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# Boorse and Galen: an overlooked connection

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**Abstract**

This article examines the important issue of how the philosophy and history of medicine influence each other and the need to take account of this when considering fundamental concepts of ontological significance to medical science. The author analyses one of the most significant modern theories in the philosophy of medicine — the naturalistic theory put forward by Boorse. The latter suggests regarding how fully the function of a particular body part, organ, or the organism as a whole, is performed as a criterion by which the organism's condition can be assessed: whether it is healthy or sick depends on how fully particular functions are performed. Boorse's theory refers to the statistically typical level of a particular function for a biological species overall, and effectively suggests that functions can be quantitatively assessed. The functionalist approach has always been extremely important to the development of medical theory and practice. The author notes that Boorse's theory has a strong ontological connection to the teleological tradition in the history of medicine, first clearly expressed by Galen. The link between Boorse's ideas and Galen's views is substantial, but, apparently, no one, not even Boorse himself, has previously recognised it. The author asks whether it is possible to put forward a convincing modern philosophical theory of an applied science such as medicine while ignoring its history.

**Keywords**

history of medicine, philosophy of medicine, naturalistic theory, Galen, Christopher Boorse, teleology, functionalism

## Introduction

This article concerns a medical historian's understanding of certain aspects of the contemporary debate over theories of the philosophy of medicine. By no means all the concepts found in this academic field relate to medicine per se, in my view. Only some of them truly help to understand medical theory and practice, providing a universal explanatory model useful to doctors. These include the "naturalistic" theory, expressed most clearly in the works of its founder, Christopher Boorse (Boorse 1977, 1997, 2002, 2011, 2014), who has developed "a sophisticated philosophy of biomedical science" (Aas and Wasserman 2016). He prefers to call his theory "biostatistical", because of the significance of its quantitative arguments. A significant number of critics of this concept are, in my view, wrongly called "philosophers of medicine": unfamiliar with the problems of clinical medicine, they simply choose some of them, relating to medicine, as a pretext for discussion. Typically, these are examples of mental illnesses (often of a sexological nature), or aspects of social life relating to healthcare practice (such as various problems of adaptation for people with disabilities), taken out of context (Kukla 2014; Silvers 1998; Venkatapuram 2011). Essentially, many works on the "philosophy of medicine" are varieties of postmodernist theories, aimed at suppressing and ultimately eliminating the health/disease dichotomy (Bolton 2008; Cooper 2002;

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Amundson 2010; Guerrero 2010). However, this dichotomy, and the multiple definitions of "normal" and "pathological" emerging from it, provide the framework for the basic conceptual understanding of medical science that has developed since the time of Hippocrates and Galen.

A philosophical understanding of the aspects of the development of any modern scientific field is an extremely important objective. I believe that any modern scientific theory, which, by definition pretends to universality, should take account of the history of the relevant specialist field: the main tenets of physics, mathematics, medicine, and so on, have developed for a reason and over a long time. However, many academics within the philosophy of medicine today consider it unnecessary to explain how their ideas relate to the previous history of medical science. This article aims to show the inadequacy of such an approach using the examples of support for and criticism of the naturalistic theory. As a historian of medicine, I ask: is it possible in principle to put forward a convincing modern philosophical theory of applied science (in this case medicine) while showing no interest at all in its history?

## The core principles of the naturalistic (biostatistical) theory

At the heart of Boorse's theory is the principle of function. He suggests how fully the function of a particular body part, organ, or the organism as a whole, is performed as a criterion by which the organism's condition can be assessed: whether it is healthy or sick depends on how fully particular functions are performed (Boorse 1977). An example of the impairment of a local function is a fracture or dislocation of one of the lower limbs, which makes walking significantly harder. An example of an impairment to the function of an organism that brings the human body from a state of health into a state of disease, according to Boorse's theory, is a demyelinating disease of the central nervous system. With such a pathology, the integral regulation of the functions of the organism overall is impaired.

Boorse interprets "normal" functional activity in terms of the accomplishment of "certain species-typical goals". According to Boorse's theory, an organism is considered "healthy" if the parts of the body perform their functions in full, making it possible to ensure that the organism in its entirety functions properly. According to Boorse, this assessment, made in terms of the fullness of performance of the functions of the organism, describes the "goals of human life" (Boorse 1977). Thus, if "health" corresponds to the full performance of functions (the "norm"), impairment of this is described as a pathology and deviation from the norm, i.e. "disease" (Boorse 1977 and 2002).

Boorse's theory refers to a statistically typical level of a particular function for a biological species, in this case *Homo sapiens*. The American researcher interprets the state of a function using a diagram in which the norm for a given biological species is taken as the hypothetical average reference point. Above this point is a zone described as "dimensions of positive health"; below is a range of states reflecting "dimensions of disease". Boorse believes that the states of health and disease are not invariable. In other words, they can be expressed in various degrees: an organism may be more or less healthy, and more or less sick (Boorse 1977).

This idea undoubtedly reflects actual medical practice. Any doctor, for example, understands that someone may have normal blood pressure, or, for various reasons, experience a state of hypotension or hypertension. If a blood pressure value where the ratio of systolic to diastolic pressure is 120/80 mm Hg is taken as the hypothetical norm, blood pressure of 130/90 mm Hg, or 170/120 mm Hg, will signify a state of disease, albeit in different ways. A value of 130/90 mm Hg may be regarded as the upper limit of the norm for some patients, depending on their individual physical characteristics.

For Boorse's theory to "work", it is important to be able to assess the functions of the organism as a whole, as well as the function of an individual part of the body, in quantitative terms. He states this directly, calling his theory "biostatistical" (Boorse 2011 and 2014). Typically, thanks to the state of clinical medicine and medical technology today, this does not require any particular effort. But even where the technology is available to measure the state of a function and it is possible to show these measurements visually and to produce a quantitative assessment, what Boorse

calls the species norm can hardly be presented as an absolutely clear and precise point in a coordinate system. For example, even in the case of blood pressure there is no one point representing the species norm: from a clinical point of view, we consider a medium range of values to represent normotension. Accordingly, the definition of a norm or of a normally expressed function, or its impairment, needs to be supported by another, qualitative, assessment, as well as a quantitative one. Here the question arises as to what the goals of human life are and how to describe the species norm (how does it help in achieving them?).

