Chapter 8
Biological Organization and Pathology: Three Views on the Normativity of Medicine

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Abstract Medical knowledge aims to identify different diseases as wrong conditions of biological organization. One main issue within the field of the philosophy of medicine is the question of just how confident we can be that what we know about biological organization will help us to identify diseases and propose cures or treatments for them. The concept of biological organization is a complex abstraction which requires the coexistence of constitutive, interactive and experiential aspects; while the main attempts at naturalist descriptions of the concept (functional, mechanistic and systemic) fail to be fully comprehensive. Different arguments have supported a naturalist normativity in medicine; the strongest such perspective contrasts the normal or typical state of organizational elements with their "broken" versions. However, the complexity of biological organization suggests that there are multiple ways of being healthy or diseased. Thus, the normative goal of medicine of identifying diseases encounters two fundamental questions: (1) Is biology itself normative and can it define the "natural" state? (2) Can medicine rely on knowledge other than biological knowledge to identify what goes wrong? As a normative discipline, medicine comes into conflict with the multiplicity in the very ontology of diseases, which needs to be complemented with epistemic pluralism. Philosophy of medicine therefore needs to explore the sources of that normativity.

Keywords Naturalism • Constructivism • Normative and descriptive • Functional approach • Normal–broken framework

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8.1 Introduction

Debates concerning the concepts of health and disease involve the issue of whether pathologies can be identified according to explanations of the biological organization of living systems or not. Although ideally the practice of medicine aims at being grounded purely in biology, differences in how biological organization is conceived influence confidence in the authority that biology confers on medicine when it comes to identifying diseases.

The hypothesis of this chapter is that medical knowledge is normative, rather than merely descriptive or explanatory. This is because one of the goals of medicine is to identify and evaluate the state of an organism with respect to how a given harmful or negative condition will progress and how it might affect the life of the organism. Deciding which biological conditions should be considered to be diseases requires an evaluative judgement that they are bad or undesirable. Although it has other social, legal and economic consequences, the normativity inherent in medicine emerges from the very need to diagnose conditions and propose treatments and cures. This normativity is supported by science; but medical knowledge cannot be value-free, unless biological knowledge is also considered to be normative. Yet, the argument contained in this chapter is that medical knowledge is normative in a way that biological knowledge is not.

In debates concerning naturalism and normativism within the philosophy of medicine, the two perspectives are sometimes regarded as incompatible.[1] From a strong normativist perspective, health and disease depend on values at many levels—individual, social and medical values being the most salient. However, such a perspective fails to grasp the factual or inevitable aspect of disease. If all diseases are perceived as constructed according to cultural practices, preferences and prejudices, including those that arise within the scientific domain, then they appear to be arbitrary to a large extent; devoid of any reality that is inevitable (although of an unknown nature). If diseases are conceptualized as socially constructed, they become ontologically subjective[2]: they lack an objective reality although they can be very real in the minds of people (Hacking 1999, 22). So, a strong normativist perspective sees disease as contingent upon a social matrix of ideas, and thus not inevitable. However, that is not the way diseases are always perceived. In fact, in their personal experience, many people understand the conditions called diseases as something factual, objective and to some extent inevitable. Even mental illnesses share this feature to a certain extent. Thus, the main argument against forms of strong normativism is derived from the sense of objectivity or inevitability present in at least the most paradigmatic cases of diseases; something that scientific medicine has tried to make explicit by appealing to biology.

[1] For naturalist accounts, see Boorse 1977, 1997, 2014, and Chap. 9. For normativist positions, see Nordenfelt 2007 and Chap. 12.

[2] Following Searle (1995), Hacking characterizes social constructions as "ontologically subjective but epistemologically objective items" (Hacking 1999, 22).

By adopting a post-positivist view of science—according to which it is recognized as an activity that aims at objectivity, but in which knowledge is not reducible to facts that are considered to be neutral or free from interests and values—a weaker normativist position with regard to health and disease can be grounded in science. From such a perspective, scientific knowledge is motivated by what we want or need to know; and the outcome is related to activities and practices. Accordingly, the scientific character of medicine is not so different from that of other disciplines such as physiology or evolutionary biology. Yet the goal of medicine is normative in a special way, as it is based on descriptions of facts that are considered to be undesirable or harmful. Unlike strong normativism, weak normativism holds that scientific knowledge and technology crucially form part of the process of identification of diseases.

An important aspect of the discussion on this issue revolves around how scientific theories and methods help us to identify diseases, and the relevant kinds of normativity we have at our disposal. In principle, diseases are conditions that are initially evaluated negatively by the subject who experiences them and later identified as pathologies by medical knowledge (Nordenfelt 2007); although in some situations related to highly technological settings, pathologies identified as crucial deviations from the statistical norm may be previous to experience (Giroux 2010). In the former scenario, subjective experience is the more immediate component, while the objective biological explanation may be practically unknown or unobtainable in full. In the latter, medical knowledge relies fully on biological or laboratory tests; the experience of the subject is vanquished from the concerns of scientific medicine and displaced to a different realm of inquiry (for example, medical ethics, counselling, etc.).

Naturalism regards medical knowledge as descriptive; whereas strong normativism conceives it as being based on subjective and cultural values. The goal of this chapter is to examine how the normativity of medicine is compatible with methodological naturalism. I hope the proposal will allow us to gain an understanding of the real and objective ontological status of diseases; even if that can only be known through subjective evaluations of the related costs in terms of quality of life.

To this end, in Sect. 8.2 I consider the tensions between descriptive and normative attitudes towards biological organization within different fields of biology. I suggest that the normative versus descriptive discussions within biology are fundamentally methodological, as in fact, biology has historically alternated between both views.

