Acta Ant. Hung. 42, 2002, 67–76

ISTVÁN M. BODNÁR

SCIENCE AND PHILOSOPHY IN THE ACADEMY*

Summary: The evidence for a philosophical project assignment for the mathematical sciences in the Academy can be traced back to the generation after Plato, and as such it is the result of philosophical reflection on the intellectual enterprise pursued at the Academy. This is then contrasted with the histories of the mathematical sciences compiled in Aristotle's school, which acknowledged the methodological and ontological independence of these disciplines.

Key words: Mathematical sciences at the Academy; Pythagoreans; Eleatics; Aristotle's planetary observations; Eudemus' histories of the mathematical sciences; hypomnematic writings; Eudoxus; Callippus; *sôzein ta phainomena.*

The core of this paper will concern the interaction of philosophy and the sciences in the two most important Athenian philosophical schools of the classical period, the Academy and the Peripatus. To many readers much of what I am going to say will certainly appear as belabouring the obvious. Nevertheless, I shall need to go into some detail about the place of mathematical sciences in the curriculum of Plato's school, and then in the program of research in the Academy and the Peripatus. For contrary to a recently emerging orthodoxy, I shall maintain that at least the Academy was not exclusively a philosophical school and the stories about the philosophical guidance of scientific enquiry conducted there capture important aspects of the atmosphere of its common intellectual enterprise. Needless to say, I shall be able to present only the bare bones of the philological arguments to this effect, and, although it might seem premature to some readers, I shall proceed to some preliminary conclusions from what I hope to have established by the end of the paper.

* This is a revised version of a talk given at the conference "The Humanities and the Social Role of the Intellectual" at Collegium Budapest – Institute for Advanced Study (February 11–13, 2000, Budapest). A first version of the paper has appeared in: A. WESSELY (ed.), *Intellectuals and the Politics of the Humanities* (Collegium Budapest Workshop Series, Budapest: Collegium Budapest). I am grateful to Anna Wessely for all her care and attention.

0044-5975 / 2002 / $ 5.00

1

Any account of the interaction of science and philosophy in the Academy should first take stock of the course of philosophy and science in the preceding centuries. This is certainly not the place to provide an overall view. Instead, as an introduction, I want to stress only a few points about the parallel development, interaction, social and institutional background of science and philosophy.

What stands out most about early Greek philosophy is the almost kaleidoscopic multiplicity of the aims, objectives and methods of this intellectual enterprise – if we are entitled at all to speak about such an enterprise in the singular, instead of presenting our findings about different and competing notions of philosophy in the plural. What needs to be singled out here, even to the exclusion of other Presocratics, are the two *schools*, of the Pythagoreans and the Eleatics, respectively. Unlike other figures in early Greek philosophy both Pythagoreans and Eleatics formed intellectual communities. This is clear in the case of the Pythagoreans, with their alleged almost proverbial secrecy. We do not hear of anything similar in the case of the Eleatics, yet it is remarkable, considering the deviations of students from their masters in other lines of intellectual succession, how Zeno rested content with defending Parmenides' convictions and how cautiously Melissus introduced a few – albeit major – modifications to Parmenidean doctrines, clearly in order to enhance their overall coherence rather than to advance some independent vein of thought. It is also remarkable that these two philosophical schools worked in close proximity to each other in what was called Magna Graecia, in Southern Italy and Sicily. Apart from the traces of Pythagorean influence on Eleatic thought, which suggest some sort of interaction or even affiliation, territorial proximity itself, as Hermann Diels stressed more than a hundred years ago, might account for institutional similarities: confronted with the Pythagorean school the Eleatics had to adopt a similar institutional framework in order to be able to compete for talented young students who would be later suitable colleagues.[1]

