others, the total integration of the physical and the biological sides of the cosmos resulted in a totally new cosmology, one that can only be characterized as purely Stoic.

1. G. Verbeke, *L'évolution de la doctrine du pneuma du stoicisme à S. Augustin* (Paris and Louvain, 1945), 11–90, contains a useful discussion of old Stoic cosmobiology, in which an attempt is made to differentiate the views of each of the old Stoics (cf. especially 34–41, 53–61, 81–90). Cf. also J. Moreau, *L'âme du monde de Platon aux Stoiciens* (Paris, 1939), 158–89, and M. Pohlenz, *Die Stoa: Geschichte einer geistigen Bewegung*[3] (Göttingen, 1964), 1.73–77.

2. Cf. F. M. Cornford, *Plato's Cosmology* (London, 1937; reprinted New York, 1957), 96–97.

3. W. Theiler, *Zur Geschichte der teleologischen Naturbetrachtung bis auf Aristoteles* (Zürich and Leipzig, 1925), 16–23, suggests that Plato and Xenophon may acutally have derived the idea they assign to Socrates from Diogenes of Apollonia. Even so, it is probable that the Stoics were acquainted with this view through the writings of Plato and Xenophon (Cicero's Stoic source in *Nat. D.* 2.18 shows a knowledge of Xenophon's version). The similarities cited by Theiler, 57–61, between Diogenes and the Stoics are not enough to establish Diogenes as a direct, major influence on the Stoics.

4. Cf. Moreau (above, note 1), esp. 173–78, 182–89. Moreau discusses at length the continuity and transformation of the concept of a world soul from Plato through the fourth-century thinkers to the Stoics.

5. Cf. [Plato] *Epin.* 983b–c; Speusippus *apud* Cic. *Nat. D.* 1.32; Xenocrates, fr. 15 Heinze. See E. Zeller, *Plato and the Older Academy*, trans. S. F. Alleyne and A. Goodwin (London, 1888), 570, and note 38 (*sic*); 591–93; 619.

6. *Metaph.* 2.5a28–b10. For the interpretation of this difficult, corrupt passage, see W. D. Ross and F. H. Fobes, *Theophrastus: Metaphysics* (Oxford, 1929), 46–47, and J. B. Skemp, "The *Metaphysics* of Theophrastus in Relation to the Doctrine of *κίνησις* in Plato's Later Dialogues," in *Naturphilosophie bei Aristoteles und Theophrast*, ed. I. Düring (Heidelberg, 1969), 218. Cf. also E. Grumach, *Physis und Agathon in der alten Stoa*, Problemata 6 (Berlin, 1932), 61, note 2.

7. For a careful analysis of this whole development, see Grumach (above, note 6), 50–64, and the additional observations of Skemp (above, note 6), 217–23. Cf. also H. Siebeck, "Die Umbildung der Peripatetischen Naturphilosophie in die der Stoiker," *Untersuchungen zur Philosophie der Griechen*[2] (Freiburg, 1888), 183–225.

8. *Nat. D.* 2.23–32. F. Solmsen, "Cleanthes or Posidonius? The Basis of Stoic Physics," *MNAW*, n.r. 24 (1961): 265–89, has shown that it is highly probable that Cleanthes was the original source for this section of Cicero. Basically, his reasons are that the section is a single connected whole of which a part is explicitly assigned to Cleanthes (Cic. *Nat. D.* 2.24); second, that the doctrine is consistent with the ideas expressly attested for Cleanthes; and finally, that the doctrine is more appropriate for the third century B.C. than for any later time. The attempt of J. Mansfeld, *The Pseudo-Hippocratic Tract* "ΠΕΡΙ ἙΒΔΟΜΑΔΩΝ" *Ch. 1–11 and Greek Philosophy*, Philosophical Texts and Studies 20 (Assen, 1971), 93–97, to refute Solmsen and refer this section to Posidonius is no more persuasive than any of the earlier attempts. For further bibliography on the controversy see Mansfeld, 86–87, and notes 103 and 104.

9. *Nat. D.* 2.28, 30, 31, 32. In Appendix 5 I have suggested that the order of the arguments may originally have been different from the order given here by Cicero; but since nothing depends on this conjecture, I will discuss the arguments in the order in which Cicero presents them. Cicero uses this passage, as well as Zeno's syllogisms (*Nat. D.* 2.20–22), to prove that the cosmos is god and that god therefore exists. Significantly, none of Zeno's proofs nor the general line of argument of Cleanthes' proof is directed specifically toward the conclusion that the cosmos is god. This conclusion is slipped into the middle of the passage from either author, not as a proven conclusion but as a self-evident inference from the proven conclusion that the cosmos is intelligent (*Nat. D.* 2.21, 30). Apparently, though Zeno and Cleanthes may have mentioned the divinity of the cosmos, in composing these proofs it was not their aim to prove it. (The proofs in *Nat. D.* 2.32–44 likewise seem to aim at proving reason and wisdom, not divinity.) This suggests that the original reference of the proofs of Zeno and Cleanthes was cosmological. Cleanthes may have written this passage for his chief physical work, *On the Natural Science of Zeno*.

10. The alternative interpretations of this difficult passage are summed up by Cornford (above, note 2), 243–45. Either the revolution of the heavens exerts a centripetal pressure on the elements or the outer circumference encompasses all the elements as a boundary beyond which no elements may go. On either theory the circumference has an active role in restricting the movement of elements and preventing their separation.

11. *SVF* 2.447 shows that Stoics later took the term *σφίγγω*, both in Empedocles and in general, to refer to the function of the pneumatic tension in holding the cosmos together. This means they took the idea of binding literally, but they applied it to the internal cohesion produced by the pervading *pneuma*.

12. The original word has been supplanted by *saepsit* from line 470. Lachmann proposed *flexit*, but *cinxit* would also be fitting in this context and would make the parallel with Cleanthes even closer.

13. It should be remembered that Zeno's second proof (balanced forces), the one that attempted to meet Epicurean criticism, was of no use in explaining the cohesion of the cosmos. The light and heavy elements still had to be bound together in some way, either by a natural centripetal movement, or by some other means, of which no trace has survived.

14. Cf. also Verbeke, *L'évolution* (above, note 1), 67–68, who in connection with Chrysippus's "containing *pneuma*" (συνεχον πνεῦμα) discusses the reaction against Epicurean atomism implied in the "containing" function of the soul.

15. This is not to say that Cleanthes did not also use more physical explanations for the coherence of the cosmos in the void, but no physical explanations have survived under his name.

16. It is, of course, not impossible that Zeno made this application himself; but we do not know of it, either because the texts are lost, or because he made it later in life after his book on cosmology had already been published.

17. The evidence in favor of this hypothesis is presented in Appendix 7, along with a detailed analysis of the argument of this section and reference to other fragments that bear on its interpretation. As I suggest in the Appendix, this argument fits better after that of *Nat. D.* 2.30–32 (*atque etiam. . . .esse mundum*).

18. If Cleanthes, and not a compiler of proofs for divinity, is actually the author of *Nat. D.* 2.42–44, some reassessment of the value of this section as evidence for Aristotle's *On Philosophy* will be necessary. For Cleanthes, attempting to compose a persuasive Stoic argument, may have treated Aristotle more freely than a disinterested compiler would have. In particular, W. Jaeger's (*Aristotle: Fundamentals of the History of His Development*[2], trans. R. Robinson [Oxford, 1948], 148–49) attempt to refer the entire section to Aristotle will have to be reconsidered, and some of Jaeger's conclusions may have to be revised. For example, the reference to heavenly bodies feeding on exhalations from earth and sea (*Nat. D.* 2.43) may be Cleanthes' own contribution to the argument and is not necessarily an idea of Aristotle's *On Philosophy*, borrowed by Cleanthes (Jaeger, 150, and D. J. Furley, "Lucretius and the Stoics," *BICS* 13 [1966]:23). Again the allusion of *Nat. D.* 2.43 (*ordo autem. . . .divinitate moveantur*) to Plato *Leg.* 10.888e–898c is as likely to be the work of Cleanthes, who elsewhere (*Nat. D.* 2.32) expressly refers to Plato *Leg.* 10.894b–899b, as of the young Aristotle (Jaeger, 151).

19. *Leg.* 10.891e–898c. [Plato] *Epin.* 982a–e deduces intelligence directly from the regularity of the celestial movements; there is no mention of self-movement as in the passage from Plato's *Laws*. Incidentally, *Epin.* 983a, c, contrasts nature with intelligence, just as Plato does in the *Laws*.

20. When attributing this idea to Cleanthes we must always be aware that it may not have been his own innovation, but could be the expression of an idea of Zeno's that does not happen to be attested in the fragments of Zeno.

21. The reasoning seems to be: The cosmos has a part that possesses sensation and reason (i.e., the vital heat), just as we have a part that possesses sensation and reason (the rational soul). Therefore the cosmos may be called intelligent, just as we are.

22. It may seem unjustified to include under one head both sustaining the cosmos (*Nat. D.* 2.25–28) and giving it life (*Nat. D.* 2.31–32; literally giving it soul; but soul

makes the cosmos a *living* thing). However, the human analogy on which *Nat. D.* 2.25–28 is based shows very clearly that the sustaining processes of nutrition and growth (*ali et crescere*) are merely more specific descriptions of the general process of life (cf. *vita, vivit, vim vitalem, Nat. D.* 2.23–24).

23. *Nat. D.* 2.29–30. This conclusion follows even without the assumption that *Nat. D.* 2.40–44 belongs between 29 and 30. For Cicero says: "In ea parte igitur in qua mundi inest principatus [i.e., the heat] haec [scil. "sensum atque rationem"] inesse necesse est." Solmsen, "Cleanthes" (above, note 8), 277, asserts, "Cleanthes does not entrust the vital heat with the task of thinking or other noble functions of men and animals," but Solmsen considers only *Nat. D.* 2.23–28, 30 (*Atque*)–32, the sections dealing with the sustaining and perceptive functions of the cosmic heat (cf. Solmsen, "Cleanthes," 272, note 25).

24. Aristotle discusses them in detail in *De An.* 2.2–3.8 (nutritive: *De An.* 2.4; perceptive: *De An.* 2.5–3.2; rational: *De An.* 3.3–8) and mentions them elsewhere as the three obvious varieties of soul, e.g., *Eth. Nic.* 1.7.1097b33–1098a5; *Gen. An.* 2.3.736a32–b29. In some summaries (e.g., *De An.* 2.2.413a20–25, b10–13, 3.414a29–32, 414b32–415a8) Aristotle adds another faculty, that of local movement, which he discusses in detail after the other three (*De An.* 3.9–11). However, this faculty, unlike the other three, cannot be correlated precisely with Aristotle's three major classes of living beings (plants, animals, and man), since it is found in some, but not all, animals and in man (cf. *De An.* 2.3.415a6–7; 3.9.432b19–21); so it cannot serve to define any class of living things. Moreover, though Aristotle is certain it cannot be simply identified with any other faculty (*De An.* 3.9), he shows that movement involves other faculties, namely the perceptive, the appetitive, and in the case of man the rational, and is not independent of them. Ulitmately the cause of movement is found in the object of desire (ὀρεκτόν), which moves the appetite (ὀρεκτικόν, ὄρεξις) and so initiates movement if the mind permits (*De An.* 3.10.433a9–b13, cf. 13–18). The appetite, however, cannot function without the imagination (φαντασία, *De An.* 3.10.433b27–29), which is itself an effect of perception (*De An.* 3.3.429a1–2).

25. Cf. Solmsen, "Cleanthes" (above, note 8), 274–79.

26. Cf. *Gen. An.* 2.6.744a1–5; *Part. An.* 2.16.659b17–18. See F. Solmsen, "Greek Philosophy and the Discovery of the Nerves," *MusHelv* 18 (1961):175–76.

27. With this argument *Epin.* 982a–985e should be compared. In the *Epinomis* the analogical argument of Aristotle and Cleanthes is also used (*Epin.* 984b–c), and the celestial bodies are said to have the sharpest sight (*Epin.* 984d).

28. Compare Plato *Leg.* 10.888e–898c.

29. The class of living things that lacks sensation, namely, plants, also lacks local movement (*De An.* 2.2.413a20–b1, 3.414a29–415a13; 3.9.432b13–19).

30. See Appendix 6.

31. Cf. A. A. Long, "Aristotle's Legacy to Stoic Ethics," *BICS* 15 (1968):79–82.

32. *SVF* 1.143; 2.827–31, 836, 885. Some, e.g., L. Stein, *Die Psychologie der Stoa* (Berlin, 1886–88), 2.108, note 219, have maintained that Zeno did not use the word *hegemonikon*, and that Cleanthes introduced it. Though it is true there is no evidence that Zeno tried to identify the *hegemonikon* of the cosmos, *SVF* 1.143 would seem to be evidence that he did use the term of the human soul. If he divided the soul into eight parts, he must have had some name for the chief part; so why should we not believe he used the term *hegemonikon*? Moreover, Cleanthes' discussion in *Nat. D.*

2.29 does not give the impression that the term is new in reference to man, animals, and plants; but it does suggest that the application of the term to a part of the cosmos is an innovation. F. Adorno, "Sul significato del termine ἡγεμονικόν in Zenone stoico," *La Parola del Passato* 14 (1959):31–33, comes to the same conclusion.

33. Cic. *Nat. D.* 2.29 (assuming that the argument originally contained some mention of the fact that the sun is the *hegemonikon* [*SVF* 1.499]; cf. Appendix 6).

34. Cf. Verbeke, *L'évolution* (above, note 1), 54–55; *Kleanthes van Assos*, Verhandelingen van de Vlaamse Academie voor Wetenschappen, Klasse der Letteren, vol. 11, no. 9 (Brussels, 1949), 134–35. He is probably right in minimizing the influence of the Oriental sun-cult on Cleanthes' doctrine.

35. νεαραί (instead of νοεραί) is the convincing emendation of J. Meerwaldt, "Cleanthea," *Mnemosyne*, 4th ser. 4 (1951):53–54.

36. DK 13 A 7.5. As O. Gigon, *Der Ursprung der griechischen Philosophie* (Basel, 1945), 113–14, points out, this theory cannot be harmonized with the theory given in DK 13 A 6. G. S. Kirk and J. E. Raven, *The Presocratic Philosophers* (Cambridge, 1957), 152, suggest that DK 13 A 6 is due to the imputation of the theory of Xenophanes and Anaxagoras to Anaximenes because of a misunderstanding of Anaximenes' theory. DK 13 A 7.5 is more in keeping with Anaximenes' ideas in general than is DK 13 A 6.

37. Anaximander, DK 12 A 27, may show a trace of this view, though other explanations of this fragment are possible. For discussion cf. C. H. Kahn, *Anaximander and the Origins of Greek Cosmology* (New York, 1960), 67, 103; W. K. C. Guthrie, *History of Greek Philosophy* (Cambridge, 1962–69), 1.97–98.

38. The number of exhalations in Heraclitus is one of the first problems. G. S. Kirk, *Heraclitus: The Cosmic Fragments* (Cambridge, 1954), 271–76, maintains that DK 22 A 1.9–11 is Aristotle's theory read back into Heraclitus, though Solmsen, *Aristotle's System of the Physical World*, Cornell Studies in Classical Philology 33 (Ithaca, N.Y., 1960), 409–10, has called attention to differences between the dual exhalation theory ascribed to Heraclitus and that of Aristotle. Second, some of the *placita* of Heraclitus may be expressed in Stoic terms and therefore distorted. For example, the statement of Aëtius 2.20.16 (=DK 22 A 12) that the sun is "an intelligent kindling from the sea" (ἄναμμα νοερὸν τὸ ἐκ θαλάττης) may be more Stoic than Heraclitean (cf. *SVF* 1.121, 501; 2.652, 655, 656), since there is no evidence that Heraclitus regarded the sun as intelligent, and since his ideas that "the sun is new every day" (DK 22 B 6) and that it is an exhalation burning in a bowl (DK 22 A 1.9–10; cf. A 12) do not sound like descriptions of an intelligent, living being.

39. The concept of nourishment occurs in DK 22 A 11, cf. Kirk, *Heraclitus* (above, note 38), 264–66.

40. *Meteor.* 2.2.354b33–355a32. This passage is sometimes now taken as referring to Heraclitus; e.g., by H. Cherniss, *Aristotle's Criticism of Presocratic Philosophy* (Baltimore, 1935), 133, note 541; and H. D. P. Lee, *Aristotle: Meteorologica*, Loeb Classical Library (London, 1962), 133, note c. Kirk, *Heraclitus* (above, note 38), 264–66, is skeptical and seems to prefer the traditional ascription to a group of early physical philosophers. The basis for referring it to Heraclitus is chiefly that the doctrine that an exhalation provides fuel for the sun is attested most clearly for Heraclitus and less clearly for others.

41. DK 22 A 12. According to Diogenes Laertius, Zeno used a bowl of water to illustrate an eclipse of the sun (*SVF* 1.119); but since a solar eclipse is said to be

caused by the moon intercepting the sun's light, the bowl analogy is obscure to us. Possibly Zeno had more than one explanation for eclipses, just as he may have had more than one theory of the nature of the moon. For his explanation for an eclipse of the moon in *SVF* 1.119 (falling into the shadow of the earth) implies that the moon is not fire, whereas in *SVF* 1.120 Zeno is credited with the opinion that the moon is fiery. Cleanthes, who said the moon is fiery (*SVF* 1.506), may well have used its hemispherical shape to explain eclipses and phases. A Heraclitean influence on Cleanthes' astronomy is strongly maintained by R. Hirzel, *Untersuchungen zu Cicero's philosophischen Schriften* (Leipzig, 1882), 2.120–21; cf. also A. C. Pearson, *The Fragments of Zeno and Cleanthes* (London, 1891), 261–62.

42. *SVF* 1.497 (see Appendix 3). The statement of this fragment that "the middle offers resistance" to the fire (ἀντιτυπήσαντος αὐτῷ τοῦ μέσου) is perhaps a reflection of the idea that the *tonos* is a "blow of fire."

43. *SVF* 3.471. This is actually a fragment of Chrysippus, but Chrysippus claims that this is the doctrine of Zeno.

44. H. G. Liddell, R. Scott, and H. S. Jones, *A Greek-English Lexicon*[9] (Oxford 1940), s. v. τείνω, τόνος.

45. In a discussion of the arm *tonoi* and *neura* are interchanged (*Art.* 11 [4.108–12, Littré = 3.226–28, Jones]), and in a discussion of the spinal cord the author speaks of sinewy *tonoi* (τόνοι νευρώδεες) and states that an outgrowth from the *neura* is linked to the *tonoi* (*Art.* 45 [4.190–92, Littré = 3.288, Jones]). Galen has no doubt that Hippocrates used the terms *tonoi* and *neura* interchangeably for the nerves proper (*De Plac. Hipp. et Plat.* 1.9 [5.205, Kühn]; *In Hipp. de Art.* 46 [18A.380–81, Kühn]). Some of the *tonoi* are considered especially important by the author of *On Joints*, because they cause pain if pressed by a bone (*Art.* 59 [4.256, Littré = 3.340, Jones]; cf. *Mochl.* 4 [4.366–67, Littré = 3.423, Jones]), and allow the ribs to deteriorate if they become infected (*Art.* 50 [4.218, Littré = 3.309, Jones]; cf. *Mochl.* 36 [4.378–80, Littré = 3.434, Jones]). The author of *Epidemics II* uses *tonoi* of the nerves extending from the brain (*Epid.* 2.2 [5.125–27, Littré]).

46. The Hippocratic treatises *On Breaths* and *On the Use of Liquids* also associate heat with the expansion of the *neura* (*Flat.* 8 [6.102, Littré = 2.238, Jones]; *Liqu.* 1 [6.118, Littré]).

47. *Nat. D.* 2.37–39. The passage is reprinted in part in *SVF* 2.641 and 1153. The passage presents a continuous argument; it is unfortunate von Arnim has broken it up and omitted a key part.

48. Cic. *Nat. D.* 2.32 (*Atque*)–36 shows the same Platonic basis for proving the intelligence and wisdom of the cosmos. All the arguments seem compatible with Chrysippus's philosophy and may originally have come from his pen. If so, they merely confirm the portrait we have been painting of Chrysippus.

49. Cf. Solmsen, "Cleanthes" (above, note 8), 280–81. Rufus of Ephesus (= *SVF* 1.127) claims, "Zeno says heat and *pneuma* are the same," but his testimony cannot be trusted. Even if he is referring to Zeno of Citium (and we cannot be sure of this), he may have misunderstood Zeno (cf. Solmsen, "Cleanthes," 281, note 61), especially since Rufus, in general, seems unacquainted with Stoic doctrine (this is the only reference to the old Stoics von Arnim has found in his writings).

50. Tertullian *Apol.* 21.10 (= *SVF* 1.160, 533) is a small piece of evidence that he did not. Zeno is said to have made the *logos*, or mind, the creative power in the universe, in contrast to Cleanthes, who assigned this task to the *pneuma* that permeates the cosmos. Cf. Verbeke, *L'évolution* (above, note 1), 39, 55.

51. Cf. *Nat. D.* 2.23–24; and the discussion of Cleanthes' view earlier in this chapter.

52. *SVF* 1.525 speaks of a disagreement between Cleanthes and Chrysippus on the role of the *pneuma* in causing local movements. This may stem from actual discussion in the Stoa at a time in which the Stoa was seriously grappling with problems connected with the *pneuma*. Perhaps it was Chrysippus who stimulated the discussion by rejecting Cleanthes' theory of heat as mover (Cic. *Nat. D.* 2.23, 32) in favor of Zeno's theory that the *pneuma* causes movement (*SVF* 1.135). This would not be the only time Chrysippus diverged from Cleanthes; Antipater of Tarsus wrote a book *On the Difference between Cleanthes and Chrysippus* (*SVF* 3.Antip.66). M. Pohlenz, "Zenon und Chrysipp," *NGG*, Phil.-hist. Kl., N.F., Fachgruppe I, vol. 2 (1938), 173–210, discusses some of Chrysippus's innovations.

53. Cf. Arist. *Gen. An.* 2.3.736b29–737a1 and Chapter 3, note 52.

54. The importance of heat in the biological works of Aristotle and Theophrastus is good evidence of its reputation in Zeno's day.

55. F. Steckerl, *The Fragments of Praxagoras of Cos and his School*, Philosophia Antiqua 8 (Leiden, 1958), has collected the fragments of Praxagoras and has provided a preliminary discussion of some of his theories and of his historical position. For what follows, see especially pages 10–21.

56. Fr. 18, 19. The apparent contradiction is discussed by Steckerl (above, note 55), 10–11.

57. Herophilus's opinion on the *pneuma's* role in sensation can be inferred from Galen *De Usu Part.* 10.12 (3.813, Kühn); *De Sympt. Caus.* 1.2 (7.88–89, Kühn); and in movement from Galen *De Tremore* 5 (7.605, Kühn). For Erasistratus's opinion on the role of the *pneuma* in movement, see Galen *De Melanch.* 5 (5.125, Kühn); cf. *De Loc. Affect.* 6.5 (8.429, Kühn). On the whole question and especially on the reconstruction of Herophilus see Solmsen, "Discovery" (above, note 26), 185–88.

58. Epicurus *Ep.* 1.63 described the soul as "most resembling *pneuma* with an admixture of heat" (cf. Lucr. 3.231–37). Theophrastus approved of the opinion of medical writers who considered paralysis a condition of the *pneuma* (πνευματικὸν πάθος), and he seems to have believed the *pneuma* is the cause of heat and motion, so that the blood will cease flowing and grow cool if the *pneuma* is interrupted (fr. 11, Wimmer). Cf. Solmsen, "Discovery" (above, note 26), 182–83.

59. For Herophilus, see Rufus *De Anat. Part.* 74; Galen *De Usu Part.* 8.11 (3.667, Kühn); Aët. 4.5.4; Tert. *De An.* 15.5. For Erasistratus, see Galen *De Plac. Hipp. et Plat.* 7.3 (5.602–4, Kühn); *De Usu Part.* 8.13 (3.673, Kühn); Aët. 4.5.3. Cf. Solmsen, "Discovery" (above, note 26), 192–93.

60. A word of warning is in order. Since Hellenistic medical theories are at the present time very imperfectly understood, any conclusions must be tentative. Perhaps further research in the bulky, but little read, corpus of Greek medicine will some day allow a clarification of the relationship between the Stoa and Greek medicine.

61. Cf. W. Jaeger, "Das Pneuma im Lykeion," *Hermes* 48 (1913), 43–55 (=*Scripta Minora* [Rome, 1960] 1.70–83), and Solmsen, "Discovery" (above, note 26), 174, who also point out that this is a legacy of the Sicilian school of medicine. See also W. Wiersma, "Die aristotelische Lehre vom Pneuma," *Mnemosyne*, 3d ser. 11 (1943): 102–7.

62. Galen *An in Arter. Nat. Sang. Cont.* 2 (4.706–7, Kühn = Praxagoras, fr. 31, Steckerl); *De Usu Resp.* 2 (4.473–74, Kühn); Aët. 4.22.3. Cf. Steckerl (above, note 55), 19.

63. Cicero's exact source for these sections is disputed. K. Reinhardt, *Kosmos und Sympathie* (Munich, 1926), 162–68, and M. van den Bruwaene, *La théologie de Cicéro* (Louvain, 1937), 119–21, think Posidonius is Cicero's source, whereas M. Pohlenz, "K. Reinhardt, Kosmos und Sympathie," *GGA* 188 (1926): 281–88; *Stoa* (above, note 1), 2.99, and I. Heinemann, *Poseidonios' metaphysische Schriften* (Breslau, 1928), 2.195–204, believe Panaetius supplied the material for these sections.

64. *SVF* 2.847. Galen (*SVF* 2.782, 783) mentions the same theory that Plutarch records, namely that the *pneuma* is sustained by respiration and by evaporation from the blood. Von Arnim believes Galen includes the Stoics in these general statements; but, in fact, Galen does not identify his sources precisely enough to make these passages useful as evidence for the Stoics.

65. Von Arnim includes in *SVF* a reference to Galen's treatise *De Usu Respirationis,* which attempts to prove that respiration is for cooling the innate heat (*SVF* 2.765); but there is no evidence that Galen obtained this theory from the Stoa.

66. *SVF* 2.885. Unfortunately, the word for breath has been corrupted in the MS; εὔπνοια, the conjecture of Petersen, is adopted by von Arnim. ἔμπνοια is another possibility (cf. *SVF* 2.792).

67. Chrysippus's student, Diogenes of Babylonia, too seems to have believed that breathing supplies at least part of the psychic *pneuma* (*SVF* 3.Diog.30).

68. We cannot here go into all the reasons for this statement. Cf. Steckerl (above, note 55), 20, 43–44; Solmsen, "Discovery" (above, note 26), 180–81. M. Pohlenz, "Karl Reinhardt, Kosmos und Sympathie," *GGA* 188 (1926): 281–84, has called attention to some striking parallels between the account of Cic. *Nat. D.* 2.135–38 and Erasistratus, but there are also some significant differences. In Cic. *Nat. D.* 2.136 heat and cooking are involved in digestion, as much as the mechanical grinding attested for Erasistratus (Galen *De Nat. Fac.* 2.8, 3.4, 3.7 [2.110–11, 118–19, 157, 166, Kühn]; *In Hipp. de Aliment.* 2.7 [15.247–48, Kühn]; *Def. Med.* 99 [19.372–73, Kühn]). In Cic. *Nat. D.* 2.139 the *nervi* seem to be ligaments, at least primarily, and in addition originate in the heart, whereas Erasistratus used the term to designate the nerves that are connected to the brain (Galen *De Plac. Hipp. et Plat.* 7.3 [5.602–4, Kühn]; cf. *De Usu Part.* 8.13 [3.673, Kühn]; Aët. 4.5.3; see Solmsen, "Discovery" [above, note 26], 184–97). As I have suggested above (note 60), the whole subject of the development and diffusion of Hellenistic medical theories requires much further study.

69. *De An.* 1.5.411b27–30; 2.2.413a22–b4, 3.414b18–19, 414b28–415a13; 3.3.427b6–14, 12.434a25–30; *Part. An.* 2.10.655b29–656a8; *Eth. Nic.* 1.7.11–13.1097b30–1098a4. For the background of Aristotle's scale, cf. F. Solmsen, "Antecedents of Aristotle's Psychology and Scale of Beings," *AJP* 76 (1955): 148–64.

70. *SVF* 2.634. The fragment is not completely clear and is probably corrupt. The doxographer's insertion of Stoic opinions on the *hegemonikon* of the cosmos (= *SVF* 2.644) has contributed to the confusion. What is clear is that the argument is based on the analogy from microcosm to macrocosm, and that the scale of psychological functions is found in each. What is not clear are the details. Even though we know the details of the four psychological functions and the scale of beings from other sources,

it would be unwise to attempt to fill out or even to locate the lacuna (von Arnim's lacuna before αἰσθητικῶς is an unsatisfactory solution). For some of the difficulties facing a would-be emendator, see below, note 72.

