Introduction

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I.1 Galen's Scientific Epistemology

Galen of Pergamum (129–ca. 216 CE) was the greatest physician and medical theoretician of the Imperial era. Apart from his medical *œuvre*, he wrote a large number of works on philosophical subjects ranging from logic and epistemology to ethics, almost all of which have been lost.[1] Many philosophical asides and digressions are to be found throughout his enormous surviving corpus. And while assessments of Galen's status as an original philosopher in his own right may differ, there is no doubt that his attempt to develop a system of medicine rests on certain views about the conditions of knowledge and the ways of arriving at it, which are derived from the philosophical tradition with which he was intimately familiar. He knew Aristotle's *Organon* inside out, and was the author of the earliest known commentaries (for private use) on both *Analytics*, as well as on the *Categories* and *De Interpretatione*.[2] He was also a student of post-Aristotelian Peripatetic logic, a commentator on Chrysippus' logical works,[3] and wrote two works on Plato's 'logical theory'.[4] All these writings have perished, and some indeed were lost in Galen's own lifetime.[5] But their relevance to epistemology and methodology of science is indicated by the fact that Galen classifies them among works 'useful for demonstration',[6] i.e. for the discovery of properly scientific arguments. Galen never describes logic as a 'tool' (*organon*) of science, as Alexander of

[1] His own list of them occupies several pages of his *My Own Books* (*Lib.Prop.* XIX.8–48 K.; also edited with French translation in Boudon-Millot, 2007: 134–73; English translation in Singer, 1997: 3–22) 14.1–19.3, XIX.39–48 K. = 164,1–173,4 BM; and it may well not be complete. The greatest loss of all is his magnum opus *On Demonstration* in 15 books (*Lib.Prop.* 14.8, XIX.41 K. = 165,21–3 BM). See further below, n. 27.

[2] See *Lib.Prop.* 14.11–15, XIX.41–3 K. = 166,8–167,6 BM.

[3] Ibid. 14.16, XIX.43 K. = 167,6–10 BM.

[4] Ibid. 16.1, XIX.46 K. = 170,17–19 BM.

[5] In the catastrophic fire of 192: ibid. 14.9, XIX.41 K. = 166,1–5 BM.

[6] This is the title of ch. 14 of *Lib.Prop.*; although there is some doubt as to whether the titles are Galen's own, they are well-established in the Arabic tradition: BM (2007, 180–1 n. 4) retains them.

Aphrodisias was to do a bit later;[7] but his insistence on the fact that it should be useful comes to more or less the same thing.[8]

The words 'science' and 'scientific' are controversial in this context. In English, at least, they tend to be reserved for the 'hard' sciences, and historians (and scientists) have sometimes baulked at using them to characterise the activities of natural investigators prior to the early modern period.[9] But it is sometimes hard to find better equivalents for *epistêmê* and its cognates, at least when they are used in a particular strict sense, which goes back to Aristotle. At *Nicomachean Ethics* 6.3, 1139b31–2, Aristotle defines *epistêmê* as a 'demonstrative state' of the soul (*hexis apodeiktikê*), i.e. as a developed capacity for providing demonstrations of why things are the way they are. On the other hand, he also uses the word to refer to a structured system of propositions pertaining to and fully describing a particular domain.[10] In the first sense, *epistêmê* may be translated as 'knowledge' or, perhaps better, as 'understanding';[11] but in the second sense, it is best rendered as 'science', or 'a science'.[12] Still, the two uses are intimately linked, which is why some scholars prefer to use the phrase 'scientific knowledge' to render *epistêmê* in the first sense.[13] The link is constituted by the notion of demonstration (*apodeixis*): *epistêmê* in sense 2 is characterised by the *demonstrability* of its propositions, with the exception of the first principles; the derivative propositions follow from those principles by strict deductive logic. In the first sense, then, *epistêmê* is a cognitive capacity, which is actualised in demonstrations, the totality of which are *epistêmai* in sense 2. Galen is constantly aware of these connotations when using the words *epistêmê*, *epistêmonikos*, etc., in connection with medicine: hence the crucial role of demonstration and demonstrative theory in his works.