Although Socrates and the Sophists, in their distinctive ways, also attracted herds of adolescent Athenians on a more or less permanent basis, in their case we cannot speak about the organisation of a school proper: neither Socratic ignorance and the repeated examinations of *bioi* from scratch, nor the itinerant Sophists with their intellectual one-man shows, allowed for systematic enquiry within institutional framework. Pythagoreans and Eleatics, the two earliest schools, are all the more important from the point of the Academy, because Plato clearly drew some inspiration for shaping his school in Athens from what he saw and heard from Pythagorean friends on his visits to Sicily. The little we know about the Pythagoreans tells us that they integrated mathematical instruction and research with a philosophical way of

[1] DIELS, H., "Über die ältesten Philosophenschulen der Griechen," in: *Philosophische Aufsätze. Eduard Zeller zu seinem fünfzigjährigen Doctor-Jubiläum gewidmet.* (Leipzig 1887), 241–60, esp. pp. 247f.

life.[2] This was, in a modified way, characteristic of the Platonic Academy as well, as I shall argue below in defence of the traditional view.

2

In what follows I shall first pursue what might seem a rather indirect approach. Prior to an evaluation of testimonies about the Academy, I shall discuss what we can learn about the activities of the Academy from the writings of Aristotle, a member of the school for twenty years, from the age of 17 to 37. Since Aristotle's works are the best preserved from all those of Plato's students, we might hope to find some clues in them about the instruction and the ensuing scientific project assignments Aristotle received during his two decades at the school.

First of all there are the repeated and implacable criticisms Aristotle made of the doctrines of Plato, and his followers, particularly Speusippus, Plato's nephew and successor as head of the Academy. Aristotle unceasingly chastises Speusippus for mistaking (a theory or ontology of) mathematics for philosophy. Similar remarks are also made about Plato's other students. This shows that both fields must have been discussed at the school, otherwise there would have been no temptation to mistake (the principles of) the one for (principles of) the other. This alone might be enough to convince some. Nevertheless, since it has been argued recently that the Academy was interested only in the philosophy of mathematics to the exclusion of mathematics proper, we may want to look into Aristotle's knowledge of mathematics, assuming that all or at least most of it was acquired during his formative years at the Academy.

The most momentuous piece of knowledge mentioned is the new theory of proportions, referred to in *Posterior Analytics* I.5. Aristotle says that previously the various forms of proportion – proportions between numbers, lines, volumes and times – were treated separately in a parallel manner, and a theorem intended to apply to all these different forms of proportion had to be proved for these different domains in separate procedures. Aristotle adds that the new theory of proportions makes such a piecemeal procedure superfluous, having been superseded by a general proof.[3] Strictly speaking this assertion might be true of theories of proportions other than the Eudoxan theory, nevertheless one would be hard pressed to name any other suitable candidate for a theory of proportions that Aristotle could have had in mind here. But in the present context, it is almost immaterial what theory of proportions Aristotle refers to here, since it is far more important that Aristotle is aware of different proof procedures and of an overall advance from an earlier methodology to novel discoveries. It is certainly not an advance in the philosophy or ontology of mathematics that Aristotle reports, but rather an advance in mathematical methods themselves.

[2] Note that the order of initiation and instruction is different – Plato will claim that mathematical studies lead up, and are subservient, to the appropriation of dialectics, which provides the deepest philosophical insights.

[3] See also *Posterior Analytics* I.24 85a36–b1.

The other major area of mathematical research we encounter in Aristotle's works is astronomy. As explicitly asserted in *Metaphysics* XII.8, Aristotle relies here on the astronomical systems of Eudoxus and Callippus. As Eudoxus features more than once in this discussion, we should take stock of the the evidence for the details of his affiliation to the Academy before making inferences about Aristotle's knowledge of his work.

