

Astronomy & Cosmology

Katheryn Wilson, Pennsylvania

Hipparchus and the Scientific Values of the Hellenistic Period

It is a cruel happenstance of history that the only surviving work of Hipparchus of Nicaea, the greatly skilled astronomer, is his commentary on the *Phainomena* of Aratus. This commentary does not adequately demonstrate the brilliance of the man who discovered the precession of the equinoxes, although it has proved useful for understanding the *Phainomena*. It can help us understand its author as well, however, by providing insight into Hipparchus' stance on contemporary scientific values. This paper will explore how Hipparchus' commentary reflects existing attitudes about three important issues in the study of ancient science: the role of poetic sources, the level of precision, and, most importantly, the tension between innovation and respect for tradition. Hipparchus' claims for himself, his attempts to distinguish himself from his rival Attalus of Rhodes, and his treatment of Aratus illuminate the state of these issues in the Hellenistic period.

Scholars have typically read Hipparchus as disdainful of his source text, because it is in verse, and have attempted to excise poetic works from the tradition of scientific texts (Tueller and MacFarlane 2009). Hipparchus does claim that Aratus is given undue authority because of the 'χάρις' of his work (Hipparch.1.1.7), but his treatment of the poem shows that he does not treat it differently from any other astronomical text because of its format. For example, he frequently critiques Aratus' lack of precision in locating constellations, errors that modern scholars typically ascribe to poetic license, but which Hipparchus will not excuse (Kidd, Pendergraft 1982). He contemptuously quotes Attalus' literary comments on the poem, but this is to distance himself from his rival, and to clarify his own interest in the *Phainomena*. For Hipparchus, the poem has a place in scientific inquiry; his valuation of it rests entirely on its content and not its aesthetic qualities.

Hipparchus particularly criticizes Aratus' mistaken trust in Eudoxus, the same charge he levels at Attalus (with respect to Aratus). These critiques reflect his feelings about the relative value of tradition and personal observation. In a programmatic passage, he claims to depend entirely on personal autopsy to the exclusion of reliance on older texts, quoting Attalus' methodology of balancing between his own observations and trusting the poem. Despite Hipparchus' strong assertions to the contrary, the quotation shows that the issue was very much in debate at the time, and although our modern sensibilities favor Hipparchus' approach, Attalus' was probably much more pervasive. Although the commentary does not help us to understand any of the impressive breakthroughs in astronomy that Hipparchus made, it can help us understand the scientific values that he used in making those discoveries.

Dr Muhammad Reza Ghafoorian Research fellow of SPER, Amirkabir University On the role of astronomy in construction of theological views of the Muslim philosophers

The earth, the heavens and its stars and planets, and the relation between them, were taken to be the important signs of God's knowledge by Muslims, representing the magnificence of his creative powers. In this vein, peripatetic philosophers, who believed in Ptolemaic geocentric view, and added elements from Aristotelian and neo-Platonic views into their thought, took God to be "the necessary being" and "the prime mover". Then, following the scheme inspired by Plotinus (taken to be Aristotle by the peripatetic followers!), they put "the first emanated" or "the first effect" in the first plane after God. The first effect had been called equivalently "the Nous" or the "first intellect" in this tradition. The Nous had caused three effects in its turn: the second intellect, and the psyche and the corpse of "the outermost sphere" or "the crystal sphere". This chain went down to the sphere of the moon. Peripatetic philosophers followed Ptolemy's *Almagest* in assuming that there were nine spheres implemented in the universe, and as every sphere was imagined to be made by its pertinent intellect, they came to the conclusion that there are 9 intellects working together in creation of the heavenly world. They also believed in existence of a 10th intellect in the sublunary domain, in which the four elements and the three compounds dwell. As a conclusion to this talk, I show that the peripatetic philosophers appealed to the intellects in their philosophy to explain the perfect and permanent circular motions of the planets, who desired to imitate the perfection of the intellects. At the end, we will show that the peripatetic theory of Nous, and the relevant plan of the universe was not base on astronomy, because the existence of the Nous and intellects is demonstrated by applying the neo-platonic rule of "the emanation of One", not by appealing to the empirical facts.

