Dmitry A. Balalykin

Galen on Apodictics

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With a foreword by Alexander L. Gungov

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Foreword

Alexander L. Gungov

The main objective of Dmitry Alekseevich Balalykin's book, which appears as the seventh volume of *Studies in Medical Philosophy* at ***ibidem*** Verlag, consists in presenting the philosophical grounds for Galen's integral theoretical and practical system, emphasizing the understanding and application of the apodictic method. The author clearly states that his concept of apodictics in ancient medicine consists in the understanding of "a combination of the use of anatomical dissections, the physiological experiment, the rational doctrine of general pathology and clinical systematization." As a physician and distinguished historian of medicine, Balalykin is perfectly up to engaging with the medical side of Galen's works. In terms of philosophy, the most significant part of Galen's apodictic method is the "rational doctrine of general pathology and clinical systematization", which is interpreted by Balalykin with appropriate erudition and skills.

Balalykin examines the ontological, epistemological, logical, and natural-philosophical conceptions of Plato, Aristotle, Anaxagoras, Empedocles, Stoicism (in particular works of Chrysippus), and the ancient atomism as sources of Galen's philosophical views (or as philosophical ideas that Galen does not accept but opposes), and their decisive influence on his theoretical medical concepts and clinical findings and claims. Balalykin pays special attention to the notions of *eidos*, *lekton*, *entelechia*, and *cataleptic* impression, as well as to Aristotle's doctrine of the four types of causes. In regard to the apodictic method, various types of evidence known in antiquity are considered in his book: apodictic, aimed at reaching the truth; dialectical, meant to get to plausible conclusions, which could serve as hypotheses for further quests in the name of truth or for didactic and other practical purposes, including convincing interlocutors; rhetorical, dedicated to persuasion; and sophistic, striving to win a dispute at any cost, even by means of manipulation and deliberate misleading. In connection with the apodictic method, Aristotle's categorical syllogism is discussed, whereas Stoic hypothetical syllogism is analyzed as a part of the dialectical method.

The author puts at the heart of his study of the transition from philosophical foundations to medical conclusions the ancient natural

philosophical teaching of the three tetrads, followed by a number of ancient thinkers: the four elements—earth, fire, air, and water; the four humors—blood, phlegm, and yellow and black biles; and the four substances—hot, cold, dry, and moist. The book analyzes the fundamental philosophical and medical significance of the balance and imbalance between the members of each tetrad. Balance and imbalance are traced as being inseparable from the theory of *homoiomereia* in view of what in modern medical language would correspond to a certain extent to nosology, etiology, pathogenesis, therapy, and prognosis. Last but not least, the importance of the Platonic concept of the tripartite nature of the human soul for the understanding of causation in medicine, classification of diseases, control exercised by the higher rational and immortal part of the soul on the health and disorder of the body, as well as the unified origin of somatic and psychic disorders are underlined.

Balalykin has succeeded in structuring and conducting his research in view of the decisive influence of the rich array of philosophical ideas from Classical Greece and the Hellenistic period on Galen's medical theory and clinical practice. He is not tempted to interpret the theoretical legacy of the ancient physician only from the point of view of modern medicine or predominantly in the context of the development of ancient medicine per se, whereas putting into brackets such a seemingly distant and lateral area as ancient philosophy. The author reveals the formation of ontology of health and disorder on the basis of the principle of balance and imbalance within the four tetrads, as well as according to the theory of *homoiomereia* that defines the structure of the macro- and the microcosm. The quantitative idea of health and disease, as well as the presence of degrees of health and disorder, depend on these principles. *Homoiomeres* define the anatomical structure of the human body, where there are simple homoiomerous structures and tissues and complex non-homoiomerous organs. By carrying out an ontological line of reasoning, Balalykin repeatedly argues that these principles have allowed Galen to outline his concept of general pathology and to classify diseases. The author convincingly demonstrates that Galen's understanding of the causes of diseases starts from the same ontological basis. From the perspective of the ancient physician we cannot speak of the contemporary meaning of etiology, as in Galen’s classification of causes there is a trend of universalization, whereas etiology deals with the specific causes of pathology within a certain nosologic unit. However, Galen's understanding of the causes of diseases allows him to persist in

treatment aimed at eliminating the causes of a pathology (today known as "etiological treatment") and not simply at eliminating the symptoms. At the level of medical causality, the author makes a point of the four types of causes in Aristotle, shows how they have been transformed by Galen and, foremost, discusses the final cause that the ancient physician considers as a teleology of function of an organ or of the body as a whole. The doctrine of teleology, along with and inseparable from the principle of balance of the three tetrads and the principle of *homoiomereia*, are the main grounds for Galen's rejection of the explanation of the ancient Methodists regarding the causes of disease. The assertion of the Methodist physicians, who have adopted the ontology of ancient atomism that the general pathology is due to clogged pores in a certain part of the human body, is unacceptable to him. He is a follower of Plato and Aristotle and the mechanics of the atomism does not correspond to the teleology of function, inherent in the body in the states of health and disease alike. Balalykin explains that the principle of teleology should not be confused with the Stoic determinism of physicians from the Empiric school that is set by blind fate and is completely beyond any rational control. Thus, the author unambiguously shows: the philosophical preconditions at the level of ontology preset Galen's position on medical causality. Furthermore, he clarifies that the mechanisms of diseases, pathogenesis, depend on the same ontological arguments.

