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The Pythagorean influence on medicine: a historical fact or a problem of interpretation? Part 2

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The authors of this article consider the influence of the Pythagoreans' views on medicine. They justify two significant for the history and philosophy of medicine theses. The first one is the lack of influence of the Pythagoreans on the formation and development of an independent medical school. The second is the fallacy of the assertion that the medical views of some representatives of ancient medicine (the most famous of which is Alcmaeon) were formed solely under the influence of the ideas of the Pythagoreans. Alcmaeon, who is traditionally identified with the followers of the Pythagorean teaching, formed fundamental statements for further development of ancient Greek rational medicine (the thesis about the controlling role of the brain, etc.). The main argument against Alcmaeon's attributing to the Pythagorean school is his idea of the central control function of the brain. In terms of the birth and development of medicine as a science, Alcmaeon is the direct predecessor of Hippocrates and Herophilus. The interdisciplinary approach, as well as authors' scientific developments related to the reconstruction of the history and philosophy of ancient medicine, allow the authors to conclude that the Pythagorean doctrine has dual nature because of the rational and occult/magical elements in it. It is a serious reason for not overestimating the importance of Pythagorean philosophy for the development of medicine. Pythagorean teaching could not become a fundamental system of views, which was the basis for the formation of a picture of the world of the first generations of representatives of ancient Greek rational medicine and separate medical schools. However, this fact does not deny the possibility of influence of some Pythagorean ideas on the representatives of the ancient physicians in the broadest ideological sense.

Keywords: *history of medicine, history of science, Pythagoreans, ancient philosophy, ancient Greek rational medicine*

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Information on the development of Greek rational medicine in Magna Graecia is extremely limited. For instance, we know about Alcmaeon of Croton, a physician generally regarded as the originator of the first medical theory, but there appears to be little reason to use the term "school of medicine" with respect to Crotonian medicine, or to regard the town as a centre of the development and dissemination of medical knowledge. As noted in the first part of this article [1], different schools of medicine have traditionally been identified in Magna Graecia: the Crotonian and Sicilian. Some historians refer to all medicine in the Greek colonies in the south of the Apennine Peninsula collectively as "southern Italian medical tradition". Let us consider the historical context in which the term "school" is applied in the literature to the medicine of Kos or Knidos. We know that physicians worked in Kos and Knidos over hundreds of years.[1] The

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[1] Hippocrates's family history indicates that the tradition of studying and teaching medicine originated in Kos. We also know that the written legacy of the Knidian school emerged in the fifth century BC.

centres of medical knowledge in Kos and Knidos retained their significance and influence within the Mediterranean until the second century BC, whereas Croton, Akragas and Syracuse are known as places linked only with individual events of importance to the history of medicine.[2] The very terms "Crotonian school of medicine" or "Sicilian school of medicine" evidently arose because the towns in question were regarded as important, as centres for schools of philosophy — primarily that of the Pythagoreans. Foreign historians have argued that Pythagorean teaching influenced the development of medicine. If Pythagoras, his disciples and Empedocles are regarded as the most important pre-Socratic philosophers, it seems at first sight indisputable that their views had a determining influence on medicine. Accordingly, scholars also refer to the Crotonian and Sicilian schools of medicine. The Koan and Knidian schools arose in an area under the cultural influence of Miletus, and their development was significantly influenced by early Ionian physics. Consequently, it is argued, medical thought in Croton and Akragas evolved under the influence of the philosophy of Pythagoras and Empedocles. This view can be seen in works by historians of philosophy who regard Alcmaeon as a disciple of Pythagoras, and rightly point out the fundamental role of Empedocles's theory of the four primary elements in the future development of both medicine and natural sciences in general [2–4]. Another argument that bears looking at is that there were common features between the views of Alcmaeon and the Pythagoreans known to us.[3] However, the fact that the worldviews of different scholars share common features by no means proves that their teachings are ontologically related.