71. The subject of this and the following sentences is obscure. Strictly speaking, the subject should be "soul"; but Chrysippus is apparently thinking of the *pneuma*, which has different names corresponding to its function.

72. It is hard to see how Chrysippus could have gotten a strictly symmetrical scheme from this material. For strict symmetry the series of beings should run: earth-*hexis;* plants-nature; animals-soul, sensation; and man-mind. But we know that his highest part was the *aether,* not man. Again for strict symmetry on the basis of elements we should expect: earth-*hexis;* water-nature; air-soul, sensation; and *aether*-mind. He does, in fact use earth and *aether,* and substitutes the things in the air for air. But how did he bring water into relation with nature? Indeed, nature (φύσις) was considered wetter than soul (*SVF* 2.715, 787), but this fact helps little. What is more, plants, the best representatives of nature, are left out. To bring them into relation with water is even harder. The Aristotelian precedent that made footed animals the things in air assigned plants to earth (*Gen. An.* 3.11.761b13–14; cf. *De Juv* 19.477a27–30). Perhaps Chrysippus did not use a strictly symmetrical scheme. If he did not, any attempt to reconstruct his argument exactly is doomed to failure.

73. The pneumatic functions are also manifested in the cosmos as a whole. A sentient power pervades the whole cosmos (*SVF* 2.1209); nature (φύσις) holds the cosmos together and governs it (*SVF* 2.912, 1132); and *hexis* prevents it from disintegrating in the void (*SVF* 2.551, 552, 553).

74. *SVF* 2.389, 416, 439, 441, 449, 473, cf. 716. This idea is assigned to Chrysippus himself in *SVF* 2.449, 473. In *SVF* 2.1132 the cohesive function on the cosmic level is assigned to nature (φύσις) rather than to the *hexis* or *pneuma*, but it is still a function of the *pneuma,* for nature is a form of *pneuma* (cf. *SVF* 2.715, 716, 787, 1133).

75. The word *hexis* is well chosen because it means literally "holding" and figuratively "condition" or "state." As such it covers both the cohesive and the qualifying functions of the *pneuma*.

76. In *SVF* 2.1068 Chrysippus shows that he considered "being held together" (συνέχεσθαι) to be connected with nutrition, for he says, "The other gods (i.e., the heavenly bodies and the elements [cf. *SVF* 2.1049, 1076, 1077]) make use of food (τροφῇ), being held together (συνεχόμενοι) by this."

77. *SVF* 2.442, 451. Equally revealing is a statement in which Philo opposes "tonic motion" to change of place, when he wishes to describe the movement of the word of the Lord (*SVF* 2.453). The evidence that could be adduced in support of the hypothesis that pneumatic motion is local is very slight. Von Arnim prints in *SVF* Sextus's summary of an argument of Carneades that refers to movement from middle to periphery and back again and uses for this movement the word φερόμενον, which usually signifies local movement. Furthermore, he gratuitously emends the text to make *pneuma* the subject of this motion. Not only is this text of dubious value as evidence for Stoic doctrine, but it is capable of too many different interpretations to prove anything at all. In *SVF* 2.458 Philo, adapting some Stoic doctrines, speaks of the movement of the *pneuma* in local terms; but again Philo's adaptation is of dubious value as evidence for the old Stoa, and he could be speaking metaphorically, since another of his echoes of Stoicism, which we have just cited (*SVF* 2.453), points in

precisely the opposite direction. The only clear statement that tonic motion might be local occurs in Galen (*SVF* 2.450). Here tonic motion is described as possibly being local motion rapidly alternating in direction over a minute distance so that it appears to stand still, just as a swimmer swimming upstream. But Galen suspends judgment on the question whether this is the proper view of it or not, and the text does not allow us to decide whether this has been proposed as a description of tonic motion by one of its proponents, or whether Galen himself is suggesting this description. On this passage, cf. S. Sambursky, *Physics of the Stoics* (London and New York, 1959), 32–33.

78. S. Sambursky, *The Physical World of the Greeks* (London, 1956), 137–41, and (more cautiously) *Physics* (above, note 77), 22–23, interprets the pneumatic or tonic motion as something akin to wave motion, but his interesting thesis goes beyond the texts. The vibration mentioned by Galen (see above, note 77), and the Stoic idea that sound is a disturbance of the air spreading out in waves like ripples in a pond (*SVF* 2.425, 872) are not a sufficient basis for reading wave motion into all the texts pertaining to pneumatic motion. Sambursky's feeling that originally pneumatic tension "meant no more than the manifestations of the pressure of compressed air or the expansive force of steam from boiling water" (*Physical World* 135) is much closer to the actual texts.

79 In *SVF* 1.99 the word "*hexis*" is used of objects held together by a movement of all parts toward the center, and this might indicate another point of contact between Chrysippus and Zeno. There is no evidence that Zeno anticipated the entire theory of Chrysippus. Specifically there is no evidence that Zeno attributed the cohesion to the activity of *pneuma*. Furthermore, we cannot rule out the possibility that the epitomist has introduced a later term into his summary. There is a mention of the pneumatic *tonos* in *SVF* 1.106 (page 30.35–36); but this is obviously an interpolation, and, what is more, it is doubtful that anything in *SVF* 1.106 goes back to Zeno (see below, Chapter 6, note 14).

80. The most striking example of Chrysippus's integration of the physical and biological points of view is the statement quoted by Plutarch: "In whatever manner each of the parts moves when it is *grown together* [συμφυές] with the remaining parts, in the same manner it is reasonable for the part to move by itself, even if for the sake of argument we should imagine and assume it to be in a void space of this cosmos. For just as, being held together [συνεχόμενον], it would be moving from everywhere toward the middle, it remains in this motion, even if, for the sake of argument, void suddenly surrounds it" (*SVF* 2.550). Here in a single sentence Chrysippus both refers to the cosmos as "grown together" and "held together" (presumably by some active force or substance) and also speaks of the natural, centripetal movement of its parts. For furthur discussion of the physical side of this phenomenon, see above, Chapter 4. The *hexis* is referred to in *SVF* 2.551 (page 174.27–29), 552, 553; but in each case the author seems to understand it as a purely physical phenomenon.

81. This is also the view of Pohlenz, *Stoa* (above, note 1), 1.74–75, though Pohlenz does not stress as much as he might the differences between Zeno's, Cleanthes', and Chrysippus's conceptions of the *tonos*.

82. This is assuming that my interpretation of the role of Cleanthes' *tonos* in cosmogony is correct (see Appendix 3).

83. Cf. J. S. Morrison and R. T Williams, *Greek Oared Ships, 900–322 B.C* (Cambridge, 1968), 296–98.

84. These ἐπίτονοι, which seem to be a specific kind of sinew, probably in the back, are mentioned also in *Tim.* 84e and Arist. *Hist. An.* 3.5.515b6–10.

85. Rufus *De Anat. Part.* 71–74; *De Nom. Part.* 150; Galen *De Usu Part.* 8.11, 10.12 (3.667, 813, Kühn); *De Tremore* 5 (7.605, Kühn). Cf. Solmsen, "Discovery" (above, note 26), 184–88.

86. *Gen. An.* 2.6.744a1–5; *Part. An.* 2.16.659b17–18; *Mot. An.* 7–8.701b1–702a5; 10.703a4–b2; 11.703b9–18. Cf. Solmsen, "Discovery" (above, note 26), 169–78.

87. Fr. 11. Cf. Solmsen, "Discovery" (above, note 26), 178–80.

88. Cf. above, note 57.

89. Cf. above, note 45.

90. The theory of Praxagoras has been discussed above. For Erasistratus see especially, Galen's treatise *An in Arter. Nat. Sang. Cont.* (4.703–36, Kühn). Direct testimony on Herophilus is lacking, but there is at least no good evidence that he disagreed with Praxagoras and Erasistratus. Cf. L. G. Wilson, "Erasistratus, Galen, and the *Pneuma*," *Bull. Hist. Med.* 33 (1959): 295–99.

91. Cf., e.g., Praxagoras, frs. 26, 27, Steckerl; Herophilus *On Pulses* (cited by Galen, *De Puls. Diff.* 1.28; 2.6, 10; 4.2, 3 [8.556, 592, 625, 716–17, 724, Kühn]; *De Dign. Puls.* 2.2; 4.3 [8.853, 956–61, Kühn]; *De Praesag. ex Puls.* 2.3 [9.278–79, Kühn]; *Syn. Lib. de Puls.* 8, 12 [9.453, 463–65, Kühn]).

92. If we may trust the summary of [Rufus] *Syn. de Puls.* 8 (231–32, Ruelle), a summary that seems to be repeated without attribution in [Galen] *De Puls. ad Ant.* (19.634, Kühn). Since Galen assures us σφοδρότης was one of the qualities of pulse distinguished by Archigenes (*De Puls. Diff.* 2.4 [8.576–77, Kühn]) and has also informed us this quality depends on the *tonos* of the movement of the arteries, we may feel fairly safe in trusting the summary in the treatise attributed to Rufus at least on this point.

93. Cf., e.g., M. Wellmann, *Die pneumatische Schule bis auf Archigenes*, Philologische Unterschungen 14 (Berlin, 1895), 7–8, 132, cf. 131–53; Pohlenz, *Stoa* (above, note 1), 1.362; F. Kudlien, "Pneumatische Ärzte," *RE*, Suppl. 11 (1968): 1097–1106.

CHAPTER VI

The Cosmic Cycle

This cosmic order, which came into existence in the far distant past, is not eternal but must eventually perish. Its destruction will come in a tremendous conflagration, called the *ekpyrosis*, in which everything will be changed into fire (*SVF* 1.107, 510–12; 2.585–620). Then after a period during which nothing but fire exists, the world order will again come into existence, and by the very same process as that which brought the present world order into existence (*SVF* 1.109, 512; 2.593, 596, 597, 599, 620, 622–32). In fact, the future cosmos will be identical to this one in every respect. Even the people will be identical (*SVF* 2.623–627). There will be another Plato and another Socrates; Socrates will marry another Xanthippe and be accused by another Anytus and Meletus.[1] The history of the cosmos will proceed in an eternal cycle of destruction and restoration (*SVF* 2.596, 597, 617, 620, 625, 626).

A cyclical notion of history in general was deeply engrained in the Greek mind and found vivid expression in the myths of Phaethon and Deucalion, according to which humanity was destroyed by cataclysms of fire or flood. Plato used the theory of cyclical cataclysms by fire and flood to explain the absence of records and traditions about earlier civilizations and attributed these conflagrations to deviations of the heavenly bodies (*Tim*. 22b–23c; cf. *Critias* 109d, 111a–b, 112a; *Leg*. 677a; *Polit*. 270b–d). Aristotle may have picked up this idea and perhaps postulated a Great Winter and a Great Summer, in which flood and fire destroy civilizations. The Great Winter and Great Summer may have been parts of the Great Year, which Aristotle preferred to call the Greatest Year, and which he defined as the period marked by the conjunction of sun, moon, and planets in the same constellation.[2] Though Plato and Aristotle restricted the cataclysmic destructions to civilizations, others applied them to the cosmos as a whole. In the second half of the fifth century B.C. the Pythagorean Philolaos of Croton seems to have thought fire and water will destroy the cosmos (DK 44 A 18); and the astronomer Meton of Athens predicted the destruction of the cosmos, when the seven planets meet in the constellation of Aquarius.[3] On the basis of the Platonic theory of cataclysmic destructions of mankind by fire and flood, Epicurus argued that if these same forces of fire and water should sometime act with greater vehemence, the entire cosmos would be destroyed.[4] The Stoic doctrine of the conflagration seems to be another variation of this old theme of cataclysms. The Stoics follow the tradition that gave these cataclysms cosmic scope and actually interpret the cataclysms as parts of the cosmic cycle. Thus at one time there is a tremendous fire that destroys the entire cosmos; at another time this fire changes to a flood of water. Only between the watery stage and the next fiery stage does the present state of cosmic organization arise.[5] Thus the Stoics give the cataclysms a very rigidly determined role in the cyclical cosmic history.

Another aspect of the cyclical notion of history was developed primarily by the Pythagoreans. The Pythagoreans believed that the history of civilization is cyclical in the strictest sense. Every individual will arise again and repeat his life exactly. Aristotle's student, Eudemus of Rhodes, gave a description of this Pythagorean theory as an example of the repetition of numerically identical events (fr. 88, Wehrli [=DK 58 B 34]). Porphyry assigned the same doctrine to Pythagoras in a section of his *Life of Pythagoras*, which very likely comes from Dicaearchus, another student of Aristotle (*Vita Pythag.* 19 [=DK 14.8a]). We may conclude that this Pythagorean doctrine was well known and much discussed around the end of the fourth century, when Zeno came to Athens. We also know that Zeno too was interested in Pythagorean teachings; he wrote a book on the subject and may even have attended lectures by a Pythagorean.[6] Hence there can be little doubt that Zeno adopted from the Pythagoreans his theory that each man will be born again in the next cosmic cycle and will repeat his life exactly.[7] Chrysippus in his book *On the Cosmos* even stated that everything in the next world will be numerically identical with the things in this world (*SVF* 2.624), thus characterizing the nature of the repetition in the same way that Eudemus had characterized the nature of the Pythagorean repetition.

Close as the Stoic theory is to the concepts of a Great Year, cataclysmic destructions, and eternal repetition, it seems clear that these notions make up only one thread of the fabric of Stoic cosmology.[8] When these ideas are applied to the life of the cosmos as a whole, they converge with another philosophical topic, the future fate of the cosmos, which goes back to the earliest Greek philosophers. As early as the sixth century B.C. the Milesians seem to have viewed the history of the cosmos as an epic with a beginning, a middle, and an end,[9] though they may have devoted little effort to a discussion of the end of the cosmos. After the Milesians Heraclitus must have expressed views of the destiny of the cosmos. Unfortunately the evidence for his views is ambiguous; but since Heraclitus has been promoted as an ancestor of Stoicism, we cannot simply pass him by, as we may do with the Milesians. Even though we cannot settle the vexed, and perhaps insoluble, question of Heraclitus's own belief,[10] we can attempt to determine what the early Stoics knew and thought about Heraclitus, and so possibly identify another element in the origin of the Stoic theory of the conflagration and restoration of the cosmos.

In the absence of direct testimony concerning early Stoic knowledge of Heraclitus we may begin by comparing Aristotle's information on the subject. Aristotle, intentionally seeking out pre-Socratic opinion on the corruptibility or incorruptibility of the cosmos, seems to have read the works of the pre-Socratics with great care; but the results of his study were not great. He found no one who clearly stated the cosmos to be ungenerated. Of those who believed this generated cosmos will again perish, Aristotle found that some believed the cosmos is simply corruptible like any other natural compound, and others believed the cosmos will be destroyed and again regenerated in a cycle. The two men in whose works Aristotle purports to have found this latter view were Heraclitus and Empedocles (*Cael.* 1.10.279b12–17). Empedocles' fragments are clear enough to substantiate Aristotle's judgment, but Heraclitus's extant fragments are by no means so clear. Aristotle, of course, possessed much more of Heraclitus than we do, and there is no reason to believe that his judgment was not based on a reading of Heraclitus's own words.[11] Something in Heraclitus, then, must have suggested to Aristotle and the Peripatetics that Heraclitus did not believe in an eternal cosmos, and conversely they must have found no plain statement that the cosmos is eternal.[12] The Aristotelian commentator Simplicius and a Stoic commentary quoted by Clement preserve what must have been the best evidence known to antiquity for Heraclitus's opinion (DK 22 A 10; *SVF* 2.590). This is the well-known passage which stated: "This cosmos no one of gods or men has made, but always was, is, and will be: an everliving fire, kindled by measures and quenched by measures [DK 22 B 30]. . . . The changes of fire: first sea, and of sea half earth and half fiery waterspout. [Then] the sea is poured out and measured in the same proportion as it was before it became earth" (DK 22 B 31). The only other fragments of Heraclitus taken by the Stoics to refer to the conflagration are, "Thunderbolt steers all things" (DK 22 B 64), and "Want and satiety" (DK 22 B 65; cf. *SVF* 2.616), two fragments that in themselves cannot lead one to think that Heraclitus believed in a conflagration if one did not already believe this on other grounds. Since we know what antiquity considered to be the best evidence for cosmic periods in Heraclitus, and since we can surmise that Aristotle found no clearer evidence that Heraclitus believed the cosmos to be eternal, we are fairly safe in assuming that we know as much as Aristotle, the Peripatetics, and the Stoics knew about Heraclitus's opinion on the origin and destruction of the cosmos. Fortunately, we need not go into the interpretation of these difficult fragments, important as they are for establishing what Heraclitus himself believed. Since our purpose is to trace the origin of the Stoic doctrine, we may simply compare these texts with the Stoic theory and see immediately that these texts in themselves are not sufficient to account for the entire Stoic doctrine. The least that must be admitted is that the Stoics have greatly amplified Heraclitus's theory. Whether this is the best explanation for the origin of the Stoic doctrine, we shall be able to decide only after tracing the subsequent theories of the future fate of the cosmos.

In the fifth century B.C. Empedocles very plainly stated that the history of the cosmic order is cyclical, changing from a homogeneous harmony of the four elements to the present state of cosmic organization and eventually back to the state of homogeneity (DK 31 B17.1–13; A 52). The atomists held that this cosmos will eventually disintegrate and new ones will continually arise in the void (DK 67 A 1.33; 68 A 37, 40.3, 82). The various universes will be different from each other, though it is not impossible that a cosmos identical to this one will some day arise (DK 68 A 40, 81). Apart from these two theories, both of which assumed this cosmic order will perish, and one of which viewed the destruction as part of a cycle of destruction and regeneration, the fifth-century theories of the end of the cosmic order are unknown to us.

The fourth century brought a radical change in outlook. Plato took the first step when he accompanied his mythical description of the genesis of the cosmos by the assertion that the cosmos is held together by bonds that will never be dissolved, and that the cosmos will therefore exist eternally (*Tim.* 32b–c, 36e, 37c–d, 38b–c, 39d–e). Aristotle took the final step and denied that the cosmos had either a beginning or an end. Thus he affirmed the cosmos to be absolutely eternal (*De Phil.* frs. 18–20, Ross; *Cael.* 1.10–12; 2.1.283b26–284a2). At the same time the Academy under Xenocrates began interpreting Plato's myth of the genesis of the cosmos as a pedagogical device, designed to bring out certain truths about the ungenerated and imperishable cosmos (Xenocrates, fr. 54, Heinze).

With the Peripatetics and the Academy unanimous in opposing a corruptible cosmos, Zeno stepped into the scene. Zeno and his followers with their belief that the cosmos will eventually perish would appear to be reactionaries, setting themselves in direct opposition to the philosophical trend of the fourth century. Even the details of the Stoic doctrine would seem to confirm this judgment. The Stoics believed the sun, moon, and stars draw up moisture from the region of the earth; and though most of this is returned in the form of rain, some of it is consumed as fuel by the heavenly bodies and thereby converted into fire.[13] As evidence that this is taking place the Stoics seem to have pointed to the recession of the sea.[14] All these theories had already been refuted by Aristotle. In rejecting the theory that the sun uses moisture as fuel, Aristotle had said that the moisture taken up by the sun does not reach as far as the celestial region, but returns to earth in an eternal cycle (*Meteor.* 2.2.354b33–355a32). The notion that the sea is drying up Aristotle regarded as no more true than one of Aesop's fables. All the water that leaves the sea returns again in the form of rain. Moreover, the apparent recession of the sea at certain places is deceptive; for even though the sea does at times recede in one place, it increases in another place, with the result that cyclical variations are only local (*Meteor.* 1.14.352a17–b22 [cf. 352b22–353a28]; 2.3.356b9–357a3).

However, although the Stoics defended theories that Aristotle had criticized, we cannot simply jump to the conclusion that the Stoics were either unaware of Aristotle or deliberate reactionaries. We must first examine more carefully the core of the opposed doctrines, the corruptibility or incorruptibility of the cosmos as a whole. The eternity of the cosmos, the premise that was the basis for Aristotle's criticism of the theory that the sea is diminishing, is proven by Aristotle in *On the Heavens*. When he sets out to investigate whether the cosmos is eternal, or generated and corruptible, he begins by stating the method he will use to investigate this problem: "Let us state whether the cosmos is ungenerated or generated and imperishable or perishable after first running over the theories of others, for difficulties in one theory are the proofs for the opposite theory. At the same time the theory we are going to propound will be more persuasive to those who have heard the pleas of the opponents, for it will not appear so much as if we were winning the case by default. In fact, those who wish to obtain a satisfactory decision of the truth need arbitrators, not litigants" (*Cael.* 1.10.279b4–12). Aristotle makes it clear that he does not intend to propose and defend another theory that will merely compete with the current theories; he intends, rather, to conduct a trial. Each of those who have theories on this subject will be allowed to state his case. Then Aristotle will cross-examine each litigant to reveal his false statements and thereby arrive at the truth. Aristotle intends to point out the dead ends (*ἀπορίαι*) all the former theories have taken and by so doing lead men down the opposite path, the one Aristotle believes to be the road to truth.

The litigants are lined up and taken one at a time. All believe the cosmos is generated, but the first one believes it is also eternal.[15] The proponent of this view is Plato, and Aristotle cross-examines his view from several angles. First of all, his theory is contradicted by experience, for nothing else is known to have such a nature. Even mathematical diagrams are not a valid analogy to substantiate this view. The fact is that everything which is generated is also corruptible (*Cael.* 1.10.279b17–280a10). Aristotle later returns to this view to show by a detailed, theoretical analysis that things which patently exist must be either eternal, or else both generated and corruptible; no third possibility exists (*Cael.* 1.10–12.280a28–283b22).

With Plato's view eliminated only two contending theories remain: namely, that the cosmos is eternal, or else that it is both generated and corruptible. This second theory comes in two versions. According to one version the cosmos is absolutely perishable like any natural compound (*Cael.* 1.10.279b13–14). The main defendant of this theory, Simplicius tells us, is Democritus (*Cael.* 293.16–18; 294.23–30, Heiberg). Aristotle admits that if there are an infinite number of worlds, as Democritus actually believed, this theory is possible; but he dismisses it, presumably because he has already refuted the theory of infinite worlds (*Cael.* 1.8–9). However, he does point out that if the cosmos is one, as he has proven, the theory that the cosmos has come to be and will perish irrevocably is impossible, for before it came to be, there must have been a prior formation (*σύστασις*) by a change of which the cosmos came to be.[16]

In the last analysis, the theory that the cosmos is generated and perishable admits of only one defensible interpretation, that of the second version of this theory, namely, that the cosmos comes to be and perishes in a cycle forever (*Cael.* 1.10.279b24–30). Thus the only theory still competing with the theory of an eternal cosmos is the cyclical cosmos that Aristotle finds in Heraclitus and Empedocles (*Cael.* 1.10.279b14–17). When Aristotle cross-examines this theory, he finds, to our surprise, that it does not differ from his own theory that the cosmos is eternal: "Making the cosmos alternately combined and dissolved is no different from making it eternal, but merely changing the form [*μορφή*] . . . ; for it is clear that when the elements come together, the resulting order [*τάξις*] and formation [*σύστασις*] is not fortuitous [*τυχοῦσα*], but the same. . . . Consequently if the whole corporeal matter [*σῶμα*] exists continuously, but is merely disposed [*διατίθεται*] and arranged [*διακεκόσμηται*] in different ways, and if the cosmos and heaven mean the formation [*σύστασις*] of the universe, then it is not the cosmos that comes to be and perishes, but only the dispositions [*διαθέσεις*] of the cosmos" (*Cael.* 1.10.280a11–23). The word "cosmos" refers to the order that is present in the body of the universe. As long as the corporeal material retains its temporal continuity, and as long as this eternal matter maintains a continuous order, that is, does not change from order to disorder or vice versa, the cosmos must be deemed eternal. The particular state of the cosmic order may change; even Aristotle would not exclude all change from the cosmos.

This explanation clearly fits the theory of Empedocles, but its applicability to Heraclitus's fragments must be examined more carefully. Aristotle presumably found in Heraclitus his two criteria for an eternal cosmos, the continuity of corporeal substance and a succession of ordered states. With a little imagination these criteria can be found in Heraclitus's extant fragments. "This cosmos no one of gods or men has made, but always was, is, and will be: an ever-living fire, kindled by measures and quenched by measures" (DK 22 B 30). Here the eternity of the corporeal substance, fire, is clearly stated. Even if fragment 31 is taken to refer to cosmogony, it only confirms the fact that corporeal substance continues to exist, sometimes in the form of pure fire, sometimes in the form of several elements. The second criterion, a succession of ordered states, can be found just as easily. If the fire is kindled and quenched by measures (DK 22 B 30), and if the elements in their transformations keep the same proportions they had before transformation (DK 22 B 31), there must always be some sort of order. Even though the cosmos alternates between a state of pure fire and a state of several elements, it alternates between different ordered states, not between order and disorder. Therefore, "cosmos" in the sense of "order" as such is eternal in Heraclitus. Aristotle might have paraphrased Heraclitus, fr. 30, as follows: "The order in the universe no one has created; it was, is, and shall be forever, inasmuch as the universe is an eternal fire, sometimes kindled and sometimes quenched."

The result of Aristotle's trial of his predecessors is that he has discovered his own view imperfectly expressed by two of his predecessors, Heraclitus and Empedocles. After eliminating the incorrect views of Plato and the Atomists, and after putting the view of Heraclitus and Empedocles into the proper perspective, Aristotle finds that the only defensible view is that the cosmic material and the cosmic order may undergo changes. This is not to say that the philosophies of Heraclitus and Empedocles are correct; for example, Heraclitus's view on the *archê* or element of all things and Empedocles' denial of the transformation of elements are open to criticism (*Metaph.* 1.3.984a5–11, 8.988b22–989a26; *Cael.* 3.5.304a7–b22; *Gen. Corr.* 2.6). But their opinion on the eternity of the cosmos is, in the last analysis, substantially correct.

Now we are finally in a position to evaluate the Stoic attitude toward the perishability of the cosmos. A comparison of the Stoic doctrine with Aristotle's discussion shows that the Stoics have appropriated Aristotle's theory completely. The Stoics do not admit that the cosmos without qualification is perishable. They distinguish different senses of the word "cosmos." One is "that which is particularly qualified of all substantial matter" (τὸ ἐκ ἁπάσης οὐσίας ἰδίως ποιόν), also called "god." The other is the "arrangement" (διακόσμησις, διάταξις), the order in which the qualified matter is currently arranged in the cosmos. The cosmos in the sense of "the particularly qualified matter" is eternal, for the eternal matter never exists without some qualification. Only the cosmos in the sense of "this specific arrangement" is generated and destroyed in an eternal cycle (*SVF* 2.526–28, 590, 620). Accordingly, whenever the Stoics speak of the cosmic order created in the cosmogony or destroyed in the conflagration, they use the term διακόσμησις or the verb διακοσμεῖν (*SVF* 1.98, 102, 107, 497, 512; 2.526, 596, 597, 599, 611, 626, 1052). Obviously the Stoic theory is an exact repetition of the theory Aristotle expressed in *On the Heavens* (1.10.280a11–23), with only a slight change in some of the terminology.[17] Moreover, when the Stoic source quoted by Clement of Alexandria cites Heraclitus as an exponent of this view (*SVF* 2.590), this Stoic source is also following Aristotle; and what is even more significant, this Stoic source manifests precisely the same interpretation of Heraclitus that we have postulated for Aristotle. Heraclitus, fr. 30, is used as evidence that the cosmos in the sense of ordered, qualified matter is eternal; Heraclitus, fr. 31, is used as evidence that the cosmic arrangement (διακόσμησις) is generated and perishable.

The Stoics, therefore, cannot be considered ignorant of Aristotle's criticisms; nor can they be considered reactionaries. They are following a course to which Aristotle had given his approval. Though Aristotle might have been able to criticize on other grounds the cosmic destruction envisioned by the Stoics, he could not have faulted them for denying the eternity of the cosmos. The Stoics, following Aristotle's own lead, have found a way to maintain the old notion of a generated and perishable cosmos without rejecting the fourth-century preference for an eternal cosmos.