This affiliation needs scrutiny because, in contrast to the earlier understanding of biographical reports, it is often doubted today whether Eudoxus worked at the Academy at all. This is clearly falling into the other extreme. We are told that he spent some time at Athens and that his students remained for some time at the Academy after he had returned to his native Cnidus. This suggests that he took part in the debates and enquiries of the Academy not as an occasional guest, but in the capacity of somebody with some sort of regular affiliation – would we expect occasional guests to bring a whole retinue of their own students, and then leave? We are told that he spoke of Plato after his death in words of utmost reverence. We also hear of a debate between Menaechmus, a student of Eudoxus, and Speusippus and Amphinomus on the status of mathematical knowledge. This latter piece of information – unless "the debate [is] not historically factual, but the product of [Proclus'] understanding of the difference latent in two Academic theories of geometrical demonstration"[4] – is most valuable because it shows to what extent his students, the "school" of Eudoxus if you wish, was able to retain its intellectual integrity, in the course of encounters with members of the Academy. All this suggests that it is not the particular form of affiliation that is important here. What needs to be stressed is that, in whatever institutional form, Eudoxus (and his students) clearly engaged in an ongoing dialogue with Plato and his disciples. This was nothing out of the ordinary. Athens at the time was the unrivalled intellectual centre of Greece – one recalls Plato's fictional dialogues about Parmenides and Zeno visiting Athens and meeting the young Socrates there, surrounded by an exclusively small audience; or other dialogues that feature various intellectual luminaries or their disciples. It was not exceptional, either on Aristotle's or on Eudoxus' part, or even on the part of Eudoxus' students, to visit Athens and take part in the intellectual exchange there. As there is no doubt that Eudoxus visited Athens several times, a school interested in the progress of mathematical research could easily have had access to his important mathematical and astronomical discoveries.

After these general considerations we should turn to what Aristotle tells us about Eudoxus. The first, not yet mathematical or astronomical testimony is in *Nicomachean Ethics* X.2. There Eudoxus is said to propound an important, metaphysically loaded theory of value that underpins an ethical doctrine. Although it cannot be excluded, it does seem unwarranted to stipulate that Aristotle learnt about this doctrine only through intermediaries after Eudoxus' death. If, however, Aristotle could have had first hand information on ethical considerations by Eudoxus, then we have

[4] As BOWEN, Alan C., "Menaechmus *versus* the Platonists: Two Theories of Science in the Early Academy," *Ancient Philosophy* 3 (1983) p. 15 formulates the alternative he finds less appealing.

no reason to doubt that he could also gain first hand information on his mathematical results.[5]

Putting aside Aristotle's testimony about Eudoxus' theory of values, the next step is to determine when Aristotle could have learnt the details of the Eudoxan theory of celestial motions. Since I cannot go into details here, I can only dogmatically assert that attempts to sever (as later additions) the more technical remarks in *De caelo* II.12 from the rest of that work do not carry conviction. The theory propounded there is in the same vein as in the preceding chapters of the second book of *De caelo*. At the same time there is a marked difference between the system of homocentric spheres propounded here and in *Metaphysics* XII.8. This suggests that the latter indeed is a later addition to the general investigation of the principles of substance. These two chapters, one early and one late, attest then to Aristotle's life long interest in the development of contemporary theoretical astronomy.[6]

But there is more to Aristotle's interest in astronomy than these two chapters with their slightly differing versions of theories of homocentric spheres. Aristotle reports on two astronomical observations he himself made. The first is in the very same chapter of *De caelo* that describes the nested spheres of Eudoxus, at 292a3ff. Aristotle tells of having observed himself how Mars was occulted by the crescent Moon in its first quarter. There are four possible dates for this observation between 380 and 320 BCE: March 20, 361 BCE, May 4, 357 BCE, June 24, 340 BCE and September 7, 336 BCE.[7] At the time of the first two occultations Aristotle was a student or junior member at the Academy. In 340 he most probably was at the Macedonian court in Pella and in 336 in his hometown Stagira. Clearly the more likely dates for these observations are the first two: the observation Aristotle refers to needed ex-

[5] Objection: Plato apparently does not know about the Eudoxan system of homocentric celestial spheres, which do not appear even in the *Laws*. Neither is there any hint to it in the later pseudo-Platonic *Epinomis* (appendix to the *Laws*). The objection remains unconvincing: the *Epinomis* certainly does not have to be any more modern than the Platonic dialogues it imitates, whereas Plato, writing dialogues, did not have to follow up the latest results in the sciences, when he was admittedly reporting a conversation between speakers who were no experts in mathematical astronomy.