Using an interdisciplinary method of historical and medical research to analyse the biographies and scientific views of the physicians regarded as Pythagoreans makes it possible to shed light on their links with Knidos and Kos, or the influence of early Ionian physics. For example, Akron of Akragas is associated with the origins of the tradition of rational medicine in Sicily, and is also considered to have had a significant influence on Empedocles. However, we know that a number of representatives of the Rhodian branch of the Asclepiads moved to Akragas, just as physicians from Knidos moved to Croton. Given these facts in mind, it is clear that the views of the medical schools that arose under the influence of early Ionian physics were developed in the medicine of Magna Graecia as well. This, of course, does not mean that any of these physicians could have been a follower of Pythagoras or Empedocles, but it does indicate that Greek rational medicine emerged from a single centre.

Alcmaeon and Pythagorean teaching: who influenced whom?

For historians of medicine, a key question is whether the celebrated physician Alcmaeon can be regarded as a follower of Pythagorean philosophy [7–11]. Most scholars agree that he was Pythagorean. For example, Zhmud writes that he "was the first Pythagorean to leave a written tradition", citing historical and historiographical evidence [6, p. 109]. Alcmaeon is associated with the first proto-scientific ideas regarding the body as an integrated whole.[4] Greek medicine owes many of its fundamental categories to Alcmaeon. One of these is a "dynamic understanding of disease", with health being seen as a state of equilibrium between opposite qualities, or forces (δυνάμεις), in the body, and disease as the dominance of one of them, something that we later find in the Hippocratics. Among the causes of disease, Alcmaeon names excess cold and heat, too much or too little food, and external factors (water, locality, etc.), thus prefiguring similar approaches

[2] Typically, such documents relate to the life and work of individual physicians and philosophers (such as Alcmaeon and Akron).

[3] Longrigg, for example, refers to this [5, p. 48]. See also [6, p. 109].

[4] Longrigg writes: "Given the scanty nature of our surviving evidence, it would be prudent to avoid such extravagant assessments. But it is, nevertheless, apparent that Alcmaeon is a figure of great importance in inter-relations between medicine and philosophy. Alcmaeon's influence both upon later philosophical and medical thought was considerable. Owing to our lack of pre-Hippocratic Greek medical literature, it is impossible... to say whether or not he was the actual originator of the medical theories attributed to him. Our evidence, however, suggests that he was an original and independent thinker. <...> What is important is that his medical beliefs reveal precisely the same rational outlook characteristic of the Ionian natural philosophers before him and the pre-Socratic philosophers after him." [5, p. 48].

to aetiology in the Hippocratic Corpus. A healthy, normal state of the human body results from equilibrium (ίσονομία) or harmony between opposite principles. Where this balance is upset in favour of one of them, Alcmaeon calls this "monarchy" (μοναρχία). This produces disease, which can be cured only by influencing its cause — i.e., by restoring the balance of opposite principles. This is the methodological basis for the idea of treating opposites with opposites. We find similar principles in the Hippocratic Corpus: "In a word, opposites are remedies of opposites,[5] for medicine is addition and subtraction: subtraction of what is excessive, addition of what is lacking. Whoever does this best is the best healer, whereas whoever is most removed from this is also most removed from the art" [12, p. 264].[6]

Jacques Jouanna believes that Ionian physics had a significant influence on Alcmaeon's approach [13]. He notes that Alcmaeon's ideas regarding a balance of opposite substances in the human body being a sign of health are similar to the natural philosophical beliefs of Anaximander of Miletus, who proposed a description of the universe based on symmetry, with outwardly random celestial phenomena being governed by strict laws. [14, p. 15].