Yet it may still seem questionable to what extent medicine qualifies as a system of demonstrable propositions and medical knowledge as scientific in the proper sense. Medicine, after all, is a productive art, whose goal is not knowledge as such, but health,[14] and many of its characteristic

[7] See, however, Galen's *Sects for Beginners* (*SI*, I.64–105 K., also edited in Helmreich, 1893: 1–32; translated in Walzer and Frede, 1985: 3–20) 5, I.77 K. = 10,18–19 H., where 'dialectical theory' (i.e. logic) is listed among the 'tools (*organa*) in the search for what is not manifest'.
[8] *Lib.Prop.* 14.1–3, XIX.39–40 K. = 164,2–24 BM; cf. Barnes, 1993. [9] E.g., Wootton, 2015.
[10] Cf., e.g., Aristotle, *APo.* 1.10, 76a37–8; 1.11, 77a26; 1.13, 78a23; 1.22, 84a10; 2.7, 92b15; 2.17, 99a22.
[11] Cf. Burnyeat, 1981. [12] Cf. Bronstein, 2016: 20, n. 49.
[13] E.g., Angioni, 2016; Bronstein, 2016; Malink, 2017.
[14] Cf. *Constitution of the Art of Medicine* (*CAM*, I.224–304 K.; also edited with Italian translation in Fortuna, 1997) 1.1–8, I.227–30 K. = 56,19–58,22 Fortuna; *Thrasybulus* (*Thras.*, V.806–98 K.; also

conclusions will be injunctions to act. And while one might well respond that those injunctions, for a properly scientific Galenic doctor, must be based on an accurate assessment of just what has gone wrong in each case, and how the deficits can be made good on the basis of a thorough understanding of the basic physics and physiology at work, the particular prescriptions must involve a sensitivity to contingent conditions; they cannot all be expressed in the form of eternal, necessary relations that hold between universals. Galen acknowledges that diagnosis is sometimes based on expert conjecture (*kata stokhasmon tina tekhnikon*), rather than secure knowledge (*kat' epistêmên bebaian*).[15] Indeed, since the object of medical treatment is a particular patient, whose peculiar nature is 'inexpressible' and escapes precise knowledge, a doctor cannot avoid making conjectures, although of course they should be informed, indeed expert ones.[16]

But Galen does not claim that medicine is a science (in the strict sense) in all respects. He describes it more cautiously as 'the art knowledgeable of things healthy and unhealthy' (*tekhnê hugieinôn te kai nosôdôn gnôstikê*).[17] And even though he accepts the ancient account of medicine as 'the science of things healthy, unhealthy, and neutral' (*epistêmê hugieinôn kai noserôn kai oudeterôn*), he is careful to point out that 'the word "science" must be understood in a general, and not in a particular sense' (*Ars Med.* 1b.1, I.307 K. = 276,6–9 Boudon).[18] He does not explain the distinction, but he probably makes it in order to reserve the particular use of *epistêmê* to sciences in a stricter sense than medicine. Arguably he has in mind the *theoretical* sciences, i.e. those 'whose only goal is to understand the nature of things they are investigating'; following Aristotle, he includes arithmetic, astronomy, and the science of nature in their number (*CAM* 1.1, I.227 K. = 56,19–28 Fortuna; *Thras.* 30, V.861 K. = 72,14–17 H.). It is, above all, the science of nature (*phusiologia, phusikê theôria*) that introduces a properly 'scientific' ingredient into medicine. Like Aristotle, Galen believes

edited in Helmreich, 1893: 33–100; translated in Singer, 1997: 53–99) 30, V.861 K. = 72,12–27 H.

[15] *Art of Medicine* (*Ars Med.*, I.305–412 K.; also edited with French translation in Boudon, 2000: 274–392; English translation in Singer, 1997: 345–96) 19.4, I.353 K. = 332,3–8 Boudon.

[16] Cf. *The Therapeutic Method* (*MM*, X.1–1021 K.; books 1–2 translated in Hankinson, 1991a, the whole work in Johnston and Horsley, 2011) 3.7, X.206 K. See further Chapter 3 in this volume, 90–1. For the notion of 'inexpressibility', see further below, Chapter 6, 157–69.

[17] *Commentary on Hippocrates' 'Epidemics' VI* (*Hipp.Epid. VI*, partially edited in XVIIA.793–1009 and XVIIB.1–344 K.; edited in Wenkebach and Pfaff, 1956) 5.1, XVIIB.227 K. = 255,27–8 Wenkebach.