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Dr. Elizabeth Hamm, St. Mary's College California
Ptolemaic Astronomy and Analogies of the Universe

In the *Planetary Hypotheses* the second-century A.D. astronomer, Claudius Ptolemy invoked analogies to describe celestial motion. He stated that his text was written for both astronomers and instrument-makers, but the lack of mechanical details describing the device to built, coupled with descriptions of the stars possessing animate powers, makes it difficult to determine what this device would have looked like and how it could have operated. In this paper I will examine Ptolemy's analogies of the heavens, with an aim to reconcile the rift between explanations relying on mechanisms with those using animism. What will emerge is a clearer understanding of the type of device Ptolemy wanted the instrument-maker to construct.

Rebecca Taylor: University of Warwick
Micro-/macro-cosm and "Macranthropic" Theories in the Fifth and Fourth Centuries BC

The theory that humanity was originally a product of the earth goes back to early mythological stories present in Hesiod and Homer and persists through the Presocratic philosophers. In fifth and fourth century BC thought, for example in the Hippocratic Corpus and in the works of Aristotle, humanity was composed of similar, if not identical, elements to those which made up the natural world. This paper hopes to show how early ideas concerning the links between man and the natural environment persist in philosophical and medical theories about the nature of the human body and its relation to the natural environment. The theory that man was originally born of the earth and, therefore, shared the same elements present in the natural environment, has a strong link to the idea that the human body reflected the universe or the natural environment in which a person lived. A human body not only resembled the universe in appearance but it also worked in very much the same way in these micro-/macro-cosmic theories. Indeed, in some works, it is possible to see "macranthropic" theories where the universe is compared to the nature of man in order to explain how certain natural events occur. Building on the work of Geoffrey Lloyd and Frédéric LeBlay, this paper hopes to offer a new insight into how the universe may have been considered a living organism in the thought of the fifth and fourth centuries BC and will explore what impact this has on our understanding of the micro-/macro-cosm theories applied to the nature of man.

International Ancient Science & Later Plato.

Dong Qiaosheng Faculty of Classics & Needham Research Institute, Cambridge
Asexual Generation in Ancient Greece and Early China

This paper explores the different understandings of ancient Greeks and Chinese on asexual generation in humans and animals, including miraculous births, wind transformation and spontaneous generation, etc. It argues that the Chinese understandings have more political concerns. Besides the absence of "nature", the absence of "teleology" also have great influences on the Chinese worldviews.

Prof. Mostafa Younesie, Tehran
Alexander in Classical textual Iranian History of Knowledge:A Disguise Blessing?

As a rule, "history of knowledge [science]" is usually a perplexing and at the same time interesting subject for speculation and research. And if there be a "comparative initiative" among different cultures and civilization it becomes more fascinating. But when the history of sciences concentrates on "humanities" an issue which at first sight seems as a shared common issue for all humans of different cultures, it becomes more salient and thought-provoking. And if it be a topic not explored and examined in relation to a specific culture it becomes more. With regard to these two interrelated remarks, here through classical Iranian pertinent texts such as Denkard; the Greater Bundahisn; Arda viraz Namag; Sahrestanha Eran; Letter of Tansar; and Den- Vjirgard the Iranian somehow fragmented and scattered narration of the ancient history of sciences will be explored and represented. The scope of this research is from the beginning up to advent of Islam in Iran therefore it covers the pre-Islam Iran on the whole. Besides, the related narration is arranged according to the some turning points.

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Daniele Labriola, St. Andrews

On the Hierarchy of the Philosophical Sciences in Plato's *Philebus*

My essay is generally concerned with the depiction of philosophy in Plato's *Philebus*. In particular, it analyses how the dialogue distinguishes philosophy. In the *Philebus* a hierarchy of sciences, reminiscent of the one outlined in the middle books of the *Republic*, is alluded to toward the end of the dialogue. The science of dialectic, that is the science of Forms as such, is found at the top of this hierarchy. Hence, the *Philebus* shows us that Plato continues to regard a certain supra-mathematical science called 'dialectic' as the theoretical pinnacle of the philosophical life.

Dr. Christopher Buckels

Triangles and Tropes in the *Timaeus*

Plato introduces a tripartite ontology in the *Timaeus*: Being, Becoming, and the Receptacle. The first is the domain of the Forms, and things from the second come to be in the third, which provides space to them. But what exactly are these things that take up space? In his second account of the generation of the cosmos, *Timaeus* identifies the traditional elements with several of the Platonic solids which, he argues, compose all sensible things. It is commonly thought, therefore, that the most basic items of Becoming are the triangles that compose the Platonic solids. I will argue, however, that these triangles are images of Forms and are, thus, composed of particular property-instances: tropes. Triangles and the things that they compose belong in the category of Becoming, but only derivatively, since they are composed of the tropes that are actually the most basic items that come to be.

