ARISTOTELIAN *NATURAL PROBLEMS* AND IMPERIAL CULTURE: SELECTIVE READINGS

MICHIEL MEEUSEN
King's College, London
michiel.meeusen@kcl.ac.uk

ABSTRACT. The *Natural Problems*, attributed to Aristotle (but probably only partially authentic), have gained much scholarly attention in the last decades, yet a systematic study of how the collection circulated in the Graeco-Roman Empire remains a blind spot in contemporary scholarship. Indeed, the Imperial Era is a seminal period for the history of the text, not just as a conduit between Aristotle and the Middle Ages – which in itself is essential for explaining the subsequent Arabic and Latin uptake of the *Problems* more clearly – but also for the wealth of sources and testimonies it offers about the collection's ancient readership and concrete use. The evidence shows that the collection sparked much debate among a range of ancient philosophers, doctors, sophists and scholars, both Greeks and Romans. This paper provides a selection of readings representative of the different socio-intellectual milieus in which the *Problems* circulated and the different agendas that it served.

KEYWORDS: Aristotle, Natural Problems, reception, Graeco-Roman Empire.

1. The Aristotelian *Natural Problems*, its origins and success

The *Natural Problems* (*Problemata Physica*) is the third largest work in the *corpus Aristotelicum*, yet at the same time it is one of the least studied. This is unfortunate, because the collection "has much to tell us about the specific nature of philosophical and scientific inquiry in the Lyceum during Aristotle's life and especially in the years following his death" (as Robert Mayhew has recently put it).[1] Nothing is known with great certainty about the authorship of the collection as

[1] Mayhew 2015a, vii. See also Id. 2011, I, xxiv: "But if this work receives the scholarly attention given to the rest of the *corpus Aristotelicum*, I believe it has much to tell us about the nature of intellectual activity in the Lyceum, especially after Aristotle."

DOI: 10.21267/AQUILO.2018. 12.10408

we have it today (in 38 thematic 'books'). It is accepted that Aristotle initiated the work by authoring an unknown number of chapters in it,[2] but most of the content should be ascribed to his acolytes in the Lyceum.[3] As such, the uncertainty about the historical authorship, far from being a mere scholarly issue, may hint at the popularity of the genre of natural problems in a large and largely anonymous scientific community in Aristotle's school.[4]

Scholars nowadays acknowledge that the *Problems* do not necessarily have to be by Aristotle to be generally Aristotelian.[5] By finding its origin in the Lyceum, the collection is firmly built around Aristotle's concept of philosophical knowledge as causal knowledge, applied to the study of concrete natural phenomena and their material-mechanical causes – remarkably enough, though, teleological causality is generally absent.[6] The collection deals with a wide range of particular – and often very peculiar – difficulties in the broad field of ancient Greek 'physics', thus straddling a large variety of questions pertaining to ancient medicine, physiology, botany, meteorology, astronomy, music, etc., but also including problems relating to ethics and even justice (*Pr.* 27-30). The collection covers over nine hundred problem chapters, many of which demonstrate a specific link with Aristotle's authentic texts by creatively casting them in a question-

[2] Aristotle sporadically refers to his *Problems* throughout his writings: see *Mete.* 2, 6, 363a24 (cf. also 4, 3, 381b13); *Somn. vig.* 2, 456a29; *Iuv.* 5, 470a18; *PA* 3, 15, 676a18; *GA* 2, 8, 747b5; 4, 4, 772b11; 4, 7, 775b37.

[3] This explains the obvious correspondences with Aristotle's authentic writings, but it may also account for the direct conflicts and inconsistencies with Aristotelian dogma at times, since especially in its early stages the genre of natural problems was very much science in the making (see Meeusen forthcoming a). The same is true for the abundance of repeated problems that are sometimes solved differently (see already Prantl 1852; Richter 1885; Forster 1928).

[4] The debate about the collection's authorship and authenticity dates back to Medieval scholarship. See Williams 1995, 45.

[5] Cf. the titles in Centrone 2011 and Mayhew 2015a.

[6] But see Stoyles 2015 for some noteworthy exceptions. Flashar 1962, 329-330 speaks of the "Materialismus" and the "materialistische Tendenz" of the *Problems*. Fortenbaugh 2014, 80-81, at n. 38 warns that: "While the phrase διὰ τί may suggest Aristotle's efficient cause, it can be used widely to cover all four Aristotelian causes. See, e.g., *Physics* 2.3 194b19, where Aristotle uses the phrase in introducing his four kinds of cause. For a clear example of inclusive usage in the pseudo-Aristotelian *Problems*, see 4.15. The chapter begins with the question "Why, διὰ τί, is sexual activity most pleasant," after which two possibilities are advanced: "Is it so for living creatures out of necessity, ἐξ ἀνάγκης, or for the sake of something, ἕνεκά τινος?" (878b1-2)."

and-answer format, while also blending in traditional and novel ideas (especially Hippocratic and Theophrastean).[7]

What makes the *Problems* a unique source of ancient scientific learning is that it, indeed, originated from dialectical debates in Aristotle's closed intellectual circle (the Lyceum) but became immensely popular far beyond Aristotle's educational context in the times to follow. It left a lasting legacy both in learned and popular cultures from Antiquity up to the Modern Era, and became highly influential even beyond the geographical boundaries of the Occident in the form of Syriac, Arabic and Hebrew translations. A comprehensive analysis of how the *Problems* circulated in different historical settings, from the time of its creation up to its demise, offers a fascinating, kaleidoscopic perspective on the shifting socio-intellectual value of a very influential, but largely forgotten genre of natural scientific learning that played a prominent role, for over two millennia, in the study and understanding of nature and its phenomena.[8]