In Sect. 8.3, the ways in which those perspectives can be employed in the task of evaluating deviations as pathologies are examined. It might be excessively optimistic to identify disease with dysfunction or a broken mechanism if what goes wrong in a given situation has to do with organizational aspects that are poorly understood or if their complexity proves particularly challenging.

In Sect. 8.4, three different rationales that have been espoused to justify the normativity of medicine in the context of biological descriptions are presented. In the first, descriptions of the normal or typical are expected to ground evaluations of deviations. In the second, there is scepticism grounded on whether scientific

knowledge may specify what is natural or normal; therefore normativity becomes heuristic. In the third, the strong experiential and lived component in any normative assessment is underlined.

In the conclusions, I reconsider the statement that medicine is a normative discipline. Medical knowledge aims to judge that certain conditions are objective and real diseases, inevitable from the biological perspective; but this knowledge is not entirely value-free. Pathologies cannot be described as such without presuming that they have negative consequences for the life of the subject. Thus, it is necessary to postulate a multiplicity of ontological ways of "going wrong" that may be considered diseases, and to adopt pluralism in our epistemological means of evaluating them. As a consequence, the normativity of medicine is to a certain extent grounded in biological descriptions of what is wrong in a living organism; but they need to be contextualized within the experience and the opportunities of patients.

8.2 What Is Biological Organization? Descriptive and Normative Conceptions of Biology

Living organisms are individual material systems[3] characterized by the way their life processes are arranged to persist: by their *organization*. The notion of biological organization is an abstraction[4] the aim of which is to grasp how parts or material elements and processes are arranged in an individual system to display the phenomena associated with being alive. This concept has played an important role in the history of biological thought but, as was also the case with the notion of organism,[5] it has been left out of the theoretical vocabulary of the most reductionist perspectives of molecular and evolutionary biology. Organisms are complex and their parts are themselves also organized; the phenomena that emerge from the organization can be seen as resulting from a mixture of constitutive, interactive and experiential dimensions. Biological organization has been conceived as a domain in need of descriptive and explanatory research, for example in morphology or physiology; but it has also been endowed with normative components. This is the case of, for example, the biological organization that is responsible of a system being alive.[6]

[3] Not all biological individuals are organisms; organisms are characterized by the properties that provide their capacity to persist.

[4] Understood as an account that does not provide all the detail, or leaves things out in some respect in relation to the domain of full material realization of a system, but which still provides a literal perspective, without falsity, that is relevant for some purpose. In contrast to abstraction, idealization deviates from the literal perspective and introduces false assumptions, such as infinite population numbers (Godfrey-Smith 2014, 21).

[5] The notion of organism has been brought into question in several ways in the past and considered not to be theoretical; but it has acquired a new relevance in more recent biology and philosophy.

[6] The theory of autopoiesis considers organization as a criterion to demarcate life from non-life.

In Francois Jacob's influential history of biological thought (1973), organization "assembled the parts of the organism into a whole, enabled it to cope with the demands of life and imposed forms throughout the living world"; it was conceived as "an unusually complex arrangement of the component parts of the visible structure" (74). The concept is close to being normative, as through "its organization the living could be distinguished from the non-living." (74). For his part, Jacob considered that such an understanding of organization had been overtaken by the biology of the twentieth century, which transferred most of its power to the notion of genetic information (understood in purely descriptive terms). However, the organicist tradition in biology and the philosophy of biology has always preferred the stronger, or normative, understanding of the notion of organization. In medicine, the biological organization of an organism has sometimes been conceived as an expression of order or health, associated with values or norms, such as beauty (see Efstathiou 2013; Harrington 1996). In this case, medicine would import a theoretical framework which is already normative in biology itself.

In contrast, descriptive approaches to biological organization are being pursued in the systemic, holistic and integrative approaches developed by biological fields such as systems biology. In Moreno et al. (2011), organization appears as an entanglement of processes at different levels, including parts that can be described as distinguishable mechanisms or functional contributions, together with holistic or integrative regulatory processes controlling the interactions among them. As regulation is described at a separate, higher level, in this perspective low-level mechanisms or functions cannot explain biological organization by themselves.

Biological organization is also examined within the mechanistic research programme, in which mechanisms, instead of scientific laws, constitute explanations (Machamer et al. 2000; Bechtel and Abrahamsen 2005). From such a perspective, organization is considered as the way parts and processes are arranged, in multiple dimensions (temporal, spatial or contextual) and levels (or epistemic zooming effects); but the particular form of organization behind a particular phenomenon is a matter of empirical discovery (Illari and Williamson 2010). This approach's stance is not normative, but naturalist, as it aims to describe biological organization via operational mechanisms.

In short, questions regarding the origins and constitution of biological organization, its evolution, its mechanistic or generative character, individual identity and interactions, or how experience and subjective norms are involved in its maintenance, influence explanations in medicine. In all these aspects, there is a tension between descriptive and normative approaches: the latter may not be fully scientific whereas the former has been said not to be "philosophy enough" (Moss 2012). As I aim to explain in what follows, some consider that normative views are already required in biology; whereas descriptive approaches are generally favoured by those who adopt naturalist perspectives. I now continue to consider some of the issues that show the tension between the normative and the descriptive with regard to biological organization, namely: the difference between design and organization; the problem of complexity; and the interactive or ecological dimension of organization.