Essentially, Boorse's species norm is more of a statistical category. The average species-typical value of a function is this norm. Sean Aas and David Wasserman criticise Boorse on the grounds that his criterion of "normal function/dysfunction" is not universal, as it does not always help to produce a true description of certain states (Aas and Wasserman 2016). They give the example of conditions such as blindness: a person who has lost their sight will be regarded as ill from the viewpoint of functionality. The description of this species norm for *Homo sapiens* presumes, first, that the function of vision exists, and, second, that it can be measured and expressed in explicit figures. In my view, the example of blindness is an excellent illustration of Boorse's views, rather than a reason to criticise them. The function of vision may indeed be impaired: a person may be able to see, but be, for example, near-sighted. Here, the function is impaired, and the level of impairment can be described in precise mathematical terms. (Ophthalmologists have many instruments with which to assess the condition of a defective eye both qualitatively and quantitatively.) However, someone who lives with impaired vision, or has lost their sight entirely, may still achieve their species life goals, adapting to their loss of vision with enhanced senses of hearing and smell and certain technical aids (Aas and Wasserman 2016).

Aristotle's criterion for the truth of an observation consistent with common sense, and the self-evidence of an axiomatic fact as a criterion for verifying a statement, remain relevant even now, especially in medicine and its theory and practice. A physician's diagnosis concerning in the most general sense whether a patient is healthy or sick may be false from the viewpoint of various philosophical theories. For example, when a geriatrician and a paediatrician diagnose their patients as "healthy", one sees the relative nature of the concept of "health". An elderly patient will have quite a serious range of chronic conditions, and their health will be highly relative: they are healthy to the extent that, according to Boorse, they can achieve the goals of life of their species. However, it is hardly possible to determine the life goals of a species in accordance with the evolutionary theory of survival and reproduction within the framework of Boorse's theory.

Boorse's theory aims to take account not just of impairments to the functions of parts of the body (sic!), but also the extent to which such impairments hinder the achievement of the life goals of the species. Aas and Wasserman write that a blind person may adapt to their living conditions, so to regard blindness as an illness in Boorse's system is wrong or incomplete. When Boorse talks about defining the norm of a function, he uses an evolutionary argument. Drawing on evolutionary theory, the normal functioning of the individual parts of the human body, and of the organism as a whole, are assessed relatively easily in terms of the life goals of the species. Essentially, this is simply a matter of survival and reproduction. According to Darwin's teaching on natural selection, individuals whose functional capabilities are inadequate for survival in specific environment conditions simply die, while those in whom such capabilities are exercised in full produce healthy offspring, and thereby a particular characteristic of a specific function is inherited and consolidated in subsequent generations of the species. Evolutionary theory clearly no longer describes human survival in the twenty-first century. For this purpose, the elegant ideas of Jean-Baptiste Lamarck, which preceded Darwin's, are probably much more suitable. Lamarck suggested that functions could be "exercised": a member of a specific biological species "exercises" a specific part of the body and improves its function, taking account of the need to use it in particular circumstances. Variation according to Lamarck — a term that, one might think, has long since become part of the history of biological science — makes it possible to describe the life goals of modern humans reasonably precisely. Which environmental challenges are threatening human survival at the start of the twenty-first century? It may be said that there are none, because humans

do not face the question of physical survival in challenging conditions.

The weakness of Boorse's "evolutionary argument" is also apparent here. His critics argue that he is wrong to use criteria inappropriate for modern conditions: Darwinian ideas regarding natural selection under the influence of environmental conditions clearly do not "work" for *Homo sapiens* living in the early twenty-first century. A different frame of reference is required. To resolve this difficulty, we can turn to the history of science.

The prominent Russian thinker Vladimir Vernadsky (1863–1945) put forward the hypothesis that the environment in which *Homo sapiens* lived had fundamentally changed: "Recent millennia have seen intensive growth of the influence of one species' living matter — civilized humanity — on change in the biosphere. Under the influence of scientific thought and human labour, the biosphere is transforming into a new state — the *nöosphere*" (Vernadsky 1991, p. 20). The practical application of science has given people enormous opportunities: "Mankind taken as a whole is becoming a mighty geological force. There arises the problem of the *reconstruction of the biosphere in the interests of freely thinking humanity as a single totality*. This new state of the biosphere, which we approach without our noticing, is the *nöosphere*. ...The nöosphere is a new geological phenomenon on our planet. In it for the first time man becomes a *large-scale geological force*. He can and must rebuild the province of his life by his work and thought, rebuild it radically in comparison with the past".[1]

The survival goals facing humans today, living in the nöosphere rather than the biosphere,[2] are not so much biological as social: people can be on the bottom rung of society, or part of a dominant elite; they can find themselves a wonderful life partner, or stay single; they can enjoy a privileged position in society, or be a pariah. In other words these survival skills are beginning to be remarkably reminiscent of the exercises (or "training") of the necessary organ to improve the performance of a useful function according to Lamarck.

For example, someone might seek to provide a decent life and position in society for themselves and their family through a sporting career. Within the context of the theory of natural selection, it is hard to imagine a boxer with three hands emerging and passing this feature on to their descendants simply because a third hand would improve a boxer's chances of victory. But the Lamarckian (or, rather, neo-Lamarckian) improvement, or exercise, of organs with useful functions, in the shape of physical training, that, for example, improves a boxer's chances, is undoubtedly relevant. Here, we even have a sort of social Lamarckism. Social Darwinism describes the fact that society shows no sympathy to failures, and discards those incapable of survival in a particular social environment. Here, the term "social Lamarckism" conveys most clearly an understanding of how individuals fight for survival: they train their useful functions, which they need to attain an appropriate level in this society. Essentially, this is what education is all about: someone who knows more and has more skills has greater chances of survival and success in a socially competitive environment. But how does this description of modern social reality fit in with the goals of survival and reproduction, through which Boorse defines the species norm of a function?

Without the concept of the species norm, Boorse's theory does not "work". He is well aware of this. Boorse uses the term "efficiency" when discussing the fact that health makes it possible to achieve an unusual level (in this case high) of performance: "What health always allows is unusual efficiency of a process in serving physiological goals, not unusually much of the process itself. The latter may be a disease" (Boorse 1977, p. 559). In other words, Boorse is again saying that people can be healthy in different ways: some less ill, others more healthy, and others healthy in the sense in which they need to have some special, unique functionality. This is an issue of the profoundly social nature of the modern goals of "survival and reproduction" of *Homo sapiens* in the nöosphere. As an aside, I should point out that modern philosophers, including Boorse, use neither the term "nöosphere" nor its definition. Every aspect of the discussion begun by Vernadsky falls outside the purview of the philosophy of medicine today.

Boorse explains his thinking: the characteristics of an athlete's body, for example, do not

[1] Vernadsky V.I. Some Words About The Nöosphere, transl. by Rachel Douglas. In 21st Century Science & Technology. 2005; 18(1): 19, 20. In Russian, see Vernadsky 1989, p. 148, 149.

