INTRODUCTION

The Intersection of Biology and Cosmology in Ancient Philosophy

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Ancient philosophers believed that biology and cosmology are two sciences that intersect one another insofar as biological concepts explain crucial features of the cosmos and, conversely, cosmological concepts account for important biological properties and events. ‘Cosmobiology’ is the term that I shall use to refer to this view. The aim of this introduction is to present some central cosmobiological theses in antiquity, to describe how the present volume is organised, and to offer a brief overview of the chapters.

The single most notorious expression of ancient cosmobiology is the idea, first fully developed by Plato, of a cosmic soul. The cosmos as a whole – understood as the ordered system composed of the Earth, the planets, the sun and the so-called fixed stars – is a single living animate being, comparable in many fundamental respects to an animal and, especially, to an intelligent animal, i.e. a living being that is capable of thinking and of displaying the characteristic motions unique to intelligent beings. In one of the strongest versions of this idea, the Stoic one, the different species of living beings constitute the organic parts of the cosmos in the sense that they have a specific function within the whole in much the same way as the different parts of an ordinary animal (its fins or its eyes, for instance) have a specific function in the life and the behaviour of the animal as a whole.1 Cosmobiology, however, is not limited to the idea of a cosmic soul. The thesis that defines it – that biology and cosmology intersect one another – is very broad and does not necessarily imply the concept of a cosmic soul. In fact, some ancient philosophers accepted the thesis but rejected the concept. One case in point, as we shall see, is Aristotle. Moreover, philosophers who did accept the concept, often treat

1 As is noted in Sedley 2016, the notion of organisms whose functional parts are also organisms, or ‘superorganisms’, is already present in Empedocles though not specifically applied to the cosmos as a whole as in Plato and the Stoics.
cosmobiological issues that are independent from it. One example is the
discussion of ‘recapitulation’ in Plato and Plotinus, i.e. of whether the
generation of individual living beings reproduces in small scale the gener-
ation, or logical design, of their species as distinct from other species in
the cosmic order. The chapters collected in this volume address ancient
cosmobiology in all its generality, including the concept of cosmic soul but
other cosmobiological themes as well.

Nowadays, ancient cosmobiology is frequently deemed the forerunner
of influential ideas in the philosophy of science and in metaphysics.
Modern panpsychism, for instance, is the view that at least some mental
powers are fundamental and ubiquitous in the cosmos. One particular
variety of modern panpsychism, cosmopsychism, may be singled out for
attention. Cosmopsychism is the combination of two metaphysical views:
*priority monism*, according to which all things ultimately exist and have
the powers they actually possess in virtue of certain facts about the cosmos
as a whole, and *constitutive panpsychism*, according to which facts about
the mental powers of animals are constituted by facts about the mental
powers of more fundamental entities. It follows from the combination of
these two views that all facts about the mental powers of animals are
constituted by facts about the mental powers of the cosmos as a whole.

Although modern cosmopsychists are not necessarily committed to the
ancient cosmobiological thesis that the cosmos is a single agent and the
subject of complex mental activities such as thought – ‘it could be that
the consciousness of the universe is a gigantic mess that doesn’t add up to
anything coherent enough to ground cognition’ – the general idea that
the cosmos as a whole possesses mental powers is no doubt present
in cosmopsychism.

In the field of philosophy of science, a theory that claims to be indebted
to ancient cosmobiology is the Gaia Hypothesis by James Lovelock and
Lynn Margulis. This theory, opposed to the conception that life on Earth
exists only because the material conditions needed for its survival happen
by chance to be adequate, argues that the set of all living beings, or ‘biota’,
define and secure the endurance of these material conditions. One example

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*See Russell 1927 and also Eddington 1928. For a recent collection on Russelian monism see Alter-Nagasuma 2015. See Nagel 1979 and, more recently, Nagel 2012: 35–70.*

*For cosmopsychism see Mathews 2011, Jaskolla & Buck 2012, Shani 2015, Nagasawa & Wager 2016 and the collection of essays Brüntrup-Jäckola 2017. See also Chapter 15 of this volume.*