2. *Natural Problems* in circulation: scope and method

They have gained more scholarly attention in the last decades than ever before, especially in the fields of ancient philosophy and Medieval and Renaissance studies.[9] Thus far, no comprehensive study has been undertaken of the collection's global history, though. Most glaringly (and more feasibly perhaps), a systematic study of how the *Problems* circulated in the Roman Empire – that is the timespan between the revival of Aristotelianism in the first century BC and the Middle Ages – remains a blind spot in contemporary scholarship. The main objective of this study, therefore, will be to cross this scholarly divide and to provide a concise and

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[7] Exemplary for how the *Problems* creatively recycle Aristotle's authentic works is the famous chapter on melancholy (*Pr.* 30, 1), analyzed by van der Eijk 1990, who shows that the author of this chapter was clearly familiar with Aristotle's scattered remarks on melancholy and perhaps intended to systematise them.

[8] Louis 1991-1994, I, xxxiv is right that: "Dès l'antiquité, en effet, la collection des *Problèmes* a été l'une des oeuvres les plus lues d'Aristote."

[9] This resulted, most prominently, in the publication of a new English translation (Mayhew 2011, I-II) and two edited collections of essays covering a wide variety of topics dealing with the collection's philosophical-medical background (Centrone 2011; Mayhew 2015a). Generally useful for the text's later history are Blair 1999 and the contributions in De Leemans – Goyens 2006 (with a selected bibliography at 295-317). See also esp. Lawn 1963, Filius 1999 and Cadden 2013. Although selective, these studies demonstrate the particularly rich and variegated nature of the *Problems*' reception in the Middle Ages and the Renaissance. For a general introduction and bibliography to the collection and its *longue durée*, see Flashar 1962, 295-384, Louis 1991-1994, I, vii-xxxv, Bertier – Filius 2003.

preliminary overview of how the *Problems* were received in the first centuries of the Roman Empire. Marenghi rightly speaks of this period (and especially of the second century AD) as "l'*aurea aetas* dei *Problemi*".[10] This paper will provide a selection of readings that are representative of the different socio-intellectual milieus in which the *Problems* circulated and the different agendas that it served (medical, philosophical, scholarly, sophistic, etc.).

The Imperial Era is a seminal period for the history of the *Problems*, not just as a conduit between Aristotle and the Middle Ages – which in itself is essential for explaining the subsequent Arabic and Latin uptake of the collection more clearly – but also for the wealth of sources and testimonies it offers about the collection's ancient readership and concrete use. As noted, it will be of particular interest for us to examine which intellectual traditions outside of the Lyceum interfered in the text's circulation process in the time of the Roman Empire. Methodologically, this examination will depart from the view that readers play a prominent role in validating scientific knowledge: after all, it are they who will (or will not) attribute authority to the author's scientific claims and arguments by accepting, developing, re-using, transforming, interpreting, modernizing, misunderstanding, forging, criticizing, rejecting or even ridiculing them – always in agreement with specific intellectual and societal situations.

In the Aristotelian *Problems*, the reader's own inquisitiveness is triggered at a discursive level by the inquisitive organisation of the problem chapters and their question-and-answer set-up, where questions are typically introduced with "Why?" (Διὰ τί) and solved in a non-assertoric, interrogative way, viz. by means of a compound question, "Is it because X? Or because Y?" (πότερον [...]; ἢ [...];). By means of this virtual dialogue, the intended reader is invited to participate in the debate and to look for alternative explanations or by selecting the most convincing one, in case more than one solution is offered. This is probably a relic of the collection's educational backdrop, as originating from the research context of Aristotle's Lyceum, where the genre must have fostered much dialectical debate of specific scientific topics (as we saw).[11] The dynamic nature of the genre is also manifested at a macro-structural level, more precisely in its open-ended organisation, where not only novel answers could be added, but also new problems could be raised *ad libitum*. This has been ascribed to the 'encyclopaedic' nature of the problem genre that sets no formal limits to the author's inquisitiveness and, thus,

[10] Marenghi 1961, 40.

[11] On the didactic role of the Aristotelian *Problems*, see, e.g., Jacob 2004, 40-48. On the genre's dialogical nature, Oikonomopoulou 2013a.

promotes structural increase.[12] As we will see in this paper, this dynamic nature of the *Problems* will play an important role in the later history of the text.

3. Education and performance: between seriousness and play

A remarkable passage to start with is found in the first book of Athenaeus' *Deipnosophists*, where we read that Matreas, an itinerant showman from Alexandria,[13] wrote parodies of Aristotle's *Aporiai* and read them in public (1, 19de: ἐποίησε δ'οὗτος καὶ παρὰ τὰς Ἀριστοτέλους ἀπορίας καὶ ἀνεγίγνωσκε δημοσίᾳ). The questions Matreas raised are quite humoristic, indeed, and they clearly have the peculiar style of the *Problems*, as is marked by their paradoxical character:[14] "Why does the sun sink but not dive?", "Why do sponges soak up wine but not get drunk?", "How can accounts be reconciled, if they don't argue with one another?".[15] Athenaeus does not say anything about the kind of answers Matreas gave to these problems (if any), but he does note that the man "inspired admiration among both Greeks and Romans" (ἐθαυμάζετο δὲ παρ' Ἕλλησι καὶ Ῥωμαίοις). It remains unclear which kind of audiences Matreas precisely addressed, though – that is, what Athenaeus means with the adverb δημοσίᾳ. Are we dealing with public addresses to generally educated laymen (πεπαιδευμένοι), or should we think of more expert philosophical milieus? Considering Matreas' profession, the first option seems more plausible. In any case, the type of admiration (ἐθαυμάζετο) he inspired among his audiences is not the one that engenders philosophy.