[2] For more details on this, see Vernadsky 1989 and 1991.

fit into the values of the physiological norm for a non-athlete, but nor do they qualify as physiological impairments (Boorse 1977). However, the more Boorse tries to clarify his definition, the vaguer it gets. Evidently, it is impossible to avoid this uncertainty. It turns out that there is apparently no alternative to the "self-evidence" and "common sense" known in medicine since the time of Hippocrates and Aristotle. How, then, does Boorse relate his views to the development of medical theory in the past? One might think that a researcher proposing a definition would look closely at how their predecessors used it, and whether it existed at all. If it did, how, and in what context? Both Boorse and his critics view his theory as original and inarguably systemic.[3] In other words, it is a modern theory with pretensions to universality.

## Boorse's theory and Galen's ideas

But is the functional account of health (Boorse 1977, p. 554) proposed by Boorse a new idea? He mentions very briefly that a functional assessment of health existed as a kind of general guideline in the past.[4] Without looking at the works of Galen himself, with which, it seems, Boorse is unfamiliar, he cites Owsei Temkin's interpretation of Galen's views: "Such a concept of health and disease rests on a teleologically conceived biology. All parts of the body are built and function so as to allow man to lead a good life and to preserve his kind. Health is a state according to Nature; disease is contrary to Nature".[5] Temkin is rightly regarded as one of the fathers of the history of medicine in the English-speaking world. Many modern "trendsetters" in the history of medicine see themselves as his disciples, and there is evidently good reason for this.

However, I have more than once pointed out that Temkin's assessments of Galen's work are incomplete, and sometimes profoundly erroneous.[6] For instance, he unequivocally describes the great physician as an agnostic, a view that has become extremely popular and is much-quoted by historians of science.[7] The assertion that Galen was agnostic is contradicted by his own texts. For example, in three of his works — *The Diagnosis and Treatment of the Affections and Errors Peculiar to Each Person's Soul*, *The Diagnosis and Cure of the Soul's Errors*, and *The Capacities of the Soul Depend on the Mixtures of the Body*[8] — Galen sets out his views on the human soul, its nature, and the question of its existence both within and outside the human body, quite extensively. In one of his most important and fundamental treatises, *On the Doctrines of Hippocrates and Plato*,[9] Galen pays particular attention to the question of the existence and functioning of the highest, immortal part of the soul, which, following Plato, he places in the brain. In his view, a person's death is the separation of the immortal part of their soul from the flesh of their brain, as a consequence of the development of particular pathological conditions, such as apoplexy. Galen's description of one of the possible outcomes of apoplexy corresponds to the modern understanding of a haemorrhagic stroke. As a result of irreversible damage to the tissue of the brain, a "plethora" arises in it, the tissue cools, and with the brain's flesh in a state of increased moisture and coldness, the bonds

[3] Recall Aas and Wassermann's comments cited above on the fact that Boorse developed "a sophisticated philosophy of biomedical science" (Aas and Wasserman 2016).

[4] This takes up just one paragraph (see Boorse 1977, p. 554).

[5] Boorse quotes Temkin (Temkin 1973a, p. 398), see Boorse 1977, p. 554.

[6] See, for example, the introductory article to, and comments on the second volume of the works of Galen (Balalykin 2015), as well as Balalykin, Shcheglov, Shok 2014.

[7] See Temkin 1973b.

[8] See Galeni. De propriorum animi cuiuslibet aff ectuum dignotione et curatione. Ed. W. de Boer. Galeni. De propriorum animi cuiuslibet aff ectuum dignotione et curatione (Corpus medicorum Graecorum. Vol. 5. 4. 1. 1. Leipzig, 1937). S. 3—37; Galeni. De animi cuiuslibet peccatorum dignotione et curatione (= De animi cuiuslibet peccatorum dignotione et medela). Ed. W. de Boer. Galeni. De animi cuiuslibet peccatorum dignotione et curatione (CMG. Vol. 5. 4. 1. 1. Leipzig, 1937). S. 41—68; Galeni. Quod animi mores corporis temperamenta sequantur. Ed. J. Marquardt. Claudii Galeni Pergameni. Scripta minora. Vol. 2. Leipzig: Teubner, 1891 (repr.: Amsterdam: Hakkert, 1967): S. 32—79. For a Russian translation of this, see Galen 2014a, 2014b, 2014c.

[9] For a Russian translation of Galen's *On the Doctrines of Hippocrates and Plato*, see Galen 2016 and 2017. For an English translation of this work, see Galen 2005.

keeping the soul tied to the flesh break down (Balalykin 2015). Thus, the immortal part of the soul separates from the body, and death occurs. Like Plato, Galen clearly states that the immortal part of a person's soul exists outside their body after their death. In other treatises discussing the issue of reproduction,[10] he, again following Plato, states that the immortal part of the soul enters the embryo at the very moment of conception, i.e. when the male and female seed combine. The only thing Galen avoids discussing is how exactly the soul exists after death and outside the body: he avoids further discussion, saying that he is a physician and believes only in what can be empirically demonstrated and studied. As the existence of the soul after death and outside the body cannot be studied using the experiments available to the physician and the physiologist, Galen, as a self-respecting professional, believes there is no need to discuss the topic further, leaving the option to philosophers.

A second key aspect is that, within the framework set out by Plato in the *Timaeus*, Galen talks of a Divine Act of Creation, in accordance with which man was created.[11] More often than the word "God", he uses the word "Demiurge" (like Plato) or "Nature". Nor should it be forgotten that Galen was familiar with Judaic and Christian beliefs (Galen 1971, 2015e, 2018).

Knowing all this, is it possible to say for certain that Galen was an agnostic?

The teleological principle in Galen's interpretation is key to understanding the principle of a functional assessment of health. It is strange that, when he comes across Temkin's ideas on the principle of functionalism in Galen, Boorse does not turn to the texts of Galen himself.

When Karl Kühn, the most prominent therapist of his day, and the leader of the German school of eclectic internists, started publishing the works of Galen (Claudii Galeni Opera Omnia 1821—1833), in 1821—1823, they were effectively a practical aid: medicine then differed little from medicine in Galen's time, and many of the latter's texts remained practically relevant in the early nineteenth century, while those with only historical value were compared to medical theory and practice at the time. Accordingly, Galen's texts were just as "historical" in Kühn's time as a monograph by a colleague written in the mid-twentieth century is a historical text for a surgical gastroenterologist today: the technology has of course moved on, but the line of reasoning and train of thought remain relevant. Galen's texts published by Kühn in ancient Greek and Latin were not a project of a historian studying the sources, but an important aid for practising physicians and scientists at the time: unlike physicians in, say, the sixteenth century, those in the early nineteenth did not read ancient Greek fluently, but almost all of them knew Latin. Today, only a few physicians and researchers know Latin, and fluent reading of texts such as the works of Galen is the prerogative of classicists, and only a few of them at that. The situation is similar to that derided by the author of the theory of scientific revolutions, Thomas Kuhn: those who understand a text cannot read it, because they do not know its language, while those who can read it cannot understand it, as they have neither specialist training, nor relevant knowledge of the field to which the texts belong.[12]

As such, scientists today are unfamiliar with many of Galen's views, although the sources we have give an idea of his opinions on concepts such as "functional approach" and "function".