[6] Aristotle's metaphysical use of theoretical astronomy can be paralleled by Theophrastus' remarks in his *Metaphysics* about the limits of the contribution of astronomy to the investigation of first principles.

[7] The computations of these occultations were kindly made for me by Chris Peat of the Heavens Above GmbH <www.heavens-above.com>. For the calculations the new long duration planetary and lunar ephemeries (DE-406/LE-406) of the Jet Propulsion Laboratory (Pasadena, Calif.) were used, for the clock error of the Earth's rotation the value for ΔT as given in: F. R. STEPHENSON, *Historical Eclipses and Earth's Rotation*, Cambridge: Cambridge University Press, 1997. Output from the Horizons ephemeris system of the Jet Propulsion Laboratory of the NASA, accessible at http://ssd.jpl.nasa.gov/horizons.html, indicates that the 8 September 336 BCE occultation was not visible from Greece. Moreover, according to the Horizons system the 24–25 June 340 BCE occultation was quite close to the horizon, Mars – as viewed from Pella – is indicated to reappear from behind the Moon thirty minutes before its setting. If we take into consideration that the clock error of the Earth's rotation has a comparable margin of precision for Aristotle's times, there is a very slight probability that the second phase of the 340 BCE occultation did not occur above the horizon of Pella. But neither this consideration, nor the rejection of the 8 September 336 BCE occultation affects the claim that Aristotle's observational reports were linked to the Academy (cf. also note 7 above). (I am grateful to Prof. Henry Mendell for advice on the occultations and on the Horizons system.)

pert guidance. It is easiest to suppose that Aristotle was alerted to the impending occultation by someone who was making regular observations, and had at least a short range method for projecting the planetary paths. This series of observations did not require a Eudoxan theory. If we accept the most pessimistic estimates about Eudoxus' visits to Athens, he was not even at Athens during the years between 367 BCE and 350 BCE. If the occultation Aristotle talks about is either the one in 361 or in 357 BCE, then Aristotle must have been exposed to an ongoing collection of ephemerides that allowed him to follow the most spectacular sightings of these observations. Similarly it can be argued that if Aristotle made the observation he described in *De caelo* only later at Pella or when he was already in Stagira, he most probably took with himself to these (at least intellectually) more provincial locations the project of research incorporating observational astronomy from Athens, and then most probably from the Academy.

The other observation Aristotle reports on is far less easy to fix to a particular date: Aristotle says in *Meteorology* I.6 343b30 that he has observed the conjunction of one of the stars of Gemini with the planet Jupiter. As we do not know which of the many stars within the constellation he is referring to, we can only give the years when Jupiter spent several months in that constellation.[8] As these follow each other in periods of twelve years, only three observational seasons could have been applicable: 359 BCE (when Aristotle was at the Academy), 347 BCE (when he was still at the Academy or already at Assos) and 335 BCE (when he was in Stagira, or already back in Athens). Again, we can infer that either Aristotle could at least have dropped in occasionally at an ongoing series of observations in Athens, presumably at the Academy; or that he had set up something similar later when he was away from Athens in Assos or Stagira. Either way, the research most probably followed the pattern he had encountered in Athens during the years at the Academy.[9]

3

Now we can turn to the traditional testimonies by later authors on the Academy. Remarkably enough, defenders of an internalist account of the development of mathematics could only claim, with all their sceptical arsenal, that the notion of a collaboration or a philosophical project assignment within mathematics and astronomy went back to Academic circles in the late fourth century BCE. There are two points to stress about this evasive move: Firstly, this date is perilously close to Plato's lifetime (he died in 347 BCE), and a school tradition over a generation or a generation and a half might as well contain some important grain of truth. Secondly, even if

[8] These computations have also been kindly supplied to me by Chris Peat.