Alcmaeon was a contemporary of Pythagoras, and lived in the same town as him, so he could likely have met him and listened to his speeches. Even so, we should not assume from this that Alcmaeon's beliefs as a physician evolved under the influence of Pythagorean teaching. Alcmaeon's theory of opposites has much in common with Pythagoras's beliefs. A feature of Pythagorean teaching is the identification of ten basic pairs of opposites: finite and infinite; odd and even; one and many; right and left; male and female; rest and motion; straight and crooked; light and darkness; good and evil; square and oblong. For the natural philosophical beliefs of the Pythagoreans, the categories "finite and infinite" and "odd and even" played a pivotal role. Gregory Vlastos provides a very interesting analysis of this issue [5, p. 50]. He also points out the great significance of the "finite and infinite" and "odd and even" pairs to Pythagorean teaching, while noting that Alcmaeon did not use these categorical pairs. Furthermore, he argues, they contradict everything reliably known about Alcmaeon's views. Longrigg [5] and Nutton [15] point out that attempts to describe ideas of the material world in categories of opposites were also a feature of early Ionian physics.[7]

Within Pythagorean philosophy, the question arose as to how the harmony of opposites was maintained; this may lie behind Alcmaeon's interest in the structure and workings of the human body. According to him, this was based firstly on Alcmaeon's originality as a thinker, secondly on his lack of a philosophy of numbers and in his interest in natural science, and thirdly on the fact that Aristotle did not call him a Pythagorean [6, p. 109–110]. Alcmaeon's theory did not specify the number of opposites, but this in itself is not conclusive: the sources tell us only that Alcmaeon used several pairs of opposites. If, however, we regard Alcmaeon as a Pythagorean, we must assume that he used more such pairs (since Pythagoras used more pairs of opposites), but the sources for them have not been preserved. As such, this unjustified (particularly given the lack of extant sources) assumption about Alcmaeon's Pythagorean views becomes the decisive argument for his medicine being constructed in accordance with beliefs typical of Pythagorean philosophy. Zhmud notes that Democedes, Alcmaeon, Iccus, Hippo and Philolaus are united by "a rational approach to medicine, and the absence of any connection to religious and magical healing in their theories and practice" [6, p. 311—312]. This is largely a result of considering the views of Iamblichus and Aristotle: the former refers to Alcmaeon as a Pythagorean, whereas Aristotle, in *Metaphysics*, links Alcmaeon's idea of opposites

[5] Contraria contrariis: this is the basic principle of Greek and all subsequent therapy — allopathy, as opposed to the homeopathy of Samuel Hahnemann (similia similibus). See also: Hippocrates: Aphorisms, II, 22.

[6] In addition to the aforementioned passage from *On Winds*, Hippocrates, in *Aphorisms*, gives an example of how to treat opposites with opposites: "Diseases which arise from repletion are cured by depletion; and those that arise from depletion are cured by replacing; and in general, diseases are cured by their contraries." http://classics.mit.edu/Hippocrates/aphorisms.2.ii.html This aphorism establishes the principle of "contraria contrariis" that underlies allopathic medicine.

[7] The only difference is that here they were not postulated in ten categorical pairs, and were not used in mathematical categories as they were by the Pythagoreans.

with the development of Pythagorean thought, but with an important qualification: he is not sure whether Alcmaeon took the idea from Pythagoras or whether the Pythagoreans took it from Alcmaeon [17]. However, we can only point to the numerous coincidences between Alcmaeon's views and the aspects of medical knowledge that are reflected in the Hippocratic Corpus. We cannot say any more precisely who influenced whom.

The concept of "health", then, was closely connected with that of "disease" in Hippocratic medicine. In the Hippocratic Corpus, health is defined both apophatically (through what it is not — as an absence of suffering) and cataphatically (through what it is — the body being composed of a balanced mixture of elements). "Disease" is the state opposite to "health": it is the suffering of the human body as a result of a disruption to the harmonious relationship between the primary principles (elements, fluids and substances). We can see here the continuity between the ideas of Hippocrates and pre-existing theories of health and illness. The innovation in Hippocrates' theory was that he added to the idea of equilibrium (or imbalance) the fundamental concept the basic substances making up the human body being a mixture ("crasis"). When balanced, the primary elements and fluids were "well-mixed".[8] In other words, the body was healthy. As such, the Hippocratic Corpus presents a system of general pathology that covers aspects of the balance between the internal states of the body and external influences: a key concept here was the category of "change" (μετάβαση), a central component of the Hippocrates theory of pathology. In other words, there is no clear boundary in the works of the Hippocratic physicians between normal and pathological condition of the body: the health is a fragile balance that can easily be broken.