Clearly, Boorse is not interested in how the principle of functionality has been conceived in the history of medicine. However, it would have better if he had been, not least in order to avoid excess criticism and to strengthen his theory. As soon as Boorse attempts to justify the idea of the species norm, his theory becomes vulnerable. The evolutionary principle underlying the species norm, as well as the variability of the states of disease and health, appear weak arguments. Clearly, the natural selection of individuals, i.e. the evolutionary factor in the shape of the impact of the environment on humans today, do not have a decisive influence. In turn, the factors affecting the assessment or improvement of the functions of

[10] For example, *On Semen* (Claudii Galeni Opera Omnia 1821—1833, vol. 4, p. 512–651).

[11] See Galeni. In Platonis Timaeum commentarii fragmenta. Ed. H.O. Schris. Timaeum commentarii fragmenta [CMG, supplementum. Vol. 1. Leipzig: Teubner, 1934]. P. 9—26. For a Russian translation of this, see Galen 2015e.

[12] For more on Thomas Kuhn's theory, see Kuhn 2014.

the parts of the human body are expressly social in nature.

Boorse's critics also use social arguments against him. It is no coincidence that they use mental illnesses as examples (an aspect that is in general rather relativistic, particularly in the conditions of today's society and modern drug treatment). They also pay particular attention to examples of disability where the patient's condition, clearly pathological according to their opponent's theory, is fully compensated for by technological aids, which provide people with all the capabilities they need, according to Boorse, to achieve particular species-typical goals.[13]

The problem, in my view, is that the functionalist arguments sound genuinely convincing specifically within the context of a teleological approach. The purposes of the functions of a particular part of the body, included by the architect of the Universe, God the Creator, in the design of the "human", is the only consistent basis on which the principles of functionality can exist without contradicting one another. Moreover, this creation is perfect not because a human has five wonderful fingers with which it is convenient to use a stone or stick, but because humans, created in the image and likeness of God cannot but be ideal, just as their Prototype is. However, is hard to think of a modern theory of the philosophy of medicine that includes the concept of creationism and explains the workings of the human organism as a perfect product of God's creation.

Boorse writes: "In my view the basic notion of a function is of a contribution to a goal" (Boorse 1977, p. 555). This is practically a quotation from Galen, with the difference that the latter expands on this idea from a position of recognising God's design: "Thus, God and Nature, like the one who first built a house, knew the parts in advance because it was their use that provided the pattern. We, on the other hand, are like those who observe an already existing house, and further, if we don't make this knowledge as similar as we can to that of God, it will be impossible for us to recognize whether every part exists for some use, or some are without a purpose".[14] Boorse uses arguments from biology: "Organisms are goal-directed in a sense that Sommerhoff, Braithwaite, and Nagel have tried to characterize: that is, they are disposed to adjust their behaviour to environmental change in ways appropriate to a constant result, the goal. In fact, the structure of organisms shows a means-end hierarchy with goal-directedness at every level" (Boorse 1977, p. 555–556). The last phrase, which is also, I believe, reminiscent of Galen's arguments, is used by Boorse's critics against him. In fact, if the goal is a comfortable existence in society, then blindness, which can be compensated for by modern technological appliances, is certainly not a pathology. At the same time, blindness is clearly a disorder. With regard to how humans correspond to the ideal image in accordance with which they, like an ideal architectural design, were created, all parts of their body, including their eyes, must function in accordance with their design. Boorse talks of "reference class and species design", generalising his theory and giving it a kind of universality. If a medical theory is proposed, its object, it would seem, must be the human. However, the need to use an evolutionary argument compels Boorse to expand his focus to different species. But his theory of health and disease cannot be applied to, say, snakes, antelope and chipmunks in exactly the same form as it applies to humans. Any attempt to do so will fail, and Boorse's critics have pointed this out. He places particular emphasis on "general pathology" and has been criticised for underestimating the social factors and erroneously interpreting diseases directly linked to our existence in a social environment (psychological and mental disorders).

What, though, does Galen understand by "health" and "disease"? He considers these concepts by reference to the state of the organism's internal environment and the functional constituency of individual parts of the body and of the organism as a whole. Galen talks of "general

[13] We find a clear example of such criticism in Aas and Wasserman. Blindness is a clearly pathological condition that does not fit into Boorse's theory. See Aas and Wasserman 2016.

[14] Galen. On the Constitution of the Art of Medicine. In Galen. On the Constitution of the Art of Medicine. The Art of Medicine. A Method of Medicine to Glaucon. Edited and translated by Ian Johnston, Loeb Classical Library 523, Cambridge, MA: Harvard University Press, 2016, p. 25. For a Russian translation of this, see Galen 2015b.

health", which, he believes, requires a favourable balance of the principles, essences, humours and elements. He clearly describes the possible changes to the organism's internal environment, and, in essence, his ideas correspond precisely to what is known as medicine today as homeostasis. Here, the state of the body's internal environment and the balance of its main components are such that the body's condition is comfortable for humans and allows them to achieve the life goals of their species to the best possible extent. These goals are explained in Galen's theory through the functional aspect of health. The same applies to his understanding of disease as a state contrary to the state of health. One of the four key signs of health proposed by Boorse — absence of disease — is practically a quotation from Galen.

The internal environment is described as the balance or imbalance of the tetrads of constituents of the organism's internal environment. Galen adds the qualification that a disease may also be the result of a third important component: a defect in the conformation, size or number of parts of the body, as well as in the position of a particular part. Examples of this are congenital defects of the musculoskeletal system such as an underdeveloped limb or an extra digit. At the same time, a body with a defect in terms of the form, conformation or number of its parts may be healthy in terms of the balance of its internal environment or the function of its other parts.

Galen sets out the functional criterion clearly and unambiguously: the boundary dividing health and diseases consists in clear damage to a function.[15] Reading Boorse, I was astounded by how reminiscent his statements, particularly everything concerning the main points of his theory, are of Galen's texts.

