1 From Philosophy of Medicine to Philosophy of Physiology

A huge body of scientific literature describes how organisms function – how bacteria reproduce, how photosynthesis happens, how bears survive during hibernation, how humans sleep – as well as how they *typically* dysfunction via infection, dehydration, starvation, insomnia, scurvy, diabetes, cancer, multiple sclerosis, and so on. The former is called "physiology," the latter "pathophysiology," though both are typically subsumed within an expansive understanding of "physiology." Physiology (in this broader sense) is not an exclusively medical science, but it certainly is a core science for medicine. As with any other science, physiology is likely to raise conceptual problems. For instance, why are some bacteria called "pathogens" if they never produce symptoms or shorten lifespan in some individuals? Is cancer one or many diseases? What does it mean for an organism to "repair itself"? Is disease a universal and necessary fact of life? How can we measure degrees of "health," are there mechanisms of health, and what exactly is the difference between health and fitness? If you are interested in these questions, it seems natural to turn to philosophy of medicine. But this section argues that this is not the best place to start. Instead, it proposes an alternative approach, one centered on the philosophy of physiology, and argues that this is a better path to understanding health and disease.

1.1 A Short Overview of the Health and Disease Debate in Philosophy of Medicine

If you are diagnosed with major depressive disorder, you may protest and argue that in fact, *the world* is depressing and that *you* are not sick – only lucid. Psychiatrists would be encouraged to label this behavior "poor insight" (that is, a weak degree of the patient's awareness of their symptoms). On the Hamilton Depression Rating Scale, a standard tool in psychiatry, that would be a sign of the severity of the disease. This is just one of the many examples where doctors seem to be entitled to decide *factually* how you should be treated. What justifies such authority of medical science?

Sociologists have *described* the social process that leads to this authority, and called it "medicalization" (Conrad 2007), that is, the social consensus that a problem should be dealt with by medicine. In philosophy of medicine, the question raised is the *justification* of this authority. This question has been interpreted as a question of definition. Indeed, with a correct definition of health and disease, we would have criteria to decide what really is a disease.

In recent history, philosophers of medicine have polarized into two camps:

- *Naturalists* define "health" and "disease" in terms of biological functions and dysfunctions. The knowledge of biological facts justifies that you have a disease (or not).
- *Normativists* claim that "health" and "disease" definitions reflect social values. The observation of what is deemed to be "harmful" in a society justifies that you are judged sick (or not).

This alternative is deeply ingrained in the health and disease debate: most contributions in philosophy of medicine dealing with the definition of disease either endorse, reject, or combine these positions.

Undoubtedly, the champion of *naturalism* is Christopher Boorse. His seminal paper, "Health as a Theoretical Concept" (Boorse 1977), has both initiated this debate and proposed a complete, naturalistic definition of health. It is called the "Biostatistical Theory of health and disease" (BST). According to the BST, "Theoretical health (. . .) is the absence of disease; disease is only statistically species-subnormal biological part-function; therefore, the classification of human states as healthy or diseased is an objective matter, to be read off the biological facts of nature without need of value judgments" (Boorse 1997). In other terms, physiology determines the nature and statistically normal level of efficiency of all functions of the parts of an organism in a given species, or, more precisely, in the various "reference classes" in a species – that is, mainly, groups defined by being either male or female and child, adult or elderly. Thus, basic concepts of physiology determine the generic criteria for specific conditions to be considered real diseases.

Although a majority of articles endorse *normativism*, there is no dominant version of normativism. Some forms of normativism draw criteria of health and disease either from values (Engelhardt 1996), requirements of human action (Clouser et al. 1981), or conditions for happiness (Nordenfelt 1995).One common form of normativism consists simply in counter-arguments to naturalism without clear endorsement of normativism (e.g., Kingma 2010).

Hybrid positions have also been held. Focusing on mental disorders, Wakefield has proposed that the two requirements of harm and biological dysfunction must both be met for a condition to truly be pathological (Wakefield 1992).

The development of these views and their criticism has fed a voluminous literature which has now reached a certain level of sophistication, sufficient to scare off many newcomers. At the same time, skepticism has grown over the possibility or utility of a definition of health or disease (Hesslow 1993; Worrall & Worrall 2001). Somewhat paradoxically, the number of articles dedicated to the question has substantially increased.