So far we have been looking only at the physical side of the Stoic doctrine of conflagration and regeneration, but like the rest of Stoic cosmology this doctrine also had a biological side. Since we know the

Stoics considered the cosmogony to be a birth, we might expect that they would consider the destruction of the cosmos to be its death. But Chrysippus maintains that death is technically not a correct description of the destruction of the cosmos: "Since death is a separation of soul from body, and the soul of the cosmos is not separated, but grows continuously, until it has absorbed all the matter into itself, it ought not to be said that the cosmos dies" (*SVF* 2.604). In the conflagration the elements of the cosmos change into fire as into a seed (σπέρμα), so that the fire may be called the seed of the future cosmos.[18] Thus the Stoics obviously saw in the cycle of conflagration and restoration a cycle of growth and reproduction, the cycle that every species of animal experiences.[19] Moreover, since the cosmos grows and reproduces itself, if does not actually perish, but survives eternally.[20] For this reason from the biological point of view, just as from the physical point of view, the cosmos must be deemed eternal.

The Stoics were not the first to apply the analogy of growth and reproduction to cycles of cosmic regeneration. When Aristotle in *On the Heavens* interpreted the theories of Empedocles and Heraclitus to mean that the cosmos is eternal but merely changes in form, he argued that to say the cosmos perishes according to their theories is "as if one should think that a man coming from a boy and a boy coming from a man is sometimes destroyed and sometimes exists" (*Cael.* 1.10.280a11–15). What is significant is that Aristotle here not only made use of a biological analogy to explain cosmic cycles, but that he made use of this analogy in both directions. If he had merely used the analogy of a man coming from a boy, we might think he was loosely comparing the cyclical cosmos to something that changes shape and size without altering its essential nature. But he added the example of a boy coming from a man, an event that can occur only in reproduction. The analogy Aristotle is obviously calling to mind is the continuity of the species, which is eternal regardless of the alterations in shape and size produced by growth and reproduction. As individual men grow and reproduce themselves, but the species "man" remains the same eternally, so individual states of the cosmos may change, even perish and be regenerated, but the cosmos exists eternally. Aristotle explains the theory of the eternity of the species in more detail in purely biological contexts. The nutritive soul, in virtue of which all living things have life, has two functions: the assimilation of food (i.e., growth) and reproduction. Reproduction is "making another like itself . . . in order that the subject might participate in the eternal and divine in the only way possible. . . . Since it cannot share in the eternal and divine by continuity, because no perishable thing can remain one and the same numerically, it shares in this in the only way it can. . . . It is not the individual itself which remains, but something of the same kind, being one, not in number, but in species" (*De An.* 2.4.415a28–b7; cf. *Gen. An.* 2.1.731b24–732a1). According to Aristotle the nutritive soul, which all living things possess, is responsible for a cycle of growth and reproduction; and it is this cycle that causes each species to participate in eternity. This idea Aristotle suggested as an analogy to the cosmic cycles of Heraclitus and Empedocles to give the cyclical cosmos a form of eternity. The Stoics seem to have taken up Aristotle's suggestion; and in keeping with their belief that the cosmos is a living being, they have applied Aristotle's analogy literally and have interpreted the cosmic cycles as cycles of growth and reproduction.[21]

In the Stoic doctrine of conflagration and regeneration three lines of thought converge: the concept of the Great Year with its periodic cataclysms and (among the Pythagoreans at least) eternal repetition, the Aristotelian explanation of the eternity of a cyclical cosmic order, and the Aristotelian theory of the eternity of biological species.[22] Once again the Stoics have taken Aristotle's cosmological theory and synthesized it with his biological theory, following an analogy suggested by Aristotle himself. Then with this synthesis they have merged the additional motif of the Great Year and the eternal repetition. Characteristically, the result is not an unrecognizable hybrid but an entirely new breed of cosmology.

1. *SVF* 1.109; 2.625, 626. The Stoics seem to have speculated at some length on the nature and extent of the repetition. Chrysippus in *On the Cosmos* said everything in the next cosmos will be numerically identical with the things in this cosmos. Nevertheless, the Stoics admitted that things might differ in nonessential characteristics; for example, a freckle-faced person might not have freckles in the next cycle (*SVF* 2.624). According to Origen the Stoics said that it will not be the same Socrates who comes again, but a man indistinguishable from Socrates will live a life indistinguishable from that lived by the last Socrates (*SVF* 2.626).

2. The evidence for this theory is admittedly somewhat weak, but there are some strong hints that Aristotle put forth some such theory in his *Protrepticus* and perhaps

also in *On Philosophy*. Censorinus *De Die Natale* 18.11 preserves a fragment of Aristotle's *Protrepticus* (fr. 19, Ross, Walzer) in which Aristotle says the year marked by the conjunction of the sun, moon, and five planets should be called, not the Great Year, but the Greatest Year. After this Censorinus describes the cataclysms of the Great Summer and Great Winter. We know from *Meteor.* 1.14.352a28–b3 that Aristotle believed the Flood of Deucalion to be an example of a Great Winter, but he did not think of this cataclysm as destroying the cosmos. So when Censorinus describes cataclysms that destroy the cosmos, we may suppose he is going beyond Aristotle; his description of the conflagration of the Great Summer sounds Stoic. It is quite possible that in the *Protrepticus* Aristotle mentioned his less extensive catalysms of the Great Year, but Censorinus substituted the cosmic version of the Stoics. (Walzer prints the entire passage of Censorinus; Ross omits the description of the cataclysms.) *De Phil.* fr. 8 (Walzer) speaks of *μέγισται φθοραί*, which could refer to cyclical cataclysms, especially since this work described the cyclical nature of knowledge (cf. W. Jaeger, *Aristotle: Fundamentals of the History of His Development*², trans. R. Robinson [Oxford, 1948], 128–38, esp. 137). See also *Phys.* 4.14.223b24–224a2.

3. Tzetzes *Chil.* 10.534–42; 12.219–25, 283–88, Kiessling. On Philolaos and Meton, cf. W. Burkert, *Weisheit und Wissenschaft: Studien zu Pythagoras, Philolaos, und Platon* (Nürnberg, 1962), 293–95.

4. Lucr. 5.338–347, cf. 380–415. See E. Bignone, *L'Aristotele perduto e la formazione filosofica di Epicuro* (Florence, 1935–36), 2.475–84.

5. See above, Chapter 3. This is another example of the coalescence of different motifs in Stoic cosmology. Here the motif of cataclysmic destructions coalesces with the cosmogonal motifs of elemental change and biological genesis. It is interesting to note that Arius Didymus calls the Stoic cycle by Aristotle's term, "the Greatest Year" (*SVF* 2.599). In *SVF* 2.625 the Stoics are given credit also for the idea that planetary conjunction marks off the cosmic cycle.

6. See below, Appendix 1.

7. Cf. W. Wiersma, "Die Physik des Stoikers Zenon," *Mnemosyne*, 3d ser. 11 (1943):203–11; B. L. van der Waerden, "Das grosse Jahr und die ewige Wiederkehr," *Hermes* 80 (1952):131; E. V. Arnold, *Roman Stoicism* (Cambridge, 1911), 193.

8. Van der Waerden (above, note 7), 129–55, considers these three motifs to be different aspects of a single basic belief, which he traces back to Mesopotamia. For the Stoic doctrine he points out that in *SVF* 2.625 all three motifs, planetary conjunction, cataclysms, and eternal repetition, coincide.

9. Cf. C. H. Kahn, *Anaximander and the Origins of Greek Cosmology* (New York, 1960), 199–200; N. Rescher, "Cosmic Evolution in Anaximander," *Studium Generale* 12 (1958):728; W. K. C. Guthrie, *History of Greek Philosophy* (Cambridge, 1962–69), 1.389.

10. The state of the question is summarized by G. S. Kirk, *Heraclitus: The Cosmic Fragments* (Cambridge, 1954), 335–38; cf. Guthrie (above, note 9), 1.456, note 1.

11. Kirk (above, note 10), 319–24, suggests that Aristotle did not mean to attribute cosmic periods to Heraclitus, but carelessly inserted Heraclitus's name with that of Empedocles because he had Plato *Soph.* 242d–e in the back of his mind. This is hardly likely. If Aristotle had made a mistake, would not Theophrastus have corrected him, as he did in other cases? Kahn (above, note 9), 19–20 (cf. in general 17–24), calls

attention to several cases in which Theophrastus has corrected Aristotle's misinterpretations of the pre-Socratics. Significantly, one of these pertains to Heraclitus. Theophrastus admits that the condensation-rarefaction motif that Aristotle claims to have found in all pre-Socratic monists, including the one who made fire the ultimate substance (*Phys.* 1.4.187a12–16, 6.189b8–10), is not clearly attested in the text of Heraclitus (DK 22 A 1.8) but can be documented only for Anaximenes (DK 13 A 5). Yet Theophrastus (DK 22 A 5, cf. 1.8) and the Aristotelian commentators who followed him were apparently satisfied that Aristotle had interpreted Heraclitus correctly in respect to his doctrine of cosmic cycles. That Aristotle possessed some sort of book by Heraclitus (whether a continuous work or a collection of sayings [cf. Guthrie (above, note 9), 1.406–8]) can be deduced from *Rhet.* 3.5.1407b11–18 (= DK 22 A 4).

12. Kirk (above, note 10), 321, is surprised that Theophrastus and the commentators accepted Aristotle's misinterpretation, even though "it is fairly plain from the fragments that Heraclitus did not postulate any such absorption by fire"; but one can hardly claim that it is fairly plain, when even modern interpreters with all their tools of semantic analysis cannot agree on the meaning of fragment 30. Contrast, for example, Kirk (above, note 10), 307–18, and Kahn (above, note 9), 224–26.

13. *SVF* 2.593. On the Stoic belief that the heavenly bodies consume moisture from the sea, cf. also *SVF* 1.501, 504; 2.421, 650, 652, 655, 656, 658, 663, 806 (page 223.8–9).

14. *SVF* 2.594. If *SVF* 1.106 is based on Stoic arguments, it would be further evidence (esp. page 30.5–29), but the source of the arguments in *SVF* 1.106 has been the subject of an extensive controversy. That Zeno was actually the ultimate source is unlikely (cf. W. Wiersma, "Der angebliche Streit des Zenon und Theophrast über die Ewigkeit der Welt," *Mnemosyne*, 3d ser. 8 [1940]:235–43, and J. B. McDiarmid, "Theophrastus on the Eternity of the World," *TAPA* 71 [1940]: 239–47). Even the third argument (pages 30.29–31.29), which because of its form seems to be the most Stoic, is incompatible with what we know of the Stoic theory of the perishing of the cosmos. The imagery of the passage suggests that the perishing of the parts, and consequently of the cosmos, is viewed as sickness and death (cf. *SVF* page 30.34–31.8: *σήπονται, νεκροῦται, οἷα ψυχὴν ἀφῃρημένον ζῷον, νοσεῖν, φθίνειν, τρόπον τιν' ἀποθνήσκειν, ἀτροφῆσαν, χωλόν*). As we shall see, the Stoics viewed the end of the cosmos, not as death but as maturation and reproduction.

15. *Cael.* 1.10.279b12–13. Throughout his treatment of this theory Aristotle for the sake of completeness also deals with the converse theory that something ungenerated may be perishable; but since this converse theory is irrelevant to cosmology, and since it is refuted by the same arguments as the theory in which we are interested, we may dismiss it from our summary.

16. *Cael.* 1.10.280a23–26. H. Cherniss, *Aristotle's Criticism of Presocratic Philosophy* (Baltimore, Md., 1935), 181, note 162, tries to identify the defendant of this view. He wonders whether it might be Anaxagoras, who did believe the cosmos to be unique; but he concludes that Anaxagoras cannot be referred to, because there is evidence that Anaxagoras believed cosmic motion eternal, and moreover, Eudemus (*apud* Simplic. *Phys.* 1185.9–15, Diels [= DK 59 A 59]) reveals that Anaxagoras did not clearly express himself on the topic of the end of the cosmos. Therefore, Cherniss believes Aristotle is merely generalizing as part of his refutation of the theory of Democritus.

17. The Aristotealian term διακοσμεῖν is appropriated by the Stoics; but instead of Aristotle's σῶμα and its σύστασις the Stoics speak of τὸ ἐκ ἁπάσης οὐσίας ἰδίως ποιόν.

18. *SVF* 1.98, 107, 512, 2.596, 618, 619. It may have been to emphasize this positive aspect of the process that Chrysippus objected to Cleanthes' use of the word "flame" (φλόξ) for the fire of the conflagration and preferred instead the word "ray" (αὐγή, *SVF* 2.611. Cf. Cleanthes' use of ἐκφλογισθέντος in *SVF* 1.497 to describe the cosmos during the conflagration). For the Stoics after Chrysippus "flame" (φλόξ) is the form of fire that feeds on a fuel and consumes it (*SVF* 2.612) and so is generative only of itself. "Ray" (αὐγή), on the other hand, is the light given off from flame (*SVF* 2.612), and from Homer on had most frequently been used of the light of the sun. When Xenophon made the distinction between the creative fire of the heavenly bodies and ordinary fire, a distinction that the Stoics eventually adopted (see above, Chapter 4), he used "ray" for the growth-promoting light of the sun (*Mem.* 4.7.7). Similarly Theophrastus, who noted that ordinary fire is generative only of itself (*De Igne* 1), differentiated creative heat from destructive fire and in this context used "ray" of the sun, which is the source both of creative and of ordinary heat (*De Igne* 5). Given this distinction in the connotation of the words, it is understandable that Chrysippus made the change in terminology; it is doubtful that this represents any significant change in doctrine.

19. The growth that occurs in the conflagration is attested not only in the literal quotation from Chrysippus just cited (*SVF* 2.604), but also in a garbled passage in which Philargyrius describes the doctrine of Zeno (*SVF* 1.108). According to Philargyrius, Zeno says the cosmos "grows [*crescere*], but does not arrive at death, because elements remain by which it may recover [*revalescat*]." Philargyrius interprets this to mean that "the cosmos remains forever because elements [*elementa*] inhere in it from which matters [*materiae*] are generated." Exactly what Philargyrius means by *elementa* and *materiae* is not clear. The *elementa* that survive to generate *materiae* must refer either to the single *elementum* fire, or more likely to the active and passive principles that serve a biological function in cosmogony. The *materiae* that are generated from the *elementa* might be the four elements, or else the corporeal matter (ὕλη) which was absorbed into the soul in the conflagration (cf. *SVF* 2.604). In spite of the imprecise terminology the motif of cyclical growth and reproduction is clear.

20. *SVF* 1.108 and 2.620 both attribute the eternity of the cosmos to the fact that it regenerates itself eternally. The language of *SVF* 1.108 has a noticeable biological cast (cf. *intereant, generantur, crescere, interitum, revalescat*).

21. In Aristotle's biological theory each successive member of the species is identical, not in number, but in kind. When Alexander says Chrysippus believed the future cosmos will be numerically identical to this one, we should not see a discrepancy between the theory of Aristotle and Chrysippus. Chrysippus may be using numerical identity in a slightly different sense. We should remember that Eudemus described the identity of the Pythagorean repetition as numerical (Eudemus, fr. 88, Wehrli [= DK 58 B 34]). Numerical identity may refer to a one-for-one correspondence not only of the parts of each cosmos but also of the events performed by the parts (i.e., the men in the cosmos). Repetition of specific events is not found in Aristotle's theory of the generic identity of successive members of a species.

22. We should perhaps mention that in Plato's theory of cataclysmic destructions of mankind a "small seed" (σπέρμα βραχύ) always survives to regenerate the popula-

tion (*Tim*. 23c; cf. *Leg*. 3.677a). Plato has applied the analogy of biological reproduction to whole populations. In a sense this is the first step toward the Stoic doctrine. The Stoics have subsequently taken both the cataclysms and the analogy of reproduction and applied them to the cosmos as a whole.

CHAPTER VII

Epilogue: The Definition of Nature and the Origins of Stoic Cosmology

In the course of its transformations the cosmic fire creates the universe, destroys it, and re-creates it again in an eternal cycle. This is the course of nature, and the Stoic definition of nature substantiates that fact. In Zeno's words, *physis* or nature is "a craftsmanlike fire, proceeding methodically [literally, by a path] to genesis" (πῦρ τεχνικὸν ὁδῷ βαδίζον εἰς γένεσιν).[1] This pithy definition of nature, so unlike any definition of nature up to its time, conceals a host of clues to its origins, and in fact, in its six words reveals as much about the Stoic approach to physics as any of the more elaborate cosmological doctrines we have been examining. Thus it may serve to exemplify in microcosm the origins of Stoic cosmology.

To determine the origins of the Stoic definition of nature we must analyze carefully both the language and the substance of the definition. The first thing we notice is that nature is defined as one of the material elements of the cosmos, namely, fire. Second, it is obvious that nature is viewed not merely as dead matter but as a dynamic substance; for nature is not any and all the fire in the cosmos, but only a specific form of fire, the craftsmanlike fire that proceeds to genesis. Zeno distinguished two kinds of fire, the uncreative (ἄτεχνον) fire, which destroys things, and the creative, craftsmanlike (τεχνικόν) fire, which causes growth and preservation and can be found in plants and animals, as well as in the heavenly bodies (*SVF* 1.120; cf. 504). Zeno's nature is the dynamic, creative kind of fire in the universe. He underscores its dynamic life by giving it an anthropomorphic description. It is "craftsmanlike" (τεχνικόν); it "walks along a road" (ὁδῷ βαδίζον); and it heads for "creation" or "begetting" (γένεσις). The anthropomorphic description reveals a third characteristic of Zeno's concept of nature. Nature is conceived as operating in the manner of a craftsman, who follows a methodical course (ὁδῷ) in the process of creation.[2]

Though Zeno's definition of nature is, as a definition, unique, the individual aspects of it are not unprecedented, and so allow us to see how Zeno arrived at his concept of nature. We may begin with the idea that nature operates as a craftsman, for the ancestry of this idea is the most obvious, at least in its basic features.[3] Already in the fifth century Empedocles in a tentative way used the model of the crafts to help explain the origin of the world of living things,[4] but it was really Plato in the fourth century who fully formulated the idea. In the *Timaeus* Plato developed the theory that the cosmos was brought into existence by a divine demiurge or craftsman, who intended to introduce as much order and perfection into his creation as is possible in the world of becoming.[5] Plato distrusted *physis* or nature, because the term had previously in pre-Socratic philosophy been applied to the random operation of the powers and material substances of the cosmos; and so in the *Timaeus* all order and craftsmanlike activity was assigned to an extrinsic force, the demiurge (*Tim.* 52d–53b; *Soph.* 265a–e). Aristotle, in turn, ignored the pre-Socratic heritage of *physis* and assigned the craftsmanlike production of form and order to nature herself. Thus we must look to Aristotle for the real origin of the Stoic concept of nature as craftsman.

In both *Physics II,* which is Aristotle's chief discussion of the concept of *physis,* and in *On the Parts of Animals I,* which is Aristotle's introduction to the study of biology, Aristotle makes it absolutely clear that he regards the craftsman as the best model of the way nature operates.[6] As a craftsman aims to produce a finished product through the use of material instruments, so nature uses matter to produce natural objects. The major difference between nature and art is that in nature the motive cause is in the object itself (e.g., a man begets a man), whereas in the crafts the motive cause is in another (e.g., a craftsman is required for making a bed) (*Phys.* 2.1.192b8–23; *Gen. An.* 2.1.735a2–4; cf. *Eth. Nic.* 6.4.1140a10–14). One result of Aristotle's conviction that nature operates as a craftsman is that he uses countless analogies taken from the crafts to explain physical and biological processes.[7] More important is the fact that the model of the craftsman serves to reinforce Aristotle's teleological view of nature. In the crafts the important thing is the finished product; the materials, tools, and even the craftsman's activities are chosen for their efficacy in producing the desired result. In Aristotelian terminology material and efficient causes are subordinate to formal and final causes. So nature, too, in Aristotle's eyes is "in the class of final or purpose causes" (τῶν ἕνεκά του αἰτίων, *Phys.* 2.8.198b10–11). Aristotle's exposition of the concept of nature begins with the assertion that nature is essentially the principle and cause of movement and rest in natural things, that is, in those things that have their principle of movement within themselves (*Phys.* 2.1.192b8–23); and it ultimately reaches the conclusion that though nature is cause in all four Aristotelian senses, it is cause primarily in the sense of the form which is the final goal toward which all natural things strive (esp. *Phys.* 2.1.192b8–193b21; 2.7–8.198b4–199b33).

Zeno's definition of nature is in complete harmony with Aristotle's in regarding nature's operation as craftsmanlike and aiming at the production of natural objects. Moreover, the Stoics like Aristotle were fascinated by the manifestations of purpose in nature.[8] Thus we are safe in saying that, broadly speaking, Zeno's definition of nature is in Aristotle's debt. Yet honesty compels us to admit that the only direct link between Zeno's definition and Aristotle's discussions is the word *technikon*, that is, the fundamental idea that nature operates as a craftsman. No direct connections are detectable between "walking along a path to genesis" and anything in Aristotle's discussions of nature. One might be tempted to compare Aristotle's statement that "nature, in its etymological sense, like genesis, is a path to nature" (ἡ φύσις ἡ λεγομένη ὡς γένεσις ὁδός ἐστιν εἰς φύσιν, *Phys.* 2.1.193b12–13). But though this statement uses several of the words of Zeno's definition (γένεσις, ὁδός, εἰς), its resemblance is largely superficial. Aristotle is defining nature as a process in which form is actualized in a natural object; Zeno seems to be speaking primarily of the regular, methodical course followed by nature in the act of creation. The influence of Aristotle's idea of nature as process on Zeno's definition is a subject to which we will have to return. Right now all we can say is that the second half of Zeno's definition of nature is terminologically only remotely related to Aristotle's discussions of nature and of the role of craft as an analogy to nature.

We might be tempted at this point to abandon our search for the origins of Zeno's definition in terms of the analogy between nature and craft, for we could be satisfied with the substantial progress we have made in determining Zeno's debt for the idea that nature is craftsmanlike. But the Stoic definition of craft proves that we have not fully exhausted the influence of the technomorphic model on Zeno's definition of nature. One of the Stoic definitions of craft, reliably assigned to Cleanthes, and very likely going back to Zeno himself, is "a pathmaking disposition" (*ἕξις ὁδοποιητική*), or in slightly different words, "a disposition which accomplishes all things by a plan or method" (*ἕξις ὁδῷ πάντα ἀνύουσα*).[9] According to the early Stoics the essential characteristic of craft is that it does not depend on chance or trial and error but makes use of a definite, methodical process or *hodos* to bring something into existence. It is precisely this characteristic that determines the second half of the Stoic definition of nature, according to which fire in a craftsmanlike way proceeds toward creation by a methodical process. Not only are the ideas of creation and of methodical process common to both definitions but the word for methodical process is the same in each, that is, *hodos*. There can be no doubt that the Stoic definition of nature incorporates the Stoic definition of craft.[10] The question we must now ask is where the Stoics got their definition of craft.

In the *Nicomachean Ethics* Aristotle devotes a chapter to art or craft as one of the intellectual virtues (*Eth. Nic.* 6.4.1140a1–23). In this discussion he makes two major points. First, all craft deals with bringing something into existence (*περὶ γένεσιν*), and consequently is concerned with making (*ποίησις*), not with doing (*πρᾶξις*). Second, craft differs from other impulses to *genesis* in its objects and procedure. It differs from necessity in that its objects are capable either of being or not being, from nature in that its objects have their origin in the maker and not in the thing made, and finally from chance and lack of craft (*ἀτεχνία*) in its procedure: "In a sense chance and art are concerned with the same objects; as even Agathon says, 'Art loves chance and chance loves art.' Art, then, as has been said, is a kind of disposition which creates with correct reasoning [*ἕξις τις μετὰ λόγου ἀληθοῦς ποιητική ἐστιν*] and lack of craft [*ἀτεχνία*], the opposite, a disposition which creates with false reasoning [*μετὰ λόγου ψευδοῦς*]. Both deal with that which can be otherwise" (*Eth. Nic.* 6.4.1140a17–23). Thus, Aristotle, like the Stoics, regards craft as a disposition for making something; and in addition, Aristotle makes explicit, what the Stoic fragments leave implicit, namely, that art bears some resemblance to chance, but can be distinguished from chance by the presence of an element of planning or design. Finally, the Aristotelian definition of craft ("a disposition which creates with reason") differs only slightly from the Stoic definition. Hence we can conclude that there is some connection between the Stoic and the Aristotelian concepts of craft, though we do not know whether the Stoics took their definition from the Peripatetic school directly or whether both drew on a commonplace definition.[11]

The only difference between the two definitions is that for Aristotle's phrase "with reason" the Stoics substituted "by a methodical process." The significance of this difference is hard to judge in the absence of an extended discussion of the Stoic theory. It might seem that the Stoics stressed the technique used by the craftsman, whereas Aristotle stressed the knowledge that enables a craftsman to choose the right technique to accomplish his desired end. This could suggest that the Stoics considered craft nothing more than a technique learned by practice, involving no intellectual activity. In fact, it could then even include some instinctive activity of irrational animals, like nest-building, honey-making, or web-spinning. But it would probably be wrong to read such a theoretical difference into this terminological discrepancy, for the other common Stoic definition of craft, used by Zeno and Chrysippus, held that craft is "a collection of apprehended perceptions (καταλήψεις) exercised together for some goal useful to life" (*SVF* 1.73; 2.56, 93–97; cf. 3.189). Here the craftsman's intellectual activity is clearly a part of his craft. Furthermore, this definition was eventually used as grounds for denying that animals use craft in their productive activities, like honey-making and web-spinning.[12]

If there is not necessarily a basic difference between the Stoic concept of craft and Aristotle's, we might well ask why the Stoics did not use the Aristotelian definition without change. This is, of course, an unanswerable question, especially since we do not even know whether the Stoics based their definition directly on Aristotle's or whether they were following an alternative formulation of a commonplace definition of craft. We can speculate and observe that Aristotle often used the word *hodos* in a logical context to refer to methods of rational inquiry. He used the word of the method to be followed in constructing a syllogism (*Anal. Pr.* 1.29.45b37, 30.46a3), of the process of reasoning to and from first principles (*Anal. Pr.* 1.27.43a21; 2.1.53a2; *Anal.*

Post. 1.23.84b23), and of methods of proof in general (*Anal. Pr.* 1.28.45a21, 31.46b24, 33; *Anal. Post.* 1.21.82b12, 29, 32; cf. 2.5.91b12). As such it came very close to *logos,* in the sense of argument or reasoning process.[13] But *logos* was a favorite word among the Stoics and there seems to be no gain in substituting *hodos* for *logos* in the definition of craft. Some advantage can be seen in its use in the definition of nature, where *hodos* can be used to create an anthropomorphic image of nature. This emphasizes the craftsmanlike quality of nature and also allows the Stoic definition to incorporate Aristotle's concept of nature as motive cause, according to which nature is called a "path to nature" (ὁδός εἰς φύσιν).[14] Moreover, the idea that nature walks along a path in creation may have enabled the Stoics to bring their definition into relationship with Heraclitus's statement about "the way up and down" (DK 22 B 60), which Theophrastus and the Stoics probably took as a reference to elemental change.[15] Finally, and perhaps most significantly, the Stoic formulation is now reminiscent of Plato's solemn pronouncement of some ancient words of wisdom: "God, who holds the beginning, the end, and the middle of all things, as the old saying goes, travelling by nature on a straight path, accomplishes his end" (εὐθείᾳ περαίνει κατὰ φύσιν περιπορευόμενος, *Leg.* 4.715e–716a).

However, simply guessing at some advantage that might be derived from the Stoic formulation of the definition of craft does not account for the discrepancy between the Stoic and Aristotelian definitions. Fortunately, there is no need to fret over this discrepancy; the similarities are sufficient to demonstrate that Zeno has adopted a current definition of craft and has used it to construct his definition of nature. The intellectual process that produced Zeno's definition is therefore fairly clear. Zeno has begun by adopting Aristotle's notion that nature operates in a craftsmanlike way, and that the analogy of the crafts can consequently be used to understand the operation of nature. From this he has apparently concluded that a valid definition of craft ought to be valid as a definition of the activity of nature; so he has incorporated into his definition of the activity of nature a current definition of craft, found in Aristotle's *Nicomachean Ethics,* if nowhere else.