Health, according to Galen, is a state in which the human body functions correctly (in accord with nature): "All men, whenever they have the functions of the parts of the body faultlessly directed to serving the actions of life, persuade themselves they are healthy, whereas, whenever they are damaged in any one of these [functions], they consider themselves to be diseased in that part. If this is so, one must seek health in these two things: either in functions which accord with nature, or in the constitutions of the organs by which we function, so that disease is equally damage of either function or constitution".[16] A state of disease differs from a state of health in the extent to which the normal functioning of individual parts of the body, and of the whole organism in general, is preserved: "A disease is some condition contrary to nature and harming function".[17] In other words, for Galen, disease is a state contrary to nature that impedes natural functioning.

The structure of the parts of the body determines their ability to perform their particular functions without impediment, or to function normally. For instance, if one's legs do not ache and perform their function of movement fully, they are healthy. "Normal" is understood as "in accord with nature", meaning that the body part is fully capable of performing its function, and thereby of supporting the organism's normal vital functions. As such, an organism is understood to be healthy if it functions in accord with its innate capabilities, endowed by nature. If all the parts of the body allow a person to

[15] See Galen. The Art of Medicine In Galen. On the Constitution of the Art of Medicine. The Art of Medicine. A Method of Medicine to Glaucon. Edited and translated by Ian Johnston, p. 173. For a Russian translation of this, see Galen 2015a, p. 178. See also: "Function is damaged in three ways — it may be weak, deficient or fail to occur at all." (Ibid., p. 233), for a Russian translation of this, see Galen 2015a, p. 200; "But if health is this, then clearly disease is the opposite, i.e. either some constitution contrary to nature, or a cause of damaged function" (Galen. On the Differentiae of Diseases. In Galen on Diseases and Symptoms, translated, with an introduction and notes, by Ian Johnston, Cambridge University Press, 2006, p. 134), for a Russian translation of this, see Galen 2015c, p. 579; "A disease is a condition of a body primarily impeding function" (Galen. On the Differentiae of Symptoms. In Galen on Diseases and Symptoms, p. 186), for a Russian translation of this, see Galen 2015d, p. 706; "[Only] what is primarily harmful to function [is called] a disease and what precedes this [is called] a cause of disease, but not yet a disease. ...Furthermore, the injury of function itself is a symptom of the animal." (Ibid, p. 186), for a Russian translation of this, see Galen 2015d, p. 706; "They occur, then, when there is destruction of shapes, colours, magnitudes, functions and affections (*pathemata*) that accord with nature. And this is the most specific definition of it — a change of what accords with nature." (Ibid, p. 187), for a Russian translation of this, see Galen 2015d, p. 707.

[16] Galen. On the Differentiae of Diseases, p. 134. For a Russian translation of this, see Galen 2015c, p. 578–579.

[17] Galen. On the Differentiae of Symptoms, p. 185. For a Russian translation of this, see Galen 2015d, p. 704.

perform the necessary vital functions, the organism as a whole is healthy. Here, Galen is talking about a causal relationship: it is vital for the body's constitution to be in accord with nature, and for the functions of all its parts to be maintained according to the Creator's design and the logic underlying his Divine creation. Accordingly, the body's constitution relates to its functions as a cause. If health is the harmonious constitution of all the parts of the body, an organism that functions normally, writes Galen, is "in accord with nature". Accordingly, disease constitutes a state unambiguously contrary to nature, being a combination of processes damaging the functions of the organism. To describe the essential state of the organism, Galen uses the terms "balance" (to describe the state of a healthy organism) and "imbalance" (to describe a state of disease or pathology). A "eucrasia" (proportionate balance) of the elements is a feature of a healthy organism, all parts of which function "in accord with nature", while a "dyscrasia" (disproportionate balance) leads directly to the impairment of the functioning of individual body parts, or of the organism as a whole.

## Evolution in the biosphere and human life in the nöosphere: criticism of Boorse's theory

The use of an evolutionary argument to explain the nature of the species norm has led to some confusion in Boorse's ideas, and has been probably the main reason for criticism of his theory (Nordenfelt 1987; Schroeder 2013; Schwartz 2007). The assertion that the functional purpose of parts of the body, being optimal for the goals of survival and reproduction, developed through the process of evolution returns us to the issue of the independence of humans today from the evolutionary factors that previously applied. In the past, *Homo sapiens* evolved in the biosphere,[18] but since the mid-twentieth century, people have lived in the nöosphere, i.e. in an artificially created environment. This is full of technological aids that either mitigate or fully compensate for the traditional factors of evolution found in the biosphere. Human survival is taking place in a social environment, and the criteria for this survival are, again, purely social rather than biological. Humans need to attain the best position in society, so as to earn enough money and/or to have greater social guarantees, and this is achieved through numerous "exercises" (again, this is a kind of social neo-Lamarckism): they get an education; they win championships; they defend dissertations to earn academic degrees; they start their own businesses with the aim of winning favourable contracts, and so on. Naturally, their functions are increasingly performed in a non-material environment, and the issue of survival and reproduction no longer depends on purely evolutionary criteria. Human life and survival in the nöosphere are completely different from in the biosphere,[19] and many things humans needed in the past are not as important in modern society.

Reading critics of biostatistical theory, such as Ron Amundson (Amundson 2000), it seems that they and Boorse are talking about completely different things, even though both sides claim to be discussing what "health" and "disease" are. For example, in one of his works Amundson writes: "Naturalists[20] consider disease to be a straightforward, non-evaluative, theoretical concept within the sciences of medicine and physiology. Normativists consider disease concepts to embody evaluative judgments of the conditions designated as diseases" (Amundson 2000, p. 34). However, it is not clear what frame of reference these "evaluation judgments" exist in. They clear do not fit into the concept of human survival in the nöosphere, because in this environment a person develops many other functions, and, accordingly, impairments to them, which cannot be accounted for within the framework of the ordinary average norm. However, it is this norm, in the shape of a certain quantitative description of the species average for a particular function, that lies at the heart of Boorse's biostatistical theory. Amundson draws attention to this when he states that

[18] For example, even during the scientific revolutions of the nineteenth century, which might appear to be relatively recent, the technological possibilities for countering adverse environmental factors, and for the pharmaceutical treatment of impairments to the functions of body parts, and of the organism as a whole, were extremely limited.

[19] Someone whose hands and feet work properly may successfully hunt food for their family — this was a reality of human history right up to the twentieth century.