Plato's *Meno*

Naoya Iwata, Cambridge

Plato on the Geometrical Hypothesis in the *Meno*

My paper examines the second geometrical problem in *Meno* 86e4-87b2. Its purpose is not to offer an alternative interpretation on the problem but to explore the implication of Cook Wilson's interpretation, which has been most accepted by scholars, from a different perspective in relation to the nature of hypothesis. The paper argues that (a) the geometrical hypothesis in question is a tentative answer to a more essential problem which cannot be solved by available methods at that time, and that (b) despite such temporary and intuitive choice of the hypothesis in the end, there is a rational process for positing that hypothesis based on the method of analysis. Time permitting, I hope to contain discussions about other relevant important techniques in Greek mathematics: problem reduction and a diorism, which have often been ambiguously explained in relation to the method of analysis.

Hugh MacKenzie, UCL

Platonic Mathematics as Naturally Arising from Thinking about Matter.

This paper proposes that Plato's mathematical entities fleetingly arise from the phenomenon of mind (*nous*) using the concrete cosmos. The Sophist dialogue proposes such mental use as a first metaphysical principle. Divine or human *nous* spontaneously these instrumental entities in order to journey constructively between contemplation of the intelligible and awareness of the unintelligible, and vice versa.

I discuss two complimentary depictions of numbers as instruments. Firstly they arise from the last stage of the *divine* mind's creative application of forms, and secondly from the first stage of the *human* mind's intuition of forms. In support of each of these respective emphases I offer one piece of hardly discussed Platonic argument: (i) *In terms of divine maths, a cosmological argument, from the Timaeus and Philebus*: Divine mind uses numbers (as well as Forms), in its crafting of physical things from the unintelligible, primeval space; (ii) *In terms of human maths an epistemological argument, from the Meno and Republic*: Human minds discern mathematical realities by an immediate, instinctual intuition, through practical engagement with sensed objects (in order to be able to contemplate the Forms). It unpacks divine craft.

Both pieces of evidence show mind using numbers to enable the mental journey between contemplating the intelligible Forms and unintelligible sensation. This mathematical mediation is necessary (i) for the demiurge to set optimum limits upon the primeval Unlimited and thus to form physical objects, and (ii) for Man to grasp the resultant One-Many tension that is present in human linguistic description of physical objects. Man thus instinctively emulates the demiurge, which is a "good" thing to do. Numbers for Plato are transitional instruments naturally arising from the initial stage of mind's encounter with matter.

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Dr. Joachim Aufderheide, KCL.

Dreaming and waking up in Plato

Everybody knows that Meno's slave acquires a true belief through talking to Socrates. Scholars debate how exactly 'repeatedly ask[ing] these same questions in various ways' would help the slave to achieve knowledge that is 'as accurate as anyone's', and how this is supposed to help with understanding recollection. What has escaped scholarly attention is to ask what it means that 'the beliefs are stirred up for him like a dream.' In this paper I explore a) to what extent the slave is similar to the dreamers familiar from Rep. V: the sight lovers; b) why the slave, but not sight lovers, is able to wake up; and c) whether Socrates' discussion with the slave can serve as an exemplar for waking up dreamers (who are, after all, frequently).

Science in Homer and Hesiod.

Saffi Grey, Warwick

Homer'S *Odyssey*: Astronomical Textbook?