According to Balalykin the respective central concepts of Plato's and Aristotle's ontology and epistemology, *eidos* and *entelechia*, become decisive for the formation of the apodictic method in Galen. The creation and functioning of the sensory world after a model of the non-sensory *eidos* that guarantees realization in the sensory world of certain patterns, perceptible by the human mind, gives Galen the opportunity to follow in the medical theory and practice a method based on a cognizable necessity. The feasibility of apodictic method is reinforced by the Aristotelian *entelechia*, which justifies teleological changes both in healthy and diseased persons, and also the state of a person between health and disease. The author points out why Empirics, criticized by Galen, following the Stoic view of *lekton* adhere to the situational understanding of diseases and cannot perceive the apodictic method that yields the necessary conclusions. Instead, they are forced to rely on a dialectical method that provides nothing more than probabilistic conclusions. Stoic *lekton* has no ontological status of necessity, unlike *eidos* and *entelechia*, because it is not material in character,

and for the Stoics this is equivalent to a lack of reality. This means that disease observations—diagnosis of the disease, as well as its treatment decisions—are *lektons* with probabilistic value. The non-acceptance in principle of the theory leads to the underestimation of medical causality and disinterest in the mechanisms of diseases among physicians from the Empiric school. Moreover, these philosophical reasons limit the diagnostic and therapeutic actions of Empirics to addressing pathological symptoms using their own experience gained in similar situations or the experience of their counterparts, applied depending on the available pharmacological and dietary agents that have proven their effects in such symptomatology. Here, the author is a very shrewd observer when he perceives an essential dialectical feature ('dialectical' not in the sense of the ancient dialectic, but of Georg Hegel's speculative dialectic) according to which the Empirics, by denying the possibility of knowing general principles, are not able to apply individualized treatment and are inevitably entangled in repetitive patterns. Balalykin intuitively and completely justifiably perceives that this paradoxical situation expresses the fact of the transformation of one-sided rational statements into their opposites. The Empirics, following dogmatic one-sided constructions of Stoicism and insisting on the significance of only a singular disease situation, allow an insurmountable gulf between the singular and the universal, thus falling into the lifeless generalization of oversimplification. Galen's approach, based on Plato's and Aristotelian philosophical views, freely overcomes the rational one-sidedness and rises up to the level of rational speculative dialectic by perceiving the unity between singular, particular, and universal. The singular symptoms of a patient manifest themselves in an inseparable and individualized unity with the universal and indispensable features of the given disease (according to the modern terminology of the "nosological unit") and thus form the particular type of a specific patient's disease. The interpretation of schematization during treatment by the Empirics proves that the assumption and knowledge of universal features of diseases and their treatment does not prevent, but on the contrary supports the application of an individual approach to diagnosis and treatment.

In studying Galen's apodictics, Balalykin addresses a purely logical problem. He points out that Galen holds on to making necessary conclusions through categorical syllogism, which provides true knowledge, while physicians from the Empiric school, in conformity with their understanding of probable and solely plausible knowledge, use hypothetical

syllogism. The author is quite right that in both forms of hypothetical syllogism, pure hypothetical syllogism and hypothetical categorical syllogism, there is an element of hypothesis that gives some probability to the conclusion reached. Nevertheless, it should be taken into consideration that the very inferences of these types of syllogism produce necessary conclusions. The two forms of the inference are known as *modus ponens* and *modus tollens*, which are accepted as valid both by traditional formal logic and by its modern symbolic version. Furthermore, the categoricalness of the strict categorical syllogism's premises is not necessarily identical with their truthfulness and leaves room for a certain dose of probability. There is Aristotle's well-known claim about the middle term of the categorical syllogism being identified by dialectical means of the art of topics. The truthfulness of categorical syllogism (not just logical validity) is borne not only by the formal laws of this type of inference, but by the overall context in which it takes place. Similarly, the probability of a hypothetical syllogism (again, not just logical validity) depends on the context of its application. We should not neglect the practical reliability of the negative modus of the hypothetical categorical syllogism *modus tollens* in clinical practice. During the differential diagnostics procedure diseases with similar symptoms are excluded in order to determine the real disease(s). The exclusion is done by the *modus tollens* rule whereby the absence of a necessary symptom or sign leads to an absence of the corresponding disease. In terms of logical validity, this is a completely necessary and correct conclusion. In medical practice, it excels the positive *modus ponens*, where the inference is driven from the presence of the cause of a disease to the disease itself, because even the presence of the necessary cause of a disease cannot lead to the disease in the case that the sufficient cause is not also present. However, when discussing the necessary validity of the eliminating *modus tollens*, we should not forget that it is a common situation in diagnostic practice when the absence of a symptom or sign (in the case it is not a pathognomonic symptom or sign) does not guarantee the absence of the disease we are looking for. This means that the decision to reject or affirm the presence of a disease goes beyond logical necessity, but that does not at all mean, as the author clearly demonstrates, that the decision is not subject to the apodictic method.