[20] I.e. advocates of the naturalistic theory.

his criticism primarily concerns the social factors in the assessment of the state of "health" or "disease". "Describing individuals or groups as 'abnormal' is seen as marginalizing them by use of a falsely objective criterion" (Amundson 2000, p. 33). Can a "marginal" population group be called "abnormal" because its members have, say, only one hand? In terms of medical science or biology, there is no marginalisation here: different members of a species live their lives, and a biologist simply states that if the 95% of its members who have two hands are considered normal, then the word "abnormal" is entirely acceptable to describe the 5% who only have one. Marginalisation may arise in a completely different area of the life of *Homo sapiens*: in the social sphere, when the benefit of functionality is not a successful hunt, but, say, obtaining a professorship or election to parliament. It is only within the highly complex conceptual frameworks by which modern society lives that the issue of marginalisation arises. The marginalisation Amundson describes is the assignment of individuals or groups considered "abnormal" to underprivileged social groups (Amundson 2001; Amundson and Tresky 2008). But what have evolution and the biological understanding of functionality got to do with this? These are totally different frames of reference.

Amundson develops his arguments, explaining that the very concept of "functionality" is rational (Amundson 2005 and 2012; Amundson and Tresky 2007). He argues that Boorse pays too much attention to numerous examples of the "typicality" and "atypicality" of the manifestation of a particular function. Amundson describes the "normal function" in Boorse's theory as "functional determinism". Anita Silvers observed that it is very important to distinguish between the "level" performance of a function and the "mode" of its performance (Silvers 1998). When it comes to the possibility of measuring a function with anthropometric, biometric or laboratory indicators, the impression is created that it is easy to determine the average value. Furthermore, the tradition of clinical medicine provides ready-made solutions here for supporters of the naturalistic theory. Physicians know that with certain values people feel good, and these values are taken as the norm, deviation from which is bad and regarded as a pathology. The desire to distinguish between the level of performance of a function and its mode, i.e. the degree or completeness of its implementation, in Amundson's criticism is a result of the wish to separate the variables that are clear and easily demonstrable within Boorse's theory (which include the level of performance) from what is debatable (the mode of the performance). As such, what we have here is not even an argument about the mode of the performance, but a debate over whether this mode exists (Amundson 2015).

Amundson's criticism[21] is an interesting, albeit, in my view, not very successful, attempt to show the inadequacy of the previously existing concepts that Boorse develops and modifies. Amundson evidently has a very vague idea of the history of medicine. This is a general shortcoming in many authors writing about the philosophy of medicine: they talk about philosophical theories relating to medicine, but pay no attention to its history. For Amundson too, the teleological concepts he links to Boorse's theory are purely philosophical theories. Amundson apparently believes that these theories emerged comparatively recently. He mentions the tradition of British natural theology, which he describes as pre-evolutionary. The second source of teleological views he mentions is the "Kantian concept of biological directedness", which, in his opinion, "focuses on the processes of embryological, ontogenetic development, which are directed towards the development of functioning adults" (Amundson 2000, p. 38). Of course, medical arguments understood in terms of theories of the eighteenth and nineteenth centuries that are purely philosophical and, moreover, "pre-evolutionary", cannot help to answer any practical question.

In discussing Galen's legacy, we talk about fundamental principles of medical thought, about an integrated system of theory and practice. Galen's functionalist ideas have influenced the development of medicine right up to today. These ideas are common sense to any physician. We also need to take account of Galen's interpretation of the concepts of "norm" and "pathology". Here, we see a concurrence of two very important systems for assessing the human organism: the balance of its internal environment (homeostasis) and the physically expressed functions of specific body parts. This, in turn, makes it possible to speak of the integrity and general functioning of the hu-

[21] See Amundson 2000, 2001, 2005, 2009, 2010, 2012, 2015; Amundson and Tresky 2007 and 2008.

man body. The upshot is that Boorse relies on something of minimal importance to the history of medicine (an evolutionary argument), while Amundson and his supporters criticise his theory for something that it cannot contain.

When we analyse Amundson's criticisms of Boorse's framework, the ambiguity of the frames of reference within which the arguments for and against the naturalistic system are made becomes especially noticeable. It should not be forgotten that this is a matter not of abstract theory, but of the philosophy of medicine. In other words, a general philosophical system proposed by a particular researcher should work with regard to specific physiological and pathophysiological situations. It should be aimed at medical practice. But what arguments does Amundson use? For a start, he is clearly impressed by an example often cited by physiologists: the fact that the ordinary everyday processes of the central nervous system involve only a small proportion (some say no more than 10%; others, no more than 20%) of the neurons making up the tissue of the brain. At the same time, we need to remember that modern neuroscience cannot explain how exactly the brain works, and experiments on the latter are like those of a naive child with their toys: the child understands how to move them, but has no idea how they are constructed (Amundson 2000, 2009, 2012).

This brings us back again to the reasoning used by Galen, in whose time (and later) the question of "superfluous" parts of the body was a subject of serious discussion in medicine. Many of Galen's opponents, particularly the Empiricist physicians, did not understand the ultimate purpose of certain organs, such as the spleen. Accordingly, there was a theory that they were superfluous. Galen thought otherwise: he believed that nothing in the organism was superfluous, because everything made by the Creator, including the human, had a purpose, so each of its parts (the parts of the body) was given a certain important function. We do not know what some of these functions are, but that does not mean they do not exist. Galen insisted that experience showed that the purposes of other body parts had not been fully understood until recently. For example, before Galen's experiments demonstrating the innervation of the muscles from the brain through the nerves, no one understood the purpose of neuromuscular junctions. He, however, understood the nature of the neuromuscular reflex and described it brilliantly, having demonstrated it by experiment. Amundson's argument that a significant proportion of the neurons are superfluous, on the grounds that contemporary neurophysiologists do not understand how they work, is an example of this. This is where Boorse's critics are weak. They are very good at finding fault in his argumentation: the diseases that have emerged in the nöosphere cannot be analysed in terms of the mechanisms of adaptation to the biosphere, and vice versa. However, when it comes to the specific application of the theory in practice, Boorse's critics are very much found wanting. In practice, Boorse's theory appears less contradictory, because he instinctively (specifically instinctively, because he does not know the history of medicine) draws on the preceding 2,500 years of experience of the birth, establishment and development of clinical medicine.