8.2.1 Design vs. Organization

Recent attempts to naturalize biological organization reconsider Kant (1790), who viewed organisms as self-organized entities that cannot ever be the object of scientific knowledge.[7] Kant's appeal to an intention was answered by Darwin, who explained how design can be conceived without a designer. Yet, Kant's pessimism regarding the prospect of a (descriptive or naturalist) science of the living, is motivated by his own view of the self-organization of organisms. In contrast, the Darwinian tradition relies on an atomistic conception, compatible with considering that the organization of living beings and machines is analogous; something that Kant denied and with which the Darwinian tradition still struggles.[8]

The Darwinian and the Kantian traditions are examples of descriptive and normative approaches to biological organization. The former comprises arguments concerning design, and aims to find a natural explanation of how it can emerge without appealing to intentions; but the analogy between organisms and machines (such as watches) is not considered to be problematic for biology. The Kantian approach, on the contrary, stresses a fundamental difference between machines and organisms: whereas a watch is formed of fixed components, produced beforehand and later assembled, in an organism all the parts are formed in interaction with the other parts, so that they are causes and effects of one another. That is why the system is self-organized.

From the viewpoint of evolutionary biology, many contend that biological organization may not be "optimal" from a rational point of view, as it is the result of many contingent events. Then, Jacob's notion of "tinkering" suggests that, in evolution, natural selection has merely led to improvements of the materials originally available: thus, perfect design should not be expected (Jacob 1977). O'Malley (2010) uses a similar concept, "kludging", also to underline that biological systems are suboptimal and complex products of evolution. All these aspects might be overlooked if biology focuses too narrowly on normative aspects.

8.2.2 Complexity: Reductionism and Closure

Another difference between descriptive and normative approaches to biological organization has to do with embracing a reductionist or a holistic approach. Within this framework, the main epistemological problem concerns whether we should

[7] "[I]t would be absurd for humans even to make such an attempt or to hope that there may yet arise a Newton who could make comprehensible even the generation of a blade of grass according to natural laws that no intention has ordered; rather, we must absolutely deny this insight to human beings." (Kant 1790, §75).

[8] Recent evolutionary biology has addressed the issue of "organismality," as an account of different kinds of organization produced by evolution. Meanwhile, evo-devo has pursued generative explanations by including developmental processes in evolutionary accounts.

adopt a top-down perspective, in which upper-level phenomena shape the detailed mechanisms in the parts, or a bottom-up one, in which the properties of the parts and the relations between them characterize the whole. In the former holistic approach, formal, mathematical or abstract models are elaborated to account for living organization, understood as the operation of parts that produce an individual identity by achieving closure of processes. Organismic phenomena are characterized by the mutual, organizational relations between the components: spatiotemporal relationships, feedback and control, the role of constraints, self-organization, and emergence or downward causation. The latter constitutes a more reductionist approach in which research is often experimental and the characterization of system phenomena is based on the descriptions of properties of the parts.

While holistic views of biological organization emphasize generative and ecological dimensions, mechanistic or internalist perspectives tend to leave them aside. This is relevant for pathology, since such complexity of different dimensions, or "multi-levelness" is: "a hallmark of disease-relevant processes, which challenges conventional dynamic systems theory" (Wolkenhauer and Green 2013, 5939).

8.2.3 Ecological and Interactive Views of Individuality

Another aspect of current debates concerns how biological organization is generated and preserved as individual identity. Ecological studies of living organization consider organismal traits to be the result of a continuous interaction of living processes with their environment. From such an interactive perspective, all organic processes take place in a continuous "dialogue" with an environment, which includes other organisms. This challenges the view that organizing principles are internal; and calls into question the common-sense notion of what a biological individual is, as it is not at all clear that we can simply identify the internal with whatever belongs to the self: to think that living entities are enclosed in strict boundaries that separate the internal from the external may be too simplistic.

Thus, complaints are raised concerning an "individualistic bias" in biology and medicine, and claims emerge that most organisms are composites, just as lichens are; symbiosis "is replacing an essentialist conception of 'individuality' with a conception congruent with the larger systems approach" (Gilbert et al. 2012, 326). Many different aspects suggest that organisms are not confined individuals, but heterogeneous and interactive, akin to ecological systems in which the boundaries between the self and others are not fixed. Many organic processes that occur in animals (including humans) are realized in symbiotic collaboration with organisms that belong to other species; they are chimeras from the anatomical perspective: they develop in relation to microbes and possess many genomes, while the immune system is configured in collaboration with the resident microbiome.

Thus, descriptive explanations of how biological phenomenology is actually realized enter into conflict with the normative views of organization as an arrangement related to goals in current biology. However, tensions between normative and

descriptive approaches in biology and in medicine surface in different ways. In the domain of biology, the confrontation is mainly methodological about how best to study biological phenomena. In fact, historically, biology has alternated between teleological holistic views and mechanistic reductionist views; which can, nonetheless, be considered to be complementary to a large extent. However, in the case of medicine, the knowledge required is inherently normative, because the relevant characteristics or interactions described by physiology or anatomy are instrumental to the main task of judging when a given condition is undesirable or harmful.

8.3 How Are We to Identify Diseases?

According to Canguilhem, there are two main conceptions of disease: ontological theories try to localize disease as something that can enter or leave the body (germs, tumours, etc.); whereas dynamical theories are not "localizationist, but totalizing" and they refer to functioning and processes. Canguilhem says that both are optimistic in their hopes of grounding the normative authority of medicine on a theoretical scientific framework based on descriptions of what there is.[9]

In the remainder of this section, some reasons for qualifying that optimism when identifying diseases are discussed about (1) functional approaches and the main criticism directed to them; (2) the normal–broken paradigm and its relationship to the functional approach via mechanistic accounts; and (3) the challenges posed by systemic accounts in medicine.