*Goff-Seagar-Hermanson 2017.*

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given by the proponents of the Gaia Hypothesis is that of atmospheric temperature: although the energy provided by the sun has steadily increased since life began on Earth, the Earth atmospheric temperature has remained within the levels needed for the continued existence of life, and this regulation was supposedly achieved by the co-operative work of all biota through the performance of certain control functions, which vary from one species to the other. A similar explanation is given of the stability of oceanic salinity, of the overall amount of oxygen in the atmosphere, of the acidity of the soil, which are all crucial conditions for life. The idea that all living organisms work cooperatively to achieve the survival at the level of species has led Gaia theorists to claim that the biosphere is itself a large single living organism. In the face of several scientific criticisms, the Gaia Hypothesis has evolved in many respects since it was first formulated, and has become an increasingly complex and sophisticated theory that cannot be adequately described in this introduction. But the basic idea that all living beings taken together constitute a single living organism is obviously something that may be traced back, at least in general terms, to antiquity.

Leaving aside the question of whether all, or even some, of these modern ideas are present in detail in ancient cosmobiology – an issue that is not addressed systematically in this volume – the key philosophical themes discussed in the present volume may be divided as follows. (a) Why would the cosmos have a soul of its own? What is the analogy, if any, between the psychic powers of the living beings and those of the cosmos? (b) Although biology and cosmology depend on one another by the use of biological concepts in cosmology and of cosmological concepts in biology, is either of these two disciplines more basic than the other or are they at exactly the same explanatory level? (c) What is the teleological relation between living things and the cosmos as a whole? In particular: do the former serve a higher cosmological purpose or is the cosmos teleologically ordered for their sake? What is the place of human beings within this complex structure? (d) If the cosmos is an animate intelligent being, what is the nature of its thoughts and actions? How do these relate to our own thoughts and actions? And do they pose a threat to our autonomy as subjects and agents? (e) What is the place of zoogony in cosmogony? No account of the generation of the cosmos could be complete without an account of the origin of living species, but how exactly do these evolve

6 See for instance Tyrrell 2013.
7 Chapter 15 discusses in detail modern panpsychism in connection with Plotinus.
from lower species or, in the case of non-evolutionary theories, how does their design involve features of lower species?

Despite their importance, most of these themes are still under-investigated in scholarship on ancient philosophy, and the sixteen essays that compose this volume will help to set the ground for the discussion of the issues. The chapters are divided by ancient authors ranging from key Preplatonic thinkers to Plato himself and the Middleplatonists (Chapters 1–5), and from Aristotle (Chapters 6 and 7) to the Stoics (Chapters 9–12) and to later Platonists (Chapters 13 and 14) and their reception in Avicenna (Chapter 15). Chapter 8 pursues the theme of biological recapitulation across the history of ancient philosophy, from early Preplatonic to late Platonic philosophy.

In most ancient Greek philosophies, ‘soul’ (ψυχή) is the principle of life. Any living being has a soul in virtue of which it is a living being as opposed to a non-living one. Thus even plants, insofar as they are living, have a soul. Higher mental capacities such as intellection or cognition, in the form in which they exist in human beings, are also accounted for by the possession of soul. Its explanatory connection to life and mental capacities is what defines soul. This accounts for why ancient conceptions of the cosmos as a living being need to postulate a cosmic soul. The cosmos is supposed to have a soul of its own, distinct from the soul of the individual living beings that inhabit the cosmos, that explains why it is in itself a living intelligent being. This idea began to occupy a prominent place in ancient cosmobiology with Plato. But it is commonly assumed that it is an idea that Plato largely inherited from earlier thinkers, who should be regarded, therefore, as the first Greek cosmobiologists. The actual evidence for this, however, is extremely weak as is demonstrated by André Laks in Chapter 1 ‘Souls and Cosmos before Plato: Five Short Doxographical Studies’ in connection with Thales, Anaximenes, Heraclitus, Pythagoras and Alcmeon. As is argued by Laks, the attribution to these authors of the concept of a cosmic soul is to a large extent the result of a Platonising and Stoicising exegesis.