For the ancients, as with us before the 19th century, the great expanse of the sky was once the source of a fundamental social tool – the source of time keeping, calendar making, and the intimate union between man and the cyclical laws of nature. Astronomy, from its most mundane to its most sophisticated, was both the foundation and the edifice of social, civic, and religious life. Astronomy gave early peoples both municipal and agricultural calendars, as well as a sacred avenue to the will of the gods. Astronomy was key. In many early cultures oral myths were similarly essential for the preservation of history, culture, and wisdom. Only the most important details would be worthy of transmission through great stories that passed through centuries and ancestors until they were finally preserved on papyrus. These oral myths communicated the beliefs and the knowledge of the cultures before them. And what knowledge could be more important than when to plough, reap and sail, how to govern society, and how to communicate with the gods? As one of the earliest pieces of Western literature, we should expect to find this information scattered throughout the *Odyssey*, a text Alexander Pope knew as Homer's *Allegory*. The likes of Heraclitus, Strabo, and even Gilbert Murray believed there was more to the adventures of Odysseus than it first seems, that they were meant to *teach*. Examination with an astronomical eye shows that the *Odyssey* contains both calendrical mathematics, and celestial details outlining the names, colours, and patterns of the stars. This paper argues that the *Odyssey* was composed in order to preserve astronomical details in a memorable and recognisable tale. So that the bard could both trace his wondrous plot through the night sky, while teaching those that listened the celestial knowledge which so governed their lives.

Emilie-Jade Poliquin, Laval et Toulouse II.

Stargazing with the Ancients: A Celestial Journey between Science and Poetry

The stars have always fascinated mankind. Throughout history, artists draw, sculpted, painted or forged the night sky ; poets sang its beauty and philosophers tried to discover its laws and principles. In this quest, arts, literature and science are not as opposed as they are today, but seek the same goal : to grasp the intangible. Also, one must not forget that basic astronomy is largely a product of human imagination : the constellations for example are more or less random groups of stars scattered in the sky. Ancient astronomers gave them names and shapes ; artists and poets magnified their legends. But when Latin authors like Hyginus, Germanicus, Avenius, Manilius and Martianus Capella wrote about specific stars, were they more influenced by poets like Aratos or "scientists" like Eratosthenes ? Is there a part of science in their work? In this paper, we intend to study how writers of ancient astronomical texts depict the sky and the constellations, focusing mainly on description of star magnitudes.

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Yukiko Saito, Liverpool & Kyoto Seika University

What is *phoinix*?: a study on the transformation of colour in translating myth

What is *phoinix*? Red? Dark red? Or, just shades? Based on my primary interest in colour, and my on-going research project on how colour-sense has been perceived or progressed in antiquity, in this paper, I focus on bright shades, mainly *phoinix*, attempting to provide a new angle for re-reading Greek poetry, shedding light on the role of colour, especially in the Homeric epics, with the discovery of colour's metaphorical function(s) and its social role. Searching for every instance of *phoinix*, I examine its context to explore how the poet employs *phoinix* to develop the course of action, including definition of characters. My questions are: How are those appearances of *phoinix* composed and interconnected? How do they metaphorically affect their contexts? What do they symbolise during the story? Through this examination, I show that *phoinix*, ranging from negative darker red to positive brighter red, is appropriately selected for each context as a significant indicator, and plays an important role in brightening and darkening contexts, efficiently and picturesquely. I also plan to integrate my investigation with my previous research that examined other colour terms and propose my point of view on *phoinix*, whereby the inter-related associations of *phoinix* with other colours can be deduced. Then, part of the Greek, Homeric bright colour world will be illustrated. Colour has a mysterious potential power to affect the mind. This investigation, therefore, which intends to pursue the ancients' perception of their world, leads to interdisciplinary contribution to multicultural understanding of even our modern thought.

Tuesday:

Aristotle and Explanation.

Julie Journeau, Lille

Ethics and Medicine in Aristotle

Except a papyrus (*ex Aristotelis Iatricis Memomiis et aliis Medicis eclogae*), there is no Aristotelian treatise about medicine. But, in *Nicomachean Ethics*, Aristotle explains the scientific status of ethics by comparisons between ethics and medicine. This connection between medicine and ethics is interesting from two points of view: first, such a comparison can throw some light on Aristotelian conception of medicine and second, it can help us to understand the scientific character of ethics.

The achieved character of Hippocratic medicine justifies Aristotle's use of medicine to stabilize and to define the peculiar scientificity of ethics. In fact, Aristotle is aware of the problems raised by his conception of ethics as a science: firstly, ethics bear upon actions which are contingent objects; secondly, ethics are not an exact knowledge and thirdly, ethics do not provide a moral principle or a principle to rely on to make a decision. The connections between medicine and ethics have been studied in two papers: one of Jaeger and the other of Lloyd. Jaeger has a very historical approach replacing Aristotle's comparison in relation to Plato's and Lloyd draws the conclusion of a kind of assimilation of ethics with medicine. I will defend the position that there is not an unitary comparison between medicine and ethics, but a plurality of comparisons. Thus, in this paper, I will first clarify the different terms of those comparisons in order to show what each comparison explains about ethics. We can distinguish some comparisons which involve supreme good and health, others which involve physicians and judges and others which involve the contingent character of the studied object. This clarification of those different comparisons will be the basis of an attempt to precise how Aristotle can stabilize the scientific nature of ethics by relying on the scientific basis of medicine.