8.3.1 The Functional Approach

When biological organization is characterized as the functions or contributions of parts to overall capacities, such as reproduction, survival, fitness, or self-maintenance, the function of a part or process is what it does or should do, and pathologies stand out as (total or partial) failures to contribute. The organization or design of each species specifies which functions or roles are typical for it. Within a functional approach, medicine distinguishes disease from health by viewing biological organization as an abstraction according to which: (1) parts ought to serve functions; (2) biology is responsible for saying which parts and which functions exist; and (3) medicine will understand diseases as deviations from the first premise: situations in which, in some individuals, parts do not serve the expected functions.

[9] "Medical thought has never stopped alternating between these two representations of disease, *between these two kinds of optimism*, always finding some good reason for one or the other attitude in a newly explained pathogenesis. Deficiency diseases and all infectious or parasitic diseases favour the ontological theory, while endocrine disturbances and all diseases beginning with dys- support the dynamic or functional theory." (Canguilhem 1991, 40–41).

The literature on biological functions has offered several concepts of disease. The most influential account, Boorse's biostatistical theory (Boorse 1977, 1997), derives "disease" from a goal-directed account of biological function as contributing to the survival and reproduction of an individual organism, in relation to the corresponding statistically normal contribution in other individuals of the same reference class (same age and sex). Accordingly, the natural functioning of the subsystems of the body corresponds to statistically normal functioning in members of a corresponding reference class. Functions are evaluated according to the design of the species; and diseases are deviations from those evolved functions. As a consequence, there is no essential optimum or ideal functioning: diseased organisms are those whose functioning is below the statistical normal of the reference class to which the organism belongs (See Chap. 3, Forest and Le Bidan further discuss Boorse's functional account).

The functional approach to identifying diseases is criticized on at least four points. The first three critical claims have to do with the scientific standing of functions, as there is no justification for them being seen as value-free, and suggest that there is a plurality of ways of conceiving functional explanations and identifying diseases. The fourth is directed at the alleged naturalism of functional accounts of diseases: it is discriminatory to try to associate the normal with the natural and scientifically tested.

First of all, functional accounts of health and disease do not question the division of the whole into parts serving functions, but consider that science can grasp a "natural" decomposition of the organism into its functional parts. Critics complain that functional descriptions "presuppose a vantage point on the causal structure of the world, a stance taken by intentional creatures when they single out certain preferred behaviours as worthy of explanation" (Craver 2013, 134). This analytical procedure casts doubts on the naturalist claims of medicine, as it is not value-free: "while it is true that function is a term of art in biology (which is a science), it is a teleological rather than (purely) causal term; and teleology [...] can be connected conceptually through purposes and intentions to values" (Fulford 2001, 83).

Second: in fact, different notions of biological function have been used in medicine, each considering the contributions of the parts differently and suggesting different grounds for the normativity of medicine; within a pluralist framework, they may be considered to be complementary.[10] According to etiological function accounts—the main alternative to Boorse's—the function of a part is what it does

[10] For instance, Wouters (2003) distinguishes four notions of function in biology. One of them views function as the activity a part or organ performs or is capable of performing, without considering the use of this activity. For many authors, this is the most neutral concept of function; but as it does not support multiple realizability, it is a rather unusual concept. The other three notions view function as use or role, because they attempt to identify the role or roles of a given structure or part, understood as its contribution to survival and reproduction (in the case of function as biological advantage), to a selected effect (in the case of the etiological function) or to a complex activity (in the case of function as causal role).

that explains its having been selected in the past. In the biology literature, this notion has been conceptualized as normative, since it distinguishes the "natural" or "proper" function of a part from its other possible effects. Within such a framework, disease occurs when an organ does not realize the function that allowed it to become the norm via natural selection. One of the major problems of this type of account is that, as it does not take into account the current adaptation of organisms to their environment, but the past, it evaluates health and disease according to how organisms adapted to their conditions in the past (Valles 2012). Forest and Le Bidan (Chap. 3) also consider this issue.

Third, it is assumed that if a functional part fails to work (or does not work so well), the organization will cease to exist or pathology will appear. However, the functional organization of organisms is generative: causal processes generate (sometimes ephemeral) parts, integrate them into the organization, and both the parts and the integration of the whole are transformed in development and evolution. For instance, donors of certain vital organs, such as kidneys, do not see their overall functionality diminished by half, because the remaining organ is often capable of adapting to the situation and takes on more work. Meanwhile, the functional contribution of a certain part is substituted if it is made by another part that contributes similarly, even though the new part operates through a different mechanism. For example, many prostheses do not work in exactly the same way as the organs they replace; but they make a similar contribution to the organization of the overall system. Internal adaptation between parts and processes can occur at many levels. Developmental approaches raise awareness of the importance of the plasticity of biological organization.

Fourth, a final criticism of the functional approach is that we cannot theorize about disease from a prejudiced notion of normality. Amundson (2000) argues that normality is not objectively grounded in biology and biomedical science; biology does not ground a concept of functional normality that allows us to distinguish between normal and abnormal function, because different people can achieve similar levels of performance without having to use the same "modes" of functionality. Kingma (2013) observes that reference classes are not value-free, objective, homogeneous groupings, but social constructions. Accordingly, even if the functional component of Boorse's concept of disease was naturalist, the normal statistical part would be socially constructed, not natural. In short, such a line of argument claims that in medicine, naturalist accounts cannot rely on biology, because biology does not define what a natural state is. Ereshefsky (2009) argues that biological functions, as they appear in medical textbooks, are idealizations for teaching purposes, and do not serve to conclude that their variants or deviations are necessarily pathological.