[9] In a recent note, ("A lunar occultation of Mars observed by Aristotle," *Journal for the History of Astronomy* 31 (2000) 342–344) F. Richard STEPHENSON reports that his computations produce May 4, 357 BCE as the sole possible date for the occultation between 370 BCE (when Aristotle was 14) and Aristotle's death in 322 BCE. Note that the rejection of the other three dates does not affect the status of mathematical and astronomical research at the Academy, as it squarely situates the observation during the years of Aristotle's tenure there.

these stories originate from the Old Academy, they are transmitted by intermediaries who cannot be suspected of much love for Plato and his school. Eratosthenes, head of the Alexandrian library, and for a while disciple of Arcesilaus of the Middle Academy, had no particular inclination towards orthodox Platonism. His choice of the dialogue form and of a plot where the Delian problem of doubling the volume of the cube is submitted to a (beyond doubt, fictitious) gathering of Plato, Archytas, Eudoxus and Menaechmus was designed to present alternative solutions to the problem.[10] The role Eratosthenes assigns to Plato in this dialogue is a resounding tribute to his alleged insight into the nature of geometric research. Such tribute, as even sceptical historians of mathematics admit, must have rested on some source from within the Old Academy. The Epicurean (!) philosopher, Philodemus (1st c. BCE) in his *Academica* (preserved on a papyrus roll from Herculanaeum) quotes an author who describes Plato as the organiser and architect of scientific enterprises. Guesses as to the identity of the quoted author range from Dicaearchus (a disciple of Aristotle's) to Philip of Opus (a disciple and, in fact, secretary of Plato, credited with editing Plato's *Laws* and writing the *Epinomis*). With both options we reach the generation after Plato, as it is highly unlikely that the Peripatetic Dicaearchus would assert such architectonic activity without previous testimonies to this effect. Of less weight is the testimony about this alleged organisational activity of Plato by Sosigenes, a Peripatetic (!) commentator from the first century CE and teacher of Alexander of Aphrodisias. He attributes to Plato the program of *sôzein ta phainomena* (saving the appearances) i.e., accounting for the apparently irregular motions of the planets by means of a combination of circular motions. Again, this was probably no mere conjecture on Sosigenes' part: he presumably relied on a school tradition. Notice that some cardinal elements of this school tradition are present when Theo Smyrnaeus, a contemporary of Sosigenes quotes the account of Adrastus, which also described the task and endeavours of the ancient astronomers in this idiom.[11] Plato is explicitly credited neither with setting this task for the astronomers, nor even with observing

[10] The solutions of Archytas, Eudoxus and Menaechmus are also presented in Eratosthenes' letter and in his dedicatory epigram to Ptolemy, where he stresses the feasibility of his own solution, by means of a special device, the *mesolabê*, that can construct means between given magnitudes.

[11] The expression is not present in Aristotle's writings, instead he describes the aim of introducing Callippus' additional spheres into Eudoxus' system (*Metaphysics* XII.8 1073b36–37) and of adding his own counteracting spheres to the Callippan system (1073b38–1074a1) in terms of *apodidonai ta phainomena* (render the appearances). Prior to Sosigenes we find the phrase used for the fit of a theory with the data it is supposed to explain in the 2nd century BCE by Attalus (quoted and criticised by Hipparchus) and by Hipparchus himself. Then the expression is employed by Geminus (as reported by Simplicius, see below), and Adrastus (as excerpted by Theo) – who even recasts Aristotle's *apodidonai ta phainomena* in this idiom at 180.9f HILLER –, and among the contemporaries of Sosigenes by Plutarch (about Aristarchus). Note that the occurrence of the expression in 2nd century BCE astronomical literature might allow that when Simplicius' report (at *In De caelo* 497.17-22 = Eudemus fr. 149 WEHRLI) on Eudemus' report about Callippus' reasons for introducing his additional spheres is formulated in terms of saving the appearances, the phrase need not necessarily have been introduced by Simplicius, but might as well have already been present in Eudemus' report. (Cf. also Simpicius' reports on Heraclides of Pontus' celestial theory in Heraclides frr. 106, 107, 108 and 110 WEHRLI, (the last item being a quote of Alexander from Geminus' *Epitome of Posidonius'* Meteorology) in terms of saving the appearences.)