Prof. Barbara Sattler, St. Andrews.

Making Motion intelligible – from the motions of the heavenly bodies to the motion of earthly objects

The scientific investigation of motion in Ancient Greece starts as astronomy, as the investigation of the motions of heavenly bodies. It is only with Aristotle that we get a general investigation also of the motions of earthly objects, in Aristotle's *Physics*. My talk will explore some reasons for this development by focusing on the question how the notion of the body (*soma*) performing the motions inquired changed. Body is originally understood in some connection to soul, and it is only with the atomist that this link is not central any longer. Rather, the basic bodies, the atoms, are seen in contrast to the void, which separates bodies from each other and allows for their motions. As the basic motion is the same for all atoms, it seems that the

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atomists lay the ground for a possible physics. However, the atomic motions are completely chaotic and thus not a possible object of scientific investigation. Plato takes up the completely chaotic motions of the atoms for his account of the motions of the elements in his *Timaeus*. Because of their complete lack of any regularity, these motions are not a possible object of science. What can, however, be scientifically investigated are the heavenly bodies and their regular motions. But the regularity of their motion is due to the regular motions of the world soul. It is only ensouled bodies that can perform regular motions, and it is only regular motions that can be measured and hence be an object of scientific study. For Aristotle the motions of the heavenly bodies keep a special status, but they are no longer the only ones that can be measured and rendered intelligible. This is due to two important changes vis-à-vis Plato: (a) the paradigm body of natural philosophy is no longer the ensouled body, but the natural body, which includes the four elements; and (b) Aristotle binds time and space closer to the bodies (e.g. by understanding *topos* as the first unmoved body that is surrounding), without, however, focusing on the individual body. The first change allows Aristotle to see the two kinds of natural motion so differently characterized in Plato - the motions of the elements and the motions of the heavenly bodies - under one heading. The second change allows him to treat all bodies alike in such a way that they can be determined by time and space (which is not possible for Plato). But Aristotle not only binds time and space closer to bodies, he also binds certain kinds of motion closer to certain kinds of bodies and shows how we can understand these different kinds of motion. What seems to be adversary for the development of physics – from physics we normally expect a set of rules that hold for *all* bodies – turns out to be the way in which the motions of all bodies were made intelligible: by giving different rules for different motions.

Dr. Tim Crowley, University College, Dublin
The Matter of the Elements

At *De Gen. et Cor.* II.1 Aristotle says that there is some matter of the perceptible bodies, and that it is from this that the so-called elements come to be (329a24-6). What this seems to suggest is that the elements fire, air, water, and earth are not the most fundamental kinds of matter that Aristotle recognises, for there is a 'matter of the elements', in the sense of a matter that *composes* the elements. In this paper I want to argue that that is not the case. I shall argue that there is scope in Aristotle's texts for an interpretation that accommodates *both* the claim that the four so-called elements are the most fundamental kinds of matter, *and* the claim that there is some matter from which the elements come to be, which is other than, but common to, the elements. In other words, I do not believe that the acceptance of the latter claim threatens the elementary status of the so-called elements fire, air, water, and earth. A key distinction to which I shall appeal in this paper is that between the ways in which one thing may be said to be 'from' (*ek*) another. If we say, for instance, that 'A is *from* B', then we might intend that A is *from* B in the sense that B is that out of which A is *made*, or *composed*; alternatively, we might intend that B is the *source* or *origin* or *principle* of, or the starting point in the change that leads to, A. The distinction is important because, whereas with the former use of 'from', B is a *constituent* of A, with the latter, B need not be, and generally is not, a constituent of A (*Metaph.* XIV.5, 1092a29-30). Let's call this a distinction between 'constitutive' and 'non-constitutive', or 'originative', uses of 'from'. In this paper I intend to argue that the elements come to be from the matter of the perceptible bodies according to the second use of 'from'. In other words, the elements come to be from (*ek*) some matter, in the sense that they emerge from this matter, or are generated from it; the matter is, as it were, the *origin* of the elements, but it does not persist as material constituent of the elements. It is not, then, the matter 'of' the elements in the constitutive sense of 'that of which each of the elements is composed', or 'made of'. But what is this matter? It is precisely what Aristotle says it is, i.e., the matter of the perceptible bodies, understood as the matter of familiar composite substances; in other words, it is itself something that comes to be *from the elements* (that is, in the constitutive use of 'from'). I believe that the rather novel interpretation I propose is supported by the textual evidence; it is consistent with key principles of Aristotle's system; and, moreover, it defuses a number of problems in Aristotle's *De Gen. et Cor.*