8.3.2 *The Normal–Broken View*

The functional approach to disease relies on a "normal–broken" view (as do some mechanistic accounts, if they are linked to functions). According to such a view, knowledge of malfunctioning mechanisms stems from knowledge of "normal" or "healthy" states and operations (Moghaddam-Taaheri 2011; Garson 2013). The normal–broken paradigm is the most obvious scheme from which pathologies can be identified as deviations from conditions that are considered to work correctly; but it may be too narrow, depending on our view of what biological organization is.

Nervi recently questioned the normal–broken view by arguing that malfunction should not be understood as "a mirror image of function" (Nervi 2010, 216), because knowledge of pathologies does not necessarily arise from knowledge of how physiological mechanisms are impaired. Accordingly, pathology (or malfunction) and physiology are independent of each other; he claims that it cannot be assumed that a pathological mechanism is the negation of a physiological one, because pathological mechanisms are often considered as "separate theoretical entities"[11] in medicine. Likewise, Nervi's claim suggests that pathologies may have independent organizational principles or at least that medical knowledge of diseases does not rely only on knowledge of positive contributions to biological organization.

Moghaddam-Taaheri (2011) analyses the problem raised by Nervi as a discussion concerning whether diseases can be seen as "broken mechanisms" or not. According to her, viewing pathologies as broken mechanisms is a practical and relevant approach to finding therapies; she argues that that is in fact the procedure used when developing drugs. According to this framework, disease is related to some contribution that has not been accomplished; either because a part is damaged, because it is prevented from fulfilling its role by some internal or environmental cause, or because it was an evolutionary adaptation that is no longer adaptive. Although Nervi thinks that knowledge of the physiology of the system should be valuable to inform us negatively of the disease (what is "broken") and positively of its cure (how to repair or regenerate the contribution), he defends the notion that sometimes pathologies are not identified in this way.

For Nervi, the mechanism of the malfunction may be independent of and different from the malfunction of a physiological mechanism. Within the mechanistic camp, a number of authors follow Cummins's descriptive approach to causal role functions and maintain that the notion of mechanism is not committed to it being functional in an organism. As causal role functions do not appeal to natural or intrinsic normativity, mechanistic explanations have no commitment to evaluations of the utility or the validity of the proposed mechanisms.[12]

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[11] The question of the ontology of diseases will not be pursued here.

[12] According to Bechtel and Abrahamsen (2005, 423), a mechanism is "a structure performing a function in virtue of its component parts, component operations, and their organization" so that the orchestrated mechanism is responsible for one or more phenomena. This approach is considered to be as useful to understand pathological phenomena as it is physiological ones, insofar as both can be described as mechanisms. In this respect, Nervi follows Craver (2001, 67) who explicitly maintains that his account of functions "does not appeal to any sense of adaptiveness in an environment; instead it appeals only to roles in contextual systems […which] may be adaptive or destructive."

Mechanisms are purely conventional and devoid of normativity when it comes to distinguishing the pathological from the physiological. Nervi criticizes the "implicit agreement about the fact that a mechanism must be valuable for the organism" (217) and that therefore "malfunction is conceptualized as a failure in one or more steps in the physiological sequence of events"; but he is also aware that what is pragmatically wise sometimes, cannot be generalized to all medical knowledge. Thus, he maintains that pathological mechanisms might be independent, especially when the natural history of the disease is of primary importance and it is necessary to describe "causal chains of pathological events that lead from the initial aetiology (if known) to the possible outcomes of that particular disease" (218). For example, those causal chains are taken into account when describing different kinds of diabetes, so that therapies can interrupt them at the best possible point. Furthermore, pathological phenomena can affect sets of organs that are not considered to be physiological systems.

Another position, closer to Boorse's naturalism, defends that mechanisms must be understood functionally, because only in this way is it possible to say how a given mechanism breaks: "a broken mechanism is just one that is not performing its function" (Garson 2013, 330). As suggested in the previous section, one premise involved in this position is the uniformity and correctness of the healthy biological organization; thereby making it a reliable standard for comparisons with pathologies.[13] Another premise is the function–failure dichotomy. Mebius (2014, 46) says that "the distinction between 'function' and 'failure' is inadequate because mechanistic phenomena are primarily situated in a continuum between these two extremes and, most often, not circumscribed (bound) by either."

Nervi distinguishes between the "malfunction of a mechanism" (within the normal–broken paradigm) and the "mechanism of malfunction". The advance of medicine was not only made possible by the former; the latter had to be examined and understood too. Medicine needs to understand the mechanisms involved in malfunction in order to be able to search for adequate therapies: pathologies are independent of physiological mechanisms. From a systemic perspective on biological organization, there are principled reasons founded on systems biology to adopt this approach (Nervi's "independent entity"), because from such a perspective diseases appear to be "caused by network perturbations and might correspond to network states that themselves exhibit organization and robustness" (Gross 2011, 490–91).

This question is relevant for another issue. From the perspective of the normal–broken paradigm, a cure has to re-establish the "normal" or healthy state, at least partially. Often, however, a cure (in terms of restoring lost capacity) does not mean that the primitive physiological mechanism returns or that the function is re-established. Marcum (2011) argues that, for example, type-1 diabetes is generally treated by injecting insulin into the patient whose pancreatic cells are unable to secrete this hormone. Although this treatment saves lives and provides relative quality

[13] We are told, for example, that "there are many more states of an organ or organ system compatible with disease than with health. […] The same point can be made about function. There are many more states of an organ or organ system compatible with its failing to perform its function than with its performing its function." (Garson 2013, 326).

of life, it is not at all clear that it constitutes a cure of the disease; rather it only seems to restore the patient to the state in which the disease can be ignored as such.