The Stoic conception of nature as a craftsman presupposes a dynamic conception of nature, and the dynamic conception is the second characteristic of the Stoic definition of nature that bears investigation. Fortunately, the origin of this concept is easy to discover, now that we have traced the Stoic concept of nature as craftsman back to Aristotle; for Aristotle's conception of nature as craftsman already presupposes a dynamic conception of nature. In fact, the restoration of a dynamic conception of nature was one of Aristotle's important contributions to philosophy.[16]

Though the early Greeks saw no difficulty in assuming the elements to be self-moving and alive, by the end of the fifth century philosophers felt the need to postulate along with the elements some force to move them, either the force of an outside agent, like Anaxagoras's Mind, or an unexplained phenomenon inherent in the elements, like Democritus's atomic motion. At any rate, movement in nature could no longer be assumed and passed over without comment. By the fourth century the problem had become so important that the source of movement in the world was one of the major subjects in the philosophy of Plato and Aristotle. After exploring the problem in great depth, Plato came to the conclusion that all movement in nature is ultimately due to a self-mover and that this self-mover is soul (*Leg*. 10.893b–896b; *Phaedr*. 245c–246a). Aristotle, on the contrary, found this explanation of movement unsatisfactory and instead restored nature to its early pre-Socratic position as the source of movement in and of itself.[17] In Aristotle nature took over the major activity of Plato's soul, causing movement not only in living things but also in the elements and the heavenly bodies. Nature thereby became "the principle of movement in all things that have their principle of movement within themselves" (*Phys*. 2.1.192b8–23). As the dynamic principle in living beings and in the cosmos as a whole, it was now also prepared to take over the management of the cosmos in a craftsmanlike way. The dynamic conception of nature thus accompanied the idea that nature operates as a craftsman as this idea was absorbed into Zeno's definition of nature from Peripatetic philosophy. As a result we can say that the dynamic character of nature in Zeno's definition owes its existence to Aristotle's conception of nature as a principle of movement.[18]

Having traced the Stoic conception of nature as a dynamic, craftsmanlike force back to Aristotle, we might jump to the conclusion that the Stoic definition of nature represents basically a Peripatetic conception. Nothing could be further from the truth. Zeno says nature is craftsmanlike fire proceeding by a methodical process to genesis. No matter how closely the activity of this fire resembles the activity of the principle Aristotle calls nature, Zeno's nature is still fire, and not the Aristotelian principle, or *archê*, that embraces the four causes of genesis in the natural world. To be sure, fire, or at least heat, was in Aristotle's eyes the most active and important element in nature, yet it was still only a tool that nature uses to accomplish its ends; it was not nature itself. Nor could it be, for nature is present in all elements as a source of movement and cannot be restricted to a single element. No discussion in Aristotle even remotely suggests that nature is, by definition, fire. Since Zeno emphatically states that nature is, by definition, fire, a vast chasm separates the Aristotelian conception of nature from Zeno's definition.

This chasm may seem unbridgeable, but it is not; and it is in the bridging of this chasm that Zeno's originality lies. We have in an earlier chapter discussed some of the principles governing Stoic definitions, but since the Stoic method of definition helps to account for Zeno's definition of nature, we shall have to review the Stoic method here.[19] In defining virtues, vices, and qualities in general the Stoics could say, for example, either that virtue is a state of the soul or that virtue is the soul in a certain state. The Stoics did not differentiate between the subject of an affection or quality and the genus of the affection or quality. This method of definition has been shown to be dependent on Aristotle's discussion of definition in the *Metaphysics*. Aristotle maintained that definitions ought to include both the matter and the form. As examples of such definitions Aristotle suggested: "A threshhold is wood or stone lying in a certain way"; "A house is bricks and wood lying in a certain way"; or generally, "A thing is certain things disposed in a certain way" (ὡδὶ ταδὶ ἔχοντα).

Aristotle maintained that the natural philosopher who deals with perceptible susbstance, that is, with formed matter, will, ideally at least, always include both form and matter in his definitions.[20] In fact, Aristotle expressed doubt whether qualities and activities per se could be said to exist, inasmuch as they cannot exist apart from a material substrate (*Metaph.* 7.1.1028a10–29; cf. 9.1.1045b27–32; 11.3.1061a7–10; 12.5.1071a1–2; 13.2.1077b4–9; 14.2.1089b24–28; *Phys.* 1.2.185a31–32; *Cat.* 5.2a34–b6). The net result of Aristotle's discussions was to suggest that a quality ought not to be defined apart from the subject which possesses that quality. Accordingly the Stoics defined a quality of the soul, like virtue, as "the soul in a certain state."

Let us now assume that Zeno wished to follow this principle in defining nature. Convinced that nature is characterized by a craftsmanlike mode of creation, he would have to ask himself what it is that acts in a craftsmanlike way. If craft is a habit of creating in a methodical way, what is it in nature that possesses the habit of creating in a methodical way? It is not hard to imagine how Zeno came to conclude that it is fire that possesses the craftsmanlike habit of creating in a methodical way. Fire was considered the most active and important element not only by Plato, Aristotle, Epicurus, and probably other intellectuals of the day, but also by Zeno himself; obviously, Zeno would have to conclude that the possessor of the creative power in the cosmos is fire. Hence a definition of nature in accordance with the Stoic method of definition would have to include fire, the material subject that possesses the power of acting in a creative way.

Zeno's definition of nature is a unique and original definition, not in the ideas and concepts that it contains but in the way in which these ideas are put together. The importance of fire as a creative agent in nature, the idea that nature operates in a craftsmanlike way, the concept of craft as a habit of creating with a plan in mind, and even Zeno's particular way of expressing a definition were all found in the philosophy of the Peripatos; and some of these ideas may even have been commonplace among Athenian intellectuals in Zeno's day. Zeno has synthesized these ideas into a new form to reflect his new spirit, and it is this synthesis that constitutes his originality.

The synthesis that led to the Stoic definition of nature is typical of the more intricate syntheses that led to the manifestly complex theories of Stoic cosmology, and so this investigation of the origins of the definition of nature may stand as a prelude to a survey of the complex origins of Stoic cosmology. We embarked upon a systematic comparison of Stoic cosmology with its antecedents to determine on whom the Stoics depended, what they borrowed from their predecessors, and how they used the material they borrowed. These questions, which have been investigated in detail, may now be answered in summary fashion.

The comparison has suggested that Heraclitus, whose influence on Stoic physics has so frequently been stressed, had almost no direct influence on Stoic cosmology. Some of his cosmological and astronomical theories seem to have been cited, especially by Cleanthes, as precedents for the Stoic view. But citing Heraclitus as a precedent cannot be regarded as a sign of direct influence any more than Zeno's citation of Hesiod and Chrysippus's allusions to Homer and other Greek poets can be regarded as signs that Stoicism was directly influenced by the Greek poets. It is possible that in a few details, such as the shape of the heavenly bodies and the symmetry of his cosmogony, Cleanthes shows a direct influence of Heraclitus; but Cleanthes' idea about the heavenly bodies was unique among the Stoics, and his doctrine of cosmogony is too imperfectly known to allow firm conclusions. Therefore, Heraclitus cannot be considered the father of Stoic cosmology.

The real antecedents for Stoic cosmology clearly lay in the fourth century. The Stoics accepted from Plato not only commonplace definitions, such as the mark of true being and the definition of death, but also major doctrines, such as the application of the principles of genesis to the cosmos, the conviction that the cosmos is a living, ensouled animal, and specific theories concerning the world soul. In addition, Plato provided a precedent for the theory that the cosmos consists of four transformable elements.

If in cosmology Stoicism's debt to Plato was large, its debt to Aristotle was even larger. Aristotle's metaphysical analysis prepared the ground and provided seminal concepts from which the Stoics developed the theory that all real things are corporeal. Aristotle initiated the quest for principles or *archai*, and his concepts of matter and prime mover contributed something to the two Stoic principles. Aristotle's conception of the physical structure of the cosmos and his theory of natural movements and places were taken over by the Stoics with only a few changes. Finally, Aristotle's discussion of the eternity of the cosmos provided the theoretical basis for the Stoic theory of cosmic cycles.

Moreover, Aristotle's influence was not restricted to the physical side of Stoic cosmology. His theories of sexual reproduction and embryology were the ultimate basis for the Stoic doctrine of principles and also for their theory of cosmic genesis. His scrutiny of the biological function of heat and its relation to soul opened the way for the Stoic identification of heat with the soul of the cosmos. Moreover, his analysis of the three types of soul supplied the functions of the heat and the *pneuma* in the systems of Cleanthes and Chrysippus. Finally, his theory of the eternity of the species may have been absorbed by the Stoics into their explanation of the eternity of the cosmic animal.

In addition to influences from Plato and Aristotle the Stoics seem to have accepted the notion of eternal recurrence from the fourth-century Pythagoreans. Epicurean influence and criticism may also have accounted for some developments in Stoic cosmology, such as the extracosmic void and some aspects of the theory of stability in the void. Finally, the stress laid by late fourth- and early third-century medical theorists on the *pneuma* induced Chrysippus to modify Stoic cosmology so far as to find a place for the *pneuma* and its biological functions in the cosmic processes.

Looking over this catalog of borrowed philosophical material, one might be tempted to label the Stoics as eclectics. This judgment would certainly be wrong. The Stoics did not simply borrow philosophical statements and theories intact from their predecessors but transformed everything that came into their hands. It is in this transformation that the originality of the Stoics lies. If we wish to peer into the Stoic mind, we are going to have to survey the process of transformation to see whether any guiding principles may be discerned.

One principle that cries out for attention is the principle of extrapolating biological theories to the cosmos. This procedure rests on the deep conviction that the cosmos is a living animal. This idea cannot be traced to a specific philosophical predecessor, but was a conviction rooted in the consciousness of the Greek people, as well as of other ancient peoples. Though philosophy, especially in the late fourth century, shunned this idea in its literal sense, it could not, or would not, uproot this fundamental outlook from the Grrek mind. So it is understandable that the idea would spring to life again if given a chance; but it took the Stoic genius to bring about the resurrection and make the idea intellectually respectable. The Stoics did this by describing the cosmos *qua* cosmos in physical terms, but by describing the cosmos *qua* living animal in contemporary biological terms. Thus the Stoics synthesized what they felt was the best cosmological theory with the best biological theory, transforming all into a fundamentally original theory of cosmology.

From one point of view the Stoic biologization of cosmology might seem to be an attempt to account for unexplained phenomena by use of a biological model, a perfectly conceivable explanatory method, but it is doubtful that this is what the Stoics were trying to do. There seems to be nothing hypothetical about the Stoic use of the biological model. Nor did the Stoics ever suggest that the biological model is in any way analogical. For the Stoics the biological model possessed as much ontological reality as did the phenomena it explains. Thus it not only explains phenomena; it is itself a phenomenon. This makes the Stoic biologistic cosmology quite different from the "likely tale" of Plato's *Timaeus* or the countless analogies in Aristotle's scientific works. Stoic physics, therefore, does not seem to be an attempt to explain what might be an opaque world by reference to better known phenomena from the world of living things. Rather it seems to be an attempt to describe the nature of a perfectly clear and intelligible cosmos, a cosmos that has a dual nature, physical and biological, both of which must be comprehended if we are to understand the cosmos fully.

The Stoic synthesis of theories from two separate, contemporary sciences, cosmology and biology, carried the Stoics in a different direction from that in which Peripatetic and Alexandrian science was heading. In contrast to Aristotle, who compartmentalized knowledge and sought the principles for each science, the Stoics, like their contemporaries, the Epicureans, strove for a unified science, based on a single set of elementary principles. Within the Stoic synthesis biology and cosmology, for example, did not require separate principles and theories; both could be treated in terms of the same basic principles and as parts of a single unified world view. In fact, whether the Stoic was talking about the origin of the cosmos, the origin of the human race, the sprouting of plants, or the birth of a baby, he could use the same basic principles to describe genesis. The impetus toward the specialization of science and scholarship, for which Aristotle had laid the foundations, was reversed by the Stoics. Instead, the Stoics sought the common ground on which all wise men might stand, and they found this ground in a synthesis of the theories of contemporary science.

Not only did the Stoics synthesize theories from different sciences but they synthesized disparate theories within a single science to provide a common ground of agreement between antagonistic ideas. An example of this would be the Stoic harmonization of the Aristotelian and Epicurean concepts of what is beyond the cosmos. Frequently, real synthesis was unnecessary. The Stoics often found statements by predecessors that could be interpreted or (if you will) misinterpreted to mean the same as their own dogma. Then, too, mythology could be allegorized and words could be etymologized at will to concur with Stoic dogma. These phenomena all suggest that the Stoics wished their teaching to be viewed as the *consensus omnium*. Stoicism was to be identical with the wisdom of the ages. Hesiod once said, "Best of all is the man who thinks out all for himself; but that man, too, is good who listens to one who speaks well" (*Op*. 293, 295). Zeno is said to have reversed the quotation to make it say, "Best of all is the man who listens to one who speaks well; but that man, too, is good, who thinks out all for himself."[21] Apparently Zeno had no desire to put forth an original system, but wished only to accept and use the theories that had been developed by others. Yet in selecting, adapting, and synthesizing these established theories, Zeno created a new philosophy, whose complexities can never be comprehended by any simple formula.

Thus Stoic cosmology reveals a paradox that no doubt holds true for Stoic physics in general. On the one hand, it was a serious attempt to synthesize, harmonize, and unify contemporary philosophical and scientific ideas, and, wherever possible, also ideas of the past. On the other hand, this synthesis resulted in a totally new conception of nature. Accordingly, whereas Stoicism contributed a great deal to the diffusion of certain Aristotelian concepts and theories, it also provided a completely new set of concepts and theories with which to analyze the world. It had the paradoxical effect both of popularizing some of the results of contemporary scientific research and of creating a totally new world view. This, in effect, was the essence of the Stoic achievement in physical philosophy.

1. *SVF* 1.171; cf. 1.172; 2.422, 774, 1133, 1134. For further allusions, cf. A. S. Pease, *M. Tulli Ciceronis De Natura Deorum* (Cambridge, Mass., 1958), 2.683–84. This definition may have been adapted for use as a definition of god, the creator of the universe, by restricting the genesis to the cosmos. Aët. 1.7.33 (=*SVF* 2.1027); [Galen] *Hist. Phil.* 35 (=*DG* 618); Athenag. *Leg. pro Christ.* 6 (broken off in midsentence in *SVF* 2.1027), describe god as "a craftsmanlike fire proceeding methodically toward creation of a cosmos" (*πῦρ τεχνικὸν ὁδῷ βαδίζον ἐπὶ γένεσιν κόσμου*).

2. The word ὁδῷ is a key word in the definition, though Zeno plays with this crucial word by using an ambiguous phrase (*ὁδῷ βαδίζον*), which may mean "walking along a road" or "proceeding methodically according to a definite plan." The metaphorical meaning is by far the most important, as we shall soon see, though the vividness of the image allows little doubt that Zeno wished the reader to keep the human model of his concept of nature clearly before his eyes.

3. The evolution of this idea has been traced by F Solmsen, "Nature as Craftsman in Greek Thought," *JHI* 24 (1963): 473–96.

4. See esp. DK 31 B 73, 86, 87, 96. Cf. Solmsen (above, note 3), 476–79.

5. *Tim.* 29d–30c, and passim. Solmsen (above, note 3), 481–83, discusses the great variety of manual activities used to explain the creation of the cosmos and its inhabitants.

6. For what follows see *Phys.* 2.1–2, 7–9, (cf. 2.3); *Part An.* 1.1. See also H. Meyer, *Natur und Kunst bei Aristoteles* (Paderborn, 1919); J. M. Le Blond, *Logique et méthode chez Aristote* (Paris, 1939), 326–46; Solmsen (above, note 3), 487–95; and G. E. R. Lloyd, *Polarity and Analogy* (Cambridge, 1966), 285–91. For a careful analysis of Aristotle's concept of nature in general, see A. Mansion, *Introduction à la physique Aristotélicienne*[2] (Louvain and Paris, 1946).

7. See Meyer (above, note 6), 62–84, and Lloyd (above, note 6), 285–86, for examples and references.

8. Cf. *SVF* 2.1106–67; Cic. *Nat. D.* 2.73–153; see M. Pohlenz, *Die Stoa: Geschichte einer geistigen Bewegung*[3] (Göttingen, 1964), 1.98–101.

9. *SVF* 1.72, 490 (Quintilian 2.17.41 gives *potestas viam efficiens* according to one MS and *potestas via efficiens* according to another, making it hard to tell which Greek rendering he has in mind. Recent editors read *via*.). The scholiast on Dionysius Thrax assigns the definition "path-making disposition" to Zeno (*SVF* 1.72). Von Arnim has reservations about the reliability of the scholiast because Olympiodorus *In Plat. Gorg.* 12.1 (63, Norvin) assigns the very similar second definition to Cleanthes and with an addition to Chrysippus, while assigning to Zeno an entirely different definition of craft, namely "a collection of apprehended perceptions exercised together for some goal useful to life" (*SVF* 1.73). Of course the scholiast could be wrong, but we cannot be sure of this merely from the fact that Olympiodorus assigns a different definition to Zeno. The two definitions are not incompatible; and, what is more, Chrysippus seems to have used both definitions, that is, if we may believe both Olymp. *In Plat. Gorg.* 12.1 (63.6–7, Norvin) and Sextus Empiricus *Adv Math.* 7.373 (=*SVF* 2.56 [page 23.21–22]). The probability that Zeno himself used the definition that the scholiast assigns to him is increased by the fact that this definition of craft serves as the basis for Zeno's definition of nature, as we shall see.

10. The close connection between the Stoic definition of craft and the Stoic concept of nature is apparent in the argument of Olympiodorus *In Plat. Gorg.* 12.1 (63.4–8, Norvin), where Olympiodorus objects to Cleanthes' definition of craft ("a disposition doing everything methodically") because it is then identical with nature, which is "a kind of disposition making everything methodically" (*ἕξις τις ὁδῷ πάντα ποιοῦσα*). He goes on to approve Chrysippus's definition of art as "a disposition advancing [*προιοῦσα*] methodically with perceptions." It is interesting to note that Chrysippus's improvement incorporates the idea of progressing, which is also found in Zeno's definition of nature. The connection between the Stoic definition of craft and nature is also evident in the version of the definition of nature attributed by pseudo-Galen *Hist.*

Phil. 20 (=*DG* 611) to "some people," presumably Stoics: "Nature is a creative, path-making *pneuma* [πνεῦμα ἔντεχνον ὁδοποιητικόν]." Apparently some Stoics also used as the basis for a definition of nature the definition that makes craft "a path-making disposition."

11. In this section Aristotle admits that his distinction between ποίησις and πρᾶξις is in agreement with that of the *exoterikoi logoi*. The identification of the *exoterikoi logoi* is debated. W. D. Ross, *Aristotle's Metaphysics* (Oxford, 1924), 2.409–10, and I. Düring, *Aristoteles: Darstellung und Interpretation seines Denkens* (Heidelberg, 1966), 556, believe Aristotle refers to popular philosophical writings of unspecified authorship or to commonplace notions of the day. F. Dirlmeier, "*Physik* IV 10 ('Ἐξωτερικοὶ λόγοι = EL)," in *Naturphilosophie bei Aristoteles und Theophrast*, ed. I. Düring (Heidelberg, 1969), 51–58, believes he refers to his own propaedeutic collections of opinions on various subjects, in this case to *Eth. Nic.* 1.1.1094a1–18. In any case, the distinction between ποίησις and πρᾶξις was not original with the Peripatos, and the definition of τέχνη may also have been current outside the Peripatos. F. Heinimann, "Eine vorplatonische Theorie der τέχνη," *MusHelv* 18 (1961): 105–30, has shown that the concept of craft was widely discussed from the late fifth century through Hellenistic times, not only by philosophers but also by physicians and rhetoricians, and that one aspect of the discussion was what element of craft enabled the skilled to be distinguished from the uninitiated or from the poor practioners of the craft.

12. Philo, *De Animalibus adversus Alexandrum* (=*SVF* 2.731). For the Stoics' concern with apparent intelligence in animals, see Pohlenz, *Stoa*, 1.84–85; 2.49. For a completely different interpretation of the Stoic and Aristotelian concepts of craft, see E. Grumach, *Physis und Agathon in der alten Stoa*, Problemata 6 (Berlin, 1932), 44–71, who gives a valuable analysis of the evolution of the Stoic concept of nature (in the broad metaphysical sense) from the metaphysical speculations of Aristotle and Theophrastus and sees a new Stoic concept of craft at the root of the Stoic change from a transcendent to an immanent prime mover. According to Grumach's analysis Aristotle felt that the mere existence of the form of the object in the soul constitutes the craft; but the Stoics, realizing that the layman can possess the form of an object in his soul without being able to produce it, now assert that craft is essentially a knowledge of the technique or orderly process of producing the object and that the form of the object is only an auxiliary cause. This interpretation seems to underestimate the importance of the knowledge of technique in Aristotle. Discussions such as *Eth. Nic.* 3.5.1112a18–b31; 10.9.1180b7–28; *Part. An.* 1.1.639b11–641a14; and *Phys.* 2.7–8, suggest that Aristotle considered knowledge of technique, i.e., the best method of obtaining the desired end, to be part of the knowledge of the form that constitutes the craft. For example, the doctors' art involves knowing how to produce health under various circumstances in addition to a knowledge of health per se. See K. Bartels, "Der Begriff Techne bei Aristoteles," *Synusia: Festgabe für W. Schadewaldt* (Pfullingen, 1965), 275–81. On the other hand, Grumach probably overestimates the role of technique in the Stoic theory. To be sure, some Stoics (not necessarily all—cf. ἄλλοι) regarded regularity and consistency of result as a mark by which to distinguish the skilled from the unskilled (Sext. Emp. *Adv. Math.* 11.206–207 [=*SVF* 3.516]), but this does not necessarily make regularity and technique a sufficient definition of craft. The case for a fundamental difference between the Stoic and Aristotelian views is no stronger than the case for the essential similarity of the Stoic and Aristotelian conceptions. Moreover, even if Grumach's hypothesis of a dispute over the concept of craft could

be made convincing, it would be a somewhat insecure foundation on which to posit the radical change from Aristotelian to Stoic metaphysics. It is unlikely that Stoic physics can be reduced to a single *archê* and that the overall Stoic point of view is due to a single idea.

13. Cf. Bonitz 435a21–45. This usage of ὁδός also occurs in Plato; cf. G. A. F. Ast, *Lexicon Platonicum* (Leipzig, 1835–38), s.v. ὁδός.

14. *Phys.* 2.1.193b12–13. It should be noted that the anthropomorphic expression ὁδῷ βαδίζον does not necessarily forfeit its logical connotation. Aristotle used not only the word ὁδός but also the word βαδίζω, of a logical process or argument (*Anal. Post.* 1.23.84b33; 2.13.97a5, b14; *Eth. Nic.* 10.9.1180b21; *Metaph.* 6.4.1027b12; 9.8.1050a7). Thus the Stoic phrase, "proceeding by a methodical process to creation," could be interpreted in a metaphorical sense to mean essentially the same thing as Aristotle's phrase, "creating with true reasoning" (μετὰ λόγου ποιητική).

15. See above, chapter 3, note 68.

16. On this entire subject, see F. Solmsen, *Aristotle's System of the Physical World: A Comparison with his Predecessors,* Cornell Studies in Classical Philology 33 (Ithaca, N.Y., 1960), 92–117; W. Theiler, *Zur Geschichte der teleologischen Naturbetrachtung bis auf Aristoteles* (Zürich, 1925), 84–85; and Grumach (above, note 12), 47–48.

17. On several occasions, notably in *Physics VII–VIII* and *Metaphysics XIII*, Aristotle tried to get behind and beyond nature as a source of movement and postulated an extracosmic prime mover, which, in the last analysis, moves the universe as a final cause. But otherwise in his physical researches he was usually satisfied to trace the causation of the movements of natural objects to their nature. For further discussion of the relation between natural movement and the prime mover, see above, Chapter 2, and Solmsen (above, note 16), 222–49.

18. Cf. Grumach (above, note 12), 47–48.

19. See above, Chapter 1, for a more detailed discussion and the full evidence.

20. *De An.* 1.1.403a29–b12. For interpretation, cf. the commentary of W. D. Ross, *Aristotle: De Anima* (Oxford, 1961), 164–65, 169–70. See also Arist. *Metaph.* 6.1.1025b30–1026a6; 8.2–3.1043a14–36.

21. *SVF* 1.235. See below, Appendix 1, for a fuller discussion of this story and the other biographical evidence for Zeno's character.

APPENDIXES

Influences on Stoicism According to the Biographical Tradition

In antiquity numerous reports regarding the intellectual parentage of Stoicism were in circulation. These reports might harbor important clues to the origins of Stoicism, and so the biographical traditions about the early Stoics must be examined carefully for any aid they might render in a quest for the origins of Stoic cosmology. To begin, it is well known that Zeno was born of a Phoenician father, Mnaseas, in the city of Citium on the island of Cyprus.[1] We may surmise that he received the usual Phoenician education, and so it is conceivable that his philosophy was molded by this education and the attitudes of his early life.[2] Since nearly nothing is known of Phoenician ideas of this period, we cannot reliably trace any Stoic views to a Semitic influence. All we can do is keep open the possibility of a stratum of Semitic ideas underlying Stoic philosophy. Thus our first biographic fact proves to be of little aid in our quest.

The second thing we know about Zeno is that he came to Athens during the summer of the year 312 B.C. at the impressionable age of 22.[3] Diogenes Laertius tells us that Zeno's first action in Athens was to attach himself to the wandering Cynic preacher, Crates of Thebes, who then resided in Athens.[4] A group of related anecdotes deals with Zeno's conversion to philosophy and his first meeting with Crates. Diogenes Laertius relates that Zeno, on a voyage to sell Phoenician purple, was shipwrecked at Athens. While shipwrecked, he sat at the door of a bookstore and read Xenophon's *Memoirs of Socrates*. He was so impressed that he asked the bookseller where he could find men like Socrates. The bookseller pointed to Crates, who happened to be near by, and said, "Follow that man." This was how Zeno came to be a follower of Crates (Diog. Laert. 7.2–3 [=*SVF* 1.1–2]). Demetrius of Magnesia gives a variation of the story. He says that while Zeno was still a boy in Citium his father, a merchant, brought "many of the Socratic books" from Athens for his son to read. That was how it happened that when Zeno came to Athens, he attached himself to Crates (Diog. Laert. 7.31–32 [=*SVF* 1.6]). Which books about Socrates Zeno read is not told us. They could have been books by Plato, Xenophon, Antisthenes, or Aeschines.[5] Perhaps referring to this same story, the Aristotelian commentator Themistius says that it was the *Apology of Socrates* that brought Zeno from Phoenicia to Athens (*SVF* 1.9). This is more specific, though we still are not told whether it was Plato's or Xenophon's *Apology*. Nevertheless, the anecdotes prove that by the first century B.C. it was generally believed that Zeno was a student of the Cynic Crates and was attracted to him by his resemblance to Socrates.

That Zeno was, in fact, a close friend of Crates is proven beyond doubt by the fact that Zeno wrote *Memoirs of Crates* (*SVF* 1.41), of which a few fragments perhaps survive.[6] Moreover, if this was Zeno's original title for the work, it is likely that Zeno was acquainted with Xenophon's work and possibly considered his relationship to Crates to be like that of Xenophon to Socrates. Although Zeno was certainly an acquaintance of Crates, one must also bear in mind that later Stoics may have exaggerated Zeno's connection with Crates, through whom the later Stoics traced their spiritual ancestry to Diogenes of Sinope, Antisthenes, and finally Socrates himself, thereby justifying their claim to be Socratics. This succession of teachers and students is largely fictitious, but it illustrates the determination of later Stoics to connect Zeno with Socrates.[7] It may have been the same determination that motivated the anecdotes of Zeno's first attachment to Crates, for these anecdotes portray Zeno regarding Crates as a second Socrates. The anecdote which declares that a reading of Xenophon's *Memoirs of Socrates* prompted Zeno to follow Crates could very well have been inspired by the title of Zeno's own work, the *Memoirs of Crates*.[8] Consequently, the most we can conclude, if we limit ourselves to solid evidence, like the title of Zeno's work and its fragments, is the simple fact that Zeno knew Crates and perhaps considered himself a follower of Crates at one time.

According to the biographical tradition, Zeno left Crates after a time and became a student of Stilpo of Megara, who apparently made occasional visits to Athens.[9] Diogenes Laertius gives a vivid description of Athenian crowds flocking to hear Stilpo's demonstrations of dialectic (Diog. Laert. 2.119). He also relates that Stilpo attracted students away from other teachers, such as Aristotle and Theophrastus, to join his school in Megara (Diog. Laert. 2.113–114). We should probably not think of Zeno as becoming a formal student of Stilpo, for this would have meant moving to Megara; but it is quite likely that Zeno attended his lectures when he visited Athens. In addition to Stilpo, Zeno seems to have associated with other dialecticians of the day, such as Diodorus Cronus of Iasos in Caria and his student, Philo of Megara (Diog. Laert. 7.16, 25 [=*SVF* 1.4, 5]).