1.2 Philosophy of Medicine Is Not the Philosophy of the Sciences of Health and Disease

How and why doctors judge that you have depression and treat you is a question about practice. Practice is one thing. Among the many reasons why doctors judge and treat depression as they do, one is science itself. But science is another thing. Is science justifying practice? To answer that question, it is necessary to investigate the science of diseases itself. Perhaps it contains no scientific argument to justify that a condition is a disease. At the very least, one needs to examine this literature to answer the question. There is no other reason why recent handbooks see philosophy of medicine essentially "as part of the Anglophone philosophy of science tradition" (Solomon et al. 2017, 2).

Medical science is not one discipline, but many. The core science of health and disease is physiology. A surprising fact is that, on average, philosophy of medicine about health and disease is only superficially interested in its core science, as compared to how much philosophy of biology is interested in biology, philosophy of physics in physics, or even the rest of philosophy of medicine is, for instance, in scientific debates about causality or evidence in medicine. To get a sense of the level of engagement of philosophy of medicine with science, let us have a look at citations and references of articles in the health and disease debate. Citations are mentions *by* other articles, while references are mentions *to* other articles. A two-dimensional measure of the integration of the health and disease debate consists in counting how many citations and references are scientific (see Figure 1). For instance, "Health as a Theoretical Concept" (Boorse 1977), which is one of the top three papers cited in philosophy of science journals between 1977 and 2017, is marginal in medical science (with about fifty citations, by papers rarely cited themselves). This may sound unproblematic. After all, why should philosophers be cited by other disciplines if only philosophers truly understand what they do? In principle, this is valid. Yet in comparison, philosophers of biology, physics, or even medicine more broadly, do get more scientific attention (even if this remains modest). What may seem more problematic are the references. One third of the 110 articles about the health and disease debate used in the preparation of this Element do not cite *any* scientific article at all. Scientific references constitute less than 20 percent in two thirds of these articles. References often provide examples of diseases that could have been replaced by other examples and are not even always the standard or expected references about the disease in question.[1] As an example, Boorse's article cites mostly

[1] One exception to this situation is Jerome C. Wakefield's work on the definition of mental disorder, both mainly published in science journals and cited and discussed by psychiatrists.