At the same time, we need to try to understand whether there is any connection between the fundamental views of the Crotonian physicians on medicine and any natural philosophical traditions. Alcmaeon managed to bring a new, "physiological" direction to pre-Socratic natural philosophy, by focusing it on aspects of the structure and vital functions of the human body. This, however, most likely indicates that with Alcmaeon being a distinguished scholar his views influenced those of the first generations of Pythagoras's disciples, rather than that Pythagorean philosophy was significant to the development of the worldview of Alcmaeon himself.

The question arises here as to Alcmaeon's views on the nature of the human soul and their relationship to different natural philosophical traditions. The following comment from Zhmud is particularly significant here: "...In Alcmaeon, the only Pythagorean philosopher who taught that the soul was immortal, there is no evidence of any doctrine regarding its transmigration... Alcmaeon was the first person to link personality with the brain, the seat of perception and thought..., ψυχή, meanwhile, he understood as the principle of life and movement, but we do not know where he situated it. Evidence for the immortality of the soul is the fact that it, like all divine heavenly bodies, is in constant circular motion — an argument later developed by Plato. How far Alcmaeon's analogy between the circular motion of the soul and heavenly bodies went, and what happened to the soul after death, we do not know' [6, p. 332]. Alcmaeon was the first person to identify the brain as the seat of control for bodily activities, to which sensations flowed via "pores" (specialised channels) from the different sense organs.

The doctrine that the soul was immortal and located in the brain was exceptionally important to the development of rational medicine in antiquity. This may explain why many natural philosophers have been concerned with the nature of sleep (in its resemblance to death) and dreams (as manifestations of spiritual life). It is worth noting that Alcmaeon did not share the Pythagorean view of metempsychosis. He believed that human intellectual activity took place in the brain. His views on sleep and semen are interesting: sleep, according to Alcmaeon, comes about because of an outflow of blood from the brain to the blood-carrying veins; semen is also produced by the brain. He sees embryogenesis as the mixture of seed from a man and a woman (the child's sex depends on whose seed dominates). In the womb, the foetus's head develops earlier than the other parts of that body, believes Alcmaeon, because of the dominant role played by the brain. Alcmaeon evidently studied the anatomy of the embryo, and his views on reproduction should

[8] Galen would use this concept to describe health.

be seen as an entirely logical development of his ideas, backed up by empirical evidence.

Alcmaeon stands alone in the history of science. Given the influence of early Ionian physics and Koan medicine that can be detected in his views, it seems highly likely that there were works of the Knidian school that influenced the development of the Crotonian physicians' views on medicine. One of the most important events in the history of medicine in the fifth century BC is Alcmaeon's description of the link between the eyeball and the brain via the optic nerve, based on findings from empirical observation. It is believed that it was this observation that led Alcmaeon to conclude that the eye, as a sense organ, merely received information, which was transmitted to the brain via a connecting nerve. It was the brain that was the seat of control for the senses. Accordingly, Alcmaeon has been seen as a pioneer of surgery and anatomical research. Some scholars, however, disagree, arguing that Alcmaeon's conclusion was based not on the results of surgical manipulations performed on a human, but on information from animal dissections.