Dr Hassn Khodaverdian, SPER, Amirkabir University of Technology
Al-Tusi on the fourth figure of syllogism

In *Prior Analytics*, only the first three figures of syllogism are attended to by Aristotle. Some ancient and medieval logicians had acknowledged this form, but it barely received the popularity of the other figures. Its validity or at least its practical usefulness has always been contested by the scholars. The absence of the fourth figures is also common among the Arab logicians (see Rescher 1963, p.72). Avicenna and Averroes both treated the fourth figure dismissively enough, courtesy of its (psychologically) bizarre form. Avicenna went so far to call it "the abrogated form of syllogism" (*Kitab al-shifa'*, pp.106-107). But Al-Tusi (d.1247) made an exceptional case among the Arab logicians. In this speech, we go into some details in reading Al-Tusi's view on the fourth figure of syllogism, as it is presented in his commentary on Aristotle's logic, named

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Asas-al-Iqtebas (*The foundation of every knowledge*). In the fourth chapter of the first part of the book, Al-Tusi began his account of the fourth figure by giving a report of Avicenna and Aristotle's disregard for the fourth figure. The important point (underlined by us in this speech) is that the Aristotelian context notwithstanding, Al-Tusi showed more concern for the formal procedure, and was less concerned with the psychological bearing of the forms of the syllogism. Although he justified Aristotle and Avicenna's dismissive behavior by making some remarks about the psychological implausibility of the fourth figure, he took some steps to show that there are formal considerations at issue in undermining the status of the fourth figure: formally speaking, the fourth figure is more similar to the second and the third figures, and less to the first one. This makes it hard to give straightforward procedures for examining the validity of the moods of the fourth figure. Interestingly enough, this did not prevent al-Tusi to put the fourth figure into a distinct category, and give a detailed account of the conditions under which its moods would lead to valid consequence. He numbered all of the moods of this figure, and then, by appealing to the rules of conversion and the proof through impossibility, obtained the five valid moods out of the lot. Thus, with regard to the fourth figure, Al-Tusi took an approach which was significantly dissimilar to the views of his predecessors, Aristotle and Avicenna. We refer to phrases from his introduction to *Asas-al-Iqtebas* and some other remarks to indicate that this dissimilarity roots in a deeper disagreement about the nature of logic, and the definition of syllogism.

Hellenistics.

Robert Heller, Royal Holloway

The Stoics on Perceiving and Experiencing Time

The Stoic philosophers seem to be the first thinkers in antiquity to have drawn up an elaborate theory of time perception. Nevertheless, in contemporary scholarship the fragmentary evidence has often been interpreted in the light of Aristotle's concerns regarding the problems of time. As such, in interpreting the Stoic theory of time the focus has been on how the Stoics intend to solve such issues as the metaphysical reality of time and the problems of measurement – both of which had troubled Aristotle. In this paper I argue that the Stoics were innovators and that their theory of time is better understood as a response to some of the issues which Aristotle's account of time raises, but which Aristotle fails to account for in his exposition in *Physics* IV.10-14. I argue that the Stoics developed their theory in the context of their philosophical system with a concern for the lived experience of time. In support of this, the Stoic definitions of time are examined in relation to the Aristotelian and evidence for the Stoic emphasis on time perception and experience is gathered.