The teaching on norm and pathology that arose in the nineteenth century is another highly important area for the history of medicine, to which neither Boorse, nor his critics have paid due attention. For example, the nineteenth century in general was a time when medical knowledge of pathogenic factors significantly improved. For example, microbiology and the germ theory of disease emerged. Claude Bernard, Ivan Pavlov and Rudolf Heidenhain established modern synthetic physiology. However, it should not be forgotten that nineteenth-century scientists made a huge contribution to the establishment of individual fields of medicine and the development of medicine overall, greatly increasing the volume of knowledge, and so on, but did not change the Hippocratic/Galenic view of health, which consisted in an understanding of the essential and functional impairments of the state of a body part (or of the organism as a whole) as a criterion of disease. Just as Vesalius and other anatomists in principle did not change Galenic anatomy, the great physiological discoveries of the second half of the nineteenth century did not change the Galenic essence of the understanding of health and disease. It was simply that the abundance of accumulated facts and experimental data and systematised experience enabled medicine to reach a new, qualitatively more complex, level. Today, any medical student understands that anatomy and physiology can be normal or pathological. This is a legacy of the scientific revolution of the nineteenth century. "Pathological" means only that the decisive role in the development of a par-

ticular state is played by a factor causing disease, i.e. causing a state of "abnormal" functioning. It is only when criteria other than the purely medical start being applied to the definition of "abnormal" that the confusion arises. It is no coincidence that Amundson and other researchers are concerned about the marginalisation of those individuals or groups who are branded abnormal. However, this has nothing to do with medical utilitarianism per se: they are purely interested in the social impact of using such terms, which is of less importance. In other words, this has nothing to do with assessing the organism's evolutionary adaptability in the biosphere. It is solely a question of a natural desire to help those with some form of abnormality to adapt in the nöosphere, and this is a completely different matter.

L.R. Grote's idea, developed by Jiří Vácha (Vácha 1978),[22] of replacing the species norm with the concept of the individual norm or individual response, does not contradict Boorse's theory. It shows a profound understanding of the lack of variance in functional adaptations and an attempt to steer the conversation away from evolution in the biosphere to evolution in the nöosphere (even if Vácha is unfamiliar with the term). Looking closely at this idea, we find that Vácha's arguments do not contradict Boorse, but develop and embellish them, providing new topics for discussion. Rather than embellishing the debate, however, Amundson's opponents propose sweeping the chess pieces from the board and setting them out again, or moving to some other platform.

## Conclusion

Comparing the arguments of Boorse and his critics, one gets the impression that while on paper they are discussing the same thing — health and disease — they are actually talking about completely different things. In addition, the frames of reference in which their arguments are set out are ambiguous, and this lack of clarity is a source of confusion in the assessment of many factors, including the role of evolution. It is no accident that Amundson calls for the medical model to be replaced with the social model. For a medical theory designed to help regulate medical practice, the arguments of Amundson and his supporters are inadequate. It turns out that Boorse is talking about a medical model, and his critics about a social one.

The many weaknesses in the arguments of both Boorse and his critics are a result of their ignoring or not knowing the history of medicine. Functionalist approach has always been extremely important to the development of medical theory and practice. Boorse's theory has a strong ontological connection to the teleological tradition in the history of medicine, first clearly expressed by Galen. The link between the ideas of Galen and Boorse is significant, but no one, not even Boorse himself, has recognised this. This leads Boorse to certain errors, just as if a study were published that used the idea of the tripartite structure of the human soul, but failed to mention Plato or to explain his understanding of this idea, and what makes this new interpretation of it different. I believe that, at the very least, the researcher's reputation would suffer. However, we can see that in a number of cases Boorse practically repeats Galen's arguments, while basically failing to mention his works and views, save for the quotation from Temkin.

To conclude, I will repeat my question: is it possible to put forward a convincing modern philosophical theory of an applied science such as medicine while showing no interest at all in its history?

[22] For more on this, see Amundson 2000, p. 43–44.

## References

Aas S, Wasserman D (2016) Disability, Disease, and Health Sufficiency. What is Enough?: Sufficiency, Justice, and Health. Eds. C. Fourie, A. Rid. Oxford University Press. DOI: 10.1093/acprof:oso/9780199385263.003.0010

Amundson R (2000) Against Normal Function. Stud Hist Phil Biol & Biomed Sci 31(1): 33–53. DOI: 10.1016/s1369-8486(99)00033-3

Amundson R (2001) Adaptation, Development, and the Quest for Common Ground. Adaptation and Opti-

mality. Eds. S.H. Orzack, E. Sober. New York: Cambridge University Press. P. 303–334.

Amundson R (2005) Disability, ideology, and quality of life: a bias in biomedical ethics. Quality of life and human difference. Eds. D. Wasserman, J. Bickenbach, R. Wachbroit. Cambridge: Cambridge University Press. P. 101–124.

Amundson R (2009) Evolutionary developmental biology. Routledge Encyclopedia of Philosophy. Taylor and Francis. DOI: 10.4324/9780415249126-Q123-1

Amundson R (2010) Quality of Life, Disability, and Hedonic Psychology. Journal for the Theory of Social Behaviour 40(4): 374–392. DOI: 10.1111/j.1468-5914.2010.00437.x

Amundson R (2012) Homology and Homoplasy: A Philosophical Perspective. Encyclopedia of life sciences. Chichester: John Wiley & Sons, Ltd. Published online: 15 October 2012. DOI: 10.1002/9780470015902.a0003445.pub2

Amundson R (2015) Preface. Conceptual Change in Biology: Scientific and Philosophical Perspectives on Evolution and Development. Ed. A.C. Love. Berlin: Springer. P. V–X.

Amundson R, Tresky S (2007) On a Bioethical Challenge to Disability Rights. Journal of Medicine and Philosophy 32(6): 541—561. DOI: 10.1080/03605310701680924

Amundson R, Tresky S (2008) Bioethics and Disability Rights: Conflicting Values and Perspectives. Bioethical Inquiry 5(2—3): 111–123. DOI: 10.1007/s11673-008-9096-3

Balalykin DA (2015) Meditsina Galena: traditsiya Gippokrata i ratsionalnost antichnoy naturfilosofii [Galen's medicine: the Hippocratic tradition and the rationality of ancient natural philosophy]. Galen. Sochineniya [Works]. Vol. 2. Ed., comp., introd., and annot. by D.A. Balalykin. Moscow: Prakticheskaya meditsina. P. 5–106. (In Russ.)

Balalykin DA, Shcheglov AP, Shok NP (2014) Galen: vrach i filosof [Galen: a doctor and philosopher]. Moscow: Vest. 416 p. (In Russ.)

Bolton D (2008) What is Mental Disorder? An essay in philosophy, science, and values. Oxford University Press.

Boorse C (1977) Health as a Theoretical Concept. Philosophy of Science 44 (4): 542–573. DOI: 10.1086/288768

Boorse C (1997) A rebuttal on health. What Is Disease? Eds. J.M. Humber, R.F. Almeder. Totowa, NJ: Humana Press. P. 1–134.

Boorse C (2002) A rebuttal on functions. Functions: New Essays in the Philosophy of Psychology and Biology. Eds. A. Ariew, R. Cummins, M. Perlman. Oxford: Oxford University Press. P. 63–112.