If anything, Matreas' parodies provoke laughter and scoff – albeit erudite laughter and scoff. Presumably his audience had at least a preliminary notion of the Aristotelian genre of natural problems; otherwise they would probably not have grasped the travesty. And therefore the passage demonstrates (at least implicitly) how popular the genre had become in his time.[16] As such, Matreas' persi-

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[12] Cf. Oikonomopoulou 2013b (on the 'encyclopaedism' of Plutarch's corpus of *quaestiones*).

[13] The Suda lemma on Ματρέας describes him as a λαοπλάνος (LSJ: "misleader of the people"), instead of Athenaeus' πλάνος (LSJ: "vagabond, impostor"). He enigmatically said that he was raising a beast that devoured itself (probably an octopus).

[14] On the paradoxical nature and formulation of the *Problems*, see Flashar 1962, 299 and 342-343. Apollonius the paradoxographer (second century BC) references the *Problems* frequently: *Mir.* 7 (~ *Pr.* 21, 24; 38, 10); 9 (= fr. 234 Rose); 21 (= fr. 230 Rose); 22 (~ *Pr.* 10, 44); 23 (= fr. 219 Rose ~ *Pr.* 38, 7); 28 (= fr. 237 Rose); 37 (~ *Pr.* 13, 10); 42 (= fr. 239 Rose); 45 (= fr. 228 Rose); 51 (= fr. 232 Rose).

[15] For text and commentary, see Olson 2006-2012, I, 108, n. 148.

[16] Unfortunately, Matreas' *floruit* is unknown. But this does not detract from the humoristic effect his questions must have had on Athenaeus and his Imperial readers.

flage hints at a rather playful opposition against the established reputation and authority of the genre of natural problems in philosophical milieus, where they provided suitable topics for debate. The passage is also significant for the performative nature of the natural problem genre, as it nicely illustrates how such problems lent themselves rather well for frivolous rhetorical performances and for humoristic adaptations of their often peculiar style and content.

In intellectual circles, however, like Plutarch's, such problems were taken rather *au sérieux* – at least within the limits of the 'spoudogelastic' intellectual discussions held at dinner parties and symposia. In line with convivial decorum, these discussions mediated between seriousness and play (σπουδή – παιδιά).[17] But natural problems also provided useful topics for debate in Plutarch's philosophical school in Chaeronea, where they formed an integral part of his natural philosophical curriculum.[18] Even though these discussions are very much tongue in cheek at points, they never turn to plain derision (take, for instance, *Quaest. conv.* 3, 3: "Why are women least liable to drunkenness but old men most quickly?"; *Quaest. nat.* 36: "Why are bees quicker to sting people who have just committed adultery?").

In one of his *Table Talk* (*Quaest. conv.* 8, 10), Plutarch writes that his Roman friend and patron, L. Mestrius Florus, obtained a copy of Aristotle's *Problems* that had been brought to Thermopylae, and shared it with his friends for discussion during daytime strolls (the so-called *peripatos*).[19] Plutarch writes that one such problem came up one way or another (οὐκ οἶδ' ὅπως) at a dinner party: "Why are dreams particularly unreliable in the fall months?". We read that Aristotle had already solved the problem (it cannot be traced in the extant collection, though:

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[17] On the aspect of play in Plutarch's *Table Talk*, see Frazier 1998. The notion of σπουδογέλοιον is nowhere expressed with this precise term in the *Table Talk*. Yet, in several passages Plutarch does emphatically call for a healthy balance between seriousness and play, which he connects with sympotic protocol. See, e.g., *Quaest. conv.* 1, 4, 621DE (ἔστι γὰρ καὶ γέλωτι χρῆσθαι πρὸς πολλὰ τῶν ὠφελίμων καὶ σπουδὴν ἡδεῖαν παρασχεῖν); 2, 1, 629F (οὐ γάρ τι μικρόν [...] τῆς ὁμιλητικῆς μόριον ἡ περὶ τὰς ἐρωτήσεις καὶ τὰς παιδιὰς τοῦ ἐμμελοῦς ἐπιστήμη καὶ τήρησις); 6, *praef.*, 686D (τὰ δὲ φιλοσοφηθέντα μετὰ παιδιᾶς σπουδάζοντες εἰς γραφὴν ἀπετίθεντο). Intellectual entertainment and instruction were important aspects of the symposium: see, e.g., Roskam 2009. For the notion of σπουδογέλοιον in ancient Greek literature more generally, see Arnould 1990, 113-122.

[18] On the educational backdrop of Plutarch's *Causes of Natural Phenomena*, a collection of around 40 natural problems modeled after the Aristotelian *Problems*, see Meeusen 2017, 187-233.

[19] A witty allusion both to Aristotle's ambulant teaching method and to the name of his followers, the Peripatetics.

see fr. 242 Rose). Aristotle explained, so Plutarch writes, that fresh fruit and grain, at the time of harvest, produce much unruly breath (πνεῦμα) in the body, which causes bad dreams. Plutarch's peers do not simply accept Aristotle's theory but take it as a starting point for further debate by adding alternative explanations.