Pamela Zinn, Trinity College, Dublin

Lucretius on the salty taste of sea air'

Given the importance of the senses in Epicurean thought and, particularly, their centrality to the *De rerum natura* of Lucretius, surprisingly little scholarly attention has been paid to the mechanisms by which they operate - with the exception of sight. Notable exceptions to this trend include the work of Koenen, Rosenmeyer, and Schoenheim. Rosenmeyer largely follows Schoenheim in reducing all of the senses to touch, but - taking as his primary evidence the passage in Lucretius on the salty taste of sea air - argues that taste in Lucretius operates by means of effluences, rather than by direct contact. This paper demonstrates that the salty taste of sea air and like examples represent a red-herring. It argues for a return to the more traditional interpretation of taste; Lucretius shared the understanding, relatively common in antiquity, that taste operates by means of direct contact with the sense-object. It proceeds by analyzing the physiological mechanisms underlying the sense of taste and their relationship to Lucretius' representation of select aspects of the water cycle, particularly that of evaporation. It thus sheds further light on the mechanics of those processes as well.

Dr. Fabrizio Bigotti, The Warburg Institute

Materia Sensiens: Galen on the problem of embodied knowledge

After the rediscovery in 1939 of a summary of the treaty *Peri ēthōn* from an Arabic source, we can understand more consistently how Galen's moral and physiological views were linked together. Until the publication of the paper of Richard Walzer (*New light on Galen's moral philosophy*, 1949) the general acknowledgement of Galen's moral philosophy was based predominantly, if not exclusively, on the report of the *Quod animi mores*. But the outstanding definition of *ēthos* as "an inborn irrational disposition of the soul due to the inherent nature of men" contained in the *Peri ēthōn* finally sheds light on one of the most controversial concept of the late-Hellenistic philosophy. Galen's naturalistic approach actually refers to a more general context developed according to Hippocratic theory of elements – in which Galen tries to

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convert the Aristotelian form into the 'state, or result, of a temperament' – and the idea that knowledge (or a certain form of it) is an inborn attitude shared by both men and animals, different in degrees but not in substance. The result is to expand the domain of sensation extending its boundaries until including the rational part of the soul. Trying to link together these pieces of the puzzle – philosophical fragments scattered confusedly but not infrequently in the Galenic works, most of all in the *De placitis Hippocratis et Platonis* – we witness an attempt to convert the Platonic nativism in a embodied and 'hereditary' knowledge; an attempt that would have constituted one of the most original ways to actualize Plato's legacy in medicine.

Aristotle, Mathematics and Physics.

Prof. Christopher Frey, University of South Carolina

Aristotle on the Homonymy of 'Heat' and the Continuity of Material Explanation

According to Aristotle, an organism's parts and tissues come to be as they are and act as they do for the sake of bringing about the organism's form—for the sake of bringing into existence a perfect exemplar of a specific kind of life. Having a form-determined function fixes the very identities of an organism's organs and tissues and thereby renders them susceptible to homonymy claims. For example, a hand severed from a living body is a hand in name only. In one of the *Meteorology's* more infamous passages, Aristotle extends this analysis beyond an organism's organs and tissues to the simple bodies that are present in the mixtures these tissues comprise. Just as a hand is what it is because it came to be for the sake of an organism's formal realization, the identity of the fire, earth, air, and water that are mixed by an organism's generative and nutritive activities is fixed by the form for the sake of which these activities occur. Thus the fire that is present in an organism and the fire that is present in our inorganic environment are not the same in account; they are called 'fire' homonymously. In this paper, I defend this reading of the *Meteorology* and extend it to the simple body's natural capacities: the hot, the cold, the wet, the dry, the light, and the heavy. Organic and inorganic heat do not share an account; therefore 'heat' is a homonym. This interpretation raises an obvious worry. Aristotle's biological works mostly contain explanations of physiological phenomena that look indistinguishable from material explanations of inanimate systems. What justifies this methodological continuity if the organic/inorganic divide marks an ontological difference in the material capacities that are active in these domains? I answer this question by (i) giving an account of why an organism's material components act in roughly the same way that inorganic bodies do, and by (ii) giving an account of Aristotle's scientific method that shows why material explanations can prescind from their explanandas' ontological differences.

Janine Guhler, St. Andrews

Aristotle on the Imperfection of the Mathematical World

While there has always been a tendency in the literature to drive a wedge between Plato and Aristotle, this paper will endorse the view that in spite of Aristotle's efforts to argue otherwise, Plato's and Aristotle's view on mathematics share common ground on the epistemological level but unsurprisingly fall apart at the ontological level. Aristotle whose ontology, contrary to Plato's, lacks independent abstract objects that could easily account for perfection, appears *prima facie* to fall short of explaining why we have an understanding of perfect properties, such as triangularity, that seem indispensable for mathematics. *Pace* Lear and beyond, I argue that Aristotle considers mathematical properties in perceptible objects as incomplete but not as imperfect. Similarly, *pace* Nehamas, I argue that a similar but not parallel reading is available for Plato as well.