Diogenes Laertius also tells us that Zeno was a student of Polemon, the head of the Academy after 314/13 B.C. (Diog. Laert. 7.2 [=*SVF* 1.1]). Diogenes' source for this information is unfortunately not specified. Since much of his material on Zeno comes from Apollonius, one would like to believe that this information comes from him too. But it is also known that a contemporary of Apollonius in the first century B.C., namely, the head of the Academy, Antiochus of Ascalon, was vitally interested in maintaining a close connection between Zeno and Polemon.[10] Antiochus, in reaction to the previous skepticism of the Academy, had initiated an eclectic dogmatism consisting of Platonic, Peripatetic, and Stoic elements. He asserted that true Platonism was handed down from Polemon to Zeno and thereafter through a succession of Stoic philosophers to himself. To Antiochus, the nominal Academic Arcesilaus was a heretical student of Polemon and had led the Academy astray into skepticism. In the view of Antiochus, then, Zeno was actually teaching Platonic doctrine under a slightly different guise.

This point of view has left clear traces on the biographical tradition. The Academic philospher, Numenius of Apamaea, describes the conflict between Polemon's two students, Zeno and Arcesilaus (*SVF* 1.11, 12). Cicero, a student of Antiochus, describes Zeno as the student of Polemon who corrected (*corrigere*) the Academic doctrine, and adds that it was this correction (*correctionem*) that Antiochus expounded (*Acad*. 1.33–35). Elsewhere Cicero reflects the corollary of Antiochus's theory, namely, that Zeno was not an original philosopher, but appropriated the teaching of the Academy and merely invented new terms for the borrowed doctrines. Cicero calls Zeno "not so much an inventor of new ideas as of new words" (*Fin*. 3.5, 15

[=*SVF* 1.34]; cf. *Acad.* 2.15, 16). This same idea underlies a story in which Polemon, spying Zeno unobtrusively entering the Academy, is said to have retorted, "You don't escape me, slipping in by the garden gate, and like a Phoenician stealing my doctrines and giving them a new dress."[11] This story could be very revealing, if it were not for the fact that it fits no imaginable historical setting. Polemon's accusation is that Zeno is at the moment stealing Academic doctrines and hence is a student of some kind. Yet Polemon's statement clearly implies that Zeno is already teaching, for to make the accusation Polemon must have had an acquaintance with Zeno's doctrines. Diogenes must have recognized this, for he dates the incident to a time when Zeno was "already making progress" (ἤδη προκόπτων) and places it in the section of the book dealing with Zeno's life after the founding of the Stoa. Even so, the portrait of Zeno eavesdropping in the Academy one day and selling disguised Platonism in the Stoa the next is psychologically so implausible that it cannot be taken literally, but must be considered an anecdote reflecting the view that Stoicism is an offshoot of the Academy. It is most likely an invention in the tradition of the historical fictions of Antiochus of Ascalon. That leaves only Diogenes' bare statement still above suspicion;[12] and even this statement, added almost as an afterthought to the list of Zeno's teachers, is not necessarily from an independent source, but could be Diogenes' own inference from the anecdote in 7.25.

There is reason, therefore, to be somewhat skeptical of the intimate relation between Zeno and Polemon that is attested in our sources. Yet it is improbable that Antiochus invented it *ex nihilo*. Though he may have exaggerated the influence of Polemon, Antiochus must himself have believed there was a historical connection between Polemon and Zeno. The impetus may have come from a genuine historical tradition, but it may also have been a misinterpretation of a tradition that brought the two men together only later in life. Such contact seems highly probable, since it is known that during Polemon's lifetime, Zeno's Stoic doctrine was attacked by at least one member of the Academy, Crantor of Soli, an intimate friend of Polemon.[13] Finally, it may be only a striking coincidence, but if Zeno came to Athens in 312/11 B.C., he came in the archonship of Polemon (ἐπὶ Πολέμωνος). Is it possible that some statement of the date of Zeno's arrival at Athens in Apollodorus's *Chronika* or in a biography of Zeno misled Antiochus into believing Zeno came to Athens to study under Polemon the Academic?[14] All we can really say for sure is that Antiochus, a prejudiced source, said Zeno was a student of Polemon; how far he can be trusted we have no way of deciding.

The biographical tradition records one other teacher for Zeno, namely, Xenocrates, the head of the Academy before Polemon. The statement occurs in Diogenes Laertius's list of teachers (Diog. Laert. 7.2 [=*SVF* 1.1]) and in a similar list by Numenius (*SVF* 1.11), whose source was probably Antiochus of Ascalon. The statement is virtually impossible if our reconstruction of Zeno's chronology is correct. For Xenocrates probably died in 314/13 B.C., and Zeno did not come to Athens until 312 B.C.[15] Moreover, even if Zeno did have an opportunity to hear Xenocrates, it is unlikely that he entered into any intimate intellectual relationship with Xenocrates, at least if Diogenes' characterization of Xenocrates is correct. Diogenes records that on one occasion a man who knew no music, geometry, or astronomy wanted to attend Xenocrates' lectures. Xenocrates sent him away, saying, "You have no handles on which philosophy may lay hold" (Diog. Laert. 4.10). Zeno's later philosophy suggests that he had not the slighest interest in any of the subjects that Xenocrates considered prerequisites for his course, and so it is hard to believe Xenocrates and Zeno could ever have entered into a mutually satisfying scholarly relationship for any period of time.

Some writers who have been aware of the chronological difficulty have simply dismissed this statement in Diogenes and Numenius without another thought,[16] but it is not likely that the statement was simply invented as a deliberate fiction. One explanation offered for the origin is that it arose from the mistaken chronology of Apollonius who made Zeno live for 98 years rather than the actual 72.[17] Granted that the statement presupposes the longer Apollonian chronology, it is questionable whether the long chronology in itself can be assigned as the cause of the statement. First of all, Diogenes Laertius seems to say that a certain Timocrates in a work called *Dion* is the authority for the statement that Zeno studied under Xenocrates. Hence the false chronology as well as the false conclusion must be pushed back to Timocrates. But who was this Timocrates? One possibility is that this was the brother of the Epicurean, Metrodorus, though no work named *Dion* is otherwise attested for him. However, this Timocrates was a contemporary of Zeno, and it would be hard to assign a false chronology to him, especially since the long chronology seems to be derived from the spurious letter of Zeno to Antigonus (Diog. Laert. 7.8–9), a letter that must have been composed long after Zeno's death. Not only would this Timocrates be unlikely to have published a false chronology, he would also be unlikely to have believed Zeno was a student of Xenocrates, if in fact he was not. This difficulty can be eased somewhat by assuming the Timocrates referred to is a later, otherwise unknown, writer;[18] but on this question we must suspend judgment. Second, regardless of the original source of the long chronology, there is only one possible way in which it could actually have been the cause of the belief that Zeno studied under Xenocrates. If Apollonius did, in fact, state that Zeno was head of the school for 58 years, and also knew the year of Zeno's death, he would have placed the founding of the Stoa in ca. 320 B.C. (Diog. Laert. 7.28). Then Zeno could not have heard Polemon; and Apollonius, if he was conscious of a tradition linking Zeno to the Academy, might have speculated that he heard Xenocrates instead. This explanation, however, requires the assumption that Apollonius knew the exact year of Zeno's death and the exact year of the accession of King Antigonus, but did not know the correct date of the foundation of the Stoa, although his contemporary Philodemus did (*SVF* 1.36a). It seems at least as plausible to assume that Apollonius had as much information as Philodemus, that is, Apollodorus's *Chronika*, and he knew the date of the founding of the Stoa, but his statement that Zeno was head of the school for 38 ($\overline{\Lambda H}$) years, was misread by Diogenes as 58 ($\overline{NH}$) years.[19] On this hypothesis the long chronology of Apollonius may still be a presupposition for the belief that Zeno studied under both Xenocrates and Polemon, but it cannot be called the cause. The mere fact that Zeno arrived in Athens in time to have heard Xenocrates does not adequately account for the report that Zeno studied under him. The basis for this report must still be sought.

One possible explanation, which should not be overlooked, is that the biographical tradition originally recorded another real teacher of Zeno, and this man's name became corrupted into Xenocrates. It is not unknown in Diogenes Laertius for an unfamiliar name to be replaced by a better known, but similar, name.[20] It is generally the latter part of the name that is altered. If we search for Athenian teachers who could have been active in the last decade of the fourth century, one in particular stands out as a prime candidate, Xenophilus of Chalcidice. Xenophilus belonged to the last generation of Pythagoreans and is the only Pythagorean known to have lived in Athens in the fourth century (DK 52.1, 2). Although his date is unknown, he seems to have been teaching in Athens when Aristoxenus of Tarentum arrived sometime after 344 B.C.[21] According to Pseudo-Lucian, Aristoxenus is supposed to have said Xenophilus lived 105 years (DK 52.2). Whether this improbably high age is correct, we cannot say. If Aristoxenus actually said it, it may be correct. It is also possible that Aristoxenus is the authority only for the date of Xenophilus's death and his age was subsequently calculated from the known death date and a presumed birth date. Diodorus Siculus states that the last generation of Pythagoreans was flourishing in 366 B.C. (Diod. 15.76.4). This date is probably intended to coincide with the restoration of Timotheus and the beginning of Athens' resistance against Thebes, which ended in the Battle of Mantinea and the death of Epaminondas. If Xenophilus's age was calculated on the basis of this year as an acme, he would have been born in 406 and would have died in 301 B.C. Not only would this mean that Zeno could have heard Xenophilus, but he could have heard him for ten years as the text of Diogenes states in regard to Xenocrates. Alternatively, the birth of Xenophilus could have been calculated by the Apollodoran method of making the teacher 40 years older than the pupil.[22] Xenophilus was best known as a friend or teacher of Aristoxenus (DK 52.1, 3; Aristoxenus, fr. 25, Wehrli). Since the Apollodoran date of Aristoxenus's acme was the 111th Olympiad (336/32 B.C.), coinciding with the accession of Alexander the Great (Aristoxenus, fr. 1, Wehrli), his birth must have been dated to 376/72 B.C. The birth of his teacher, Xenophilus, might then have been dated to 416/12B.C. and his death between 311 and 307 B.C., perhaps 311 B.C., if Aristoxenus's acme was dated at 336 B.C. Either dating of Xenophilus brings his lifetime down into the time when Zeno was in Athens. Regardless of whether Xenophilus was as old as the sources seem to make him,[23] Aristoxenus assures us that he was healthy and active to the end of his life (DK 52.2) and could well have been teaching when Zeno arrived.

It may seem surprising to suggest that Zeno attended lectures of a Pythagorean, but it must be remembered that interest in the Pythagoreans ran very high in the last half of the fourth century. Nearly every

Academic and Peripatetic philosopher of note wrote about the Pythagoreans. Speusippus, Heraclides Ponticus, Xenocrates, Aristotle, and Aristoxenus wrote separate books about them; and Theophrastus and Eudemus included the Pythagoreans in their histories of philosophy.[24] That Zeno shared their interest is proven by the fact that he also wrote a book about Pythagoreanism (*SVF* 1.41). How far Xenophilus contributed to the widespread interest in Pythagoreanism in fourth-century Athens, we do not know; but we do know he was primarily responsible for Aristoxenus's interest (Aristox., frs. 1, 19, 20, 25, Wehrli). If he was still living, it is possible that he was responsible also for Zeno's interest in Pythagoreanism, and that some report of this in the biographical tradition gave rise to Diogenes' report that Zeno studied under Xenocrates; but this must remain in the realm of speculation.

In addition to personal instruction, the biographical tradition depicts Zeno as having received instruction from books. One of the anecdotes describing his conversion to philosophy tells how Zeno asked an oracle what he should do to live the best life. The oracle is said to have replied, "Take on the color of the dead." In response, Zeno began reading the ancient authors.[25] That Zeno read the old Greek authors is certain. He wrote a book on Homer and quoted Hesiod and Euripides.[26] The titles of two of his own works, *Memoirs of Crates* and *Republic*, suggest he was acquainted with the works of similar titles by Xenophon and Plato respectively (*SVF* 1.41, cf. 260). Anecdotes, though of questionable historicity, assign to him an acquaintance with the *Apology* of either Plato or Xenophon and Antisthenes' essay on Sophocles (*SVF* 1.9, 305). A fragment of one of his works shows he also knew of the existence of Aristotle's *Protrepticus* (*SVF* 1.273). Since he was acquainted with works by Homer, Hesiod, Euripides, Xenophon, Plato, Aristotle, and perhaps Antisthenes, we may safely conclude he was fairly well read and must have been acquainted with the writings of his philosophical predecessors.

Finally, we must also remember that the biographical tradition is an accidental and fragmentary collection of the most entertaining, but not necessarily the most significant, information. The tradition may well have passed over important influences on Zeno's thought. Therefore we must not overlook the possibility of influences from the Peripatetic school. Theophrastus was beyond doubt the most popular lecturer of the day; his lectures attracted a total of two thousand students (Diog. Laert. 5.37). It would be strange if Zeno had lived in Athens, thirsting for instruction, without having heard so much as a single lecture of Theophrastus. Theophrastus could not only have acquainted Zeno with his own version of the Peripatetic philosophy but also have introduced him to the results of Aristotle's unpublished philosophical activity, if this was not otherwise accessible to him. Then, too, in 306 B.C. Epicurus opened his school in Athens. Zeno very probably came into contact with his future rival soon after Epicurus had begun teaching. So Epicureanism too must be considered part of the background against which Stoicism arose.

The anecdotes that antiquity loved to collect are notoriously unreliable as historical sources, but their portrait of Zeno and his early intellectual activity in Athens makes a delightful conclusion to this survey of the biographical tradition. Apollonius of Tyre relates that when Zeno had abandoned Crates to hear Stilpo, Crates tried to drag him back by force. Zeno replied, "The only proper way to grab a philosopher is by the ears. If you take me by force, you will have my body; but my heart will be with Stilpo" (*SVF* 1.278). If we are to judge from the biographical tradition, many of the philosophers at Athens must have dragged the young Zeno about by the ears; and apparently Zeno relished the experience. At least another anecdote tells us that Zeno once asked a man who had just given him a lesson in logic how much pay he wanted; when the man asked for a hundred, Zeno gave him two hundred (*SVF* 1.279). To find such generosity in the frugal Zeno is astonishing; his love of learning apparently knew no bounds. Most provocative is the very popular story of his revision of some lines of Hesiod. Hesiod had said, "Best of all is the man who thinks out all for himself; but that man, too, is good who listens to one who speaks well" (*Op.* 293, 295). Zeno is said to have interchanged the words to say, "Best of all is the man who listens to one who speaks well; but that man, too, is good, who thinks out all for himself" (*SVF* 1.235). Though Hesiod would praise most highly the man who thinks things out for himself, Zeno appears to feel no need for original thinking; the past has produced so many wise men who spoke well, that all one needs to do now is to listen to the sages of the past and to apply their wisdom to one's own life. In the view of the ancient biographers Zeno appears to have been a young outsider in the intellectual capital of the world, dazzled by its learning, running here and there to hear every man with a reputation for wisdom; too impatient to attach himself to one man or school exclusively, but learning what he could from whomever he met; of insatiable curiosity and willing to pay any price for a bit of wisdom; feeling no compulsion for original thinking, but heeding the wisdom of others; and, above all, recognizing the necessity of living in accord with the divine truth taught by wise men of all generations.

Though the biographical tradition purports to show us Zeno's relationship to the philosophical movements around him, it actually gives us very little concrete information; and some of that is of dubious historical value. As a matter of fact, the tradition gives us the impression that Zeno could have been exposed to almost any intellectual movement afloat in Athens in the last decade of the fourth century. The biographical tradition about Zeno thus offers few significant clues in a quest for the origins of Stoic cosmology.

Since the fragments of Zeno are so meager and any investigation of Stoic cosmology must include the works of Zeno's successors, Cleanthes and Chrysippus, it may be helpful also to look briefly at the transmission of Stoic cosmology through the third century to see what later influences, if any, the biographical tradition suggests in this period. The cosmological system of Zeno was transmitted both in writing and by oral instruction of students. Zeno's cosmological writings were very few. The chief work dealing with physics must have been *On the Universe*, as far as we know, in only one book (*SVF* 1.41). Apparently this work discussed the origin of the elements and of the cosmos, as well as meteorological and astronomical phenomena (*SVF* 1.97, 102, 117, 119). There is also a reference to a work entitled *On Nature* (*SVF* 1.176) and one to a work called *On Substance* (*SVF* 1.85). Since the list of Zeno's works does not mention any by these titles, and since both references concern the doctrine of the *archai* of which all things in the cosmos consist, it is not unlikely that these two fragments were also from *On the Universe*, merely designated arbitrarily by the titles *On Nature* and *On Substance*.[27] In this same work Zeno probably allegorized Hesiod's *Theogony*.[28] Since no other cosmological writing is known, it is unlikely that Zeno transmitted by writing any more than the bare foundations of the cosmological system that was eventually to develop. Any further details that Zeno himself had developed must have been passed on to pupils orally.

The most important of Zeno's students was Cleanthes of Assos.[29] Cleanthes grew up in Assos, the city in Asia Minor where in the fourth century the tyrant Hermeias had gathered a number of philosophers, including several Platonists, Aristotle, Xenocrates, and perhaps also Theophrastus.[30] Whether the memory of this school survived into Cleanthes' day and had any influence on him we do not know. We do know that in Assos, Cleanthes was a boxer and therefore probably spent most of his time training in the gymnasium (*SVF* 1.463). This may possibly have brought him into contact with some medical theories of strength and health. When he came to Athens, he became a student of Zeno. As far as we know he attended lectures of no other philosopher. The traditions concerning his life as student and later as scholar stress two characteristics. As one might expect of an athlete, Cleanthes was renowned for his physical strength and his capacity for hard labor (*SVF* 1.463, 466, 597, 598, 611; Val. Max. 8.7.11). In fact, he had to draw water by night to support himself, so he could study philosophy by day. His strength earned him the nickname, "Heracles the Second" (*SVF* 1.463). Second, he was considered somewhat dull and uncreative, but a faithful and unswerving follower of Zeno in every Stoic doctrine (*SVF* 1.463, 464, 599, 600). The fact that Cleanthes wrote a commentary on Heraclitus shows that he was interested in at least this one earlier philosopher, undoubtedly interpreting him as a precursor of Stoicism (*SVF* 1.481, cf. 519). In addition, the fragments suggest that Cleanthes was also acquainted with Homer, Sophocles, Euripides, and other poets.[31] That he was aware of his contemporaries in philosophy is clear from the fact that he was attacked by Arcesilaus, wrote treatises against the Epicureans and Aristarchus the astronomer, and mocked the Peripatetics;[31] but the sources show no awareness of an influence of any of his contemporaries on his thought. Thus judging from the biographical tradition, one would not expect to find innovations or the importation of outside influences by Cleanthes.

Like Zeno, Cleanthes devoted only a small effort to cosmological writings. Of the more than fifty titles ascribed to Cleanthes, it is likely that only two contained extensive expositions of Stoic cosmology.[33] One was entitled *On the Natural Science of Zeno* in two books and may have been his basic work on physics. Since it is longer than Zeno's book on the same subject (*On the Universe*), it must have elaborated on Zeno's doctrine or defended it at greater length. The other was a commentary on Heraclitus in four books, a work that could hardly avoid a discussion of cosmology.[34] If *SVF* 1.519 is from this work, we may infer that Cleanthes' method was to harmonize Heraclitus with Zeno's doctrines; but the introductory statement that Cleanthes' method was to set Zeno's doctrines alongside those of his predecessors for comparison suggests this fragment may have come not from the commentary but from the more general work *On the Natural Science of Zeno*. In addition, Cleanthes' polemics against the Atomists and against Aristarchus and his book *On Time* probably also mentioned Stoic cosmology.[35]

Cleanthes had two prominent students. Sphaerus of Borysthenes, after having been a student of both Zeno and Cleanthes, left Athens and spent the rest of his life in Sparta with Cleomenes, and after Cleomenes' fall, in Alexandria with Ptolemy Philopator (*SVF* 1.621–25). Sphaerus wrote two treatises on cosmological subjects, *On the Cosmos* in two books, and *On Elements*. Like his teacher Cleanthes, he also wrote a long work on Heraclitus, and a refutation of the Epicureans (*SVF* 1.620). It is noteworthy that the titles of nearly all his physical works find a counterpart among the works of his teachers, Zeno and Cleanthes. The only totally original titles are *On Elements* and *On Seed*. He may have been a conservative follower of the physical teachings of Zeno and Cleanthes.

Cleanthes' most famous pupil was Chrysippus of Soli, who later became his successor. Of Chrysippus's life as little is known as of Cleanthes'.[36] Like Zeno, Chrysippus was a Semite and spoke Greek only as his second language (*SVF* 2.24, cf. 894). When he came to Athens, he became a student of Cleanthes (*SVF* 2.1). Diogenes Laertius states he later became a student of Arcesilaus and Lacydes, successive heads of the Academy (Diog. Laert. 7.183–84[=*SVF* 2.1]). His account implies that Chrysippus quarreled with Cleanthes and as a result joined the Academy shortly before Arcesilaus's death, but this seems highly improbable in view of his later selection as head of the Stoa and his ardent battles with the Academy. It is possible that he studied under Arcesilaus as a fellow student with Lacydes, as soon as he arrived in Athens, before he ever joined Cleanthes' class.[37] It is also possible that the story is fictitious and was devised to explain why one of Chrysippus's books contained Academic rebuttals of Stoic epistemology without comment or refutation by Chrysippus.[38] The biographical tradition depicts Chrysippus as a very acute and original thinker, who created his own new arguments in support of the traditional Stoic doctrines (*SVF* 2.1, 21). In so doing, he may well have modified details in order to make the main tenets more defensible against Academic attacks, for he is said to have differed in doctrine from Cleanthes and Zeno (*SVF* 2.1). He had read very widely in Greek poetry, philosophy, and medical writings, and quoted so many authorities that it was said if the quotes were erased, his pages would be bare.[39] Therefore, in Chrysippus the biographical tradition leads us to look for influences from almost any published literature, as well as logical developments within the system on the basis of traditional Stoic premises.

Chrysippus was a most prolific writer, turning out at least 705 volumes (*SVF* 2.1). Unfortunately Diogenes Laertius' list of these works is broken off before the section of his physical works (*SVF* 2.13–18), but from the titles mentioned in the fragments we may suppose Chrysippus wrote very extensively on physics.[40] Of the few titles accidentally preserved to us, no less than four are general treatises on physics, all of which may have included cosmological material: *On Nature* (also called *Physics*),[41] *Physical Investigations, Physical Theses,* and *Physical Arts*. The important work *On Nature* contained at least five books and *Physical Investigations* at least two. Moreover, Chrysippus wrote a work allegorizing old myths into Stoic physics (*On the Ancient Natural Scientists*) and a separate work *On the Cosmos* in two books. Then, too, we know the titles of several works dealing with some of the basic principles of physics and cosmology: *On Substance, On the Void, On Hexeis,* and *On Motion*. One can readily understand why the system of Chrysippus is known so much better than that of Zeno or Cleanthes. Of the books written by early Stoics more than nine-tenths were by Chrysippus. It is only natural that the later Stoic handbooks would be based on this, the most thorough of the Stoic writers, with Zeno and Cleanthes cited only to prove the antiquity of the various doctrines. The titles of Chrysippus's works reveal another interesting fact. Chrysippus shows a definite inclination to discuss the principles of physics, including the subject of movement, a subject so important for Plato and Aristotle, but seemingly neglected by the Stoics. Thus, not only does Chrysippus seem to have discussed physics in greater depth than any previous Stoic, but he must have extended his inquiry to many new subjects.

In conclusion, upon critical examination the biographical tradition proves to be of little value in deciding which philosophical movements actually influenced the early Stoics. The traditions concerning Zeno, where they are not of questionable historicity, show him to have been exposed to most of the intellectual influences of the day as well as to the thought of the past preserved in books. Then, although Cleanthes and Chrysippus appear to have expanded, refined, and modified Zeno's system, the biographical tradition is conscious of few external influences on them that were not already present in Zeno's day. There is no evidence that either one was influenced significantly by a non-Stoic teacher, and the books they read were for the most part the same as those that Zeno read. Consequently it seems clear that the biographical tradition, interesting as it may be in itself, is of little value in a search for the origins of Stoic cosmology.

1. On Zeno's life, see M. Pohlenz, *Die Stoa: Geschichte einer geistigen Bewegung*[3] (Göttingen, 1964), 1.22–25; 2.14–15.

2. For attempts to identify the Semitic influence on Stoicism see Introduction, note 8. I must confess more sympathy, however, with the cautious reservation of E. Bevan, *Stoics and Sceptics* (Oxford, 1913), 20–21. Pohlenz's theory of extensive, identifiable Semitic influences has been attacked by reviewers; e.g., L. Edelstein, *AJP* 72 (1951): 427–28; and F. H. Sandbach, *JHS* 71 (1951):262; cf. also E. Schwartz, *Ethik der Griechen* (Stuttgart, 1951), 161–62; and W. Schmid, *Der Hellenismus in der deutschen Forschung, 1938–1948* (Wiesbaden, 1956):83–84.

3. For a concise discussion and bibliography of the problems of Zeno's chronology, see K. von Fritz, "Zenon von Kition," *RE* 10A (1972): 83–85. The date of Zeno's arrival at Athens can be calculated from the information of his close friend and follower, Persaeus, who says that Zeno came to Athens at the age of 22 and died at the age of 72 (Diog. Laert. 7.28[=*SVF* 1.6]). Since it is known that Zeno died in the archonship of Arrheneides and Arrheneides was probably archon in 262/61 B.C., Zeno's arrival at Athens can with probability be dated to 312/11 B.C. (*SVF* 1.7–8; 36a [for variant readings and reconstructions of this text, see F. Jacoby, *Die Fragmente der griechischen Historiker* (Berlin, 1930), 2 D 736–37]). B. D. Merrit, *The Athenian Year* (Berkeley, 1961), 221–26, 233, argued that Arrheneides should be moved down to 260/59 B.C. because of the uncertainty of the text of the Herculaneum index (*SVF* 1.477); but since the reading of this text has since been confirmed by F. Sbordone (cf. W. K. Pritchett, *Ancient Athenian Calendars on Stone*, University of California Publications in Classical Archaeology 4 [Berkeley, 1963], 388–89), Merrit

has abandoned his suggestion and has come to accept the traditional date of 262/61 B.C. ("Metonic Intercalations in Athens," *Hesperia* 38 [1969]: 112).

4. Diog. Laert. 6.105; 7.2(=*SVF* 1.1). Diogenes' source is perhaps the biography of Zeno by Apollonius of Tyre (early first cent. B.C.). The same information comes from Demetrius of Magnesia (first cent. B.C.). Diog. Laert. 7.31–32(=*SVF* 1.6) and Numenius of Apamea (second cent. A.D.) (*SVF* 1.11), who, in turn, may have derived his material from Antiochus of Ascalon (first cent. B.C.) (cf. Pohlenz, *Stoa* [above, note 1], 2.14). Several anecdotes also connect Zeno with Crates (*SVF* 1.1–2, 278). On the life and teachings of Crates, see D. R. Dudley, *A History of Cynicism* (London, 1937), 42–53; F. Sayre, *The Greek Cynics* (Baltimore, 1948), 31–36.

5. Diog. Laert. 2.64. On Antisthenes' *Socratic Discourses*, cf. Dudley (above, note 4), 14–15, and 16, note 3. An anecdote implies Zeno's later acquaintance with the works of Antisthenes (*SVF* 1.305).

6. *SVF* 1.272, 273. Neither fragment is directly assigned to the *Memoirs;* in fact, *SVF* 1.272 is alleged to be from the Χρεῖαι. However, no such title is listed for Zeno by Diog. Laert. 7.4 (=*SVF* 1.41), and it is likely that the Χρεῖαι is the same work as the *Memoirs*. The title Χρεῖαι was a standard title in Hellenistic times for a collection of apophthegms or anecdotes. It would probably have been appropriate for a collection of the sort of material found in Zeno's *Memories of Crates* (cf. U. von Wilamowitz-Moellendorff, *Antigonos von Karystos*, Philologische Untersuchungen 4 [Berlin, 1881], 106, note 6; and A. C. Pearson, *The Fragments of Zeno and Cleanthes* [London, 1891], 31).

7. This fictitious succession is evident in the arrangement of Diog. Laert. Books 6 and 7; cf. 2.47. The link between Antisthenes and Diogenes of Sinope is certainly fictitious, since Antisthenes died before Diogenes reached Athens. See Dudley (above, note 4), 1–3; Sayre (above, note 4), 56. Sayre, 63–64, even maintains that the link between Diogenes and Crates is fictitious. He argues that since Diogenes was nothing more than a street preacher, Crates cannot, strictly speaking, be called his pupil. The line of succession was probably invented by the Stoics and subsequently popularized by the Alexandrian succession-writers (Dudley, 3–4; Sayre, 91–92).