Plutarch more often draws from the Aristotelian *Problems* in his own natural problems.[20] Yet, the passage at hand provides exceptional detail about the collection's availability in Graeco-Roman times. It nicely illustrates how the collection passed from hand to hand and from mouth to mouth, showing how it circulated – physically – in the Mediterranean region and provided much *gefundenes Fressen* for intellectual debate in networks of highly educated individuals. Clearly, the *Problems* were not conceived of by Plutarch and his peers as a static text but a dynamic one that was open to further development and adaptation. Aristotle's authority is not simply accepted by them but provides a useful starting point for further debate. That is probably why in the introductory paragraph to the passage at hand Plutarch stresses, in a very programmatic way and with a quote from Aristotle himself, that "all-round education produces many starting points" (fr. 62 Rose: τὴν πολυμάθειαν πολλὰς ἀρχὰς ποιεῖν). Accordingly, at numerous instances, Plutarch, underlines the novelty of the explanations he records and the conceptual creativity (εὑρησιλογία) that this type of discussion involves.[21]

What is also important is that Florus is described in the *Table Talk* passage as a person "filled with questions himself, as is natural for a philosophical spirit" (αὐτός τε πολλῶν ἀποριῶν, ὅπερ εἰώθασι πάσχειν ἐπιεικῶς αἱ φιλόσοφοι φύσεις, ὑπεπίμπλατο). This, I believe, is an allusion to Plutarch's own aporetic method in philosophy, which he considers a continuous and open-ended pursuit of the truth.[22] In his capacity as a Platonic philosopher and a sympathizer of Academic Scepticism, Plutarch especially appreciated the inquisitive approach of the genre of natural problems, where explanations are typically phrased interrogatively rather than assertively (as we saw). By emphasising its search for plausible explanations and potential alternative ones, Plutarch aimed to reconfigure the Aristotelian genre within an essentially Platonic framework. This ties in closely with the Academic ἐποχή he advocates in natural scientific matters (cf. *De prim. frig.* 955C), and, more broadly, with his Platonic view of the world, as inspired, by the εἰκὼς μῦθος of the *Timaeus*.[23] As such, it was not so much the research in itself of enigmatic natural phenomena that appealed to Plutarch, but rather the method employed in addressing them.

[20] See Meeusen 2016.

[21] See Meeusen 2012.

[22] See Opsomer 1998.

[23] For further detail, see Kechagia 2011 and Meeusen 2014 and 2015.

What seems to be very different between Plutarch's natural problems and those ascribed to Aristotle, then, is the epistemological fundament on which their natural scientific research is based. Plutarch postpones final judgement, since he, in line with Platonic-Academic theory, refuses to put much confidence in knowledge deriving from sensory data, whereas Aristotle's avoidance of argumentative conclusiveness was more practically motivated, aiming to foster further research and debate of specific scientific topics in the Lyceum context. In the end, Aristotle put much more trust in the feasibility of natural science than Plutarch, as a faithful Platonist, ever did.

Another source to illustrate the popularity of the *Problems* with the educated elite of the Imperial Era is found in the *Attic Nights* of Aulus Gellius.[24] In this work, Gellius aims to demonstrate his eminent scholarly talent and all-round education by offering a compilation of reading notes and anecdotes from his student years, famously composed during the cold Athenian winter nights. Gellius has a deep fascination with books and bookish knowledge: as a Roman scholar he was particularly fond of quoting Greek texts and terms, thus proving his culture and wide reading to his own readers. Aristotle is frequently cited in the *Attic Nights*.[25] The greatest number of quotations comes from the *Problems*, which Gellius at one point praises for its charm, as being "most delightful and filled with choice knowledge of all kinds" (*NA* 19, 4, 1: *lepidissimi et elegantiarum omnigenus referti*). He excerpts, paraphrases, and translates several chapters from the *Problems*,[26] but, remarkably enough, most of his borrowings have specific ethical rather than strictly physical interests, which seems to support the critique of Holford-Strevens that natural science was "not beneath his cognizance but above his head".[27]

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[24] For a short overview of Gellius' quotes from the *Problems*, see Forster 1928, 164; Marenghi 1961, 40-43.

[25] For Gellius' acquaintance with Aristotle and the Peripatetics, see Holford-Strevens 2005, 270-272.

[26] Gellius says that he, indeed, "made excerpts" from the *Problems* (*NA* 2, 30, 11: *cum Aristotelis libros* Problematorum *praecerperemus, notavi* [...]; cf. *Pr.* 26, 37).

[27] Holford-Strevens 2005, 261. We come across problems on the psychological effects of music in battle (*NA* 1, 11, 17-19), on sensual pleasure (*NA* 19, 2, 5), on micturition due to fear (*NA* 19, 4, 1), on the luxury of ψυχροποσία (*NA* 19, 5, 9), on colour change due to fear and shame (*NA* 19, 6, 1), on ill-tempered stagefolk (*NA* 20, 4, 4). There is an exclusive interest in physical matters in the references to the *Problems* in *NA* 2, 30, 11 (on the effect of winds on the colour of the sea), and *NA* 3, 6, 1 (on the wonderful strength and nature of the palm-tree).