It would be entirely justified to state that *Galen on Apodictics* masterfully demonstrates the philosophical impetus in the formation of the apodictic method in Galen's clinical practice and theoretical treatises and

outlines this method as “an expression of a new type of rationality in the field of medicine” during the Roman Empire. No doubt, Balalykin’s book is a significant and valuable contribution to studies in the field of philosophical analysis of Galen’s works on an international scale and deserves excited and committed readers.

Introduction

Modern academic literature generally accept the existence of a unified branch of science—the "history and philosophy of science". Unfortunately, historians concerned with separate areas of natural science have very little interest in philosophical methodology: they are often concerned with specifics and do not seek to generalise and identify common patterns in the development of the subject under investigation.

The history of medicine is dominated by a tendency for narrowly specialised analysis, which is generally typical for the history of natural sciences. Among medical professionals studying history, priority interest is payed to the events directly influencing the modern image of medical science and practice. There are extensive studies in historiography devoted to the history of surgery, cardiology, immunology, the establishment of medical education, etc.[1] By virtue of mental inertia, their chronological framework mainly covers the 19th–20th centuries, and interest in earlier epochs is rare.

The same applies to studies on the philosophy of science. For example, V.S. Stepin considered it obvious that the history of modern science begins from the 17th century, and he masterfully dissertated on the categorical grid which describes the context of events in the 17th–19th centuries.

I presume this conviction has to do with the fact that most scientists came to the philosophy of science from physics and mathematics. They operate with familiar facts from the history of natural science disciplines. However, can data from the history and philosophy of physics be unambiguously extrapolated to the history and philosophy of medicine? Interdisciplinary research, which constitutes part of this work, enables to answer this question negatively.

Obviously the mainstream in historiography often leads to the study of the history of medicine beyond the general context of the development of natural science, global social and cultural processes, which in actuality have had a certain influence on the mindset of scholars and their research

[1] Borodulin, V.I., *History of Russian medicine. Clinical practice of internal diseases in the second half of the 19th century–first half of the 20th century* (Moscow: MedPress, 2011), 140. (In Russ.)

program. For example, the subject of substantive discussions becomes the fact itself of referring to the work of ancient and medieval scientists as "scientific". Researchers who refuse to recognise Hippocrates, Galen or Avicenna as scientists refer to the modern-day definition of the concept of "science", which involves the use of the experimental method and language of mathematical explanations.

B. Russell defines the concept of "science" as knowledge above all. It is widely accepted that this is knowledge of a special kind, which seeks to find general laws linking multiple separate facts. However, the view of science as knowledge is gradually being sidelined by the view of science as a force which controls nature. A person of science (Russell does not mean everyone, as many people of science are not scientists—he is talking about a person of science as he should be)—is an attentive, careful and consistent person. He only relies on experience in his conclusions and is not prepared to make sweeping generalisations. Such person does not accept theory just because it is elegant, symmetrical and is synthetic in nature, but examines it in detail and in real applications.[2]

According to André Comte-Sponville, science is a collection of knowledge, theories and hypotheses relating to the same subject or same field (for example, nature, living beings, the Earth, society, etc.). Science not so much states as it constructs this knowledge, in line with historical context, logically organising or proving it (to the extent to which it can be proven), achieving for it, if not universal, at least group recognition from competent minds (this is what distinguishes philosophy from all other sciences because the clash of competent minds is possible in philosophy), finally recognising that all sciences, except mathematics, are empirically falsifiable. Add to this the fact that the scientific approach usually counterposes the so-called common sense (scientific knowledge is not always self evident), and the following simplified definition could be made: science is an organised collection of verifiable paradoxes and corrected errors. An integral part of the essence of science is progress because science develops through "conjectures and refutations".[3]

Clearly, the given definitions (there are many such definitions) are fully applicable to the works of scientists from the ancient world.

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2 Russell, B., *Dictionary of Mind, Matter and Morals* (New York: Carol Publishing Group, 1993), 290.

3 Comte-Sponville, A., *Philosophical Dictionary* (Barcelona: Paidos Iberica Ediciones S A, 2003), 576.

However, it is clear that the physics of Aristotle is different from the physics of Newton or the physics of Einstein.

Today, the so-called standard conception of science is generally accepted. According to this conception, science and scientific knowledge are characterised, first of all, by objectivity. The world of natural phenomena is considered factual and objective. The goal of science is the precise description and explanation of objects and phenomena, processes and relationships existing in nature. Secondly, science establishes (this particularly guarantees objectivity) the laws of nature. Thirdly, scientific knowledge is formed in the process of impartial gathering of facts and relationships between them, the establishment of empirical laws based on said gathering of facts and further elaboration of scientific theory based on said laws.

The objectivity of scientific knowledge, in my opinion, is clear for the doctor who draws knowledge from a physiological experiment and clinical practice.

The scientific (even in the modern understanding of medicine or, for example, mathematics) nature of the actions and discourse of great doctors of the past is often so obvious that the term "protoscience" has gained a foothold in professional literature. It is generally used to describe the entire period of development of natural science, when the time before the advent of scientific revolutions is referred to as the "protoscientific" or "prescientific" period. Therefore, on one hand, the value and historical role of the work of scientists in the ancient and medieval ages is recognised, and on the other hand, the dissimilarity between the work of Aristotle or Soranus of Ephesus and the modern type of scientific research is also stated.