It is probable that the Crotonian physician did observe a patient, or else he would have been unable to draw such conclusions: to be the first person to conclude that the brain was the organ from which the nerves proceed, he had to have serious empirical and theoretical grounds. This example represents an ideal model for such reasoning, and Alcmaeon evidently had the opportunity to see for himself that the optic nerve proceeds from the brain. Alcmaeon was not the only scholar at the time to observe the eyeball hanging from the optic nerve (the historical argument over whether a human or an animal was being studied is not important here). There were presumably many such observations: battle or hunting injuries and wounds were common in the fifth century BC. For a historian of medicine, it is important to understand why it was Alcmaeon, in Croton, in the fifth century BC, who drew these specific conclusions based on these observations. Shedding light on this will allow us to reconstruct Alcmaeon's worldview as a scientist. A researcher who has never observed an anatomical dissection, has never studied medicine, and lacks even basic clinical know-how, will not be able to understand the logic of the reasoning of a researcher addressing such objectives. It matters not here whether we are talking about the fifth century BC, or the fifth or fifteen century AD. The same applies to Alcmaeon's assertions regarding the connection between the other sense organs and the brain. Longrigg rightly notes that for the passages of the nose and ears even a simple probe would have been sufficient to understand this connection. From probing them and observing the anatomy of the optic nerve, Alcmaeon could have drawn the logical conclusion that the principal senses — vision, smell and hearing — were connected with cranial activity. Zhmud points out that, unlike other pre-Socratic thinkers, Alcmaeon put forward a theory of all the sense organs apart from that of touch. Theophrastus noted the importance of the fact that Alcmaeon distinguished between sensation and thought, and their functions. The principal difference between Alcmaeon's theory and the beliefs of Theophrastus and the latter's teacher, Aristotle, is Alcmaeon's view that the brain was the seat of thought. Alcmaeon suggested that the sense organs were connected to the brain by certain specialised channels, which transmitted sensations to it. The question of where the seat of control for the voluntary functions of the human body was located was equally important. The debate on this continued until the time of Galen, whose treatise *On the Doctrines of Hippocrates and Plato* represents its culmination. Using findings from anatomical dissections, Galen disproved the view held by the Stoics and Aristotle that the guiding principle was located in the heart. In discussing the functions of the highest, immortal part of the soul, located, he believes, in the brain, he emphasises the control of voluntary movements: "After all, the very nature, or essence — call it what you will — of the object of study served to demonstrate the guiding principle governing all thoughts and words coincides with the source of sensation and voluntary movement."[9] A historical and philosophical analysis assumes that the nature of thought was a key issue. From a physician's point of view, however, thought is one of the forms of psychophysiological activity, part of the more general function of an individual conscious, controlled behaviour. Here, the controlling function of the brain plays a key role. As such,

[9] Galen: *On the Doctrines of Hippocrates and Plato*, 7.1.7; see [19, p. 257].

the development of rational medicine in antiquity may be thought of in terms of a hypothetical line running from Alcmaeon through Hippocrates and Herophilos to Galen. Alcmaeon's works may be seen as the first attempt in the history of medicine in antiquity to apply a research method based on findings from anatomical dissections.

Diogenes Laërtius writes that Aristotle, and later Theophrastus, argued with Alcmaeon over how to interpret sensory experiences: "Alcmaeon of Croton, son of Peirithous, said the following to Brotinus and Leon and Bathyllus: concerning things unseen, (*as*) concerning things mortal, the gods have certainty, whereas to us as men conjecture (*only as possible*)." [20, p. 356].[10] Alcmaeon's statement is unusual for pre-Socratic thinkers: only the gods had access to reliable knowledge about the world, while people, having a more modest capacity for understanding, had to study the world about them by interpreting the evidence of their own sensory experiences. Alcmaeon may be regarded as a rationalist physician (as can be seen in his description of the optic nerve). Moreover, everything we know about his theory indicates that the celebrated Crotonian physician adhered to physical and chemical categories when describing health and illness. The mysticism of Empedocles was alien to him. One may recall how the disease was portrayed in classical tragedy: first, it was a punishment handed down to people by the gods; second, it was a kind of independent substance, acting from the outside. Essentially, the classic descriptions of diseases in Homer's poems represent them as an "attack" on the human body by some sort of substantive entity ("with a separate existence of its own", as Longrigg puts it). Sickness is therefore perceived as the absolute evil, and the disease itself interpreted as a punishment from supernatural forces (or beings). Illness here is the instrument through which the punishment is carried out. Alcmaeon employs strictly physical terms; he rejects the occult concept of disease, which he perceives as a natural phenomenon subject to the same rules as other such phenomena.