In one passage, Gellius reports about his retreat to the country-place of a (rich) friend in Tibur, being accompanied by some of his companions and fellow students (*NA* 19, 5). Since it is the hottest season of the year, the group takes great delight in the luxury of drinking water made of melted snow. One of the companions, a Peripatetic philosopher and devotee of Aristotle (*vir bonus ex peripatetica disciplina bene doctus et Aristotelis unice studiosissimus*), repeatedly dissuades them from drinking this water, since it is unwholesome for humans and causes diseases. The Peripatetic cites the authority of noble physicians (*auctoritates nobilium medicorum*) and in particular of Aristotle, but his plea is not heard by his fellows. Remarkably enough, Gellius himself only takes the words of the Peripatetic fellow for granted once he has read the explanation for the problem in the book itself. The Peripatetic goes to the library of Tibur – then located in the temple of Hercules and well supplied with books, so we read – to fetch a volume by Aristotle, where the explanation is found. "At least believe the words of this wisest of men and cease to ruin your health", he says (*'huius saltem' inquit 'sapientissimi uiri uerbis credite ac desinite ualitudinem uestram profligare.'*).[28] In short, the explanation goes that the lightest and most wholesome part evaporates from water when it congeals so that what remains is less clean and less wholesome. Gellius paraphrases the explanation in Latin and quotes the Aristotelian problem in Greek (= fr. 214 Rose). In so doing he cannot resist to add that the Greeks call 'clear ice' κρύσταλλον.[29]

The passage at hand shows that Aristotle's authority surely means a lot to Gellius, but, remarkably enough, he is willing to accept it only once he has seen it confirmed in writing, a point that underscores the value that he, as a scholar, ascribes to the written word (*NA* 19, 5, 10: *Hoc ubi legimus, placuit honorem doctissimo uiro haberi Aristoteli*). Arguably, Gellius in this passage tries to self-fashion himself (via his literary alter-ego) not just as an expert in Greek language and literature but also as an intellectual interested in the natural world immediately around him or at least the literature devoted to it.[30] At any rate, he does not accept philosophical authority blindly but only when it is based on stable grounds,

[28] The impromptu visit to the library may serve to illustrate the work's wide publication, yet Gellius' qualification of the library as being "well-stocked" (*satis commode instructa libris*) can work both ways. In *NA* 9, 14, 3, Gellius reports that he had consulted a work by Claudius Quadrigarius in the same library.

[29] For Gellius' engagement with Greek language, see Holford-Strevens 2005, 226-232.

[30] The custom of ψυχροποσία was, in fact, a cherished topic of critique among ancient philosophers. Cf., e.g., Plin., *HN* 19, 54-55, Sen., *NQ* 4, 13, 4-5, *Ep.* 78, 23, Plut., *Quaest. conv.* 6, 4, 690B. Patients suffering from inflammations should abstain from cold drinks: Gal., *HVA* 306, 22 (= 15, 802 Kühn), cf. *MM* 9, 5 (10, 622 Kühn).

in this case Aristotle's authoritative writings. The fact, moreover, that the *Problems* are consulted for their practical, medical knowledge (where Aristotle is mentioned along with noble physicians), hints at the collection's medical interests and applicability. The work was, indeed, popular with ancient doctors and it had a rich, albeit relatively neglected, reception in medical literature (to which we will turn later).

What passages like these demonstrate is that the Aristotelian *Problems* were read and discussed in group, and were meant to stimulate further contemplation of philosophical topics, both practical and theoretical. As such we are dealing with a versatile text, particularly useful in educational community contexts. Unlike Plutarch, however, Gellius was more a man of the written word; as a scholar, he was primarily concerned with the static authority of the text and lets it speak for itself.[31] As such, the *Problems* lose their scientific relevance and dynamism, thus gradually being reduced to the status of genuine literature.

Not every ancient author appreciated the genre of natural problems as much as others did.[32] According to Seneca, most notably, there is not much use to solving natural problems. His criticism is framed in a rejection of all round learning, where he agrees with the Cynic Demetrius that such problems (e.g., concerning the ocean tides, optical illusions, twin births etc.) provide only useless knowledge. It is for this reason that Seneca, in *Ben.* 7, 1, 7, includes them among the "leisurely delights" (*oblectamenta otii*), which only bring "polish, not strength" (*cultum, non rubor*) to the powers of the mind. In fact, he considers the genre of problems more generally as "useless furniture of learning" (*Ep.* 88, 36: *supervacua litterarum supellectile*),[33] and even speaks of it as a "Greek disease" (*Brev. vit.* 13, 2: *Graecorum iste morbus fuit quaerere* [...]). This criticism can be put in perspective by adding that the right study of natural phenomena has significant moral implications for Seneca, in that it aims to provide, what Gareth Williams has recently called, a

[31] At any rate, in the passage about ψυχροποσία, he does not explain on which terms his companions "made truces" (*indutias ... factitabant*) with drinking ice water.

[32] Cf., e.g., Gell., *NA* 13, 7: *Sed ea omnia cum captiones esse quidam futtiles atque inanes dicerent, 'nolite' inquit Taurus 'haec quasi nugarum aliquem ludum aspernari.* [...]'.

[33] He says this of the four thousand books of Didymus the scholar on literary problems, in which the author investigates what was "Homer's birthplace, who was really the mother of Aeneas, whether Anacreon was more of a rake or more of a drunkard, whether Sappho was a bad lot". The passage from *De Brevitate Vitae* (13, 1-3) gives these examples: "what number of rowers Ulysses had, whether the *Iliad* or the *Odyssey* was written first, whether moreover they belong to the same author, and various other matters of this stamp, which, if you keep them to yourself, in no way pleasure your secret soul, and, if you publish them, make you seem more of a bore than a scholar".