Chapter 2, ‘The Ensouled Cosmos in Plato’s Timaeus: Biological Science as a Guide to Cosmology?’ by Barbara Sattler, addresses the concept of cosmic soul in this central cosmobiological text, and explains

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8 The only notorious exception to this view is Stoicism, see below. The issue is addressed in connection with Plato in Carpenter 2010. Which powers, exactly, are involved in the possession of life is still a matter of dispute in modern science and philosophy of science. See Tirard-Morange-Lazcano 2010 discussed by Sattler in this volume.
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how this concept is essentially biological and, in more general terms, how Platonic cosmobiology is indeed a part of biology. The Platonic cosmic soul resides in what Plato, followed by the Platonic tradition, postulates as the outermost sphere of the cosmos, the sphere that constitutes the surface of the cosmic body. The cosmic body is the focus of Dimitri El Murr in Chapter 3, ‘Platonic “Desmology” and the Body of the World Animal (Tim. 30c–34a)’. The cosmic body is the subject of Timaeus 30c–34a. One of the main arguments in this difficult passage seeks to demonstrate that the physical cohesion of the whole cosmos is effected by the divine Demiurge through the action of four, and only four, basic elements or ‘bonds’ (δεσμοί): fire, air, water and earth. El Murr analyses this passage thoroughly and evinces its close connection to the philosophical project outlined by Plato in Phaedo 99b-c. The transmission of the Platonic concept of cosmic soul in the Academy is extremely complex. In Chapter 4, ‘The World Soul Takes Command: The Doctrine of the World Soul in the Epinomis of Philip of Opus and in the Academy of Polemon’, John Dillon explores the reception of this concept in the Old Academy by exploring its development from the late Plato of Laws X to Polemon, the last Head of the Old Academy and a crucial link in the transmission of Platonic cosmology to the Stoics and to later Platonism. In fact, cosmobiology and the concept of a cosmic soul are particularly prominent in Middle Platonism. Thus in Chapter 5, ‘Begotten and Made: Creation as Cosmogony in Middle Platonism’, George Boys-Stones brings out that according to key Middle Platonists the cosmos is indeed a living (and therefore ensouled) being, whose creation is explained in biological terms and whose soul is responsible for its biological functions.

Chapter 6, ‘The De Motu Animalium on the Movement of the Heavens’ by John M. Cooper, also explores Aristotle’s criticism to the Platonic idea of cosmic soul. Cooper, however, concentrates on the De Motu Animalium and how Aristotle’s reflection of animal locomotion led to him to posit in chapters 6–10 of Metaphysics, Book Lambda, a soul for each of the moved heavenly bodies, one that thinks the unmoved mover that it desires through a form of rational desire. Thus, Aristotle departs sharply from Plato and the subsequent Platonic, Stoic and Neoplatonic traditions, according to whom celestial motion is not be explained by individual souls in each of the celestial bodies, but by a single cosmic soul. Thus these two chapters complement each other well. The former presents a negative argument that proves indirectly that the cosmic prime mover cannot be a soul. The latter, by contrast, discusses the positive argument that even though the prime mover of the cosmos is not itself a soul, each of the
heavenly bodies must possess a soul by which they desire the primer mover. Chapter 7, ‘Biology and Cosmology in Aristotle’ by James G. Lennox, is devoted to the strong interrelation between biology and cosmology in the actual practice of these two disciplines according to Aristotle. As Lennox demonstrates, there are substantive borrowings in both directions that evince how much each of them relies on facts established by the other. Before turning to the Stoics, one last chapter deals with a cosmobiological theme running through the whole of ancient science, but especially important in Plato and Aristotle. In Chapter 8, ‘Recapitulation Theory and Transcendental Morphology in Antiquity’, James Wilberding addresses the question of whether modern recapitulation theory and transcendental morphology may be traced back, at least in general terms, to ancient philosophers and scientists. The key idea in recapitulation is that ontogeny morphologically reproduces phylogeny: the morphology of an embryo must correspond to the morphology of the animal at some point in the evolution of its species or, in the case of non-evolutionary theories, at some lower level in the scale of nature. The answer given by Wilberding to the question of whether recapitulation theories, either evolutionary or non-evolutionary, may be found in antiquity is largely negative.