the constraints ensuing from it for astronomical theory,[12] but Adrastus in fact imputes far more to Plato than Sosigenes, when he asserts the vastly more momentous, and in fact impossible, claim that Plato preferred a theory of epicycles to a theory of eccentric circles.[13] The difference, then, between Sosigenes and Adrastus will be that Adrastus does not claim that the program was actually formulated and set as a task for astronomers by Plato himself, but that he himself reached the (by contemporary methodological standards) sound and in its essential insights valid solution. Consequently, in the presence of these even stronger claims we cannot credit Sosigenes with *originating* the story about Plato's formulating the essential tasks for contemporary astronomers: in an intellectual climate in which Adrastus' account could find credence, in view of the passage in *Republic* VII where Plato calls for a radical reform of the astronomical enterprise and demands that astronomers should, instead of paying almost exclusive attention to the actual paths of the celestial bodies, rather be prepared to treat these issues in problems (*problêmasin*), the conclusion was inescapable that Plato not only employed the most up to date methodology of saving the appearances, but was also responsible for its introduction as a research program. Again, behind the assertion of a Peripatetic interpreter we encounter a school tradition which stretches back at least to Adrastus' time.

Clearly, among the three testimonies the first two are more important. Not because they would be more trustworthy reporters of historical facts of the actual course of interaction between metaphysics and matemathics, but because they can be traced back to the generation after Plato. They represent the way the Old Academy wanted to project itself as the centre of research among other contemporary institutions. Sosigenes' report is important, not so much for adding further details to this portrayal, but rather as evidence of the fact that later historiographers of Greek philosophy and science, whether Epicureans or Peripatetics, could describe the early history of the mathematical disciplines only in the idiom provided by the Academy. There were no alternative constructions available. When modern historians of science defend internalist accounts, all they can do is to excise all these Academic intrusions. Even if

[12] See, however, 160.18 HILLER, where in a passage describing how a theory of epicycles saves the appearances, Plato's assent – albeit only to the annual motion of the Sun along the ecliptic – is mentioned. Nothing in the passage suggests that Plato's assent would be limited to this motion only, and that he would not have subscribed to the overarching methodological considerations mentioned here.

[13] See pp. 188f HILLER. Note that although the claim is patently false, in an anachronistically technical idiom, it grasps a major feature of Plato's account about planetary motion. As reconstructed by Wilbur KNORR, "Plato and Eudoxus on Planetary Motions," *Journal for the History of Astronomy* 21 (1990) 113–123 the Platonic account cannot be brought into line with a Eudoxan theory of homocentric spheres, as it acknowledges three components in planetary motion: diurnal rotation, rotation in the opposite direction, characteristic to the planet itself (its mean period), and a third factor that can move in both directions, thus accounting for the retrogradations and progressions of the planet. If this third component must also be produced by a regular, circular motion, the easiest paradigm will be a rudimentary theory of epicycles. This suggests that, as soon as a theory of epicycles had been proposed, it could have appeared a most natural claim that Plato had also already adumbrated such a theory. Adrastus' claim should be compared with the similar remark at 202.6f HILLER, in the Dercyllides section of Theo's work, where it is asserted that Plato maintained the astronomical hypotheses which rule out the introduction of eccentric celestial paths. Dercyllides, however, does not contrast a theory of eccenters with a theory of epicycles, but rather with the theory of homocentric spheres of (Eudoxus,) Menaechmus, Callippus and Aristotle.

modern historians are right in claiming that Eudemus' histories of mathematics and astronomy did not contain stories about Plato, Eudemus did not present self-contained disciplinary histories in a way that would have made such an interaction utterly implausible.