8.3.3 *How Systemic Views Challenge the Normal–Broken Framework*

The systemic approach that is being developed these days challenges both the functional approach and the normal–broken view, and introduces new perspectives from which to develop a naturalist understanding of health and disease. It intends to overcome the analytic approach through the use of dynamical systems. For Ahn et al. (2006a, b) the systemic approach will overcome the Cartesian analytic perspective of "divide and conquer" which aims to explain properties of complex systems through simpler units. The authors characterize reductionist practices in medicine as paying attention to a single dominant factor (which does not make it possible to contextualize the circumstances of patients sufficiently) and an excessive emphasis in homeostasis, so that complex and chaotic phenomena are ignored. They further claim that such practices lead to an inadequate treatment of risk, so that only high risk is considered important and low-risk conditions are ignored; and little attention is paid to how sets of conditions interact in different patients. For those authors, there is excessive optimism in thinking that complex conditions can be suitably treated using additive treatments and interventions that were designed for more simple ones (see also Varela et al. 2010). The network approach favours the view that diseases are caused by perturbations of robust complex networks which change their dynamic states. For instance, when discussing the example of metabolic syndrome, Gross (2011, 487) comments that in some cases "there is no component in the system that is actually broken […] the disease is characterized by the emergence of a qualitatively new behaviour that deserves to be described as a different mechanism". This example reveals the risks of trying to reduce a complex phenomenon to simpler parts.

Structural differences between healthy and diseased organisms are not necessarily relevant to understanding diseases (Gross 2011). Pathological states must overcome the robustness ("self-healing" or repair attempts) of the organism. In accounts of cancer attractors, states of the system appear which are not usually accessible.

Systemic approaches consider personalized medicine in a special way and see human organisms as biopsychosocial systems (Engel 1977; Vogt et al. 2014). Some views focus on the intrinsic autonomy and vulnerability of organisms; as in Canguilhem (1991), they link biological organization with the intrinsic normativity of living systems: the capacity of an autonomous agent to distinguish what is preferred or valuable (Di Paolo 2005). From this perspective, organisms have precarious living conditions which they continuously negotiate by interacting with their environments; disease and death are an enduring challenge in their lives. Biological organization is precarious, complex and in permanent flow; it simply cannot be grasped empirically as an arrangement of parts. A living organism continuously generates the network of its relations through material change and replacement of

components. Organization is thus associated with complexity and holistic systemic properties, which are normative.

We might use Gould's image of the "left wall of complexity" in relation to issues of health and disease. Gould (1994) argued that progress does not rule the evolutionary process. Life arises in what he drew as a left wall of the simplest conceivable and persistent complexity, which he thought was bacterial life, the most common and successful of all form of life on earth. A few creatures occasionally move to the right, thus extending the tail in the distribution of complexity. Many always move to the left, but they are absorbed within the space already occupied. Similarly (but with the due differences) we could say that the limit and most important reference for medical thought when thinking on health and disease is death. Following this idea the normative task of medicine could be seen as a drive to separate from the left wall.

Besides, as mentioned above, new insights into the ecological interdependence of living forms suggest that living organization is not individual in an essentialist sense, but intrinsically related to other forms of life. As a consequence, medicine may be entering a post-Pasteurian age (Dupré 2011, after Paxson 2008). Many facts concerning biological organization seem to enter into conflict with the germ theory of disease, according to which many conditions are due to the attack, invasion or parasitism of organisms from other species. In contrast, systemic approaches emphasize the role of interactions between biological organization and food, pollutants and the effects of different drugs or treatments.

Relational or interactive factors should be taken into account in order to change received views of biological organization and the traditional understanding of how the individual identity of organisms is defined. Evidence provided by systemic studies not only questions the boundaries between the self and the external, but also between healthy and diseased.

To sum up, much of the contemporary discussion of health and disease has been concerned with functions and failures of functions, often within the normal–broken view; but new issues are emerging in medicine which question the corresponding received views of health and disease.

8.4 Three Kinds of Normativity

In discussing whether biology can be reduced to explanations in physics and chemistry or not, both Dupré (2010) and Keller (2010) introduce several problems of interest when it comes to defining the place of biology among the sciences. For Keller, functions bring up in biology a concept that is absent from physics or chemistry. For Dupré, biology needs to be conceived of in a relational way which obliges us to avoid previous essentialist characterizations of living entities. In a similar way, medicine is characterized by its normative endeavour of judging when something goes wrong in an organism and challenges its life; a task which is beyond the scope of biology. Yet that normativity is contextualised, and to a large extent moulded according to the social and cultural perceptions of biological reality.

Descriptions of facts are necessary, but even in the most naturalist or descriptive setting, medical knowledge cannot only provide descriptions of facts; its role is to judge whether something is wrong (for another view on this issue, see Lemoine and Giroux in Chap. 2). Although the conceptualization of a phenomenon as a disease necessarily introduces normativity, the evaluation that something is wrong may be performed in at least three different ways, which I characterize in what follows. *Naturalist normativity* relies entirely on the assumption that biology describes "normal" states; *heuristic normativity* introduces scepticism towards this and proposes pluralistic methodologies; and *vital normativity* takes intrinsic norms into account.