'cosmic viewpoint' for his ethical philosophy.[34] Indeed, in his *Natural Questions*, Seneca frequently incorporates a strand of ethical paraenesis in his scientific discourse, so that the text is lifted to a moralizing echelon. As such, his study of nature rises far above the main material-mechanical approach of the Aristotelian *Problems*.[35]

When compared to Seneca's overtly moralizing goals, the genre of natural problems serves a relatively modest purpose. Their inquisitive approach and piecemeal structure clearly indicate that they were intended to attach further particulars to the universals of science as developed in more systematic treatises (mainly Aristotle's).[36] However, as we already saw (in Plutarch's case), the genre was appreciated not just for its playfully digressive contents but also for its methodological merits and inquisitive approach. As we will see in the next section, and as was already highlighted before, the genre provided a useful tool for scientific research not only among (natural) philosophers, but also among imperial medical authors.

4. Aristotelian *Problems* and Imperial Medicine

Traces of the genre of natural problems can already be found in the Hippocratic writings.[37] Aristotle was probably acquainted with a number of these writings, as his biological treatises indicate.[38] The link between Aristotelian natural philosophy and ancient medical theory is also present in the Aristotelian *Problems*, esp. in the first book (entitled ὅσα ἰατρικά). It has been shown that the author here repeatedly draws from Hippocratic writings (esp. *On Airs, Waters, Places*),

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[34] Williams 2012. Cf., e.g., *NQ* 3, *praef.* 18.

[35] Seneca formulates questions only on occasion: see, e.g., *NQ* 2, 58; 3, 11; 16; 20. But the explanations to these questions are phrased assertorically (instead of interrogatively), and there is not much place for an enumeration of several plausible explanations. Yet, by incorporating these questions Seneca (at least implicitly) acknowledges that they deserve further consideration and have their place in scientific literature.

[36] The wording is Blair's (1999, 175): "*Problemata* are one of the ways of attaching particulars to the universals of *scientia* developed in systematic treatises, through commonsensical but often sophisticated reasoning."

[37] See, e.g., *De diaet. in morb. ac.* 7 (3, 5-14 Littré) and *Epid.* 6, 2, 5 (5, 278-280 Littré); esp. in *Epid.* 2, 4 en 6. Cf. Diller 1934; Flashar 1962, 298-299. According to the tradition, Democritus was the first to compose an actual collection of problems, viz. the Χερνικὰ (or Χειρόκμητα?) προβλήματα (D.L. 9, 49 = DK68A33 and DK68B299h). See Menn 2015.

[38] For Aristotle's acquaintance with the medicine of his time, see Oser-Grote 2004 (with the review of van der Eijk 2007 for further literature); van der Eijk – Francis 2009 (with further literature).

demonstrating a specific preoccupation with incorporating their theoretical and terminological framework into the Aristotelian paradigm of causal research (or vice versa).[39]

Also the other way round, the Aristotelian *Problems*, and more specifically their causal method of research, did not remain without interest to ancient doctors. Galen, for instance, at one point criticises the belief of Archidamus (reported by Diocles of Carystus in a work named after him)[40] that oil should not be used in massage because of its drying effect on the skin. The problem is that Archidamus makes inferences based on false analogies (what happens to the body when it is boiled in oil is, indeed, different from when it is rubbed with it); in so doing he concentrates on the apparent effect and not on the underlying cause. More precisely, Galen says that Archidamus did not examine the causes of the facts he states (viz. the properties of oil) by formulating them in the form of natural problems, "as Aristotle, Theophrastus and other philosophers" did.[41] He says that "one should always clearly postulate the phenomenon first and examine its cause afterwards (if one wishes), composing natural problems in this way: 'Why does oil make things that are boiled in it dry, crumbling and brittle, whereas water makes them moist and soft?', or 'Why do things that are boiled in oil dry out, whereas things that are otherwise drenched in it retain their proper moisture even more than when they are not entirely drenched?', [...]." This is the same type of inquiry as we know from the Aristotelian *Problems*,[42] but the statement is very much in line with Aristotle's more general account of the proper method to be employed in scientific inquiry, as known, for instance, from the *Posterior Analytics*, where Aristotle famously writes that "when we know the fact, we seek the reason why".[43]

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[39] See Ulacco 2011; Thomas 2015. For a list of possible sources of the chapters in *Pr.* 1, see Mayhew 2015b, 180 n. 20.

[40] In contrast to what Flashar 1962, 309 n. 4 writes, Galen is not criticising Diocles of Carystus himself but Archidamus, whose views Diocles is reporting (the misunderstanding may be based on fr. 223, 28 Rose, where ὁ Διοκλῆς is falsely bracketed after αὐτός). Archidamus may have been Diocles' father, but this remains uncertain, see van der Eijk 2000-2001, II, 2 (= Diocles fr. 2 van der Eijk; the passage from Galen's *SMT* covers frs. 185-186 van der Eijk).

[41] *SMT* 2, 5 (11, 474, 12-14 Kühn = fr. 223 Rose): δέον δὲ ὥσπερ ὁ Ἀριστοτέλης καὶ Θεόφραστος, ἕτεροί τέ τινες ἄνδρες φιλόσοφοι, τὰ τοιαῦτα τῶν προβλημάτων ἐν τοῖς φυσικοῖς ζητήμασιν προβάλλουσί τε καὶ λύουσι.