8. See O. Gigon, "Antike Erzählungen über die Berufung zur Philosophie," *MusHelv* 3 (1946):1–21, esp. 20.

9. Diog. Laert. 2.114, 120; 7.2 (=*SVF* 1.1); 7.24 (=*SVF* 1.278); and Numenius (*SVF* 1.11). The tradition goes back to the second century B.C. Diog. Laert. 7.24 comes from Apollonius of Tyre (early first cent. B.C.), and Heraclides Lembos (second cent. B.C.) in his epitome of Sotion's *Successions* (early second cent. B.C.) agrees (Diog. Laert. 2.120). On Stilpo's life and teachings, see K. Praechter, "Stilpon," *RE* 3 A (1929):2525–33.

10. On Antiochus of Ascalon, see Pohlenz, *Stoa* (above, note 1) 1.249–54; 2.129–31.

11. Diog. Laert. 7.25 (=*SVF* 1.5). *τὰ δόγματα κλέπτων φοινικῶς μεταμφιεννύς* is often translated "stealing my doctrines and putting them in Phoenician dress." This is sometimes interpreted to mean that Polemon was accusing Zeno of giving old Greek ideas a superficial Semitic appearance. But the real import of the anecdote seems to be that Zeno took the doctrines of others and, after disguising them, passed them off as his own. Whether the disguise had a Semitic tinge or not is irrelevant to the point of the anecdote. Moreover, Cicero gives no hint that the disguise

had a Semitic coloring. He merely accuses Zeno of inventing new words (*SVF* 1.34, 35). The change wrought by Zeno on the old ideas seems to be one of terminology. Though it has been suggested that some Stoic motifs are of Semitic origin (cf., e.g., Pohlenz, "Stoa und Semitismus," *Neue Jahrbücher*, n.s. 2 [1926]:257–69), there is no evidence of Semitic influence on the terminology as such. Therefore it seems better to understand Polemon's accusation to be that Zeno is behaving as a typical Phoenician in stealing things from others, disguising them, and then selling them as his own.

12. Diog. Laert. 7.2. There is also an anecdote preserved in Stobaeus (*SVF* 1.304) that has the Academy as its setting, but Plutarch (*SVF* 1.304) gives the same apophthegm without the Academic setting. An anecdote such as this is of virtually no value in determining Zeno's relation to Polemon or the Academy.

13. Plut. *Cons. ad Apoll.* 102d; cf. Pohlenz, *Stoa* (above, note 1), 1.173–74; 2.88.

14. This same mistake is found in reverse in the *Life of Aristotle* (V. Rose, *Aristotelis qui ferebantur librorum fragmenta* [Leipzig, 1886], 429, line 1), where some statement that Aristotle entered the Academy while Eudoxus was present has given rise to the statement that Aristotle entered the Academy in the archonship of Eudoxus (cf. W. Jaeger, *Aristotle: Fundamentals of the History of His Development*², trans. R. Robinson [Oxford, 1948], 16, note 2). A comparable mistake is possible in the tradition concerning Zeno. That Apollodorus dated events by archons is shown by F. Jacoby, *Apollodors Chronik*, Philologische Untersuchungen 16 (Berlin, 1902), 57–59. Philodemus, who used Apollodorus, dates Zeno's life by archons in the fragmentary *On the Stoics*, Col. IV(=*SVF* 1.36a).

15. Xenocrates' death is calculated from the statement that Xenocrates succeeded Speusippus as head of the Academy in the archonship of Lysimachides (339/38 B.C.) and served in this capacity for twenty five years until his death (Diog. Laert. 4.14). Hence, his death must have occurred in 314/13 B.C. It is remotely possible that if the twenty five years was reckoned exclusively, Xenocrates may have died in 313/12. If we push his death to the very end of 313/12 and if Zeno was able to get to Athens early enough in the summer of 312, it might have been possible for him to have heard Xenocrates a few days before his death; but this is highly improbable. It is certainly impossible that he heard him for ten years, as Diog. Laert. 7.2 states.

16. E.g., Pearson (above, note 7), 3–4; and C. J. de Vogel, *Greek Philosophy* (Leiden, 1959), 3.44. A few, like E. V. Arnold, *Roman Stoicism* (Cambridge, 1911), 64–71; and R. Mondolfo, *Il pensiero Antico*² (Florence, 1950), 376, omit Xenocrates from their otherwise complete lists of Zeno's teachers, thereby suggesting that they too mistrust Diogenes' statement. E. Zeller, *Stoics, Epicureans, and Sceptics*, trans. O. J. Reichel (London, 1880), 37, note 1, has doubts on philosophical, rather than chronological, grounds.

17. Pohlenz, *Stoa* (above, note 1), 2.14. It is not entirely clear whether Pohlenz is giving Apollonius's chronology as the origin of the statement or merely believes the statement presupposes Apollonius's chronology.

18. W. Crönert, *Kolotes und Menedemos*, Studien zur Paläographie und Papyruskunde 6 (Leipzig, 1906), 143, note 557, speculated that the name Timocrates is an erroneous expansion of an abbreviation for Timonides, who did write a book about Dion. Since Timonides was a contemporary of Plato and Speusippus and campaigned with Dion in Sicily, it is not likely he would have lived long enough to know Zeno, much less have written about him in his book on Dion. Therefore, Crönert, 195, speculated that the statement ἔτη δέκα, ὡς Τιμοκράτης ἐν τῷ Δίωνι actually be-

longs in the biography of Xenocrates (Diog. Laert. 4.6). Crönert's theory leaves much to be desired and, in addition, takes us nowhere in tracing the source of Diogenes' statement. It is rejected by W. Capelle, "Timonides," *RE* 6 A (1937):1306.

19. This is suggested by W. Crönert (above, note 18) 138. If Apollonius reckoned exclusively, he could have been using the same data as Philodemus (foundation of Stoa in the archonship of Clearchus [301/300] and Zeno's death in that of Arrheneides [262/61]). Cronert's suggestion has been rejected as arbitrary by A. Mayer, "Die Chronologie des Zenon und Kleanthes," *Philologus* 71 (1912):223–24, note 31, and set as second choice by F. Jacoby, *Die Fragmente der griechischen Historiker* (Berlin, 1930), 2 D 738, who finds the scheme 40 + 58 years too attractive to pass up.

20. Crönert (above, note 18), 3–4 and 173, note 4_1, mentions a number of such mistakes in Diogenes.

21. Aristoxenus, fr. 1, and commentary, F. Wehrli, *Die Schule des Aristoteles*, vol. 2 (Basel, 1945), 47–48.

22. Jacoby (above, note 14), 47–48. Apollodorus seems to have derived the technique of dating by acme from Aristoxenus (Jacoby, 46–47), but it seems unlikely that Aristoxenus would himself have used this method to date a personal acquaintance like Xenophilus.

23. Gell. *NA* 4.11 (=DK 14.9=Aristox. fr. 25, Wehrli) calls Xenophilus a *familiaris* of Aristoxenus and implies that they were nearly contemporary, for he says that Aristoxenus got his material also from older Pythagoreans.

24. Speusippus, *On Pythagorean Numbers* (Iambl. *Theol. Ar.* 82.10–15, De Falco[=Speusippus, fr. 4, Lang]); Heraclides, *On the Pythagoreans* (Diog. Laert. 5.88); Xenocrates, *Pythagoreanism* (Diog. Laert. 4.13); Aristotle, *Against the Pythagoreans* and *On the Pythagoreans* (Diog. Laert. 5.25); Aristoxenus, *Pythagorean Assertions* and a life of Pythagoras (Aristox. frs. 11–41, Wehrli).

25. Diog. Laert. 7.2(=*SVF* 1.1). The story probably originated from the story of Socrates' call to philosophy by an oracle of god (Plato, *Apol.* 20e–22e; Xen. *Apol.* 14–15; Arist. *De Phil.* frs. 1, 2, 3, Ross, Walzer). See Gigon (above, note 8), 3–8.

26. Zeno's *Homeric Problems*, *SVF* 1.41, cf. 274, 275; quotations of Hesiod, *SVF* 1.100, 103, 104, 105, 167, 235, 276; and of Euripides, *SVF* 1.245. Von Arnim, *SVF* 1, page 71, postulated a separate commentary on Hesiod's *Theogony*. For this there is no evidence. The list of Zeno's works in *SVF* 1.41, probably based on Apollonius (cf. *SVF* 1.37), mentions no commentary on Hesiod. Cic. *Nat. D.* 1.36 (=*SVF* 1.167) and Val. Prob. (*SVF* 1.103) say that Zeno *interpretatur* Hesiod, but the only lines that Zeno interprets in the extant fragments are 116 (*SVF* 1.103, 104; cf. 105; 2.565), 117 (*SVF* 1.105), 120 (*SVF* 1.104, 105), 127 or 133 (*SVF* 1.276), 135 (*SVF* 1.100), and perhaps 453–58 (*SVF* 1.167, 169). All except one are from Hesiod's relatively short cosmogonal section, lines 116–35. The fragments show that Zeno interpreted Hesiod allegorically to make him conform to Stoic physical theory. Cic. *Nat. D.* 2.63, says Zeno allegorized myth less extensively than Cleanthes or Chrysippus, thereby suggesting he knew of no extended allegorical commentary of Hesiod. Zeno more likely allegorized the cosmogony in *On the Universe*, citing Hesiod as an authority for his own theory.

27. Cf. Wiersma, "Die Physik des Stoikers Zenon," *Mnemosyne*, 3d ser., 11 (1943):28–29, cites earlier authorities for this identification, though he himself believes the three are separate works.

28. *SVF* 1.100, 103, 104, 105, 167, 276; see above, note 26.

29. The only other student of Zeno who showed an interest in physics was Apollophanes (cf. *SVF* 1.404), of whom almost nothing is known (fragments in *SVF* 1.404–8). On the life of Cleanthes, see Verbeke, *Kleanthes van Assos*, Verhandelingen van de Vlaamse Academie voor Wetenschappen, Klasse der Letteren, vol. 11, no. 9 (Brussels, 1949), 50–65; H. von Arnim, "Kleanthes," *RE* 11 (1921): 558–60.

30. Verbeke, *Kleanthes* (above, note 29), 50–52; Jaeger (above, note 14), 111–15.

31. Homer, *SVF* 1.535, 549, 611; cf. Cleanthes' book *On the Poet (SVF* 1.481); Sophocles, *SVF* 1.607; Euripides, *SVF* 1.610; and mythological poetry in general, *SVF* 1.539, cf. 1.166.

32. On the attacks of Arcesilaus, see Pohlenz, *Stoa* (above, note 1), 1.174–75. His writings against the Epicureans and Aristarchus are included in the list of *SVF* 1.481, cf. 493, 500. For his opinion of the Peripatetics, see *SVF* 1.606.

33. A list of Cleanthes' works is given by Diog. Laert. 7.174–75(=*SVF* 1.481); cf. *SVF*, Vol. 1, pages 137–39. For a characterization of Cleanthes' individual works, see von Arnim, "Kleanthes" (above, note 29), 561, and Verbeke, *Kleanthes* (above, note 29), 68–90.

34. K. Deichgräber, "Bemerkungen zu Diogenes' Bericht über Heraklit," *Philologus* 93 (1938):28–30, has suggested with some plausibility that the second verse fragment on Heraclitus in Diog. Laert. 9.16 may be by Cleanthes and may have stood in the introduction to his commentary on Heraclitus.

35. Cf. *SVF* 1.493, 500. Plutarch *Stoic. Repug.* 1034d (=*SVF* 1.563), quotes from a work that he calls *Physical Notes* (*ὑπομνήματα φυσικά*). The fragment speaks of the *tonos* of the soul as the cause of various virtues. This may have been a separate work, perhaps a loose collection of notes on ethics and its physical premises (cf. Verbeke, *Kleanthes* [above, note 29], 78–79). Since the title is not found in Diogenes Laertius's list of Cleanthes' works, it might also be another name for *On the Natural Science of Zeno* (cf. von Arnim, "Kleanthes" [above, note 29], 561); or since the fragment provides definitions for the virtues, Plutarch may actually be quoting Cleanthes' *On Virtues*. At any rate, the fragment cited by Plutarch sheds some light on Cleanthes' doctrine of the *tonos*, a doctrine that had cosmological applications.

36. On Chrysippus's life, see É. Bréhier, *Chrysippe et l'ancien stoïcisme*[2] (Paris, 1951), 7–16; Pohlenz, *Stoa* (above, note 1), 1.28–30; J. B. Gould, *The Philosophy of Chrysippus*, Philosophia Antiqua 17 (Leiden and Albany, N.Y., 1970), 7–9.

37. Pohlenz, *Stoa* (above, note 1), 1.28–29. The difficulty with Pohlenz's theory is that Diogenes puts the story later in Chrysippus's life (cf. the introductory word τέλος). H. von Arnim, "Chrysippus," *RE* 3 (1900):2502, seems to make Chrysippus a student of Cleanthes and Arcesilaus at the same time.

38. Bréhier, *Chrysippe* (above, note 36), 10–11.

39. *SVF* 2.1, 22. As an example of his method see *SVF* 2.904–8. Of the poets he quoted at least Anacreon, Alcman, the Cypria, Empedocles, Epicharmus, Euripides, Hesiod, Homer, Ibycus, Menander, Musaeus, Orpheus, Pindar, Sappho, Stesichorus, Theognis, Thespis, Timotheus, and Tyrtaeus. He showed a knowledge of the philosophers Heraclitus, Empedocles, Democritus, the Pythagoreans, Socrates, Plato, Aristotle, Polemon, Arcesilaus, Strato, Epicurus, Stilpo, and Menedemus of Eretria. For references see the index of M. Adler, *SVF* 4, pages 175–86 (add *SVF* 2.636 on Heraclitus). He also showed an acquaintance with the medical writers, especially

Praxagoras of Cos and the third-century Alexandrians, presumably Herophilus of Chalcedon and Erasistratus of Ceos (cf. *SVF* 2.885, 897).

40. For a detailed account of Chrysippus's physical treatises, see Bréhier, *Chrysippe* (above, note 36), 30–47.

41. Cf. Bréhier, *Chrysippe* (above, note 36), 32–36.

The Contents of Book One of Chrysippus's *Physics*

If the surviving fragments are any indication, the first book of Chrysippus's *Physics* must have discussed the following subjects:

I. Nature and its *logos* (*SVF* 2.937).

II. The origin of the cosmos: the birth of the four elements from fire (*SVF* 2.579, 580 [first part = Diog. Laert. 7.135–36], 581).

   Transition (*SVF* 2.580[= Diog. Laert. 7.136: ἔστι δὲ . . . ἀναλύεται] and perhaps *SVF* 2.299).

III. The *archai* of the cosmos (*SVF* 2.300).

   A. The passive *archê:* The unqualified substance or matter (*SVF* 2.300, 316, 580 [= Diog. Laert. 7.137: τὰ δὴ τέτταρα . . . ὕλην]), including the distinction between matter in general and prime or ultimate matter (*SVF* 2.316, 317, cf. 1.86).

   B. The active *archê:* The cause of qualities (*SVF* 2.300, cf. 318).

IV. The prime quality proper to each element (*SVF* 2.580 [= Diog. Laert. 7.137: εἶναι δὲ . . . μέρος]).

V. The arrangement of the elements in the cosmos (*SVF* 2.580 [= Diog. Laert. 7.137: ἀνωτάτω . . . οὖσαν]).

SVF 2.937, the long fragment stating that all things occur according to the *logos* of nature, sounds like a general introduction to the whole work. That this was an important theme of the work in general is suggested by the fact that it is repeated in Book Two, the book that deals with the soul, senses, and reproduction (*SVF* 2.1181). Perhaps, as the title *On Nature* suggests, the work dealt with the Stoic doctrine of nature, Book One discussing the role of nature in the cosmos and Book Two the role of nature in man, the microcosmos. Since the discussion of the *archai* (Part III [see above]) came near the end of the book, we may conjecture that this introductory section and the discussion of the origin of the cosmos occupied the bulk of the book.

SVF 2.636 (*τὴν νύκτα θεὰν εἶναι πρωτίστην*) cannot be placed, unless it refers to the fact that air is the material substrate of periods of time (cf. *SVF* 2.693), and air is basically dark as well as cold (cf. *SVF* 2.429, 430). Then perhaps this fragment came from an allegorization of a theogony, where night is explained to be the very first goddess because dark air (night) was the result of the first elemental change made by fire (Zeus). Alternatively, if this fragment presupposes that air is dark and cold, it might belong to the discussion of the qualities of the elements; and perhaps the unintelligible sentence, *οὐ μὴν ἀλλὰ καὶ ἔτι*[1] *ἐν τῷ ἀέρι εἶναι τὸ αὐτὸ μέρος*, should be emended to *οὐ μὴν ἀλλὰ καὶ ἔτι ἐν τῷ ἀέρι εἶναι* ⟨*τὰ*⟩ *το*⟨*ῦ ἐνι*⟩*αυτο*⟨*ῦ*⟩ *μέρ*⟨*η*⟩. This emendation would bring the meaning close to Diog. Laert. 7.151 (=*SVF* 2.693), where the four seasons are called *τὰ ἐν ἀέρι γινόμενα*. Or perhaps this sentence might even be viewed as the end result of a series of corruptions produced by the doxographers before Diogenes, reflecting an original account in which night and day were described as particular states of the atmospheric air, and which went on to argue that since day was such, a month was also of this nature, and finally *οὐχ ὁ μὴν μόνον ἀλλὰ καί ἐστι ἐν τῷ ἀέρι πάντα τὰ τοῦ ἐνιαυτοῦ μέρη*. Chrysippus uses a similar sequence in asserting that all units of time are bodies (*SVF* 2.665).

1. *ἔτι* may be a relic of an *ἐστι* from an earlier, direct discourse account. If the *σ* had already fallen out, a doxographer may have neglected to remove it when he changed the account to indirect discourse. It is omitted in one of the MSS.

Cleanthes' Cosmogony

Stobaeus's summary of Cleanthes' cosmogony is one of the most obscure fragments in von Arnim's collection of the Stoic writers (*Ecl.* 1.17[=*DG* 270=*SVF* 1.497]). Because it is the only account of Cleanthes' cosmogony, it is very important; and it is therefore worth the effort required to make some sense of it, even though the end result will be, at best, highly conjectural. One method of making sense of this fragment is wholesale emendation, such as that proposed by von Arnim.[1] This procedure involves the assumption that this small section of Stobaeus's text has suffered an above-average amount of corruption, and what is more, creates as many problems as it removes without producing a clear account. It would seem to be a better procedure to attempt to keep the text, if possible, and to try to understand what Stobaeus believed Cleanthes to have said. If this reveals contradictions, internal or with other Stoic material, we might suspect, instead of textual corruption, a misunderstanding of Cleanthes by Stobaeus or his source (Arius Didymus, fr. 38 [=*DG* 470]). Then perhaps by seeking the motive for the misunderstanding we might be able to reconstruct the cosmogony that lies behind Stobaeus's summary.

Even a superficial reading of the fragment reveals two stylistic devices that may serve as guideposts to Stobeaus's meaning. The first is an antithesis between Stobaeus's words *ἐκφλογισθέντος τοῦ παντός* and a similar phrase a few lines later, *τοῦ δὲ παντὸς ἐξυγρανθέντος*. We could have expected a *μὲν* in the first phrase, and we can only wonder whether its absence is intentional or unintentional. The second device is a tripartite series: *τὸ μέσον πρῶτον, εἶτα τὰ ἐχόμενα*, and *τὸ ἔσχατον*.[2] This tripartite series is superimposed on the bipartite antithesis.

Let us first go through the account guided by the tripartite series. "When the All is enflamed, *first the middle* sinks together; *then the next parts* are completely quenched. And when the All has become wet, *the last* of the fire. . . ." So far Stobaeus's meaning is fairly clear; he is thinking of a mass of fire undergoing change. The change begins at the middle with a process of sinking together (συνίζειν), a process that in Stoic texts is frequently associated with the formation of earth (cf. *SVF* 1.104; 2.565). The adjacent parts (τὰ ἐχόμενα) are subject to the second change, which is a process called quenching (ἀποσβέννυσθαι) and subsequently described by the words: "When the all has become wet." This can only describe the formation of water.[3] Finally Stobaeus speaks of "the last of the fire." In the series this can only refer to the outermost sphere of fire, the remainder of the fire after earth and water have been formed in the middle. At this point Stobaeus becomes unintelligible if we take his words in their literal sense. He says that this peripheral fire, "when the middle offers resistance to it [We may well wonder how this is possible with water (τὰ ἐχόμενα) intervening.] is turned back into the opposite direction [This is puzzling, since the fire was not actually in motion]; and when it has been so turned, it begins to increase in an upward direction [What a surprise! If anything, after a reversal of direction it ought to begin moving down, for our account had been proceeding from center to periphery.] and begins to arrange [διακοσμεῖν] the universe." The second part of the account seems suddenly to have lost all contact with the first part, and one is tempted to conclude that either the first or the second part misinterprets Cleanthes.

To get at Cleanthes' original intent we may look at the continuation of Stobaeus's summary. "The *tonos* in the matter . . . does not cease making [read: ποιούμενον] this sort of continual cycle [περίοδος] and arrangement [διακόσμησις]; for as all the parts of a thing grow from seeds at appointed times, so also the parts of the whole . . . grow at the appointed times; and as certain *logoi* of the parts, coming together into a seed, are mixed and separate out when the parts come to be, so all things come from one and one is combined from all, the cycle [περίοδος] proceeding harmoniously on its course" (ὁδῷ καὶ συμφώνως). Since this seems to be a generalization of the cosmogonal process that Stobaeus has just attempted to describe, we may expect

Cleanthes' cosmogony to include a cycle (*περίοδος*), one motif of which will be an alternation between one and many. To identify this distinction in Cleanthes' cosmogony, we should remember that *διακόσμησις* is the technical Stoic term for the cosmos in its present state of organization (*SVF* 2.527, 528, 558; cf. 1.102; 2.597). This state, in which the cosmos consists of four elements, is generally contrasted to the state of the cosmos during the conflagration, when the cosmos consists of only one element—fire (*SVF* 1.98; 2.596, 618, 626; cf. 616). Consequently *διακόσμησις* in this passage can be expected to refer to that part of the cycle in which the cosmos is "many."

What traces are there of an alternation between the one and the *διακόσμησις* or many in Stobaeus's cosmogonal summary? At one point Stobaeus says, "the fire is turned into the opposite direction . . . and begins to arrange [*διακοσμεῖν*] the universe." This should be the beginning of multiplicity and *διακόσμησις*, and the state of the cosmos up to this point should have been unity, though the account of Stobaeus does not give this impression at all. However, in the orthodox Stoic cosmogony,[4] we find that fire changes through air into water, still remaining a single element; but then from the water earth settles out; air is evaporated; and from some of the air, fire is again kindled with the result that there are subsequently four elements. This account does, indeed, show an alternation between one and many and would seem to be a more appropriate example of Cleanthes' generalization that cosmogony marks a transformation from one to many than the account Stobaeus assigns to Cleanthes. Moreover, Cleanthes' association of "seed" with the "one" is in conformity with the orthodox Stoic association of seed with both the primeval fire and the primeval water.

In view of the peculiar appropriateness of Cleanthes' generalizations to the orthodox Stoic cosmogony, we might compare Stobaeus's description of Cleanthes' cosmogony with the orthodox cosmogony to see whether Stobaeus is merely giving a distorted account of the orthodox cosmogony. The orthodox Stoic cosmogony begins with a mass of fire and so does Stobaeus's description (*ἐκφλογισθέντος τοῦ παντός*). In the orthodox cosmogony this fire "changes through air into water," at which point only a mass of water is apparent to the hypothetical observer. Stobaeus, in contrast, gives two steps, "the middle sinks together'' and ''the next parts are completely quenched,'' implying separate changes in two different parts of the mass of fire. Though this statement conflicts with the orthodox cosmogony, it is followed by the summary: ''The all having become wet'' (τοῦ δὲ παντὸς ἐξυγρανθέντος), a summary more appropriate to a state in which the cosmos is totally water (as in the orthodox cosmogony) than to the cosmic state implied by Stobaeus with earth at the center, water in between, and fire surviving at the periphery. Thus, though Stobaeus's account for a moment diverges from the orthodox account, it returns in the phrase ''the all having become wet.''

In the orthodox cosmogony at this point there is a new development: The four elements are differentiated and multiplicity enters the cosmos. Stobaeus suggests that he found a sharp break at this point too, for he uses a genitive absolute that balances the genitive absolute at the beginning of the account (ἐκφλογισθέντος τοῦ παντός). We mentioned earlier that this stylistic device is so prominent that it must be intentional, and Stobaeus, or at least his source, must have felt that the part of the process following the phrase τοῦ δὲ παντὸς ἐξυγρανθέντος in some way balanced the process described up to this point. Since the latter part of the fragment attests the importance of the one-many symmetry in Cleanthes' cosmogony, it would not be surprising to learn that Cleanthes' actual account counterpoised the two parts of the cosmogonal process as a manifestation of this symmetry. Stobaeus's stylistic device may well be a reflection of a symmetry stressed by Cleanthes himself. Stobaeus goes on to say that the fire begins to cause διακόσμησις in the cosmos. We have already mentioned that διακόσμησις refers to the arrangement of the present cosmos, of which the first step is the differentiation of the four elements. Hence this word most likely corresponds to the differentiation of elements from the water in the orthodox account.

Thus it is possible to find statements in Stobaeus's summary that seem to reflect the orthodox Stoic cosmogony. But if Cleanthes gave the orthodox cosmogony, we are forced to ask why Stobaeus did not give it to us in simple words, as he did under Zeno's name (*SVF* 1.102). The answer may be that Cleanthes elaborated on Zeno's simple statement. What Zeno had presented in a single volume *On the Universe*[5] Cleanthes restated in two books *On the Natural Science of Zeno* (*SVF* 1.481). Cleanthes' elaboration of Zeno's doctrine may have introduced ideas that misled Stobaeus or his source. We have already hinted at one new idea that Cleanthes incorporated into the cosmogony, namely, a contrast between the one and the many in the two halves of the process. It may also be possible to detect other elaborations that might have misled a careless reader. Stobaeus tells us that Cleanthes refers to the eternal cycle of the cosmogonal process as *τὸν ἐν τῇ τῶν ὅλων οὐσίᾳ τόνον*. The role of the *tonos* is one of the most perplexing problems in Stoic physics. Cleanthes describes the *tonos* as a "blow of fire" (*πληγὴ πυρός*, *SVF* 1.563). For the significance of this "blow" in cosmogony, we must rely on a single unsatisfactory fragment from pseudo-Censorinus, in which it is said that the Stoics hold that the *archai* are *tenor* (= *τόνος*) and matter. The *tonos* is said to be that which stretches from the middle to the periphery when matter becomes rare, and which returns again from the periphery to the middle when matter contracts.[6] A few lines later the author of this statement mentions Cleanthes and Chrysippus as among the sources from which his material is derived, so it is not impossible that this statement represents the view of Cleanthes. The idea that this *tonos* moves from the middle to the periphery and again from the periphery to the middle is the generalized idea of the *tonos* (*SVF* 2.451); but two things in this fragment point to a cosmogonal application. First of all, the subject matter is the *archai;* and, second, the *tonos* is interpreted as condensation and rarefaction of matter. This fragment suggests that *tonos* in matter is a process of condensation and rarefaction. The same thing is suggested by Simplicius (=*SVF* 2.452), who in obvious reference to the *tonos* (compare with *SVF* 2.451) says the Stoics believe in a "rarefying and condensing movement" (*κίνησιν τὴν μανωτικὴν καὶ πυκνωτικήν*), which moves in and out.

A number of fragments suggest that the Stoic cosmic cycle was viewed as a process of contraction and expansion, of condensation and rarefaction. Aëtius says the cosmos expands and contracts (*SVF* 2.597, cf. 615). Dio Chrysostom's mythological cosmogony says that before the cosmogony begins, the primeval mind (equivalent to fire) is "equally distributed, with nothing dense left in it, but with rareness reigning everywhere" (*SVF* 2.622). Presumably cosmogony involves condensation. Philo and Plutarch stress the fact that the seed of the cosmos, unlike that of other living things, is larger than the full-grown offspring and the cosmogony begins with contraction and quenching

(*SVF* 2.618, 619). The words used of the process are στέλλεσθαι, παχύνεσθαι, and significantly, συνίζειν (*SVF* 2.619). The idea that elemental change involves contraction and expansion can be traced back as far as Chrysippus (*SVF* 2.413), and there is no reason why Cleanthes could not have expressed this idea in his cosmogony. Thus it seems wholly reasonable to assume that Cleanthes elaborated on Zeno's cosmogony by introducing the concept of cyclical contraction and expansion, which he designated by the term "*tonos*." The first half of the cosmogony was probably viewed as a progressive contraction and quenching, in which fire changed to air and from air to water; and ultimately some even contracted so much as to become earth. The second half of the cosmogony, in which, after earth had settled out, air evaporated from the water, and fire was kindled from the air, was probably viewed as an expansion, the beginning of the process that will ultimately convert all matter into fire again.