8.4.1 Naturalist Normativity

This perspective relies on the assumption that biological theories describe typical or statistically normal states (within a range of heterogeneity) and pathologies represent deviations from the basic principles of biological organization; in general, in accordance with the normal–broken framework. Naturalists defend the view that this normativity is supported by scientific theories, and claim that the identification of diseases is objective and value-free (Boorse 1977). They further argue that naturalism only analyses and draws conclusions concerning the medical usage of the term "disease"; that is to say, it does not invent or propose—it does not normatively say what medicine should think or how it should evaluate what diseases are—but proceeds by conceptual analysis. As Boorse tells us:

> Interestingly, many objections seem at bottom to be attacks on the concept of disease, not on my analysis of it. The serious philosophical issues between the BST and its critics are not, I think, about the correct analysis of 'disease.' Rather, they are about the prospects for a genuine concept of health—individual, non typological, positive, or some other kind—that could differ from the absence of disease, and about what medical theory, practice or social institutions might be based thereupon. (Boorse 1997, 6)

Philosophers such as Grene (1976) and others consider that descriptions can be normative to a certain extent, as do other essentialist or realist philosophers, who consider that an adequate description/explanation of an anomaly or a disorder, such as those that appear in medical textbooks, can and does very often play a normative role and can be an aid to the medical practitioner who is trying to classify a condition as disease. This is related to the conception of diseases as natural kinds; an approach that aims to characterize them correctly and unambiguously (see recent work on mental illnesses as kinds in Kendler et al. 2011).

8.4.2 Heuristic Normativity

Methodological naturalism can help produce normative judgements in a way that is different from how naturalism of the previous type does so. Biological theories authorize normative judgements in medicine; although different approaches will be

more or less appropriate in each case. So this type of normativity is not fixed or straightforward, but mediated by some heuristics grounded on the best available scientific evidence.

Against the naturalist normativity framework, the "science as practice" view challenges the role attributed to theory in traditional accounts. According to this view, scientific work in medicine aims to provide normative judgements that something is bad; and the pragmatic goal is to find cures. Deflationary approaches to the role of theory in science in general and medicine in particular challenge naturalist normativity; including the belief that medicine requires a definition of disease and a clear delineation of specific diseases. As Kincaid says:

> The paradigm of that delineation is a localizable failure of healthy functioning of the body that distinguishes one disease from others. According to this line of thinking, successful medical research would provide a full theory of causes of disease, its course and its severity, in terms of failures of biological functioning. (Kincaid 2008, 368)

Contrary to such a view, Kincaid goes on to argue against attempts to conceptually analyse the notion of disease, maintaining that biomedical science can make significant progress without precise definitions or theories of disease and normal functioning, and without having to consider diseases as natural kinds.

This pragmatic claim that medicine does not require a delineation of specific diseases is supported by two arguments in Ereshefsky's account (2009): (1) the extent and degree of variation within the human species; and (2) the fact that descriptions are idealizations.[14] According to the former, biology cannot account for what is "natural" or "normal" for all members of a biological species, because the category of species is only genealogical and cannot specify traits that are "natural" for all its members. With respect to the latter argument, Ereshefsky contends that "physiology texts provide idealized and simplified descriptions of organs, not descriptions of their inherent natures". Similarly, those descriptions can be considered as "tools for building more detailed models of organs or systems, not descriptions of natural states" (Ereshefsky 2009, 223).

This position maintaining that biology cannot provide a theory that delimits natural from non-natural states may be seen as eliminativist, in the sense that the naturalist foundations for the concepts of health and disease are not found in biology (Ereshefsky 2009, 227). Biological theories are neutral with respect to whether the phenomena studied are valuable or not; hence they do not define what is natural or healthy, or what is pathological. After examining Boorse's account of disease as dysfunction, Ereshefsky (2009) states that biology cannot define pathological states in a neutral way, as it can only provide descriptions that need to be interpreted under the adequate circumstances.

However, the eliminativist position still has to answer a question. Where do medical practitioners obtain the evidence to produce the normative claims affecting judgements concerning health and disease? According to Ereshefsky:

[14] See footnote 4 above.

> normative claims are explicit value judgments concerning whether we value or disvalue a physiological or psychological state. We often make overt value judgments when deciding which states to avoid, diminish, or promote. For example, we disvalue the rupturing of blood cells, we value having legs that can walk, and we are indifferent, at least from a medical perspective, whether people are gourmets. When these value judgments are made explicit they fall under the heading 'normative claims'. (225)

The distinction between state descriptions and normative claims is important, according to Ereshefsky, to clarify controversial cases such as whether deafness is a disease. That case illustrates very clearly how diseases do not depend on descriptions of dysfunctions, but on judgements that something is wrong or bad. Indeed, even if medical knowledge can evaluate a certain condition as pathological, the social context still has a lot to say. If the affected person does not consider a given condition to be negative, and there are reasonable cultural arguments to defend such a point of view, why should the physician consider it to be negative? Thus, eliminativism rejects the idea that there is a naturalist normativity that can define diseases, as it removes judgements of deviations, dysfunction, malfunctions etc. from the realm of science, which is considered to provide only descriptions of facts. Eliminativism can, however, be compatible with methodological naturalism.

Methodological naturalism considers that scientific descriptions can help produce normative judgements in medicine. Biological theories provide the authority for normative judgements; but different approaches will be more or less appropriate in each case. This implies that the normativity is not fixed or straightforward, but mediated by a complex heuristics, as different theories and/or evidence such as clinical trials can be applied to the task at hand. According to this view, although there is no naturalist normativity grounded in biology, the normativity of medicine stems from the best available scientific evidence. The kind of normativity appealed to here is *heuristic normativity.*

8.4.3 Vital Normativity

In the two forms of normativity I have considered so far, the judgement is "external" to the domain being identified as pathological: in the former, the normal–broken framework is invoked; whereas the latter presupposes a pragmatic actor who takes into account all the available evidence. Yet, a third form of normativity has a long tradition in the philosophy of medicine; it is related to the normativity intrinsic to any living being, both organic and experiential.