[18] The definition probably goes back to Herophilus; cf. von Staden, 1989, 103–14.

that demonstrations are possible in this area, and to the extent that medical theory and practice are based on the science of nature, medical knowledge, at least in some of its parts, can also aspire at 'scientific' (that is to say, 'apodictic') certainty.

If Galen's project of scientific medicine is, in broad outlines, Aristotelian, his *epistemology* is partly informed by the specifically medical concerns, and partly by the philosophical debates of his own time concerning the possibility, nature, and conditions of scientific knowledge. As far as the medical context is concerned, Galen situates himself amidst the controversy between the Empiricist and the 'Rationalist' (or 'Dogmatist') schools of medicine. For Galen, the controversy concerns, above all, the question of whether the inference to the hidden causes of symptoms is a legitimate way to the discovery of remedies and means of healing, or whether reasoning about causes and remedies should be carried out solely in terms of perceptible phenomena. Galen takes seriously the Empiricist objection that inferences to items unclear by nature generate 'undecidable disagreement',[19] although he ultimately believes that the serious disagreements, the ones that actually matter and have practical consequences, are in fact decidable, if we get the method right. Moreover he sympathises with the Empiricist requirement that one should 'follow the phenomena',[20] at least in the sense that one's practice should be sensitive to the appearances, and one's ultimate choice of explanatory theory consistent with (and explanatory of) them. His logic of scientific discovery and justification, as developed in his lost *On Demonstration* (*Dem.*) and applied throughout his *œuvre*, was designed to make room for the insights of Empiricism within a generally Rationalist framework.[21]

In pursuit of this project, Galen becomes a participant in a more wide-ranging debate about the nature and possibility of knowledge, which goes back to the third century BC, but was still very much alive in Galen's own time, as witnessed by his (more or less contemporary) colleagues Sextus Empiricus and Ptolemy. Galen's contribution to this debate is characterised both by a profound knowledge of, and respect for, Aristotelian

[19] *SI* 5, I.78–9 K. = 11,20–12,2 H.; for 'disagreement', see below, Chapter 1, 13–20; Chapter 2, 47–8; and *General Subject Index* under 'disagreement'.

[20] Cf., e.g., *MM* 1.4, X.36 K.; *Commentary on Hippocrates' 'Nature of Man'* (*HNH*, XV.1–223 K.; edited in Mewaldt, 1914) 1.10, XV.43–4 K. = 24,19–20 Mewaldt; *Matters of Health* (*San.Tu.*, VI.1–452 K.; also edited in Koch, 1923) 5.11.44–6; VI.372–3 K. = 164,21–30 Koch; *The Affected Places* (*Loc.Aff.*, VIII.1–452 K.; first two books also edited with German translation in Gärtner, 2015; English translation in Siegel, 1976) 3.9, VIII.174 K.

[21] See particularly Chapters 2, 3, 4, and 6 in this volume.

logic, and by his concerns as a practising scientist, but one preoccupied with method. He engages in polemic against scepticism and, while acknowledging the limitations of scientific knowledge regarding such issues as the substance of the soul or the causes of cosmic order, he believes that patient and orderly research, when focused on well-defined problems in empirically accessible areas, can produce results that are not only convincing and useful, but also demonstrably true. Despite the many obvious flaws of Galenic science, his moderate epistemological optimism remains one of the most appealing examples of what one might call 'the scientific attitude' in antiquity.

I.2 State of the Art and the Present Volume

More than 40 years ago, Vivian Nutton, Geoffrey Lloyd, and A. Z. Iskandar organised a meeting in Cambridge under the title 'Galen: Problems and Prospects'. The hope was to promote a revitalisation of scholarly interest in Galen; and the contributions were wide-ranging, and in many cases avowedly preliminary. The results were published two years later (in Nutton, 1981) and those expectations have been triumphantly realised over the intervening years. That volume contained the pioneering paper of Michael Frede, 'On Galen's Epistemology';[22] since then, other researchers – including Jonathan Barnes, Jim Hankinson, Geoffrey Lloyd, Teun Tieleman, Ben Morison, and Riccardo Chiaradonna – have contributed further studies exploring the links between Galen's understanding of the criteria and defining characteristics of knowledge, his empiricism, and his rational methods.[23]