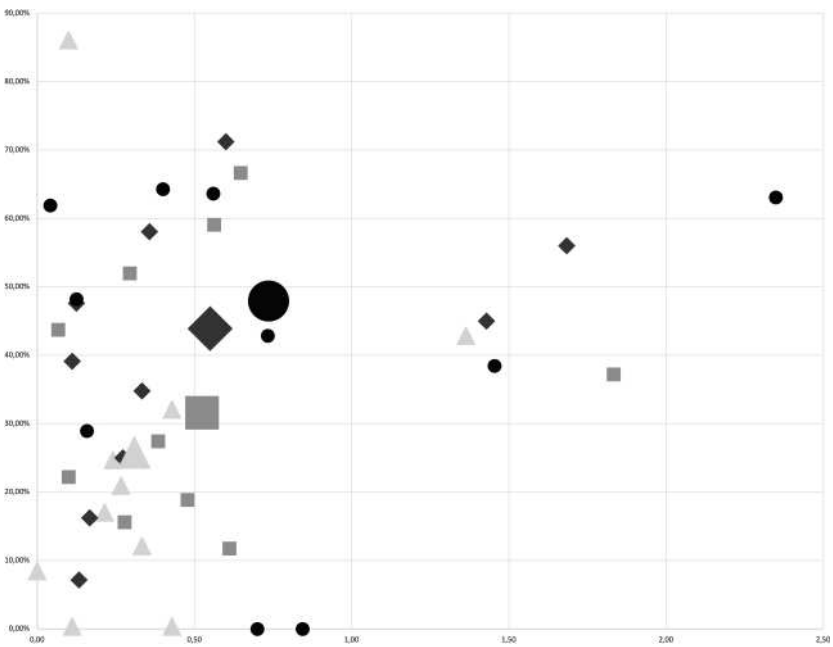

Figure 1 Bibliometric isolation of the health and disease debate from medical science, as compared to philosophy of physics relative to physics, philosophy of biology to biology and philosophy of medicine to medical science. Along the X-axis is Average Ratio of Citation (ARC) in science (Pradeu et al. 2024). An ARC of 1.00 means as many citations in a scientific field on a given year as the average article in that domain (an ARC of 0.5 means half as many and an ARC of 2.0, twice as many). Along the Y-axis is the proportion of references to science articles. Dark circles represent the 10 articles in philosophy of biology that are most cited by articles published in philosophy of science journals; light squares, in philosophy of physics; dark diamonds, in philosophy of medicine (except the health and disease debate); light triangles, in the health and disease debate. The corresponding bigger figure represents the average in each field. Philosophy of biology is the most integrated in science, the health and disease debate is the least integrated.

bibliometrically marginal articles from science journals or articles written by philosophers themselves.[2] Yet practically all of the 110 articles mentioned here cite Boorse's. This does not pose a problem for seeing how philosophy of health and disease forms a part of philosophy of medical practice. But it is very problematic for seeing how philosophy of health and disease forms a part of philosophy of science. Indeed, in contrast, philosophers of biology, physics, or

[2] Checked on the Web of Science on April 1, 2021.

epidemiology frequently refer to scientific sources directly, and generally cite standard or expected articles in science journals, not anecdotal or illustrative articles. Consequently, if you are interested in physiology, philosophy of medicine is not likely to be the place where you want to invest too much time (some exceptions notwithstanding).

This is, of course, a criticism of the health and disease debate in philosophy of medicine. However, one possible response is to claim that the real focus is on medical practice. In fact, some would even argue that, in the case of the health and disease debate, philosophy of medicine is not part of philosophy of science because medicine is not a science. However, not many would argue that physiology is not a science. However, many would argue, with some strong reasons, that the *basic* concepts of physiology – precisely, health and disease – are not scientific, and for that reason, there cannot be much philosophy of science in the philosophy of health and disease. If philosophy of physiology is what you are interested in, this discrepancy does not matter much. Surely, if "health" and "disease" were not scientific concepts, there would be other scientific concepts in physiology. This is the starting point for this Element. In fact, it will show that physiology offers no scientific definition of health and disease as philosophers of medicine would like it, that is, a straightforward justification that the conditions we call diseases really are diseases based on explicit and undisputable criteria. But that does not mean that physiology does not contain conceptually elaborated concepts that are crucial to the *explanation* of health and disease, and even, theories and concepts of health and disease. In fact, this is the core question: Are philosophers of medicine right in supposing that a definition of health and disease is independent from how these phenomena are described and explained, and even, that this definition must predate and predetermine our explanations of health and disease? Or is there a theoretical definition of health and disease to be found in the physiological literature?

Before we get to this key question, it is useful to get acquainted with the most influential article in philosophy of medicine: "Health as a Theoretical Concept" (Boorse 1977).

1.3 A Brief Presentation of Naturalism in Philosophy of Medicine

When I teach an introductory class on the health and disease debate, I play a little game with students. On the whiteboard, we draw both a table (just like Table 1) and a Venn diagram (just like Figure 2). I ask students to think of conditions that are or are not diseases according to them, and potential criteria that fit with all diseases and diseases only. We fill in the table and the Venn diagram at the same time in search for a correct definition.

Table 1 Possible criteria of health and disease and uncontroversial conditions of health and disease (after Boorse 1977). The corresponding numbers (E01, E02, . . .) are reported in Figure 2.