Boorse C (2011) Concepts of health and disease. Philosophy of Medicine. Ed.F. Gifford. North Holland. P. 13–64.

Boorse C (2014) A second rebuttal on health. J Med Philos 39(6): 683–724. DOI: 10.1093/jmp/jhu035

Claudii Galeni Opera Omnia (1821–1833) Ed. K.G. Kühn. Leipzig.

Cooper R (2002) Disease. Studies in History and Philosophy of Biological and Biomedical Sciences 33 (2): 263–282. DOI: 10.1016/S0039-3681(02)00018-3

Galen K (1971) O naznachenii chastey chelovecheskogo tela [The Function of the Parts of the Body]. Transl. by S.P. Kondratev, ed. by V.N. Ternovskiy. Moscow: Meditsina. (In Russ.)

Galen (2005) De placitis Hippocratis et Platonis. Galen. On the doctrines of Hippocrates and Plato. Ed., transl., comm. Ph. De Lacy. Berlin: Akademie-Verlag.

Galen (2014a) Sposob raspoznavaniya i lecheniya strastey lyuboy, v tom chisle i svoey sobstvennoy, dushi [The Diagnosis and Treatment of the Aff ections and Errors Peculiar to Each Person's Soul]. Galen. Sochineniya [Works]. Vol. 1. Ed., comp., introd., and annot. by D.A. Balalykin. Moscow: Vest. P. 214–248. (In Russ.)

Galen (2014b) O raspoznavanii i lechenii zabluzhdeniy vsyakoy dushi [The Diagnosis and Cure of the Soul's Passions]. Galen. Sochineniya [Works]. Vol. 1. Ed., comp., introd., and annot. by D.A. Balalykin Moscow: Vest. P. 281–302. (In Russ.)

Galen (2014c) O zavisimosti svoystv dushi ot temperamentov tela [The Capacities of the Soul Depend on the Mixtures of the Body]. Galen. Sochineniya [Works]. Vol. 1. Ed., comp., introd., and annot. by D.A. Balalykin. Moscow: Vest. P. 339–376. (In Russ.)

Galen (2015a) Iskusstvo meditsiny [The Art of Medicine]. Galen. Sochineniya [Works]. Vol. 2. Ed., comp., introd., and annot. by D.A. Balalykin. Moscow: Prakticheskaya meditsina. P. 172–230. (In Russ.)

Galen (2015b) K Patrofilu, o sostave meditsinskogo iskusstva [On the Constitution of the Art of Medicine]. Galen. Sochineniya [Works]. Vol. 2. Ed., comp., introd., and annot. by D.A. Balalykin. Moscow: Prakticheskaya meditsina. P. 292–334. (In Russ.)

Galen (2015c) O raznovidnostyakh bolezney [Types of Diseases]. Galen. Sochineniya [Works]. Vol. 2. Ed., comp., introd., and annot. by D.A. Balalykin. Moscow: Prakticheskaya meditsina. P. 578–604. (In Russ.)

Galen (2015d) O raznovidnostyakh simptomov [Distinctions in Symptoms]. Galen. Sochineniya [Works]. Vol. 2. Ed., comp., introd., and annot. by D.A. Balaly-

kin. Moscow: Prakticheskaya meditsina. P. 700–727. (In Russ.)
Galen (2015e) Fragmenty kommentariya k "Timeyu" Platona [Commentary on Plato's "Timaeus"]. Galen. Sochineniya [Works]. Vol. 2. Ed., comp., introd., and annot. by D.A. Balalykin. Moscow: Prakticheskaya meditsina. P. 759–781. (In Russ.)
Galen (2016) Ob ucheniyakh Gippokrata i Platona [On the doctrines of Hippocrates and Plato]. Books 1–5. Galen. Sochineniya [Works]. Vol. 3. Ed., comp., introd., and annot. by D.A. Balalykin. Moscow: Prakticheskaya meditsina. 560 p. (In Russ.)
Galen (2017) Ob ucheniyakh Gippokrata i Platona [On the doctrines of Hippocrates and Plato]. Books 6–9. Galen. Sochineniya [Works]. Vol. 4. Ed., comp., introd., and annot. by D.A. Balalykin. Moscow: Prakticheskaya meditsina. 494 p. (In Russ.)
Galen (2018) O estestvennykh funktsiyakh [Natural Faculties]. Galen. Sochineniya [Works]. Vol. 5. Ed., comp., introd., and annot. by D.A. Balalykin. Moscow: Prakticheskaya meditsina. P. 183–305. (In Russ.)
Guerrero JD (2010) On a naturalist theory of health: a critique. Studies in History and Philosophy of Biological and Biomedical Sciences 41 (3): 272–278. DOI: 10.1016/j.shpsc.2009.12.008
Kuhn TS (2014) After "The Structure of Scientific Revolutions". Moscow: AST. 443 c. (In Russ.)
Kukla R (2014) Medicalization, "Normal Function," and the Definition of Health. The Routledge Companion to Bioethics. Eds. J.D. Arras, E. Fenton, R. Kukla. Abingdon: Routledge. Routledge Handbooks Online. DOI: 10.4324/9780203804971.ch39
Nordenfelt L (1987) On the Nature of Health: An Action-Theoretic Approach. Dordrecht, Boston: D. Reidel.
Silvers A (1998) A Fatal Attraction to Normalizing: Treating Disabilities as Deviation from "Species-Typical" Functioning. Enhancing Human Traits: Ethical and Social Implications. Ed.E. Parens. Washington, DC: Georgetown University Press. P. 95—123.
Schroeder SA (2013) Rethinking health: healthy or healthier than? British Journal for the Philosophy of Science 64(1): 131–159. DOI: 10.1093/bjps/axs006
Schwartz PH (2007) Defining dysfunction: natural selection, design, and drawing a line. Philosophy of Science 74(3): 364–385. https://doi.org/10.1086/521970
Temkin O (1973a) Health and Disease. Dictionary of the History of Ideas. Vol. 2. New York: Scribner's. P. 395–407.
Temkin O (1973b) Galenism: Rise and Decline of a Medical Philosophy. Ithaca, London: Cornell University Press.
Vácha J (1978) Biology and the Problem of Normality. Scientia 113: 823–846.
Venkatapuram S (2011) Health Justice: An argument from the capabilities approach. Cambridge: Polity Press.
Vernadsky VI (1989) Biosphere and noosphere. Moscow: Nauka. (In Russ.)
Vernadsky VI (1991) Scientific thought as a planetary phenomenon. Moscow: Nauka. (In Russ.)

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