[42] For problems on olive oil, see *Pr.* 1.39, 42, 47; 3.5, 26, 35; 5.6, 38; 20.22; 21.1, 4, 13, 16; 23.7, 9, 15, 32, 37, 38, 40; 24.1; 30.1; 32.10; 38.1, 3, 11.

[43] *APo.* 89b29-30: ὅταν δὲ εἰδῶμεν τὸ ὅτι, τὸ διότι ζητοῦμεν. The same idea recurs in Aristotle's writings on natural science, for instance, in *Parts of Animals*, where we read that "first the phenomena should be grasped [...], then their causes discussed" (*PA* 640a14-15:

What the passage from Galen shows is that this method of inquiry was not only of interest to natural philosophers but also to doctors.

As to the reciprocity between natural philosophical and medical research, Aristotle's conclusion in *On Respiration* seems relevant (*Resp.* 480b22-32):

> As for health and disease it is the business not only of the physician but also of the natural philosopher to discuss their causes up to a point. But the way in which these two classes of inquirers differ and consider different topics of inquiry must not escape us, since the facts prove that up to a point their activities have the same scope; for those physicians who have subtle and inquiring minds have something to say about natural science, and claim to derive their principles therefrom, and the most accomplished of those who deal with natural science tend to conclude with medical principles.

As a matter of fact, we have a number of Imperial collections of medical-naturalist problems that clearly imitate the Aristotelian (i.e. causal) model of 'problematic' research as found in the *Problems*, and even share some of their content with it. There are three books of *Supplementary Problems* variously attributed to Aristotle and Alexander of Aphrodisias (but probably spurious),[44] two books of *Medical Puzzles and Natural Problems* attributed to the same Alexander (also spurious),[45] and two books of *Medical Difficulties and Natural Problems* by

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πρῶτον τὰ φαινόμενα ληπτέον [...] εἶτα τὰς αἰτίας λεκτέον). Aristotle's injunction to first grasp the observable phenomena (τὰ φαινόμενα) and to discuss their causes afterwards (τὰς αἰτίας) is an appeal towards empirical verification, where the examination of the causes (that is, the διὰ τί) of a specific natural phenomenon introduces a second phase in the scientific inquiry, after having determined the actual, empirical veracity of that phenomenon (that is, the ὅτι). A similar concern is found, e.g., in Herophilus, fr. 50a (and b) von Staden: "Let the phenomena be said first, even if they are not first" (λεγέσθω δὲ τὰ φαινόμενα πρῶτα, καὶ εἰ μὴ ἔστιν πρῶτα). In his well-known article on Aristotle's conception of what constitutes the φαινόμενα, Owen 1961 argued that Aristotle used this concept not in the sense of observable phenomena here, but of τὰ ἔνδοξα or τὰ λεγόμενα (cf. also Düring 1961). This was rejected by von Staden 1989, 117-119, who argued, more convincingly, that the concept of φαινόμενα really denotes the observable phenomena in Aristotle's biological writings, but that this does not eventually preclude the incorporation of τὰ ἔνδοξα or τὰ λεγόμενα in these writings too.

[44] Ed. Kapetanaki – Sharples 2006. See Sharples 2006.

[45] Ed. Ideler 1841-1842, I, 3-80. A new edition is currently being prepared by Carl-Gustaf Lindqvist of Gothenburg University (the forthcoming of which is, still, "eagerly awaited" to use the words of Kapetanaki – Sharples 2006, 1 n. 1). For an attempt to outline the complex bibliographical details on the problems attributed to Alexander, see Sharples 1987, 1198-1199. See also Id. 1998 and 2004. For speculation about the collection's authorship, see Sharples 2005, 53-6, who on the basis of new epigraphical evidence attributes the work (and part of the *Supplementary Problems* and the *On Fevers*) to the

Cassius the Iatrosophist.[46] Some of these collections have only recently received a modern edition, but none have attracted much further scholarly attention thus far. This is unfortunate because these works can introduce a novel, yet grossly understudied, perspective on the circulation of the Aristotelian *Problems* in the Graeco-Roman Empire, showing how the work became embedded in the medical tradition.

I will zoom in on only one collection here, viz. Ps.-Alexander's *Medical Puzzles and Natural Problems*. As I have shown elsewhere, this work is specifically linked to ancient medical education, providing numerous topics for intellectual training of aspirant doctors.[47] The preface to the first book is particularly intriguing as it propounds the types and general method of medical-natural problems, indicating which topics of investigation are of interest for medical education and how they can be approached. The preface has a clear protreptic function as it intends to instruct the reader (who is identified as a διδασκόμενος at the very end) about the proper method and procedures of 'problematic' research. First, Ps.-Alexander provides a classification of several kinds of problems based on criteria of difficulty and solubility, emphasizing the intermediate nature of medical-scientific problems. He first makes a basic distinction between problems that are soluble and those that are not. In so doing he implicitly alludes to Aristotle's *Topics*.

Ps.-Alexander begins with a discussion of which kind of questions are soluble, or to be more precise which are "immediately credible and comprehensible (πιστὰ καὶ γνώριμα), and without the savour of any ambiguity or investigation (πάσης ἀμφιβολίας καὶ ζητήσεως ἄγευστα)". These are of the type of: "Why do birds have feathers?" (this is for the sake of heating and beauty), or "Why did some animals receive horns, others stings, and still others sharp claws or the like?" (this is for the sake of defence). These problems reveal nature's providential ordering (cf. προῄδει: "nature knows beforehand"), but they do not really trigger any inquiry, since they do not really pose any difficulty, according to Ps.-Alexander.