This third form of normativity embraces the normative perspective of biological organization at the constitutive, interactive and experiential levels. From this perspective, normativity is intrinsic and every living being follows norms inherent to its agency and to its dynamic coupling with the environment. The idea is that every biological system has its own norms, which are materialized in its preferences; organisms have a vital normativity, according to which they distinguish disease as some condition that is undesirable. In the case of Canguilhem, this idea stems from

a conception of life as an evolutionary process of adaptation, grounded on a basic plasticity that can depend on the environment in many different ways. The organism actively maintains its norm and also continuously adjusts that norm in accordance with the environment; the norm expresses the margins of tolerance of the environment. From this perspective, organisms have a *living normativity*, according to which they distinguish disease (See Saborido et al., Chap. 7, and Sholl, Chap. 6, for further views on this).

In a way, this third source of normativity is the most demanding: it tries to naturalize normativity itself, so that it is identified as an object of scientific knowledge which is itself normative, the task being to explain scientifically how norms originate and act in living beings. Yet, to naturalize normativity in this way, it is also necessary to question the notion of the individual as fixed and essential. In fact, scientific views of individuals as mosaic, heterogeneous and intrinsically related to others, may cast doubt on the claims of living normativity as related to the self-image of humans as autonomous and self-sufficient. The goal of explaining scientifically how norms originate and act in living beings has its own limits. Can we scientifically capture what it is like to be a healthy or ill agent according to intrinsic norms? Apart from the fact that science as we know it might have difficulties grasping subjective experience in a descriptive way, the kind of normativity that is being appealed to here may be deceptive if facts concerning the radical social nature of subjective experience are taken into account. Among the many challenges faced by this view, one is related to the epistemic authority involved in judging when an agent is healthy or ill. This authority may well be distributed across a triad consisting of the agent, healthcare professionals, and other social agents (Casado and Etxeberria 2013); and this obliges us to situate vital normativity within a wider context.

The previous discussion demonstrates that biological individuals cannot be reduced to a single characterization. Mol (1998) explores the multiple ways of being ill in the context of actual medical practice. This multiplicity is related to biological descriptions of the pathological condition and also to social and experiential ways of living with a given disease. Thus, pluralism needs to be taken into account when we conceive of medicine as normative knowledge concerning the ways in which something goes wrong and how to deal with it (Sect. 8.4).

8.5 Conclusions: Ontology, Normativity and Medical Practice

In this paper, I consider diseases to have a real and objective ontological status, even if they can only be known through evaluative judgements. Thus, cases in which diseases can be claimed to be "social constructions"—as is often the case, for example, with attention-deficit hyperactivity disorder (ADHD)—are not considered. If a condition is called a disease but does not have an objective reality, we could say that it is not really a disease, such so-called diseases are indeed social constructions.

Medicine is normative in that it needs to offer judgements as to whether conditions are diseases or not; and those judgements are based on scientific evidence. Thus, the normative or evaluative component of medicine is not in opposition to the merely descriptive or neutral; any description of a disease is only possible after some evaluation.

This way of looking at disease, I claim, helps us to understand previous contributions to the debate in an integrated fashion. Canguilhem thought that the attempt to factually describe diseases is "optimistic"; but did not have a pessimistic attitude towards the hope of advancing medical knowledge through scientific means. Naturalist approaches, such as Boorse's, enjoy the advantages of the normal–broken view, but I have reviewed many arguments according to which that view is not always useful or applicable.

Therefore, the following six points are my conclusions.

1. Medicine is a normative discipline; it evaluates when something goes wrong in a given living being and identifies diseases. Scientific (biological, experiential, social, ecological, etc.) descriptions guide this identification, but they are not normative in the same way as medicine is.
2. For medicine, diseases are objective and real: they are negative conditions of the biological organization of a living organism. The objectivity and reality of diseases cannot always be traced from medicine back to biological facts, but they are assumed to exist (otherwise the conditions are falsely identified as diseases).
3. Biological organization is the subject of biology, but its broad nature cannot be completely known. On the one hand, the debate about functions in biology is on-going; on the other, medical knowledge is based on evaluations of when something goes wrong in a living organism, but the entities involved are complex in their constitutive, interactive and experiential dimensions.
4. Naturalism with regard to concepts of health and disease suggests that medicine always relies on theories that are well established in biology and that according to them, it is possible to demarcate what is wrong in a living organism. From this position, the normativity of medicine is wholly based on science; but it fails to consider many difficulties inherent to medicine. Epistemically, this position holds a view that is *too optimistic* concerning how descriptive knowledge of biological organization motivates the normative judgements of medicine.
5. Strong normativism concerning concepts of health and disease suggests that medicine does not rely on biological theories to normatively identify diseases; but wholly depends on social, cultural, or economic factors. Therefore, all diseases are somehow subjective or socially constructed. Epistemically, this position holds a view that is *too pessimistic* concerning how descriptive knowledge of biological organization motivates the normative judgements of medicine.
6. Weak normativism is compatible with methodological naturalism. According to this view, the normativity of medicine is pluralist; the same kinds of evidence are not always invoked, and diseases are characterized by an ontological multiplicity of ways of being. In many aspects, medical knowledge is not conclusive; it can

change over time, especially when conditions previously considered to be diseases are shown not to be (because they are not objective). Conversely, we might discover that something previously not considered to be a disease really is one (because there are arguments and evidence for its objectivity). This position avoids both the excessive optimism and the excessive pessimism present in naturalism and strong normativism.

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