The studies in this volume seek to build on these foundations and to push the discussion of these issues further. That Galen thought that experience and reason were both indispensable as tools of scientific discovery is now well known. However, it remains to be explored how precisely these tools are interrelated, and how they are supposed to contribute to discovery. In particular, the notion of *diôrismenê peira* (which we translate as 'differentiated experience') is of paramount importance in this regard. Philip van der Eijk drew attention to this concept in 1997,[24] but little work has been done on it since then.[25] We also know that Galen

[22] Frede, 1981.
[23] See Barnes, 1991; Hankinson, 1991a; Hankinson, 1991c; Lloyd, 1996; Tieleman, 1996b; Lloyd, 2005; Hankinson, 2008c; Morison, 2008a; Tieleman, 2008; Hankinson, 2009; Chiaradonna, 2014; Chiaradonna, 2019.
[24] Van der Eijk, 1997. [25] Various aspects are discussed in Chapters 3, 4, and 6 in this volume.

was a connoisseur and promoter of various logical methods, often described by him as demonstrative, such as division, definition, and analysis. But how precisely these methods are applied in particular arguments, how they contribute to discovery, and what they have to do with demonstration need to be explored with more precision and clarity than has been the case so far. Galen often speaks about these things in vague and allusive terms, and the connection between what he says about his methods and the way he actually deploys them in his writings is not always as clear as one might wish; and, in any case, such asides are scattered far and wide throughout his voluminous surviving writings. Moreover, we are hampered by the loss of almost all of Galen's technical treatises on logic and demonstrative method;[26] and the attempt to recover and reconstruct their contents is still in its infancy.[27] Finally, the role of the kind of arguments that Aristotle describes as 'dialectical' also deserves re-examination; there seems to be a fine line in Galen's works between dialectical and demonstrative arguments, and the relation between the two needs to be given further consideration.[28]

These are some of the questions motivating this book. Contributors were asked to present detailed studies, preferably (though not necessarily) based on lesser known and underexplored parts of the Galenic corpus, that would help to open up these issues to further and better-founded discussion; this volume presents the fruits of those endeavours. They are all broadly concerned with methodology, primarily as it pertains to Galen's medical practice and to his understanding of physiology. But they also address related topics, such as the role of experience and reason in Galen's practical ethics,[29] and his ways of dealing with earlier theories in the process of establishing his own scientific views.[30] Finally, in the last two chapters, we are given a glimpse of how Galen's epistemology was received in the Byzantine and Islamic worlds.

The opening piece by Jonathan Barnes broaches the fundamental issue of Galen's attitude to scepticism. Galen has no time for scepticism of any

[26] A notable exception is Galen's *Introduction to Logic* (*Inst.Log.*, edited in Kalbfleisch, 1896); see references below, 151, n. 57. A new edition and commentary are being prepared by Jonathan Barnes and Ben Morison.

[27] This is especially true of *Dem.*, the research on which has recently been boosted by new discoveries in Greek and Arabic sources; see Havrda, 2011; Koetschet, 2015; Havrda, 2016: 34–50; Koetschet, 2019: XXIX–CXXVI. An edition of testimonies is under preparation by Matyáš Havrda and Pauline Koetschet.

[28] Following upon the pioneering work of Tieleman, 1996b. See in particular Chapters 4 and 5 in this volume.

[29] Chapter 9. [30] Chapters 2, 7, and 8.

kind, and generally treats it as no more than sophistry. Barnes, however, concentrates on a passage of Galen's *Commentary on Hippocrates' 'Regimen in Acute Diseases'* (*HVA*),[31] in which Galen implies that sceptics cannot really be serious about what they say, and which adverts to the venerable sceptical challenge to prove that one is not in fact dreaming. Barnes first teases out its (Platonic) provenance, and then subjects the argument and its underlying assumptions to a penetrating analysis, the upshot of which is that, while Galen may be right to think that scepticism is from a practical standpoint unthreatening, none the less the actual arguments involved are far from trifling, and demand serious philosophical attention.