4

On balance, then, two points should be allowed. Firstly, that instruction at the Academy must have included some exposure to recent developments in mathematics and astronomy. The tradition we have encountered in so many, and so many different sources, which credits Plato with an authority to direct research leading to these developments, may represent the result of philosophical reflection on this fact.

The second point is connected to the first, and can be best approached by stating my reason for dealing with science and philosophy in such detail. After all, our workshop is concerned with the ways intellectuals are influenced by the patterns available within the humanities. Certainly, a lot could be said about instances of such influence in the case of the Academy or the Peripatus. However, these would not necessarily reveal a feature of fundamental significance about the philosophical enterprise in these schools. While in Presocratic philosophy the scientific and the philosophical enterprise often merged, these two schools stand at the crossroads where these traditions have begun to drift apart intellectually and institutionally. The fact is that, in their distinctive ways both pursued grand projects of reintegration: the Academy in the form of an imaginary rather than real metaphysical tutelage of the mathematical sciences, the Peripatus by acknowledging the autonomy of these disciplines,[14] and by producing an encyclopedic collection of their rationally reconstructed histories. These histories, together with the vast collections of data (e.g. of the institutional and social history of Greece), and the theoretical and doctrinal compendia (e.g. of different philosophical subjects and schools) constitute the class of hypomnematic writings among the works of the Peripatetic philosophers. But the fact that these writings belong to the class of hypomnematic works cannot conceal the fact that the relationship between the histories of the different sciences and the sciences themselves is fundamentally different from the relationship of the other collections and compendia to the fields of enquiry where they were put to use. Hence, albeit writing the histories of the mathematical sciences, or even of medicine, was a project of major philosophical significance, these histories did not collect raw material for the actual research into these fields, nor were there any presuppositions that mathematical research should conform to philosophical considerations.

Plato's precepts about how to treat and regulate poets and musicians in the ideal city need not be recounted here. It will suffice to stress that, for these philosophers, the humanities could present an acute problem, one that needed treatment or

[14] See Aristotle's remarks about the relationship between astronomy and metaphysics to this effect. The results of astronomy had to be accepted by the student of theology/metaphysics only to become objects for further theological analysis.

even a cure for the sake of a healthy social organism, yet they did not see any need to argue over the demarcation line between the humanities and philosophy. Such a line of demarcation between philosophy and the mathematical sciences was, on the other hand, in the process of being constituted through the ongoing debate in the circle of Plato and his students about the nature of mathematical objects and the status of mathematical knowledge. By writing the histories of the different sciences in a way that acknowledged their methodological and ontological independence, Aristotle and his disciples provided, in turn, a new and highly successful framework for this demarcation. Thus they were able to break definitively with the Pythagorean tradition of integrating philosophical insight and mathematical research, as transformed and continued in the Academy.[15]

ELTE University
Dept. of Philosophy
H-1364 Budapest, P. O. Box 107

and

Central European University
Dept. of Philosophy
H-1051 Budapest
Nádor u. 11.

[15] Besides being the originator of what can be called an internalist historiography of the mathematical sciences, the Lycaeum also prepared the way for the activities of the Alexandrian library. It is interesting to note that the classificatory, cataloguing and organisational labour of the Alexandrian library effected a new form of the integration of the different branches of knowledge. Without going into details, one should recall here that Eratosthenes, one of the authors who reintroduced the notion of philosophically supervised mathematical research in the Old Academy, was chief librarian at Alexandria.