Dr. Pieter Sjord Hasper, Indiana

Physics and Mathematics in Aristotle's Account of Infinity

Aristotle is well aware that in science we need infinities: there are infinitely many numbers, there are lines extendible to infinity, the universe is infinitely old, magnitudes are infinitely divisible, and thus infinitely many points on a line. At the same time Aristotle denies that there is anything which is actually infinite. How to make sense of the apparent contradiction?

Aristotle claims to solve the problem by introducing the notion of the potential infinite (*Physics* 3.6). Normally this is interpreted as something which is always finite, but can be extended indefinitely, without reaching completeness: it is like a day going on in that part of the day has been realized, but there is more to come – and unlike with a day, there is *always* more to come, so that it cannot be completed (this 'progressive realization model' one finds most recently in Coope, but before her in e.g. Ross, Hintikka, Lear, Hussey,

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Charlton). I first show that this cannot make sense of several points Aristotle makes about the being of the infinite, among them there being a difference between the infinite in the case of 'things that remain' and in the case of 'things that do not remain': there is no room for 'things that do not remain' within the progressive realization model, for the parts realized up to then are taken to remain. As an alternative interpretation, I take the infinite to be like a day in that only one part of it is actual (when it is actual), with the other parts possibly being actual, without them

Next I show that the distinction between the infinite in the case of things that remain and in the case of things that do not remain to a large extent coincides with the distinction between the infinite in the case of objects with physical matter and the infinite in the case of mathematical objects. In the case of things that remain there is some matter present beforehand in order to be 'taken' – and because of this persisting matter, what is taken remains. That is why Aristotle holds that the infinite extendibility of the universe would, absurdly, involve there already being an infinite amount of matter. Mathematical objects, on the other hand, do not involve some matter to be there beforehand, because they exist in thought, and thought does not remain, Aristotle claims.

Finally I show how exactly Aristotle can accommodate all the infinities required in mathematics and how he can hold mathematical claims about there being infinities to be true of something, without committing him to an actual infinity. While doing so, I will also show how Aristotle's justification for his claim that the mathematicians do not use the infinite, but merely need lines which are as long they like, refers to Eudoxus' definition of ratio, including the requirement of the quantities being homogeneous, and thus to quantity being Archimedean.

Dr. Paolo Badalotti (Udine):

Simplicius' Commentary on Aristotle's *De Caelo*.

Simplicius' commentary on Aristotle's *De caelo* is not simply an explanation of the text – it also discusses Aristotle's theories thoroughly explaining the philosopher's thought. This commentary gives us the most detailed account of the history of interpretations on the *De caelo* making reference chiefly on Alexander of Aphrodisias and relying on several other works – some of them lost – which were written not only by other Aristotelian commentators but also by thinkers of other philosophical schools. From this point of view, Simplicius' commentary presents us the account of many centuries of exegetic work on several, and sometimes contrasting, cosmological theories. The aim of this paper is to underline the importance of this commentary – giving some examples of Simplicius' methodology while discussing the theories presented by Aristotle in his treatise – and to point out the existence of a "commentaries' literature", in which various types of works used different methodologies to approach and discuss philosophical texts, mainly Aristotelian. In the last part of the paper I will focus my attention on the fact that for Simplicius using some Platonic dialogues – mainly the *Timaeus* – was part of the traditional method of explaining Aristotle's writings.

Dr. Andrew Gregory, UCL.

The Presocratics and the Supernatural

Behind its rather lurid title, what is this book about? It is possible to make a case that the presocratic philosophers attacked and entirely rejected the idea of the supernatural, believing what exists to be exclusively natural and that proper explanations of phenomena should cite natural entities only. This is called presocratic naturalism. One critique of this view is that the presocratic philosophers still believed in gods and the divine, that they believed in the efficacy of magical practices and that they indulged in animism, astrology, numerology, dream divination, magical healing and mysticism in their explanations of the world. The aim of this book is to investigate how far these criticisms are justified. It is common to find these criticisms made with the implication that the alleged belief entails a commitment to the supernatural and so a belief in an entirely natural world is compromised.