Who, then, influenced whom? If we accept that Koan and Knidian medicine could have influenced Pythagorean teaching, it becomes clear why the rational medicine of Magna Graecia was losing its significance as early as the end of the fourth century BC. In this interpretation, empirical methods of understanding, dietetics and other features of Hippocratic medicine are not a consequence of Pythagorean views, but a kind of intellectual "implant" brought from Knidos or Kos. In this context, the view of Alcmaeon as a great thinker closely associated with the (Pythagorean) Brotherhood, if not a member of it, who linked medicine and philosophy closely together [5, p. 48] should be regarded as erroneous. This changes the cause-and-effect relationship between the ideas of the Crotonian physicians and the Hippocratic Corpus. Rather than the Crotonians, influenced by Pythagorean philosophy, creating rational medicine, the tradition of which was entrenched in the Hippocratic Corpus, it was the tradition of rational medicine, which arose under the influence of early Ionian physics and was subsequently reflected in the works of the Hippocratic physicians, that was brought to Croton by physicians who came there from Knidos and, possibly, Kos.

Conclusions

Within the history of science, it is possible to identify natural philosophical systems that have influenced the development of the natural sciences in general and the establishment of the scientific method in medicine in particular. Alcmaeon developed a doctrine of "isonomy" and "monarchy" and theorised that the brain played a controlling role, on the basis of findings from observing the connection between the eyeball and the brain via the optic nerve. From an epistemological point of view, he is a direct predecessor of Hippocrates and Herophilos, as well as, in a sense, of Plato. Their work, in turn, influenced Galen. Today, we know little about the practices of the medical schools of Knidos and Kos in the fifth century BC, but what we do know about the medical tradition that arose within the context of early Ionian physics supports this line of reasoning. To be sure, such an interpretation may seem no more convincing than those mentioned above. It should be pointed out that, given the limited number of sources, the suggestion that Alcmaeon belonged to the Pythagorean school can only be speculation.

However, when discussing methods of historical reconstruction we should not forget the principle of historicism. In terms of political

[10] See also [5, p. 51].

or economic history, it is clear that the events associated with Alexander the Great's campaigns, or the economics of the ancient Greek polis, can be correctly interpreted only after attempting to understand the specific features of how people at the time saw the world. It is not possible, for example, to assess the significance of a particular mathematical idea advanced by Hippocrates of Chios or Euclid without understanding mathematics as a whole. Similarly, it is clear that one cannot discuss the features of the experimental method in antiquity, or the approach of Herophilos or Galen to anatomical dissections, without having any idea of what goes on in an anatomical theatre or physiological laboratory. It is appropriate to recall here Galen's comment "And it was someone with not the slightest idea of anatomy who had the audacity to make such statements!".[11]

It would seem that Alcmaeon's idea that the brain played a central controlling function is also the main argument against placing him in the Pythagorean school. Key to understanding the specific characteristics of medicine in antiquity is the attitude to anatomical dissections. It is this aspiration towards experimental proof, combined with an etiological approach to disease theory, that constitutes the essence of the apodictic method in medicine at the time. Summing up the historical evidence, Zhmud writes: "The information available to pre-Hippocratic medicine on the structure of the human body was obtained in the course of treating the wounded or observing dead people or animals; there was no special study of human anatomy at the time. The level of the Hippocratic physicians' understanding of anatomy and the evidence we have from the classical period show that dissection of human cadavers was not a *regular practice*, but do not mean that sporadic experiments of this type did not take place. The main reason usually given for this is that there were religious and psychological misgivings in Greece at the time against dissecting corpses, which, according to sacred religious custom, had to be buried as quickly as possible. The practice of dissecting human cadavers was, therefore, a temporary abandonment of such prejudices by individual physicians. Although secularisation undoubtedly played an important role in the development of anatomy in Greece, this explanation seems to be too speculative. Lloyd, for example, does not mention the influence of religion at all, point to the problems associated with the actual procedure of dissection in Greek medicine <...>. Lloyd... convincingly demonstrates what had also been known earlier: 'For a long time after Alcmaeon dissection was not carried out for its own sake as part of a routine procedure of investigation. Such dissections as were performed were evidently undertaken for a particular and quite definite purpose, to explain strange phenomena, to support a theory or settle a controversy.' The systematic study of the anatomy of animals was first carried out by Aristotle, and that of the anatomy of humans, and the human brain and nervous system, by Herophilos and Erasistratus. The problem, however, is that after them dissection of human cadavers was *no longer* carried out for its own sake as part of a routine procedure of investigation. Lengthy interruptions and sudden breaks in the development of the sciences in antiquity are were well-known: one only has to recall the fate of zoology after Aristotle, or of botany after Theophrastus" [6, p. 317, 319].