Active discussion over the clear definition of the concept of "protoscience" itself continues. I think T. Kuhn's theory of paradigm shift is key in understanding the structure of scientific revolutions. This theory is also subject to constant review and certain criticism. Against this backdrop, it is often quite difficult to discern ontological and gnosiological links between events and protoscientific methods and the modern-day development of certain disciplines.

When K. Popper's book titled *Conjectures and Refutations: The Growth of Scientific Knowledge*[4] came out, the term "protoscience" got a somewhat disparaging shade of meaning—"pseudoscience" or

[4] Popper, K.R., *Conjectures and refutations. The growth of scientific knowledge* (London: Routledge and K. Paul, 1989).

"something, which is not real science". Furthermore, the understanding of the history of natural science before the 17th century as the development of some "not exactly scientific ideas", taking cue from K. Popper, is typical for many historians working in the second half of the 20th century. This is a part of presentists methodology – to think only modern science is real.

I use the term "protoscience" following another, long-standing historiographical tradition under which certain works of ancient scholars are taken as ideas that are ontologically very close to modern ideas. I argue that they may be considered as partially commensurable with them. Remember, according to the modern conception of science, rationality, objectivity, reproducibility and verifiability, logical rigour, preciseness and logical interrelation of various elements are considered the hallmarks scientific knowledge. These characteristics are sometimes supplemented with utility, which reflects the essence of science as part of culture. These attributes are characterised by the ideals of scientific rigour. The task of science is to reveal patterns and general principles which facilitate not only the observation and stating of facts, but also their explanation. Such an approach defines very stringent requirements for historians and philosophers: the scientist must articulate inferences based on the analysis of sources.

When it comes to the fundamental methodological difference between the modern science and protoscience in the ancient world, two principal points are normally highlighted: the experimental method of studying specific natural phenomena and mathematical processing of the obtained data. The latter involves systematisation and description of observable phenomena using mathematical formulae and equations. But here another question arises: from this perspective, can modern-day medicine be considered science? After all, to this day, mathematical explanation of observable processes has not become part of the everyday practice of the doctor. Furthermore, I can boldly predict that it never will.

A fundamental division of modern science and science of antiquity has become general in historiography (it is considered as a result of the scientific revolution of the 18th and 19th centuries). Brief analysis of the numerous arguments of supporters of this point of view shows that they relate primarily to questions of the methodology of knowledge: in their opinion, it was believed in antiquity that the comprehension of the world around was possible only through notion sciences (philosophy and

mathematics)—natural (intrinsic) was contrasted with technical (artificial, created by man)[5]. In particular, it is suggested that science of antiquity adhere to the "empirical" method of studying nature, in contrast to the "experimental" method inherent in modern science. This thesis is generally illustrated by examples from the history of physics and, sometimes, mathematics.

On the other hand, the judgment of early Ionian physics (6th century BC), as the starting point of nature research nucleation from a rational methodology, also became general in modern historiography. In this case, the rationalism of ancient science means the union of astronomical, biological, etc. phenomena by not mystical, but natural physical causes. The three natural sciences specialties—mathematics, astronomy and medicine—are considered to be the most ancient; its appearance is directly related to the early Ionian physics. As early as the beginning of the 4th century BC we see the existence of an absolutely clear system of mathematical knowledge, an astronomical theory based on practical observations, and medicine of Hippocrates. It is in the context of the analysis of its history in the special literature that the discussion of the problem of the apodictic method of knowledge begins. In the 1960s, G. Lloyd[6] for the first time very pointedly and reasonably raised the question of the separation of mystical and occult chiliastic practices from the development of ancient Greek rational medicine. And here it becomes clear that it is precisely the development of medicine that historians and philosophers can judge most reliably in view of the quality of the source base: nothing like *Hippocratic Corpus* is at the disposal of scientists studying the birth of other disciplines. Thus, it turned out that the historically accurate picture of the history of medicine has the best background. Further, G. Lloyd raised the question of the apodictic method of knowledge in the rational medicine of antiquity. It also dealt with the absolute opposition of a clear, structured logical proof to sophistic tricks. Ideally, the apodictic method in medicine should, according to the degree of evidence of the proof, approach the mathematical

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5 See: Stepin, V.S., *Chelovecheskoe poznanie i kultura* [*Human cognition and culture*] (Saint Petersburg: SPbGUP, 2013), 96-97. (In Russ.); Stepin, V.S., *Filosofiya nauki. Obshchie problemy* (*Philosophy of science. Common problems*) (Moscow: Gardariki, 2006), 134–135. (In Russ.)