If Cleanthes attempted to describe this idea in his elaborated version of Zeno's cosmogony, Stobaeus's misinterpretation becomes explicable. What Cleanthes may have described as a contraction toward the middle (presumably into air), Stobaeus summarized as "the middle first sank together" (συνίζειν). The use of συνίζειν for the contraction of fire into air is attested by Seneca (*QNat* 3.13.1, *ignem . . . evanidum languentemque considere* [=συνίζειν]) and by Philo (*Aet. Mund.* 110, συνίζοντος μὲν πυρὸς κατὰ τὴν σβέσιν εἰς ἀέρα).[7] Cleanthes' next stage, complete conversion into water, was summarized by Stobaeus with the words, "then the next parts are completely quenched." What for Cleanthes were successive changes of the entire mass of matter were interpreted by Stobaeus as changes in different parts of the mass of matter. However, his interpretation was not carried out consistently, and Cleanthes' idea that the whole mass becomes water shows through in the words "completely quenched" and "the all having become water."

At this point Stobaeus speaks of the "last" (ἔσχατον) of the fire. He is apparently thinking of the fire at the outer periphery. Having spoken of the "middle" and the "next parts," it is only natural that he would pass on to the material that still remained at the periphery. What could have misled him into thinking Cleanthes was talking of the peripheral fire at this point? When the material of the cosmos had turned into water, the orthodox account stated that fire is "left remaining'' (ὑπολιπέσθαι, *SVF* 2.580; cf. ἐναπολειφθεῖσαν, *SVF* 2.605) in the wet. It is this fire ''left remaining'' that is presumably responsible for the subsequent elemental transformations, the development of the four elements, and the present world order. If Cleanthes also spoke of fire ''left remaining,'' it is not impossible that Stobaeus or his source, already on the wrong track in thinking the cosmogony proceeded from center to surrounding water, simply assumed this referred to some remaining peripheral fire.[8]

According to Stobaeus, ''the middle offers resistance to the fire'' and causes it to reverse its direction. The orthodox account at this point states that ''earth settles out'' and then goes on to describe the formation of air and fire from the water. It has already been observed that the elemental transformation of fire to earth was viewed as a contraction and the reverse transformation as an expansion. Perhaps Cleanthes imagined the cosmic fire to be a resilient material compressed to the point of maximum density and then springing back to its original size. If so, Stobaeus's summary is entirely appropriate.

Stobaeus then assigns three activities to the ''last fire.'' This fire ''turns into the opposite direction, namely upward,'' ''begins to increase,'' and ''begins to arrange [διακοσμεῖν] the universe.'' In the orthodox account after the fire has changed through air into water, and after earth has settled out of water, the elemental transformation begins operating in the opposite direction. Some of the water remains around the earth; the rest of it evaporates into air; and from this air, fire is again kindled. Moreover, this elemental transformation from earth to fire is viewed as expansion and increase. Finally, the development of the four elements is considered the beginning of the διακόσμησις. Hence all three activities of Stobaeus's ''last fire'' could be derived from the orthodox Stoic cosmogony.

In support of this hypothetical reconstruction of Cleanthes' cosmogony, we may cite Stobaeus's summary of Chrysippus, which manifests some of the very conceptions we have reconstructed for Cleanthes (*SVF* 2.413). Chrysippus maintains that fire is the element *par excellence* because the others consist of fire by transformation (διὰ τὸ ἐξ αὐτοῦ πρώτου τὰ λοιπὰ συνίστασθαι κατὰ μεταβολήν). He explains what he means by giving a summary of elemental transformation: ''The first transformation is from fire to air by contraction [κατὰ σύστασιν], the second from air into water, the third when water contracts [συνισταμένου] still more into earth. Then again from earth, being dissolved and melted, there is first a pouring into water, then a second from water into air, and a third and last into fire." Then Chrysippus goes on to summarize the process by saying that this fiery substance "moves down to the turning point [τροπή] and from the turning point up in a complete circle, absorbing all things into itself and from itself again restoring all things in an appointed sequence [τεταγμένως καὶ ὁδῷ]." The vocabulary of the last sentence suggests that the whole fragment has a cosmogonal reference.[9] As in our reconstructed cosmogony of Cleanthes, Chrysippus views cosmogony as a series of successive changes of a single element (fire), thinks of the process underlying these changes as contraction and expansion, and views the cosmogonal process as a symmetrical cycle, proceeding from fire to earth and back to fire again.[10]

With the fragment of Chrysippus giving us confidence that we have not gone too far astray, we may sum up what Cleanthes may have written in his cosmogony. It would seem that Cleanthes elaborated somewhat on Zeno's simple cosmogony to bring out points that Zeno had not emphasized. Cleanthes tried to stress the physical process involved in elemental change, namely contraction and expansion. He also seems to have viewed the process as a symmetrical cycle of elemental transformations, from fire to air to water to earth and then in the opposite direction up to fire again. This cycle was then described as a *tonos*-cycle and also as an alternation between one and many, between seed and offspring, and between a single element and διακόσμησις. Stobaeus, or the doxographers who transmitted this material to him, misunderstood this complex synthesis of motifs and tried to make of the physical description of the cosmogony a simple process, beginning with earth, continuing with water, and concluding with fire, unaware that air is left unaccounted for.

1. *SVF* 1.497. His translation and interpretation of the amended text are found in "Kleanthes," *RE* 11 (1921): 563–64. J. D. Meerwaldt, "Cleanthea," *Mnemosyne*, 4th ser. 4 (1951): 46–47, has pointed out a few of the many inadequacies in von Arnim's interpretation and emendations. Meerwaldt's first objection, based on the presumed influence of Heraclitus, DK 22 B 31, on the Stoic cosmogony, is unfortunate; but it conceals a valid objection to von Arnim's interpretation. Even though we cannot a priori assume that Cleanthes would not propose a cosmogony at variance with

Heraclitus, we can assume (at least, if there is no evidence to the contrary) that as a devoted student of Zeno (cf. *SVF* 1.463, 599), he would not propose a cosmogony at variance with Zeno. Meerwaldt's own discussion of this text, 47–53, is the best discussion I know of. However, he too resorts to some emendation; he deletes *τοῦ πυρός* in the third line and reads *τοῦ δὲ παντὸς ἐξυγρανθέντος τὸ ἔσχατον* [*τοῦ πυρός*], *ἀντιτυπήσαντος*, etc. Moreover, his imaginative speculations about the nature of the *tonos* and its role in the cosmogony go too far beyond the extant texts. Cf. also the discussion of J. Moreau, *L'âme du monde de Platon aux Stoiciens* (Paris, 1939), 170–73.

2. Von Arnim's emendation *εἶτα* ⟨*κατὰ*⟩ *τὰ ἐχόμενα* destroys the series. Meerwaldt (above, note 1), esp. 47–48, 52, attaches no significance to this series. Indeed, by deleting *τοῦ πυρός* and by understanding *τὸ ἔσχατον* with *τοῦ παντὸς ἐξυγρανθέντος*, Meerwaldt refers *τὸ ἔσχατον* to an entirely different subject (i.e., the cosmos in its wet state) from that of the first two members of this series (successive stages in the change of fire to air).

3. Meerwaldt (above, note 1), 47–48, interprets these first two changes as successive stages in the conversion of fire to air. Though he cites a parallel from Philo *Aet. Mund.* 110 for the use of *συνίζειν* and *σβέσις* for the formation of air, his main reason for the interpretation is undoubtedly the reluctance to allow Cleanthes' cosmogony to begin in the middle (i.e., with earth), even before the completely wet stage has been reached. In addition, however, this interpretation fits his highly speculative hypothesis (pages 49–51) that since the outward-moving tonic motion is responsible for qualities, qualification itself begins at the center and proceeds outward.

4. By orthodox Stoic cosmogony I mean the cosmogony described above in Chapter 3.

5. It seems likely that Zeno wrote only this one book on physics (see Appendix 1).

6. Fr. 1 (p. 55, Hultsch), absent from *SVF*. "Ea [scil. principia] Stoici credunt tenorem atque materiam; tenorem, qui rarescente materia a medio tendat ad summam, eadem concrescente rursus a summo referatur ad mediam."

7. Meerwaldt (above, note 1), 47–48, agrees this phrase refers to the formation of air, but he goes further and takes the next phrase to refer to the same process (see above, note 3).

8. E. Zeller, *Stoics, Epicureans, and Sceptics*, trans. O. J. Reichel (London, 1880), 162, note 2, tries to make the term *ἔσχατον* itself designate the remaining fire. For this he was taken to task by R. Hirzel, *Untersuchungen zu Cicero's philosophischen Schriften* (Leipzig, 1882), 2.128–31.

9. "Absorbing (*καταναλίσκειν*) everything into itself" is Chrysippus's expression for what occurs in the conflagration (*SVF* 2.604, cf. 1.536 [=2.1049]; 2.526, 599). "Restoring (*ἀποκαθιστάναι*) all things again" is the Stoic description of the restoration (*SVF* 2.599, 625).

10. Notice, too, the similarity of the last sentence of each account. Cleanthes: *οὕτως ἐξ ἑνός τε πάντα γίνεσθαι καὶ ἐκ πάντων ἐν συγκρίνεσθαι, ὁδῷ καὶ συμφώνως διεξιούσης τῆς περιόδου* (*SVF* 1.497). Chrysippus: *εἰς αὑτήν τε πάντα καταναλίσκουσα καὶ ἀφ' αὑτῆς πάλιν ἀποκαθιστᾶσα τεταγμένως καὶ ὁδῷ* (*SVF* 2.413).

APPENDIX IV

Accounts of the Stoic Proofs for the Immobility and Coherence of the Cosmos

Several accounts of Stoic theories of the immobility, coherence, and physical structure of the universe are so similar as to suggest they come from a single source or a closely related set of sources. Their relationship can be seen most clearly if they are arranged in parallel columns.

Arius Didymus, fr. 23
(=*DG* 459–60=*SVF* 1.99)

A.

Ζήνωνος. Τῶν δ' ἐν τῷ κόσμῳ πάντων τῶν κατ' ἰδίαν ἕξιν συνεστώτων τὰ μέρη τὴν φορὰν ἔχειν εἰς τὸ τοῦ ὅλου μέσον, ὁμοίως δὲ καὶ αὐτοῦ τοῦ κόσμου, διόπερ ὀρθῶς λέγεσθαι πάντα τὰ μέρη τοῦ κόσμου ἐπὶ τὸ μέσον τοῦ κόσμου τὴν φορὰν ἔχειν, μάλιστα δὲ τὰ βάρος ἔχοντα.

Achilles *Isagoge*

Isagoge 9 (=*SVF* 2.554)
Εἰ ἕστηκεν ὁ κόσμος.

φασὶ μὲν οὖν μένειν τὸν κόσμον ἐν ἀπείρῳ κενῷ διὰ τὴν ἐπὶ τὸ μέσον φοράν, ἐπεὶ πάντα αὐτοῦ τὰ μέρη ἐπὶ τὸ μέσον νένευκεν. μέρη δέ ἐστιν αὐτοῦ γῆ, ὕδωρ, ἀὴρ, πῦρ, ἃ πάντα νεύει ἐπὶ τὸ μέσον. διὰ τοῦτο οὖν οὐδαμοῦ ῥέπει ὁ κόσμος.

Cicero *Nat. D.* 2.115–19

Nec vero haec solum admirabilia, sed nihil maius quam quod ita stabilis est mundus atque ita cohaeret, ad permanendum ut nihil ne excogitari quidem possit aptius. Omnes enim partes eius undique medium locum capessentes nituntur aequaliter. Maxime autem corpora inter se iuncta permanent cum quasi quodam vinculo circumdato colligantur, quod facit ea natura quae per omnem mundum omnia mente et ratione conficiens funditur et ad medium rapit et convertit extrema. Quocirca si mundus globosus est ob eamque

Arius Didymus, fr. 31
(=*DG* 465–66=*SVF* 2.527)

Κόσμον δ' εἶναί φησιν ὁ Χρύσιππος σύστημα ἐξ οὐρανοῦ καὶ γῆς καὶ τῶν ἐν τούτοις φύσεων ἢ τὸ ἐκ θεῶν καὶ ἀνθρώπων σύστημα καὶ ἐκ τῶν ἕνεκα τούτων γεγονότων. λέγεται δ' ἑτέρως κόσμος ὁ θεός, καθ' ὃν ἡ διακόσμησις γίνεται καὶ τελειοῦται· τοῦ δὲ κατὰ τὴν διακόσμησιν

ταὐτὸν δ' αἴτιον εἶναι καὶ τῆς τοῦ κόσμου μονῆς ἐν ἀπείρῳ κενῷ καὶ τῆς γῆς παραπλησίως ἐν τῷ κόσμῳ περὶ τὸ τοῦτο κέντρον καθιδρυμένης ἰσοκρατῶς.	(cf. *μέρη δέ ἐστιν αὐτοῦ γῆ,*	causam omnes eius partes undique aequabiles ipsae per se atque inter se continentur, contingere idem terrae necesse est, ut omnibus eius partibus in medium vergentibus (id autem medium infimum in sphaera est) nihil interrumpat quo labefactari possit tanta contentio gravitatis et ponderum.	λεγομένου κόσμου τὸ μὲν εἶναι περιφερόμενον περὶ τὸ μέσον, τὸ δ' ὑπομένον· περιφερόμενον μὲν τὸν αἰθέρα, ὑπομένον δὲ τὴν γῆν καὶ τὰ ἐπ' αὐτῆς ὑγρὰ καὶ τὸν ἀέρα. τὸ γὰρ τῆς πάσης οὐσίας πυκνότατον ὑπέρεισμα πάντων εἶναι κατὰ φύσιν, ὅνπερ τρόπον ἐν ζῴῳ τὰ ὀστέα, τοῦτο δὲ καλεῖσθαι γῆν.
	ὕδωρ,	Eademque ratione mare, cum supra terram sit, medium tamen terrae locum expetens conglobatur undique aequabiliter neque redundat umquam neque effunditur.	περὶ δὲ ταύτην τὸ ὕδωρ περικεχύσθαι σφαιρικῶς, ὁμαλωτέραν τὴν ἰσχὺν διειληχός. τῆς γὰρ γῆς ἐξοχάς τινας ἐχούσης ἀνωμάλους διὰ τοῦ ὕδατος ἐς ὕψος ἀνηκούσας, ταύτας μὲν νήσους καλεῖσθαι, τούτων δὲ τὰς ἐπὶ πλεῖον διηκούσας ἠπείρους προσηγορεῦσθαι ὑπ' ἀγνοίας τοῦ περιέχεσθαι καὶ ταύ-

		τας πελάγεσι μεγάλοις.
ἀὴρ,	Huic autem continens aer fertur ille quidem levitate sublimis, sed tamen in omnes partes se ipse fundit; itaque et mari continuatus et iunctus est et natura fertur ad caelum, cuius tenuitate et calore temperatus vitalem et salutarem spiritum praebet animantibus.	ἀπὸ δὲ τοῦ ὕδατος τὸν ἀέρα ἐξῆφθαι καθάπερ ἐξατμισθέντα καὶ περικεχύσθαι σφαιρικῶς,
πῦρ, ἃ πάντα νεύει ἐπὶ τὸ μέσον.)	Quem complexa summa pars caeli, quae aetheria dicitur, et suum retinet ardorem tenuem et nulla admixtione concretum et cum aeris extremitate coniungitur. In aethere autem astra volvuntur, quae se et nisu suo conglobata continent et forma ipsa	ἐκ δὲ τούτου τὸν αἰθέρα ἀραιότατον ὄντα καὶ εἰλικρινέστατον. τὸν μὲν οὖν κατὰ τὴν διακόσμησιν λεγόμενον κόσμον εἰς ταύτας διακεκρίσθαι τὰς φύσεις, τὸ δὲ περιφερόμενον αὐτῷ ἐγκυκλίως αἰθέρα εἶναι, ἐν ᾧ τὰ ἄστρα καθίδρυται τά τε ἀπλανῆ καὶ τὰ

figuraque sua momenta sustentant; sunt enim rotunda, quibus formis, ut ante dixisse videor, minime noceri potest. Sunt autem stellae natura flammeae, quocirca terrae maris aquarum vaporibus aluntur iis qui a sole ex agris tepefactis et ex aquis excitantur; quibus altae renovataeque stellae atque omnis aether refundunt eadem et rursum trahunt indidem, nihil ut fere intereat aut admodum paululum quod astrorum ignis et aetheris flamma consumit. Ex quo eventurum nostri putant id de quo Panaetium addubitare dicebant, ut ad extremum omnis mundus ignesceret, cum

πλανώμενα, θεῖα τὴν φύσιν ὄντα καὶ ἔμψυχα καὶ διοικούμενα κατὰ τὴν πρόνοιαν.

τῶν μὲν οὖν ἀπλανῶν

umore consumpto neque terra ali posset nec remearet aer, cuius ortus aqua omni exhausta esse non posset; ita relinqui nihil praeter ignem, a quo rursum animante ac deo renovatio mundi fieret atque idem ornatus oreretur. Nolo in stellarum ratione multus vobis videri, maximeque earum quae errare dicuntur; quarum tantus est concentus ex dissimillimis motibus ut, cum summa Saturni refrigeret, media Martis incendat, his interiecta Iovis inlustret et temperet infraque Martem duae soli oboediant, ipse sol mundum omnem sua luce compleat ab eoque luna inluminata graviditates et partus

ἄστρων ἀκατάληπτον εἶναι τὸ πλῆθος, τὰ δὲ πλανώμενα ἑπτὰ τὸν ἀριθμὸν εἶναι· πάντα δὲ τὰ πλανώμενα ταπεινότερα τῶν ἀπλανῶν. τετάχθαι δὲ τὰ μὲν ἀπλανῆ ἐπὶ μιᾶς ἐπιφανείας, ὡς καὶ ὁρᾶται· τὰ δὲ πλανώμενα ἐπ' ἄλλης καὶ ἄλλης σφαίρας· περιέχεσθαι δὲ πάσας τὰς τῶν πλανωμένων ὑπὸ τῆς τῶν ἀπλανῶν σφαίρας. τῶν δὲ πλανωμένων ὑψηλοτάτην εἶναι μετὰ τὴν ⟨τῶν⟩ ἀπλανῶν τὴν τοῦ Κρόνου, μετὰ δὲ ταύτην τὴν τοῦ Διός, εἶτα τὴν τοῦ Ἄρεος, ἐφεξῆς δὲ τὴν τοῦ Ἑρμοῦ, καὶ μετ' αὐτὴν τὴν τῆς Ἀφροδίτης, εἶτα τὴν τοῦ ἡλίου, ἐπὶ πᾶσι δὲ τὴν τῆς σελήνης πλησιάζουσαν τῷ ἀέρι. διὸ καὶ ἀεροδεστέραν φαίνεσθαι καὶ μάλιστα

		adferat maturitatesque gignendi. Quae copulatio rerum et quasi consentiens ad mundi incolumitatem coagmentatio naturae quem non movet, hunc horum nihil umquam reputavisse certo scio.	διατείνειν τὴν ἀπ᾽ αὐτῆς δύναμιν εἰς τὰ περίγεια.

B.

οὐ πάντως δὲ σῶμα βάρος ἔχειν, ἀλλ᾽ ἀβαρῆ εἶναι ἀέρα καὶ πῦρ· τείνεσθαι δὲ καὶ ταῦτά πως ἐπὶ τὸ τῆς ὅλης σφαίρας τοῦ κόσμου μέσον, τὴν δὲ σύστασιν πρὸς τὴν περιφέρειαν αὐτοῦ ποιεῖσθαι. φύσει γὰρ ἀνώφοιτα ταῦτ᾽ εἶναι διὰ τὸ μηδενὸς μετέχειν βάρους·	*Isagoge* 7 (not in *SVF*) Περὶ περιφορᾶς. ὃι δέ φασι τὸ πῦρ ⟨διὰ τὸ⟩ ἀνωφερὲς εἶναι καὶ τὴν κύκλῳ φορὰν εἰωθὸς ποιεῖσθαι τὴν σύστασιν τῆς τῶν ὅλων περιφορᾶς πεποιῆσθαι.		

Isagoge 4 (=*SVF* 2.555)
Περὶ τῆς συστάσεως τῶν ὅλων.

Καλῶς ἂν ἔχοι πείσθεσθαι τῷ Χρυσίππῳ· φησὶ γὰρ ἐκ τῶν τεσσάρων στοιχείων τὴν σύστασιν τῶν ὅλων γεγονέναι. αἴτιον δὲ τῆς μονῆς τούτων τὸ ἰσοβαρές· δύο γὰρ ὑποκειμένων βαρέων, γῆς καὶ ὕδατος, δύο δὲ κούφων, πυρός καὶ ἀέρος, τὴν τούτων σύγκρασιν αἰτίαν εἶναι τῆς τοῦ παντὸς τάξεως (ὥσπερ γάρ, εἰ ἦν ὁ κόσμος βαρύς, κάτω ἂν ἐφέρετο, οὕτω καί, εἰ κοῦφος, ἄνω· μένει δὲ τῷ ἴσον ἔχειν τὸ βαρὺ τῷ κούφῳ), τὸν δὲ αἰθέρα καὶ οὐρανόν, εἴτε ὁ αὐτὸς εἴτε διάφορος, ἔξωθεν εἶναι

παραπλησίως δὲ τούτοις οὐδ᾽ αὐτόν φασι τὸν κόσμον βάρος ἔχειν διὰ τὸ τὴν ὅλην αὐτοῦ σύστασιν ἔκ τε τῶν βάρος ἐχόντων στοιχείων εἶναι καὶ ἐκ τῶν ἀβαρῶν,

τὴν δ' ὅλην γῆν καθ' ἑαυτὴν μὲν ἔχειν ἀρέσκει βάρος, παρὰ δὲ τὴν θέσιν διὰ τὸ τὴν μέσην ἔχειν χώραν (πρὸς δὲ τὸ μέσον εἶναι τὴν φορὰν τοῖς τοιούτοις σώμασιν) ἐπὶ τοῦ τόπου τούτου μένειν.

σφαιρικὸν σχῆμα ἔχοντα. μετὰ δὲ τοῦτον ἐντὸς αὐτοῦ τὸν ἀέρα εἶναι καὶ αὐτὸν σφαιρικῶς περικείμενον ἔξωθεν τῇ γῇ. ἐνδοτέρω δὲ αὐτοῦ τρίτην εἶναι σφαῖραν τὴν τοῦ ὕδατος περὶ αὐτὴν τὴν γῆν μεταξὺ τοῦ ἀέρος καὶ τῆς γῆς. ἐν δὲ τῷ μεσαιτάτῳ τὴν γῆν εἶναι κέντρου τάξιν καὶ μέγεθος ἐπέχουσαν [ὡς αἱ σφαῖραι]. καὶ τὰς μὲν ἄλλας τρεῖς σφαίρας ἢ τέσσαρας περιδινεῖσθαι, τὴν δὲ τῆς γῆς μόνην ἑστάναι.

ὑπὸ δὲ τὴν σελήνην τὴν τοῦ ὑπ' αὐτοῦ φερομένου ἀέρος,

εἶτα τὴν (τοῦ) ὕδατος,

τελευταίαν δὲ τὴν τῆς γῆς περὶ τὸ μέσον σημεῖον τοῦ κόσμου κειμένης, ὃ δὴ τοῦ παντός ἐστι κάτω, ἄνω δὲ τὸ ἀπ' αὐτοῦ εἰς τὸ κύκλῳ πάντῃ.

Most striking is the correspondence between Arius Didymus, fr. 23 (=*SVF* 1.99), and Achilles. Nearly all elements of Arius's account appear in Achilles, though not consecutively. Furthermore, the first argument (A) occurs in very similar words in Cicero *Nat. D.* 2.115–16, thereby linking the three accounts. Nearly as striking is the correspondence between the description of the cosmos in Cicero and in Arius Didymus, fr. 31 (=*SVF* 2.527). In both accounts the parts of the cosmos are enumerated, beginning with the earth and working up to the periphery. Then, when the accounts begin to enumerate the heavenly bodies, they start with the fixed stars and work down to the moon. The same order of enumeration is found, but without detail, in Achilles' version of the first argument (A). The link between Achilles and Stobaeus is further strengthened by the fact that Arius Didymus, fr. 31 (=*SVF* 2. 527), does not stop enumerating parts of the cosmos when he reaches the heavenly bodies, but continues down again to earth, thereby repeating the parts of the cosmos, this time in the same order in which Achilles enumerates them in his version of the second argument (B). Thus there are correspondences linking Arius Didymus (fr. 23), Achilles, and Cicero, and other correspondences linking Achilles, Cicero, and Arius Didymus (fr. 31). This fact suggests all four texts are somehow related.

The relationship is complicated, however, by the fact that the material is assigned to two different authors, Zeno and Chrysippus, and used for three different purposes. Arius Didymus, fr. 23, assigns both arguments to Zeno as proofs for the immobility of the cosmos. Achilles uses the first argument (A) without attribution as proof for the immobility of the cosmos, and the second argument (B), which he attributes to Chrysippus, as a description of the arrangement of the cosmos, even though his text makes it absolutely clear that it is another proof for the immobility of the cosmos. Cicero preserves only the first argument (A), but uses it to prove the coherence, not the immobility, of the cosmos. Finally, Arius Didymus, fr. 31, attributes an account somewhat similar to that of Cicero to Chrysippus and uses it as a description of the arrangement of the cosmos.

These data do not hold much promise of supporting a firm, detailed hypothesis of their origin. We may surmise that Zeno originated the argument for the immobility of the cosmos along the lines of Arius Didymus, fr. 23 (=*SVF* 1.99). Whether it contained a detailed description of the parts of the cosmos, we cannot say. Chrysippus preserved at least the second of Zeno's arguments, most likely with a description of the parts of the cosmos (Achilles *Isagoge* 4[=*SVF* 2.555]). Whether he preserved the first argument, we do not know for sure. We do know, however, that he used a similar argument to prove the coherence of the cosmos in the void (*SVF* 2.550), and that he enumerated the parts of the cosmos in the order that is characteristic of the first argument (Arius Didymus, fr. 31[=*SVF* 2.527]). It is quite possible, therefore, that he did preserve the first argument, either as proof for the immobility of the cosmos or as proof for its coherence (in the manner of Cicero *Nat. D.* 2.115–19), or for both purposes at once. That he also wrote a separate description of the arrangement of the cosmos, using the same basic ideas, is not impossible, but even harder to prove than that he used the first argument (A). Arius Didymus, fr. 31 (=*SVF* 1.527), is obviously an anthology of statements drawn from various contexts and so is weak evidence for the original context of any of its information. It could easily be the result of a doxographer's sifting of a text similar to that used by Cicero. Achilles (*Isagoge* 4[=*SVF* 2.555]) obviously used Chrysippus's argument for the immobility of the cosmos as a substitute for a description of its arrangement; Arius Didymus may have done something similar. Such a procedure may also account for the fact that his enumeration of parts runs from earth to periphery and back again to earth. Thus, though we may trace the ancestry of these texts back to several closely related discussions by Zeno and Chrysippus, we cannot trace precisely the steps by which Zeno's argument was expanded and adapted by Chrysippus and subsequently repeated and abridged by Arius Didymus, Cicero, and Achilles.

Chrysippus's Statement on the Alleged Imperishability of the Cosmos

In *On the Contradictions of the Stoics* Plutarch preserves a verbatim quotation of Chrysippus that purportedly shows Chrysippus believed the infinite void has a center at which the cosmos is located (*Stoic. Repug*. 1054c–d[=*SVF* 2.551]). Since this idea contradicts all other Stoic testimony on the subject, modern interpreters either have had to share Plutarch's charge of contradiction (though not the delight with which he made the charge),[1] or have had to explain away the evidence. Pohlenz has assumed Plutarch has simply misinterpreted a text torn out of context and that Chrysippus really must have meant that the movement of all parts of the cosmos toward the middle *of the cosmos* accounts for its incorruptibility.[2] Furley goes even further by paraphrasing Chrysippus's statement to say, "If matter were not arranged around the center, the cosmos would be destroyed." Furley concludes, "Chrysippus probably meant that matter must be evenly distributed or balanced around its own center."[3] It is true that Plutarch is here quoting out of context and in addition must, as a general rule, be suspected of misrepresentation; but in the present case he purports to quote verbatim, and Chrysippus's words say that the incorruptibility is due to "the occupancy of space" (*ἡ τῆς χώρας κατάληψις*) and that the cosmos is "in the middle" (*ἐν μέσῳ εἶναι*), "occupies the middle place" (*τὸν μέσον κατειληφυῖα τόπον*), and is not "anywhere else" (*ἀλλαχῇ*). Chrysippus's Greek text is not transparently clear, but it is hard to see how anyone can think that by these words Chrysippus is referring to motion toward the middle of the cosmos or to the even distribution and balance of matter around its own center.