Inna Kupreeva focuses on the methodological debate between Empiricist and Rationalist schools of medicine, as portrayed in Galen's early treatise *On Medical Experience* (*Med.Exp.*).[32] This dense and philosophically sophisticated text, preserved for the most part only in an Arabic translation, supposedly presents the substance of a dispute, witnessed by the young Galen, between his Rationalist teacher Pelops and an Empiricist opponent, about the respective roles of experience and reason in medicine. Carefully analysing the arguments on both sides, in particular as they concern the question of inductive generalisation and the nature and validity of the empirical procedure known as *epilogismos*, Kupreeva shows how Galen's presentation of a sequence of responses and counter-responses between the two protagonists serves to prefigure his own complex and hugely influential synthesis of the empirical and rationalist procedures in his own mature methodology.

Jim Hankinson's point of departure is the long discussion of the method of healing for 'hollow wounds', which occupies most of Book 3 of Galen's *The Therapeutic Method* (*MM*).[33] Galen's main concern is to vindicate the superiority of his own method of finding the appropriate treatment, which combines rational and empirical elements into a unified whole, over a 'pure', non-theoretical Empiricism on the one hand, and a degenerate sort of Rationalism on the other, which is neither founded on a fully general physics, nor is properly responsive to empirical data. A sequence of discussions of types of case of increasing complexity, and the difficulty of arriving at a proper diagnosis of the conditions, and the construction of appropriate drug therapies for them, is deployed in order to underwrite the

[31] XV.418–919 K., also edited in Helmreich, 1914: 115–366. A French edition with translation is being prepared by Antoine Pietrobelli.
[32] Edition of the Arabic translation in Walzer, 1944; English translation in Walzer and Frede, 1985: 49–106.
[33] See above, n. 16.

practical necessity of adopting his own 'mixed' method. The last part of the study completes the analysis by a consideration of how the concept of differentiated experience, *peira diôrismenê*, functions in the context of the discovery of the powers of drugs and their relations to different types of basic constitution. Properly understood, for Galen, experience serves not only to verify the predictions of theory; it also fulfils a crucial role in the generation of that theory in the first place, and in some respects anticipates the modern scientific notion of the controlled experiment.

Matyáš Havrda selects two texts designed to throw into sharp relief Galen's methods of solving natural and dialectical problems. The first comes from the treatise *The [Mixtures and] Powers of Simple Drugs* (*SMT*),[34] and deals with the power and nature of olive oil. Galen castigates one Archidamus for having arrived at a mistaken account of the oil's nature, because he has generalised from a limited set of observations of questionable relevance. In contrast, Galen proposes an orderly course of inquiry, which starts from the complete account of the oil's observable attributes and proceeds towards causal investigation by means of their empirically testable 'differentiations'. The second text is *Thrasybulus*, subtitled *Whether Hygiene Belongs to Medicine or Gymnastics* (*Thras.*),[35] and Havrda follows out in detail how Galen sets about answering that question in a quasi-dialectical manner. The first step is the discovery of an agreed starting-point, consisting of a relevant and non-question-begging description of the point at issue. This is followed by further conceptual clarification of the agreed description, which, as Havrda argues, plays a similar role in the dialectical dispute as 'differentiation' of observed attributes in the former case.

Turning to Galen's *The Doctrines of Hippocrates and Plato* (*PHP*),[36] Teun Tieleman revisits and revises his earlier studies of Galen's basically Aristotelian notion of dialectic and its relation to its Platonic antecedents, as well as to roughly contemporary 'Middle Platonist' accounts. The picture that emerges from his detailed analysis of the texts is of Galen adopting and adapting Aristotle's notion of dialectic as arguing from (provisionally) agreed premisses to provide a structure within which argumentation can contribute, albeit at a lower level of certainty and evidentness, to genuine scientific understanding, even where there is no straightforward, indicative inference to the actual essential natures of the matters under investigation. The dialectical process is part of the context of

[34] XI.379–892 and XII.1–377 K. For the title, see below, 80 n. 2 and 118 n. 11.
[35] See above, n. 14. [36] V.181–805 K., also edited with English translation in De Lacy, 1978–84.

discovery, the sorting out and weighing of the observable clues in order to establish the (provisional) demonstrative axioms from which the mature scientific theorems will be deduced. Tieleman considers a variety of material drawn from *PHP*, before turning to the *Introduction to Logic* (*Inst.Log.*)[37] and its account of the process of discovery, and then finally to a polemical passage from *Distinct Types of Pulse* (*Diff.Puls.*),[38] in which Galen takes his opponents to task for failing to engage properly in the originally Platonic process of organisation by division.