6 See: Lloyd, G.E.R., "Experiment in early Greek philosophy and medicine", in *Proceeding of the Cambridge Philological Society* (Cambridge: Cambridge University Press: 1964), 50-72; Lloyd, G.E.R., *Magic, Reason and Experience. Studies in the Origin and Development of Greek Science* (Cambridge: Cambridge University Press, 1979).

method. In this sense, the application of the "apodictic" concept to medicine can be regarded as a rather free extrapolation of the concept from the mathematical science vocabulary. However, the *Hippocratic Corpus* has already shown obvious evidence, with which to argue is as difficult as with a mathematical formula—an anatomical autopsy has become such. G. Lloyd, in fact, was the first who absolutely clearly defined the dissection as a medical apodictic. In addition, a significant number of arguments by G. Lloyd, based on a thorough analysis of sources, relate to the principles of analysis and reflection on clinical experience.

J. Longrigg asserted the incomprehensible differences, comparing medical schools of antiquity. He linked only very definite theories with later history of medicine. In the last decades of 20th century the concept of "ancient Greek rational medicine", which denoted precisely this direction, was firmly established in historiography.

It means a clear separation of Alkmeon and Hippocrates medicine, which is based on a completely clear natural-philosophical theory, from temple healing, ritual incubation, invoking spirits and other non-rational chiliastic practices. Apodictic (in the understanding of G. Lloyd) cautiously and not quite consistently begins to recognize the basis of the methodology of rational medicine of antiquity. The reason for this caution, I think, is the difficulty with a clear classification of practical knowledge. However, after J. Jouanna was able to describe the basic principles of the clinical practice of Hippocrates[7] these difficulties can be considered overcome. I suggest to use the term "clinical systematics": this is how we can describe the principle of understanding the whole set of practical knowledge about diseases and its treatment, specific to the Hippocratic school. Its development is underway, Galen only emphasizes the hierarchical, logically built and striving to match the particular and the general (that is, "systematic") nature of the comprehension of practical experience.

The works of V. Nutton have an outstanding meaning in the development of the study of the history and methods of ancient medicine. Due to decades of hard work of V. Nutton, his co-authors, students and followers, the problem of historically reliable reconstruction of the main events of

[7] Jouanna, J., *Hippocrates (Medicine and Culture)* (Baltimore, London: The John Hopkins University Press, 2001).

almost a thousand-year-old history of ancient medicine was, in general, solved.[8]

The availability of sources that allow making an impression about the development of ancient medicine after Hippocrates leaves much to be desired. It is with this that I associate the fact that in modern scholarly literature there is a tendency to consider hippocratics-rationalists and, for example, doctors-empiricist, equivalent historical phenomena. The connection between clinical practice and philosophical theory in the teachings of various medical schools is often misunderstood, their mutual exclusivity is sometimes underestimated. The main sources containing information about antiquity medicine from the 3rd century BC and later, are the works of Galen: 111 out of more than 500 reached us. However, fewer than half were translated into English, fewer than 30 texts into Russian.

Speaking of underlying methodological problems arising when studying the medical texts of Galen, above all, the conceptual framework of the 2nd century doctor has to be compared with the professional "world view" of the modern-day doctor. This pertains to the problem T. Kuhn[9] called the "incommensurability" of scientific knowledge, identifying it as key when working on translations and interpretation of sources. The question of "incommensurability" of theoretical conceptions arising in different epochs caught the attention of leading scientists in the last quarter of the 20th century.[10] In my opinion, the question of the effect of change of scientific theory on the meaning of special terms bears particular significance. When Galen spoke of "inflammation", did he mean that which modern pathophysiologists and doctors understand as inflammation? What is the relationship (if at all) between "cancer" in a patient observed by

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8 For more, I strongly recommend: Nutton, V., "Galen of Pergamum". *Farrago*. 5 (1969): 5–9; Nutton, V., *Galen's library. Galen and the World of Knowledge*, eds. Gill, C., Whitmarsh, T., Wilkins, J. (Cambridge: Cambridge University Press, 2009), 19–34; Nutton, V., *The fortunes of Galen. The Cambridge Companion to Galen*, ed. Hankinson, R.J. (Cambridge: Cambridge University Press, 2008), 355–390; Nutton, V., *God, Galen, and the depaganisation of ancient medicine. Religion and medicine in the Middle Ages*, eds. Biller, P. and Ziegler, J. (York: York Medieval Press, 2001), 15–32; Nutton, V., "The Fatal Embrace: Galen and the History of Ancient Medicine", in *Science in Context* 18 (1) (2005): 111–121; Nutton, V., "Roman medicine, 250 BC to AD 200", in *The Western Medical Tradition: 800 B.C.-1800 A.D.*, ed Conrad, L.I., et. al. (Cambridge: Cambridge University Press, 1995), 39–70; Nutton, V., Bos, G., *Galen: On Problematical Movements* (Cambridge: Cambridge University Press, 2015).

9 Kuhn, T., *The Structure of Scientific Revolutions* (Chicago: The University of Chicago Press, 1962).

10 For example, such authors as P. Feyerabend, H. Putnam, and others.

Galen and "cancer" as understood by an oncologist in the 21st century? The fact that the overwhelming majority of terms used by Galen remain in the vocabulary of the modern doctor stands out. However, in what sense were they used in the 2nd century and what do they mean today? In this case comparability of meanings indicates the ontological commonality of our thinking and the world view of the rationalist doctor, which belongs to the Hippocratic tradition. Considering the importance of this issue and its crudity in local academic literature, I think serious attention should be paid to the assessment of the problem of the "incommensurability" of the theory by T. Kuhn himself.