The Stoics, following Plato, maintain that the cosmos has psychic powers and, therefore, a soul. Chapters 9 and 10 concentrate on one particular mental power that they attribute to the cosmos: rationality or intellection. Chapter 9, ‘The Stoics’ Empiricist Model of Divine Thought’ by George Boys-Stones, examines the nature of Stoic divine intellection which is, in some respects, analogous to cosmic intellection. An empiricist explanation of divine intellection in terms of concept-acquisition faces two basic challenges: god does not have sense-organs and, even if he did, there is no appropriate object of empirical experience for him to have. Boys-Stones offers a detailed discussion of these two challenges in the case of god and argues that they can be adequately met if we look closely at the (2) Stoic theory of perception and, in particular, Hierocles’ discussion of animal self-perception. Chapter 10, ‘Why Is the Cosmos Intelligent? (2) Stoic Cosmology and Plato, *Timaeus* 30a2–c1’, offers a reconstruction of one of the arguments given by the Stoics to prove that the cosmos is an intelligent being, and explores its connection to the influential Platonic proof at *Tim*. 30a2–c1. Chapter 11, ‘Cardiology and Cosmology in Post-Chrysippian Stoicism’ by Emmanuele Vimercati, concentrates on another feature of Stoic cosmobiology: the use by post-Chrysippian Stoics of *physiological* concepts to describe the structure of the cosmos. Some Roman Stoics – especially Seneca and Manilius – argued that cosmic
breath pervades the cosmos in the same way as the blood pumped by the heart circulates throughout animals. This cardiological conception of cosmic breath has important antecedents in earlier post-Chrysippean Stoics, especially in Diogenes of Babylon and Posidonius, in whom Vimercati points out an Aristotelian influence that may have played a significant role in the development of post-Chrysippean cosmobiology. In Chapter 12, ‘The Agency of the World’, the last of the chapters in this volume devoted to Stoicism, Katja Vogt tackles the general philosophical question of how the Stoics account for the totality of movement in the cosmos. Although the cosmos is a single unified whole, it is inhabited by an extremely large number of different entities that often seem to conflict and compete with one another. So is the totality of the movement in the cosmos the mere sum of the movements of all these entities or is it, rather, a complex action performed by a single entity, the active principle of the cosmos? Vogt does not aim at presenting how the Stoics solve this problem but at clarifying its nature. She does so by comparing it, and carefully distinguishing it from, the modern problem of free will and determinism.

The last three chapters of the volume – Chapter 13, ‘God and the Material World: Biology and Cosmology in Galen’s Physiology’ by R. J. Hankinson; Chapter 14, ‘At the Intersection of Cosmology and Biology: Plotinus on Nature’ by Lloyd P. Gerson; and Chapter 15, ‘Is the Heaven an Animal? Avicenna’s Celestial Psychology between Cosmology and Biology’ by Tommaso Alpina – address late cosmobiological theories in the ancient Greek philosophical tradition: Chapter 13 explores the teleological biology of Galen in his treatise The Functionality of Parts and its relation to cosmic teleology; Chapter 14 studies Plotinus’ conception of nature as the lowest part of the cosmic soul and the extent to which this conception led him to adopt panpsychism, the view that beings other than ordinary living beings may have mental powers and, in particular, intellection or cognition; and Chapter 15 takes up an issue already addressed in Chapter 6, the attribution of soul to heavenly bodies in Aristotle, and explores its reception and development in Avicenna’s cosmology.