This is not to say that we must accept Plutarch's charge of contradiction, for there is a ready explanation in the very words quoted by Plutarch. Plutarch introduces the quotation by telling us this statement on the imperishability of the cosmos occurred not in one of Chrysippus's physical works, but in the fourth book of the work entitled *On Things Possible* (περὶ δυνατῶν), a treatise that is cataloged among Chrysippus's logical works by Diogenes Laertius (*SVF* 2.13[=page 5.22]), and that seems to have discussed Chrysippus's definition of the possible as "that which is capable of occurring, even if it never will occur" (*SVF* 2.202, cf. 283). This should be a clue to Chrysippus's approach in the words quoted; and so when we hear Chrysippus announce a discussion of the question whether the cosmos is perishable, we can expect a discussion of the applicability of the term "perishable" in the light of Chrysippus's theory of possibility. This is right in the tradition set by Aristotle. In *On the Heavens* Aristotle takes up the very same question and after a lengthy semantic discussion rejects the thesis that the cosmos may be called perishable because this statement does not conform to his definition of the perishable as that which either existed formerly, but exists no longer, or exists now, but will not exist at some time in the future (*Cael.* 1.12.281a28–b33). To Aristotle the cosmos cannot be called perishable because perishability is incompatible with eternal existence (esp. *Cael.* 1.12.281b34–282a1).

Knowing the context of Chrysippus's remarks and the history of the problem, we are in a position to face Chrysippus's actual words: "Therefore with respect to the cosmos, I believe there is need for discussion whether it ought to be called perishable [φθαρτός]. Nevertheless, it appears all the more to me to be so [οὐ μὴν ἀλλὰ καὶ μᾶλλον ἐμοὶ φαίνεται οὕτως ἔχειν]." The first sentence is clear enough, but the second calls for comment. At first glance it appears insignificant, but a little examination shows it to be a crucial link in Chrysippus's exposition, without which the following words can easily be misconstrued. The first question we may ask is what Chrysippus means by "it appears to be so." Since οὕτως normally refers to something already mentioned, we must assume Chrysippus means that the cosmos appears to him to be corruptible. We must avoid the temptation to take it in the sense of "as follows" (which would be ὧδε) unless other factors compel us to take this course. The second question is what Chrysippus intended to convey by the string of particles οὐ μὴν ἀλλά. Denniston says οὐ μὴν ἀλλά generally introduces a statement that cannot be denied, even though there are strong arguments to the contrary.[4] Thus we may paraphrase Chrysippus's second sentence as follows: "Even though there are substantial arguments for claiming the cosmos is not perishable, I am convinced all the more [after considering these counterarguments] that the cosmos is indeed perishable." If this is his intent, we may well expect him to marshal some arguments against his position.

In the next sentence he says: "As if [*οἱονεί*] for the seeming [*ὥσπερ*] imperishability any great contribution is rendered even by the occupancy of space—I mean because of the fact that it is in the middle, since if it were imagined to be anywhere else, destruction would lay hold of it entirely." Plutarch omits the next part of the argument and then concludes with a quotation from further on: "For thus I suppose also the substance by coincidence [*συντέτευχεν*] occupies the middle place eternally, so that, because of that coincidence [*διὰ τὴν συντυχίαν*] as well as for other reasons, it is not capable of destruction and accordingly is eternal." These are the sentences, of course, that Plutarch wishes to use to show Chrysippus believed the void has a middle; but there are numerous indications that this argument is not Chrysippus's own argument but a counterargument that Chrysippus must refute to establish his own thesis that the cosmos is perishable. Chrysippus indicates his lack of sympathy with this argument by introducing it with "as if" (*οἱονεί*),[5] by calling the incorruptibility "seeming incorruptibility" (*ὥσπερ ἀφθαρσίαν*), by the reluctance of the "I suppose" (*πως*) with which he concludes that the substance occupies the middle position eternally, and finally by his emphasis on the coincidence of the position of substance in space (*συντέτευχεν . . . διὰ τὴν συντυχίαν*).

If this is merely an opposing argument that Chrysippus himself rejects, there is no contradiction between Chrysippus's own cosmological views and the reference to a middle of the void in this argument. Yet Plutarch could protest in defense of his charge of contradiction that Chrysippus is going along with the argument to a certain extent. "I suppose" (*πως*) may suggest reluctant acquiescence, but it is still acquiescence. Unfortunately, Plutarch's interpretation cannot be refuted with certainty as long as we do not have the full context of these quotations. From our knowledge of the general context and history of the problem we can make a guess how Chrysippus might have handled the discussion. Aristotle had refused to apply the term "perishable" to the cosmos because there never would be a time at which the cosmos would not exist. For him eternity entailed imperishability. Chrysippus, however, subscribed to a different definition of the possible, as Plutarch points out a few pages later. Chrysippus maintained that something may be possible, even if it will never occur (*SVF* 2.202), and so even "that which neither is nor will be true is yet possible" (*SVF* 2.283). Hence Chrysippus could grant that the cosmos will never be destroyed and yet maintain that the term "perishable" is applicable to the cosmos. All he had to prove was that the cosmos is capable (ἐπιδεκτικός) of being destroyed. To refute Chrysippus an opponent had to prove that the cosmos is not capable of being destroyed.[6] The eternity of the cosmos is irrelevant.

The precise logic of the counterargument that Chrysippus presents is unclear from the two sentences preserved by Plutarch. It clearly attempted to deduce imperishability from the position of the cosmos at the center of the void, but how it made this deduction and what physical principles were believed to be involved we do not know. In fact, it is doubtful that Chrysippus discussed the physical principles behind the argument, because Plutarch relies on these very sentences to deduce a theory that all parts of the cosmos have a movement toward the center of the void, a movement that would destroy the cosmos if the cosmos were not at the center (*Stoic. Repug.* 1054d–e). But the logic of the argument is of less importance than Chrysippus's line of refutation. It looks as if Chrysippus did not attack the presupposition that the void has a center, but rather the assumption that the position of the cosmos at the center necessarily entails the imperishability of the cosmos. In Chrysippus's view the position of the cosmos is at best a contributing cause (συνεργεῖ) and then not even of genuine incorruptibility, but of a seeming incorruptibility (ὥσπερ ἀφθαρσίαν). Moreover, Chrysippus was willing to grant that the substance or matter (οὐσία) of the cosmos might occupy the middle eternally; but he insisted that this position was a coincidence (<u>συν</u>τέτευχεν) and again at best a contributing factor (<u>συν</u>τυχία), along with some other cause, for the fact that the substance of the cosmos is incapable of destruction and hence eternal. Thus when Chrysippus gets to the crucial point whether the cosmos is or is not capable of destruction, he allows the counterargument to provide only a coincidental cause, not the real cause, and, what is more, to prove incapability of destruction only of the substance or matter (οὐσία) of the cosmos. This is considerably less than Chrysippus requires to justify the conclusion that the cosmos per se is incorruptible.

If we turn to other sources we find that the word "cosmos" had several meanings for the Stoics. On the one hand, it could refer to the whole mass of qualified matter (*οὐσία*) that constitutes our world. The cosmos, in the sense of cosmic material, is indeed imperishable and eternal (*SVF* 2.526, cf. 528, 599). The word could also refer to this particular world order and arrangement of elements. Since this world order is fated to perish at some time in the future, the cosmos, in the sense of world order, is perishable.[7] Arius Didymus observes that Stoic references to the destruction of the cosmos use the word "destruction" in a special sense: "From these things it is clear that in referring to the substance [*οὐσία*] Chrysippus did not use 'ruin' [*σύγχυσις*] in this sense, but in the sense of 'change' [*μεταβολή*]. For those who believe in the dissolution of everything into fire, which they call 'conflagration,' do not use 'destruction' [*φθορά*] in the strict sense when referring to the periodic destruction of the cosmos, but they use the word 'destruction' in place of 'natural change' [*ἡ κατὰ φύσιν μεταβολή*]" (fr. 36[*SVF* 2.596]). Arius Didymus confirms that Chrysippus and the Stoics in general spoke of the ruin or destruction of the cosmos. By this they did not mean the cosmos goes out of existence; they meant it undergoes change. This is the same belief reflected in the two senses of the word "cosmos." The substance of the cosmos never perishes, but its form is constantly being altered and so perishing. Eventually in the final conflagration this alteration will involve the dissolution of everything into fire.

From this it is clear that Chrysippus would have insisted that there is a sense in which the cosmos must be considered capable of destruction; and so even if he grants that the matter (*οὐσία*) of the cosmos is imperishable, he is not forced to say absolutely that the cosmos is imperishable. The counterargument based on the alleged position of the cosmos in the middle of the void proves, at best, that the cosmos in one sense (i.e., *οὐσία*) is imperishable; and even this is not proven very conclusively, since it uses as a premise what is at best a coincidence. Thus we can understand why Chrysippus would consider the proof he quotes as inadequate to shake his position that the cosmos must be called corruptible.

If this is, in fact, the way Chrysippus handled the counterargument, we need not worry about the fact that he apparently grants the presupposition of a middle in the infinite void. Chrysippus may well have been planning to use the counterargument for his own advantage, as he suggests in the statement, "Nevertheless it appears *all the more* to be so [i.e., corruptible]." Had he simply rejected the opposing argument on the grounds of an invalid premise, as he was entitled to do, he would have had to build his own case from the bottom. As it is, he has not only refuted the opponent's conclusion but has shown that the opponent's assumptions lead to his own position, at least in part. For his opponent's argument demonstrates only what Chrysippus himself also believes, namely, that the matter of the cosmos is incorruptible. Chrysippus may now go on to prove that the particular arrangement of this matter that we call our cosmos is capable of changing and therefore qualifies for the description "perishable." A parallel for this sort of dialectical procedure can be found in Aristotle's proof of the imperishability of the cosmos. Aristotle begins his proof by considering the views of his opponents; but instead of refuting and dismissing them, he shows that, properly understood, they confirm his own view. Democritus, Empedocles, and Heraclitus, all of whom reportedly believed the cosmos to be generated and perishable, are used by Aristotle as logical stepping stones to the view that the cosmos is eternal, with no attempt to refute all the un-Aristotelian cosmological presuppositions embodied in their views.[8]

In conclusion, the words quoted by Plutarch to prove Chrysippus guilty of contradiction fail to substantiate the charge. They may reveal something about Chrysippus's technique of argumentation, but they shed no new light on his cosmological views.

1. E. Zeller, *Stoics, Epicureans, and Sceptics*, trans. O. J. Reichel (London, 1880), 203, note 5.

2. M. Pohlenz, *Die Stoa: Geschichte einer geistigen Bewegung*[3] (Göttingen, 1964), 1.77.

3. D. J. Furley, "Lucretius and the Stoics," *BICS* 13 (1966): 20–21.

4. J. D. Denniston, *The Greek Particles*[2] (Oxford, 1954), 28.

5. M. Pohlenz, ed., *Plutarchi Moralia*[2], vol. 6, fasc. 2 (Leipzig, 1959), 51, emends the text to *οἷα τε . . . συνεργεῖν*, which gives the meaning, "The occu-

pancy of space can help a great deal for the seeming incorruptibility," and therefore brings it into conformity with Plut. *Def. Or* 425d, where Plutarch definitely makes Chrysippus himself subscribe to the argument and where Plutarch mentions *οἱονεὶ ἀφθαρσίαν* instead of *ὥσπερ ἀφθαρσίαν*. But Plutarch's obviously hostile interpretations can give one little confidence in emending a text that Plutarch quotes only to ridicule. The received text may well be correct as it stands and Plutarch's indirect quotation in *Def. Or* inaccurate and misleading.

6. Chrysippus's definition of "impossible" is not recorded, but "not capable of being true" is certainly a good conjecture. At least, this is the definition given by some Stoic, as Diocles Magnes attests (*SVF* 2.201).

7. *SVF* 2.526, 585. That this distinction goes back to Chrysippus can be inferred from its presence in *SVF* 2.527.

8. For a more detailed discussion of his procedure see Chapter 6.

Cleanthes' Proof for the Intelligence of the Cosmos

Cicero's summary of Cleanthes' proof that the cosmos is wise (*sapiens, Nat. D.* 2.29–30) presents several difficulties, which have long puzzled interpreters.[1] First of all, it has only a tenuous connection with what precedes it. Cicero states: "There is, therefore, a substance which holds together the whole cosmos and preserves it; and this substance is not without sensation and reason." The only supposition he seems to take from his previous argument is that a preserving substance exists in the cosmos. He nowhere in the section states what it is, though we may surmise that it is the heat. Then from the bare existence of a sustaining substance he sets out to prove that this substance has sensation and reason. The argument never gets off the ground. He begins by introducing a new concept, the ruling principle or *hegemonikon*, and explains that anything that is not simple has a ruling principle. After a few examples he states that the substance in which the principle exists is most worthy of authority and domination. This grand introduction prefaces a surprisingly flimsy argument. Since sensation and reason are present in parts of the cosmos, that part in which the ruling principle exists must possess sense and reason, and these in a greater degree. From this the conclusion is drawn that "the cosmos is intelligent and the substance which holds all things in its embrace excels in the perfection of reason." This is hardly an argument to convince skeptics; we are not given even the slightest clue to the identity of the ruling principle or the substance in which it exists. Furthermore, why should we believe that because some parts of the cosmos (we immediately think of men) have sensation and reason, therefore another part, namely, the one that contains the ruling principle, should also have it? We can only conclude that Cicero has omitted something and perhaps also distorted the argument.[2]

Fortunately, enough remains to guess what has been omitted. We know where the argument is heading, for it concludes with the statement that the cosmos is intelligent. It appears that the argument led up to this conclusion by proving that the substance that sustains the cosmos also has sensation and reason. We also know that one aspect of the proof was a syllogism reasoning from parts. As it stands the syllogism reasons from certain parts to another part; but if we assume the syllogism was originally more cogent, we might guess that it was a syllogism from parts to whole, like the syllogism used by Zeno and by Cleanthes in the previous proof. If so, and if the argument seeks to prove that the sustaining substance has sense and reason, Cicero's summary must have omitted a section that proves parts of the sustaining substance have sense and reason. To do this the argument is going to have to tell us what the sustaining substance is and what its parts are; and if it is not self-evident, there must be a proof that the alleged parts are, in fact, parts of the sustaining substance. Moreover, the elaborate introduction of the concept of the ruling principle suggests that the ruling principle should be one of the parts of the sustaining substance and perhaps the part on which much of the argument is based.

Having compiled a list of desiderata, we may begin searching for the missing parts of the argument. The easiest part to find is the identity of the ruling principle. Cleanthes tells us that the ruling principle is that part "which must and ought to have supremacy in any thing; and so it is necessary that the substance which contains the ruling principle of all nature is the best of all and most worthy of authority and domination over all things" (*omnium rerum potestate dominatuque dignissimum, Nat. D.* 2.29). In *Academica* 2.126 (=*SVF* 1.499) Cicero obligingly tells us that Cleanthes believed "the sun has domination and authority over things" (*solem dominari et rerum potiri*). Thus the sun must be the ruling principle of the cosmos, and several ancient authors assure us that Cleanthes did, in fact, hold this view (*SVF* 1.499). With this piece of information we may begin to fill the gap in the argument.

If the sun is to serve as the part from which to draw inferences about the whole sustaining substance, we must be made to see that the sun is a part of the sustaining substance, which we already know to be the vital heat, but whose identity the reader of the argument theoretically does not yet know. By a fortunate coincidence Cicero preserves a quotation from Cleanthes that does this very thing. Cleanthes proves that the sun is made of fire by the evidence of the senses of sight and touch, for the sun is brighter than any earthly fire and it warms, yes, even burns, the flesh. Light and warmth can come only from fire. But there are two kinds of fire. The fire we use is a destroyer and consumer of all things, whereas the vital and health-giving fire of the body preserves, nourishes, makes grow, sustains, and gives sensation to all things. Since the sun makes things flower and bear fruit, it must be similar to the fire in living animals (*Nat. D.* 2.40–41[=*SVF* 1.504]). This fragment, after proving that the ruling principle of the cosmos consists of vital heat and is therefore a part of the substance that sustains the cosmos, goes on to say that because the sun's fire is similar to the fire in living things, the sun must itself be a living thing and other heavenly bodies similarly (*Nat. D.* 2.41).

This fragment almost fills the gap in the argument.[3] We now have some living animals that have been proven to be parts of the substance that sustains the cosmos. All we still need is proof that the sun and the heavenly bodies have sensation and reason. This is no small order and there are no more fragments under Cleanthes' name that can help us. But since Cicero has been so generous in helping us fill out the argument, we may still have hope that he will yield the rest.

Cicero gives us Cleanthes' proof that the sun is an animal in the context of a longer proof for the divinity of the heavenly bodies. However, he introduces the section by saying that "the heavenly bodies are rightly said to be living animals possessing sensation and intelligence" (*ea quoque rectissime et animantia esse et sentire atque intellegere dicantur*, *Nat. D.* 2.39); and even though the argument directly attributed to Cleanthes proves only that the heavenly bodies are alive, Cicero follows it up with other proofs that the heavenly bodies also possess sensation and reason. Proof that the heavenly bodies possess sensation and reason is precisely what is needed to fill out Cleanthes' argument. If Cicero's whole discussion of the heavenly bodies (*Nat. D.* 2.40–44) were inserted into the argument of *Nat. D.* 2.29–30, a perfectly reasonable proof would result. Is there any evidence that the whole discussion came from Cleanthes? Cicero treats it as a single, unified whole, with one proof that the heavenly bodies are living (*animantes*) and then two proofs that they possess sensation and intelligence. The first proof that the heavenly bodies have sensation and intelligence depends on the premise that they are born and live their lives in the *aether*. This proof, therefore, depends on Cleanthes' proof that the heavenly bodies are, in fact, alive. Moreover, this proof uses the notion that the heavenly bodies are nourished by moisture from land and sea (*Nat. D.* 2.43), a notion that Cleanthes had used in nearly the same words in his proof that the sun consists of vital heat (*Nat. D.* 2.40, cf. *SVF* 1.501). The intimate connection between Cleanthes' proof and the first proof that the heavenly bodies possess sensation and intelligence makes a single author likely, but does not completely exclude the possibility that a sympathetic author may have expanded Cleanthes' discussion.[4]

An even better indication of the provenience of *Nat. D.* 2.42–44 is the fact that its ideas and vocabulary run parallel to those of *Nat. D.* 2.30–32.[5] The author of the proof for the sensation and intelligence of the stars uses precisely the same premises that the author of *Nat. D.* 2.30–32 uses to prove that the cosmos possesses sensation and soul, and in the same order. First of all, according to *Nat. D.* 2.30–31 (*atque . . . ardore teneatur*) the purer, brighter, and more mobile the heat is, the more it will produce sensation in its possessor; and this is how we know the cosmos possesses sensation. The author who wishes to prove that celestial bodies possess sensation and intelligence assumes that the purer and more rarefied the atmosphere is, the keener will be the intelligence of its inhabitants. Consequently, the animals that inhabit the *aether*, the most rarefied and constantly moving element, will have the sharpest senses; and so the stars must possess sensation and intelligence (*Nat. D.* 2.42–43 [*cum igitur . . . extenuatis alantur*]).

Furthermore, *Nat. D.* 2.31–32 (*praesertim cum . . . esse mundi*) concludes that the cosmos has a soul from the fact that the heat of the cosmos is self-moved, since nothing is stronger than the cosmos to impart movement to the heat. Thus, since, as Plato says, self-movement resides only in the soul, the self-moved heat of the cosmos must be soul. The author who wishes to prove that the heavenly bodies possess sensation and intelligence asserts that the orderly movement of the stars is the best indication of their sensation and intelligence. According to Cicero's summary, rationality is deduced directly from the uniform movement of the stars. It is not impossible that the author actually did this, for Cicero presents two other passages in which the existence of mind is deduced directly from the order of the heavenly movements. In one, the order of the movements is an indication that the heavenly bodies themselves possess mind (*Nat. D.* 2.54–56); but the other, which is actually attributed to Cleanthes, uses the order of the heavenly movement to prove only the existence of mind somewhere, not necessarily in the heavenly bodies themselves (*Nat. D.* 2.15, cf. 13). In the passage we are investigating Cicero does not make clear whether the rationality that is evident from the order of the movement is in the stars themselves or in a transcendent mind, but rather he goes on to deduce from the order of the celestial movements that this movement is by free will (*sua sponte*) and in support adduces Aristotle's proof that the movement of the stars is neither by nature nor force, but voluntary (*voluntate*). At first sight to bring in the voluntary nature of the celestial movements seems gratuitous, but Cicero or the original author may have omitted a step in the argument. We know from elsewhere in Cicero's writings that the Stoics believed will (*voluntas, βούλησις*) to exist only in the wise (*sapiens*), and will is defined as "a reasonable desire" (*εὔλογος ὄρεξις*, *SVF* 3.173, 431, 432) or as "that which desires something with reason" (*quae quid cum ratione desiderat, Tusc. Disp.* 4.12[=*SVF* 3.438]). If the movement of the heavenly bodies is by free choice or will, the heavenly bodies must have reason and be wise. This is the kind of proof needed both in the context in which Cicero presents it and in the proof of *Nat. D.* 2.30 that the cosmos is wise; and the original form of the argument may well have included this idea, though Cicero does not make this clear. Therefore, the author of the proof that the stars are rational and sentient probably bases his proof on voluntary self-motion, the same basis that the argument of *Nat. D.* 2.30–32 uses to prove the cosmos is ensouled.[6]

Therefore it seems likely that if Cleanthes composed the argument of *Nat. D.* 2.23–32, he also composed the argument of *Nat. D.* 2.40–44 for use in his proof that the celestial heat possesses sensation and reason, and that *Nat. D.* 2.40–44 was originally designed to come between *Nat. D.* 2.29 (*dominatuque dignissimum*) and *Nat. D.* 2.30 (*Videmus autem*). Then we may understand the syllogism of *Nat. D.* 2.30 as follows: We see sensation and reason in parts of the cosmos (i.e., the celestial bodies just discussed); therefore, the substance in which the ruling principle (and the other stars) exists must also possess sensation and reason, and in a higher degree. The point of the whole argument, then, is that since the part of the cosmos that sustains and preserves it (i.e., the aetherial heat that contains the heavenly bodies) possesses sensation and reason, the cosmos as a whole must be an intelligent being.

One small incongruity remains. The argument of *Nat. D.* 2.23–32 seems to proceed more smoothly without 29–30, and this fact suggests 29–30 may be an insertion.[7] What is more, in its present order the argument that the cosmos is intelligent precedes the argument that it is ensouled and endowed with movement and sensation. Movement and sensation are lower in the scale of psychic activities than reason; and, furthermore, the argument for intelligence (*Nat. D.* 2.29–30, 40–44) presupposes the existence of sensation and movement in the cosmos, whereas the argument for sensation and movement (*Nat. D.* 2.30–32 [*atque etiam . . . esse mundum*]) does not presuppose the existence of intelligence. It is, therefore, tempting to conjecture that these two arguments were originally presented in the reverse order, and that Cleanthes followed the traditional hierarchic order of psychic functions, which is also found in Cicero's next argument: i.e., (1) sustenance and growth, (2) sensation and movement, (3) intelligence.[8]

1. Cf. K. Reinhardt, *Poseidonios* (Munich, 1921), 226–27; "Poseidonios," *RE* 22 (1953):700; M. van den Bruwaene, *La théologie de Cicéron* (Louvain, 1937), 88, note 2; F. Solmsen, "Cleanthes or Posidonius? The Basis of Stoic Physics," *MNAW*, n.r. 24 (1961):272, note 25. The evidence that the entire section *Nat. D.* 2.23–32 comes from Cleanthes is marshalled by Solmsen, 265–89; see above, Chapter 5, note 8.

2. Sextus Empiricus in *Math.* 9.75–122 presents Stoic arguments so similar to Cic. *Nat. D.* 2.16–44 that a common source is quite probable (cf. Reinhardt, "Poseidonios," *RE* 22 [1953]:697–98); but *Math.* 9.119–20, the parallel to Cic. *Nat. D.* 2.29–30, gives no clue to the missing elements, a fact which suggests that any omissions in the argument were made by Cicero's source and not by Cicero himself.

3. The fact that the gap in the argument of *Nat. D.* 2.29–30 can be filled so neatly with material specifically assigned to Cleanthes further confirms the theory that Cleanthes was, in fact, the author of the arguments of *Nat. D.* 23–32, as Solmsen (above, note 1) has attempted to show.

4. Thus Posidonius, the suggestion of K. Reinhardt, *Poseidonios*, 227–34; *Kosmos und Sympathie* (Munich, 1926), 61–92; "Poseidonios," 701, is still a possibility. It may be noted that Posidonius agreed with Cleanthes that the heavenly bodies feed on moisture from the sea (cf. *SVF* 1.501).

5. K. Reinhardt, *Poseidonios*, 227–33; "Poseidonios," 700–701, also discerns the same author in *Nat. D.* 2.40–44 as in *Nat. D.* 2.23–32, but he believes it is

Posidonius. The similarities can be seen best by arranging excerpts from the two pieces in parallel columns; the similarity in ideas which these excerpts reveal are discussed in the text.

Absurdum . . . mundum esse sine sensu qui . . . acerrimo et mobilissimo ardore teneatur (*Nat. D.* 2.31).	Quod animal in eo gignatur id et sensu acerrimo et mobilitate celerrima esse (*Nat. D.* 2.42).
Mundi ille fervor purior perlucidior mobiliorque multo ob easque causas aptior adsensus commovendos (*Nat. D.* 2.30).	Etenim licet videre acutiora ingenia et ad intellegendum aptiora eorum qui terras incolant eas in quibus aer sit purus ac tenuis (*Nat. D.* 2.42).
Esse autem divinius quod ipsum ex se sua sponte moveatur (*Nat. D.* 2.32).	Sequitur ergo ut ipsa [scil. sidera] sua sponte suo sensu ac divinitate moveantur (*Nat. D.* 2.43).
Is ardor . . . sua sponte moveatur (*Nat. D.* 2.31, 32). Cf. quod est calidum et igneum cietur et agitur motu suo (*Nat. D.* 2.23).	Cf. restat igitur ut motus astrorum sit voluntarius (*Nat. D.* 2.44).
Nam quid potest esse mundo valentius, quod pellat atque moveat calorem eum quo ille teneatur? (*Nat. D.* 2.31).	Nec vero dici potest vi quadam maiore fieri ut contra naturam astra moveantur; quae enim potest maior esse? (*Nat. D.* 2.44).

We should also note that the statement of *Nat. D.* 2.42 that the stars ought to be reckoned among the gods is explicitly attributed to Cleanthes in *Nat. D.* 1.37, but this idea is too commonplace to be significant.

6. The parallel in Sext. Emp. *Math.* 1.111–14 (=*SVF* 2.1016) bears this out. In Sextus the possibilities of necessity (or vortex), nature, and choice are lined up. Necessity is eliminated on the basis of the order of heavenly movements; and nonperceptive nature (*φύσις ἀφάνταστος*) on the basis of its inferiority. The conclusion is that the heavens possess an intelligent (*νοερά*) nature. However, Sextus, like Cicero, does not elaborate on the logic that leads from choice to intelligence, but regards this step as self-evident. This step was probably absent from the common source of Cicero and Sextus, and it is possible that it was not explicit even in the original author.

7. See above, note 1.

8. Cic. *Nat. D.* 2.33–34. See also the discussion of psychic functions in Chapter 5, above.

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This new understanding of Stoic cosmology in its historical perspective sheds new light on the role of Stoicism in Greek intellectual history. It indicates that the Stoics, like their contemporaries the Epicureans, were striving to achieve a unified science based on a single set of elementary principles. Biology and cosmology, for example, were not seen as governed by separate sets of axioms and were not explained on the basis of discrete bodies of theory, but were understood in terms of the same coherent principles as integral components of a unified world view. In contrast with Aristotle, who laid the foundations for the present-day atomization of knowledge into ever more diverse and specialized fields and disciplines, the Stoics synthesized not only disparate theories from different sciences, but disparate theories within a single science, to produce, in a century of almost unparalleled vitality and growth, a totally new philosophy that was to have a signal and enduring effect on all that followed and that cannot be explained by the simplistic formulas heretofore employed.

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