T. Kuhn notes that the concept of "incommensurability" in respect to the theory of science should be interpreted metaphorically. This means that "no common measure" should mean "no common language", which essentially does not entail incomparability as well. Most of the terms and concepts can be interpreted in the same manner in "old" and "new" theories, i.e., their original meaning is retained. It is only for a very small group of terms that the problem of translation arises, and all of this, to my point of view, can be considered "partial commensurability".

We will try to illustrate the foregoing with a specific example—the term "apoplexy" used by Galen. In literature, this concept is often associated with the modern-day nosological entity of "stroke". Such an interpretation has the right to exist, it is certainly logical from a clinical point of view.[11] However, broadly speaking, Galen's "apoplexy" should not be considered exactly the same as the modern term "stroke".[12]

What did Galen mean by the term "a fit of apoplexy"? In one of his works, he defined apoplexy as a state when there is simultaneous loss of

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[11] For instance, the author of these lines holds this view with respect to certain clinical cases described in Galen's work *On venesection against the Erasistrateans in Rome* (see: Brain, P., *Galen on Bloodletting: A study of the origins, development and validity of his options, with a translation of the three works.* (Cambridge: Cambridge University Press, 1986; repr. 2018), 38–66). This treatise of Galen was translated from Ancient Greek to Russian and published in *Galen. Sochineniya* [*Galen. Works*]. Vol. 1. Edited, compiled, introduced, and annotated by Balalykin, D.A. (Moscow: Vest, 2014), 392–461. (In Russ.)

[12] One of the most respected modern researchers of this problem is A. Karenberg. See: Karenberg, A., "Blood, Phlegm and Spirits: Galen on Stroke", *History of Medicine* 2(2) (2015): 207–216; Karenberg, A. and Moog, F.P., "Die Apoplexie im medizinischen Schrifttum der Antike", *Fortschritte der Neurologie Psychiatrie* 65, 1997: 489–503; Moog, F.P., Karenberg, A., "Aristotle on stroke", in *Sudhoffs Archiv* 90 (1) (2006): 123-124; Karenberg, A., "Reconstructing a doctrine: Galen on apoplexy", in *Journal of the History of the Neurosciences* 3 (2) (1994): 85–101.

sensation and motor functions. The definitions and descriptions of this disease may differ in his various works, but this difference can be reduced to a common denominator. Apoplexy is characterised by the following symptoms: abrupt manifestation of disease, comatose state, violation of motor functions of the entire body, simultaneous loss of sensation, shallow breath, weak, slow pulse, violation of speech function, chronic disease progression. This often has a fatal outcome. The addition of fever to the above-described symptoms may have led to the condition Galen referred to as "lethargos", i.e., loss of mobility and sensation of a certain side of the body. The concept which corresponds to its description in today's medical vocabulary is "paralysis". On the other hand, Galen's understanding of the term "apoplexia" ("fit of apoplexy") was broader than today's. The modern-day doctor may associate a case of sudden, simultaneous, complete loss of mobility and sensation, including with impairment of consciousness and breathlessness with the manifestation of several diseases, starting with brain trauma, heart attack or pulmonary embolism with loss of consciousness and ending with acute toxic response. The equation of the meaning of a fit of apoplexy in Galen's work with the modern-day concept of stroke, which, at first sight, seems obvious, may lead the medical historian to the wrong interpretation of the text of the source.

For ancient doctors, the correct prediction of the course and outcome of a disease was more important than terminological nuances of diagnosis. Hence, depending on the severity of the disease, Galen drew a distinction between two forms of apoplexy, which are judged based on the familiar symptoms of irregular breathing and pulse. Critical deviations from the natural respiratory rhythm and the corresponding changes in pulse pointed to an incurable form of apoplexy with high likelihood of a fatal outcome. Minor violations of vital functions enabled to make an optimistic prognosis of the course of the disease. However, already at the stage of this distinction, the difference between the views of Galen and the views of the modern doctor with pathogenetic thinking is noticeable. Galen considered breathlessness as only the result of the patient's failure to move chest muscles. In other words, his ideas are also associated with anatomical-physiological factors, but exist in a different "explanatory model" from today's—investigative capabilities determine the type of rationality of the scientist.

In order to understand Galen's views, how he explained the origin of the fit of apoplexy is crucial. To this end, a concrete clinical problem in Galen's system of general pathology—the theories of the movement of