Based on texts from Galen's large, and largely underexplored, presentation of his doctrines on the pulse, Peter Singer provides a richly documented analysis of the conflicting and paradoxical relations between experience and *logos* in Galen's (broadly speaking) empirical inquiry. Singer explores in particular the following questions: Given the fundamental role of experience in Galen's notion of science, how does Galen deal with its perceived 'inexpressibility'? And, relatedly, how far is experience shaped by expectations and anticipations derived from previous theoretical commitments as to what could and should be perceivable? Singer concentrates on some passages from Galen's investigations into the pulse as a diagnostic and prognostic tool. Pulses are, Galen thinks, highly variable; and those variations are correlated with a wide variety of underlying conditions, of both a healthy and a pathological nature. But in order to make use of pulse-variations in diagnosis, one must first be capable of registering subtle differences in their form. This in turn requires an understanding of the basic genera of variation, the different axes along which pulses can exhibit their differing perceptible characteristics. This is partly a matter of conceptual analysis: Since the pulse consists in the filling and emptying of a solid vessel, it can vary in size along any one of the three dimensions. It can also be faster and slower, more or less vigorous, with longer or shorter intervals between beats, and so on. But it is a matter of (suitably trained) experience which of these possible combinations are as a matter of fact realised, and under what circumstances, and as indicating and portending what. The training consists in gradually coming to be able to feel the minutest variations, which involves constant practice. Galen tells of his own long struggle to come to actually recognise by touch the fact of the arterial systole, the retreat of the artery from contact with the finger, which reason dictates must actually exist. Singer finally relates all of this to the central Galenic question of how much of the *tekhnê* can be

[37] See above, n. 26. [38] VIII.493–765 K. For the title, see below, 190 n. 1.

conveyed verbally from teacher to pupil, and how much requires actual hands-on experience.

In a study focusing primarily on Book 2 of *Diff.Puls.*, Orly Lewis deals with Galen's attack on the pulse-classification of the first-century CE Pneumatist doctor Archigenes, and examines Galen's reasons for replacing Archigenes' theory with his own. Galen claims that Archigenes has no idea of the proper method of determining the real species of pulse, and he castigates him for terminological failings as well. But it turns out on close analysis that Archigenes' actual classification is very close to Galen's own; and the terminological cavils seem fairly trivial and pedantic. So what is the real substance of Galen's attack? Lewis suggests that the point at issue is partly simply a matter of professional rivalry, but partly also a consequence of Galen's insistence on adhering to the properly philosophical method of conducting divisions.

Katerina Ierodiakonou investigates Galen's treatment of the physics, physiology, and psychology of perception, in particular vision, as exemplified in texts primarily drawn from *PHP*, and its relation to and engagement with the rich philosophical tradition that preceded it. A major point of disagreement in the case of vision divides those who suppose that vision takes place because of external influences penetrating into the sensoria ('intromission'), from those who think that something from the perceiving subject reaches out to grasp the visible object ('extramission'). Her subtle discussion begins with Galen's emphasis on the fact that perception is not simply a matter of alteration, but it rather involves the recognition of it; and that is something which necessarily involves the ruling part of the soul, which for Galen is in the brain. But this recognition is not just a matter of the reception by the brain of neurally transmitted information from the sensoria; the ruling part must also ramify its power out to the origins of the nerves, for otherwise it could not be aware of the location of the sensations in various parts of the body. This argument is extended in the case of vision: since vision is the sense which locates external objects in their spatial positions, a similar extension of power into the visible world needs to be postulated. Ierodiakonou carefully sifts through the antecedents of this view, primarily in Platonism and Stoicism, in order to locate it in the tradition as well as to emphasise the extent to which it is striking, original, and influential.

The last contribution dealing directly with Galen's own works addresses the role of experience and reason in Galen's 'moral epistemology'. David Kaufman takes as his main texts two treatises of Galen's on practical ethics, which have as their goal the elimination, or at least the minimisation, of two destructive emotional states: grief, in the sense of distress in the face of