With regard to the history of medicine, it is generally assumed that the suspensions in the performance of experiments and in experimental practice were the result of religious prohibitions. However, the main reason was that within the scientist's particular worldview anatomical dissections were unnecessary.[12]

It is hard to agree with the conclusion that the method of anatomical dissection was insignificant to Alcmaeon. History should be seen as the evolution of ideas, a search for the most informative methods of proof. Consequently, the idea of experimentally studying the anatomy of living creatures had to establish itself first, then a framework of theoretical generalisations demonstrating their necessity and usefulness had to emerge, and only then, on the basis of experimental study, could researchers come to the idea of performing systematic dissections of

[11] Galen: *On the Doctrines of Hippocrates and Plato*, 7.1.18 [19, p. 259].

[12] The selective nature of this rejection of anatomical dissection from, for example, representatives of the school of the empiricist physicians was due not to religious prohibitions, but to their ideas about methods of understanding, based on the natural philosophy of Early Stoicism.

human bodies, as the most informative means of obtaining reliable knowledge. This was in fact what happened: medicine's historical development can be traced from Alcmaeon's sporadic observations to the first deliberate animal dissections described in the Hippocratic Corpus to the systematic practice of comparative anatomy at the Lyceum and, finally, to the works of Herophilos. This ultimately resulted in an accumulation of fundamental knowledge, based on which Galen was able to create his comprehensive anatomical and physiological system [21, p. 85]. Zhmud and Lloyd are right that Alcmaeon's anatomical experiments were not regular. However, at the time they could not have been, as the apodictic method in medicine had just emerged. Accordingly, Alcmaeon's works should be seen as a continuation and development of the Koan and Knidian traditions.

The view among historians that Pythagoras and the Pythagoreans had an influence on medicine can be ascribed to the traditional belief that the philosophical views of the physician-scientist and his medical practice were two parallel realities. The philosophical views and doctoral practice of a particular representative of medicine in antiquity have not usually been regarded in terms of their interrelationship. However, it seems clear that it was the physician's philosophical views that arose first. After all, it is clear that a young man who had chosen to become a doctor and had received a good education for his time studied the "science of love for truth" first and only afterwards moved on to master the skills of his future profession. His studies meant attaching himself to a particular circle of scholars based around a master. This choice was based on trust and sympathy with regard to a particular leader of a school. This trend becomes most pronounced after the third century BC: clearly, for example, a young man brought up in the traditions of Stoic philosophy who chose to pursue the art of medicine would most likely have chosen a well-known empiricist physician as his mentor. It was natural philosophical knowledge, obtained through his basic education, that defined his way of thinking, and became the basis for the development of his individual worldview. Specialised professional knowledge was of secondary importance in this regard, particularly given the fundamental differences between the teachings of the various schools of medicine.

However, the same also applies to the events of the fifth century BC: that two people knew each other or lived in the same town does not prove that a particular branch of philosophy had a determining influence on the development of medicine. We need to be careful when comparing the defining features of the theory and practice of a specific scientist/physician and the fundamental elements of the doctrine of a school of philosophy. With this in mind, we can say that the teaching of Pythagoras and his followers (at least what we know of it) did not have a determining influence on the emergence of Greek rational medicine. On the contrary, the ideas of the Koan or Knidian schools may be said to have influenced Alcmaeon's views, and, therefore, they were a continuation of early Ionian physics.

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