blood and the balance of the four humors—has to be examined. According to the Platonic tradition, of which Galen was an advocate, blood is continuously synthesised from assimilated food. Part of the food, which is useful for this purpose, is absorbed from the stomach and carried through the portal vein to the liver. There, it is converted to venous blood and "vegetative spirit" (pneum, generated by lower part of the soul), which supports the functions of growth and nourishment, and spreads to all parts of the body through veins. Inspired air becomes "vital spirit" (pneum, generated by middle part of the soul) upon entering the left half of the heart. The heart and arteries are responsible for maintaining and distributing natural heat (this was one of the key principles of the medical theory of Aristotle, as interpreted by Galen). This concept explained the fundamental principles of the functioning of the body. Galen believed that, while passing through the arteries, both the blood and the "vital pneuma" warmed up parts of the body, nourished them and maintained their vital function. The transformation of "vital spirit" occurred in the arteries, which formed the so-called "rete mirabile"—a network of vessels which, according to Galen, was located at the base of the brain. It is specifically in the rete mirabile that "vital spirit" turned into the "animal spirit" (pneum, generated by higher part of the soul), which Galen believed was located in brain ventricles (the fourth ventricle played the main role in his theory) and was the mediator for the transmission of motor and sensory pulses to all parts of the body. The transmission process occurred through the flow of the "animal spirit" via nerves, which Galen thought of as hollow tubes. The "animal spirit" reached specific body parts, passing them arbitrary "commands" from the higher, "rational" part of the soul located in the brain. This way, Galen attempted to establish the principles of interaction between the blood circulatory system and the nervous system. His model was based on Plato's tripartite theory of soul, the concept of the three kinds of pneuma[13] and the

[13] The concepts of "spirit" (with respect to "vital", "animal" and "vegetative") and "pneuma" are synonymous in some ways. "Pneuma" is a broader concept since it is not only present inside the human body, but in the surrounding environment as well. A tradition has been established in historiography which prefers the concept of "spirit" to the term "pneuma" with respect to three types of endogenous pneuma. Hence we would rather use the phrase "animal spirit", "vital spirit" and "vegetative spirit" with respect to pneuma inside the body (see: Balalykin, D.A., "The First Book of Galen's Treatise On the doctrins of Hippocrates and Plato", *Voprosy Filosofii* 8, 2015: 124–143; (In Russ.)). That being said, the use of the concepts of "animal pneuma", "vital pneuma", "vegetative pneuma" is not erroneous. The use of the concept of "psychic spirit" as synonymous with "animal spirit"is also not erroneous.

idea that the brain is the centre of control of the arbitrary functions of the body.

Galen's theory was also based on the Hippocratic theory of the four liquids—blood, phlegm, black bile and yellow bile,—and their associated qualities—hot, cold, moist and dry. Overabundance of one of the humors could be the reason for the violation of their good mixture (or "dyscrasia"), leading to the dysfunction of the body in the form of any given disease. Galen considered two scenarios of the development of apoplexy. In one case, he suggested the possible development of apoplexy in the form of local "dyscrasia"; the accumulation of a dense, viscous and sticky fluid in brain ventricles blocked the movement of the "animal spirit", which in turn made difficult or stopped the transmission of sensory and motor pulses between the brain and other parts of the body. In the other case, which best matched the modern concept of hemorrhagic stroke, apoplexy developed as a result of local plethora. Brain tissue is overfilled with excess blood, which squeezes it. The result of this excess pressure is the impairment of the functions of the brain as the centre of control of body parts. In this case, Galen does not explicitly claim that the plethora of the brain is the result of haemorrhage. Ultimately, at the last stage, both scenarios of the development of the disease lead to a critical change in the temperature of the brain and subsequent cessation of the circulation of the "animal spirit".

Galen's interpretation of the causes of brain injury as the pathological change in the movement of the "animal spirit" enabled to consider disease as a result of anatomical and functional violation of the unity of the spiritual and the corporeal. Furthermore, such a view took into consideration the possible pathogenetic effect of body ageing processes and external factors on the likelihood of the development of apoplexy. During clinical observations, Galen paid attention to the fact that the average body temperature in the elderly was usually lower than in younger people. It followed that their bodies were more susceptible to the so-called cold diseases, for example, caused by excess yellow bile. Also of great significance were climatic and seasonal factors, which influenced the "good mixture" of liquids (for example, sparking an increase in the accumulation of yellow and/or black bile in the body). Overcooling of the brain with subsequent development of bouts of disease could be a result of an unhealthy lifestyle. Any excessive eating was considered harmful: in particular, excessive consumption of wine, according to Galen, reduced natural body heat and was undesirable. The plurality of external factors, such as climate and season,

and internal predispositions (age, bad habits, etc) led to the cooling of the body and was the cause of "cold" diseases.

The basic definition of stroke in modern clinical practice is "cerebral circulation disorder". Of course, the meaning of this nosology changes over time. For instance, in the late 1980s, E.I. Gusev offered the following definition: "Stroke is acute cerebral circulation disorder".[14] Therefore, based on the nature of the pathological process, he divided stroke into ischemic stroke and hemorrhagic stroke. Hemorrhagic strokes are hemorrhages in brain matter and under the brain lining. Mixed forms of stroke were also identified, for example, subarachnoid-parenchymal stroke. Ischemic stroke is basically cerebral infarction as a result of thrombosis or embolism of the extra- or intracranial vessel. The etiological version could be neurothrombotic stroke, which is associated, for example, with atherosclerotic vascular disease. The essence of the matter is the same—violation of blood supply to the brain.[15] The interpretation becomes more complicated over time: N. N. Yakhno no longer uses the term "hemorrhagic stroke" in 2007, instead calling this disease "intracerebral hemorrhage"; however, the description of etiology and pathogenesis does not change drastically. "Stroke" now means only what was previously called "ischemic stroke". This disease certainly belongs to the group of diseases which relate to "acute cerebral circulation disorder".[16] The risk factors for the development of such disorders primarily include arterial hypertension. Furthermore, most authors make reference to old and senile age, hyperlipidemia, hyperglycemia, often associated with insufficient physical activity, obesity and bad habits. It is natural that constant stress and psychoemotional overburden feature among risk factors of stroke itself and among preconditions for the development of its primary cause—arterial hypertension.[17] Take note of the fact that the classification of stroke is refined even at the modern-day stage of the development of science: in the twenty years separating the publication of E.I. Gusev's textbook and the

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14 Gusev, E.I., Grechko, V.E. and Burd, G.S., *Nervnye bolezni* (*Nervous diseases*), ed. Gusev, E.I. (Moscow: Meditsina, 1988), 259–260. (In Russ.)