As to the insoluble questions, on the other hand, these are known only to God, who, so Ps.-Alexander notes in a Platonic vein, created the world in a providential way. He did so after the manner of a craftsman (τεχνίτης), who assembles the material bits and pieces to form compound substances (ὑποστήσαντι), and has detailed causal knowledge of how all the machinery works. Aristotle's conclusion from *On Respiration*, more precisely the point that "physicians who have subtle and inquiring minds have something to say about natural science (περὶ φύσεως)",

Commentator's father, whose name was also Alexander and who was also a philosopher – a theory as intriguing as it is tentative.

[46] Ed. Garzya – Masullo 2004. See Manetti 2012.

[47] See Meeusen 2018.

does not seem far off in the present context, indeed. The passage in Ps.-Alexander runs as follows (Ps.-Alex., *Med. Puzz.* I *Praef.* 24-34):

> All those who propose such well-known and obvious problems (γνωστὰ καὶ σαφῆ) clearly have no intelligence (νοῦ), and anyone who doubts whether heat is innate to fire, lacks the sense of touch (ἁπτικῆς αἰσθήσεως). Then again, those who feel doubt, whether nature and a providential reason predict (λόγος προνοητικὸς προμηθεύεται) the processes of generation and corruption, the order of things, their motion, position, formation, complexions and things closely related to them, should be punished (κολάσεσιν τυγχάνουσιν ἔνοχοι). In fact, these problems are completely insoluble (ἄλυτα) and comprehensible only to God (θεῷ μόνῳ γνώριμα), who also gave substance (ὑποστήσαντι) to these things. After all, a craftsman (τεχνίτης), after constructing a mechanical device, knows all the causes of its actions, whereas a layman (ἰδιώτης) is completely bereft of causal insight.

Ps.-Alexander's point is straightforward: he *a priori* accepts that there must be a providential ordering of the cosmos, the functioning of which should not be questioned. In fact, those who do feel doubt should be punished (κολάσεσιν τυγχάνουσιν ἔνοχοι). The idea, moreover, that these problems are known only to God implies that their cause cannot be grasped by our human intellect. Therefore, such insoluble questions go beyond the epistemic range of the medical-naturalist research project Ps.-Alexander has in mind.[48]

As mentioned, Ps.-Alexander's point runs very parallel to Aristotle's discussion of which topics of investigation are unsuitable for debate in Aristotle's *Topics* 1, 11, 105a3-9. Helmut Flashar interprets the concept of κόλασις in Ps.-Alexander's account in relation to the phrasing of the problems themselves, some of which would require correction ("Korrektur in ihrer Fragestellung"), but as the passage from the *Topics* shows, it are rather the people who ask such 'tabooed' questions that require "Korrektur".[49]

> One should not examine every problem and every thesis but the one about which people might be puzzled (ἀπορήσειεν) – people who require reason (λόγου) and do not need punishment (κολάσεως) or sensation (αἰσθήσεως). For those who are puzzled as to whether or not the gods should be honoured and parents loved, need punishment (κολάσεως), while those who doubt whether snow is white or not, need sensation (αἰσθήσεως). We should not discuss matters of which the demonstration is too near at hand or too far-off, for the former raise no difficulty (ἀπορίαν), while the latter raise more than is appropriate to dialectical training (γυμναστικήν).

What we learn from this is that Ps.-Alexander's medical-scientific research, including his contemplation about its scope and procedures, is firmly rooted in Ar-

[48] See Meeusen forthcoming b.

[49] Flashar 1962, 365.

istotle's theory about what constitutes proper scientific inquiry. But at the same time, it is also rooted in the ancient medical debate about the proper method to be followed for treating patients – the search for the hidden causes of diseases being a procedure common to the dogmatic school of medicine.[50] Further research is required, however, to place the collection in its wider intellectual context and to reveal the medical and philosophical traditions and sources Ps.-Alexander relies on (esp. Aristotle and Galen).[51]

5. Prospects and results

In conclusion, it can be said that the time of the Roman Empire introduced a considerable increase in the popularity of the Aristotelian *Problems*. Thanks to the expansion of social and intellectual networks all over the Mediterranean region the collection circulated in numerous and various contexts. It seems to have been relatively easily accessible (e.g., in the public library of Tibur), and its peculiar style and content were well-known among educated people, making it subject not only to serious debate but also to playful discussion and even caricature. It served the specific agendas of many readers, particularly in philosophical and medical milieus, where the genre was valued not only for its peculiar content but also, and more primarily, for its causal method.

As indicated in this paper, much pioneering work still remains to be done. I have only provided a concise and very preliminary outline of one specific period in the history of the Aristotelian *Problems*. There are numerous other testimonies that have not been systematically studied yet, although they can tell us a great deal more about how the collection circulated in a wide array of socio-intellectual environments in Graeco-Roman Antiquity and (far) beyond. Nevertheless, I hope to have provided a useful research framework and method (viz. that of the 'receptive validation of scientific knowledge') by which further study can be safely undertaken.

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[50] In a final paragraph, Ps.-Alexander indicates how such problems can be properly solved and provides a set of terms and principles (κανόσι) that are of general use. By following the proposed method the student will be able to solve any problem, so it is promised. I have argued elsewhere that with this statement the author aims to regulate the reader's reception of the work by setting out the classificatory standards and methodological principles for this kind of research. See Meeusen 2018.

[51] See Oikonomopoulou – Meeusen forthcoming.

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