15 Ibid.

16 *Bolezni nervnoy sistemy: Rukovodstvo dlya vrachey: V 2 t.* (*Diseases of the nervous system: Guide for doctors: In 2 vols.*), Vol. 1, ed. Yakhno, N.N., 4th ed. (Moscow: Meditsina, 2007), 232. (In Russ.)

17 Ibid., 233.

guide edited by N.N. Yakhno, significant amendments[18] have been made to this classification.

Now let us compare Galen's interpretation of apoplexy and the modern definition of stroke—their similarities and differences are clear straight away. It is interesting that T. Kuhn's general views on partial incommensurability and the interpretation of the text are brilliantly confirmed by this example. The modern-day meaning of the pathogenesis of stroke is based on the concept of cerebral circulation disorder. This factor basically implies overall disturbance of nutrition and vital activity of the affected part of brain matter. Obviously Galen could not explain the function of the blood, the significance of gas exchange in tissue, etc. However, his understanding of apoplexy as the impairment of the mechanism of the circulation of the "animal spirit" touches on the issue of ensuring normal activity of the brain, which, according to Galen, was ensured by the flow of blood and the "animal spirit" in the arteries. Furthermore, apoplexy, which, according to Galen, is caused by excess blood and local plethora, has many similarities with the modern-day concept of intracerebral haemorrhage. Galen calls the dropping of brain temperature as a result of the impairment of the mechanism which ensures its normal activity and "clogging" with breakdown products another factor (besides circulation of pneuma) of the pathogenesis of apoplexy. Holding forth on the risk factors of the development of apoplexy, Galen lays out the preconditions for the formation of the modern view on the problem of stroke—dietary regimen, age and physical exercise. This is largely associated with his methodology, which is based on the doctrine of the unity of the corporeal and the spiritual in the human body, which enables to take into account the impact of the psychoemotional component as a pathogenetic factor.

A crucial attribute of Galen's medical theory, which could be called "natural philosophy of medicine" has to be emphasised. In it, disease was not associated with anatomical location and a special etiological factor. In other words, in order to understand Galen, we have to ditch the modern conception of disease (or go beyond its bounds). Nonetheless, similar to how T. Kuhn compares the physics of Aristotle, I. Newton and A. Einstein, doctors, while recognising the difference between the medicine of Galen, S.P. Botkin and E.M. Tareev, have to keep in mind the various types of

[18] Ibid., 259–261.

scientific rationality, which are typical of different historical phases of the development of science.

Galen explains the phenomena of medical practice in the language of philosophy. For example, when analysing his treatise *On the Doctrines of Hippocrates and Plato*[19], it should be remembered that in the debate on the "soul", we are dealing not with the modern language of philosophy and theology, but with the specific language of science of that time, wherein this concept had meanings different from those familiar to us. The same applies to the strictly medical language of the Galenic clinician. This is the very same question of the "commensurability" or "incommensurability" of scientific knowledge from different eras. Galen also explains physiological processes occurring in the human body using the category of "soul". For instance, digestion and haemopoiesis occur with the direct involvement of the "inferior parts of the soul", which are located in the liver: for food to be properly absorbed into the body, and for primary elements to properly replenish anatomical structures of various parts of the body, there is need for the active presence of the "vegetative spirit", a type of endogenouss pneuma, which is a derived from the inferior, "desiring" part of the soul. The liver is particularly the organ which forms blood and saturates the blood with nutrients. The process of digestion and absorption ends in the liver, and functions of venous blood begin from it. The same applies to the other two types of endogenous pneuma which, according to Galen, are derived from the activity of the superior (rational) and middle (violent) parts of the soul. They particularly explain the realisation of the functions of the brain, heart and arterial blood. Therefore, according to Galen, diseases of the soul should be approached from the same standpoint as diseases of the body.[20]

Discussing the matter of commensurability, I also suggest to use the Stepin's classification: classical, nonclassical, post-nonclassical paradigms of cognition.

The potential of Galen's system is defined by the principle of teleology, which is the basis of his views on the human being. In this case, the term "teleology" is used in the classical sense as a "practical function". It is about the view on the structure of animals and human as being practical

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19 Galen, *On the Doctrines of Hippocrates and Plato*, Corpus Medicorum Graecorum V, 4, 1, 2, ed., trans. and commentary de Lacy, P. (Berlin: Akademie Verlag, 2005).

20 See: Kuhn, *The Structure of Scientific Revolutions*.