<table>
<tr><th>Criteria</th><th colspan="2">Healthy conditions</th><th colspan="2">Diseases</th></tr>
<tr><td>Value</td><td>E01: “mildly below average in any valuable physical quality, e.g. height, strength, endurance, coordination, reflex speed, beauty”; “regular access to food and water”</td><td rowspan="2">E02: Shortness; Need for sleep; blood-clotting; limb and brain regeneration; insulin production; vitamin C production; smell blindness to carbon monoxide</td><td rowspan="8">E15: Malaria, smallpox, cholera, tuberculosis, cancer</td><td>E03: Minor allergy or viral infection; Cowpox in smallpox epidemic; Myopia avoids infantry; Sterility in large family without contraception</td></tr>
<tr><td>Treatment by physician</td><td>E04: “circumcision, cosmetic surgery, elective abortions, and the prescription of contraceptives”; Sex change operation</td><td></td></tr>
<tr><td>Statistical normality</td><td colspan="2">E05: “normal for clinical variables like height, weight, pulse and respiration, blood pressure, vital capacity, basal metabolism, sedimentation rate”; 95 mm Hg as maximum normal diastolic blood; type O blood; red hair</td><td>E06: Dwarfism; Gigantism; atherosclerosis, minor lung inflammation; tooth decay</td></tr>
<tr><td>Pain, suffering, discomfort</td><td colspan="2">E07: “teething, menstruation, and childbirth”</td><td>E08: “asymptomatic disease of many kinds-tuberculosis, diabetes, liver cirrhosis, breast cancer, various forms of heart disease, syphilis”; “a complete absence of “subjective distress” is compatible with severe internal lesions”</td></tr>
<tr><td>Disability</td><td colspan="2">E09: Pregnancy; “inability to swim, fly, or see in the dark like a cat”; inability to walk in babies</td><td>E10: Death; athlete’s foot, eczema, and warts; myopia and color blindness; inability to walk in adults</td></tr>
<tr><td>Adaptation</td><td colspan="2">E11: Parent not becoming “healthier with each successive child”; Small stocky Durham miner; “violin playing, tightrope walking, impersonating a President”</td><td>E12: Inflammation</td></tr>
<tr><td>Homeostasis</td><td colspan="2">E13: “blood temperature, acidity, speed of flow”; “composition”; perception, locomotion, growth, reproduction</td><td>E14: “deafness, limb paralysis, dwarfism, sterility”</td></tr>
<tr><td>Generic usage of “disease” (including injuries)</td><td colspan="2">E16: Emmetropia ; Correct lens refraction</td><td colspan="2">E17: malaria and syphilis; spina bifida; cancer; limb paralysis; injuries, causes of death; Obesity; Inanition; Seasickness; Broken bones; Gunshot wounds; foreign bodies in the stomach, supernumerary toes, animal bites, and drowning, electrocution, asphyxiation, incineration, “general crushing”</td></tr>
</table>

“universals or types of unhealthy conditions”		E18: “cystic fibrosis bronchial asthma, trichinosis”
Disease entity		E19: Fever, diarrhea, breathing difficulty, hypoglycemia; Acidosis, glycosuria
Intrinsic/ instrumental health	E20: Unhealthy habits, like smoking; Unhealthy environments, like New York / Vermiform appendix; High tolerance for arsenic; Mutant immunity to the common cold	E21: Appendicitis
Function	E22: peacock’s tail attracts peahen, gills in fish and respiration, numerous functions of the human hypothalamus	
goal	E23: web-spinning, nest-building, or prey-catching	
individual and species survival and reproduction	E24: heart pumps blood and produces heart sounds; kidney eliminates waste and keeps bladder full	
Species design	E25: human lens focuses light on the retina; squirrel saved from a car by catching its tail in a crack; ideal types of organisms of frog, hydra, earthworm, starfish, crocodile, shark, rhesus monkey	E26: Cataract, no lens; pancreatitis requires having a pancreas that typically secretes digestive enzymes
Polymorphic functional traits / Reference class	E27: Type A, B, AB, O blood; Blue, brown, green iris; amount of skin pigmentation; either ovaries or testicles, either wombs or penises, either large or small breasts; life stages; bone growth in infant, not adult; sperm production or ovulation in adults, not infants	
Normal functioning	E28: unusual cardiovascular ability of long-distance runner	
efficiency	E29: thyroid secretes right amount of hormones; Temperature maintenance; Digestion (E29)	E30: Tuberculosis, emphysema; Cardiovascular disease; Fever, vomiting, loss of appetite

Table 1 (cont.)

Latent or asymptomatic disease		E31: Diabetes; Hepatic cirrhosis; Nephritis; Pancreatic cancer; intestinal polyp
Diseases with atypical functioning		E32: Rabies; Phenylketonuria; Herpes zoster; Vitiligo
Not life-threatening dysfunction		E33: Diseases implying melanin deficiency, deafness, diminished sense of smell
Functional readiness	E34: Not seeing with closed eyes; digestion without food; Adrenalin secretion under stress; Sweating when temperature is rising; Blood clotting after wound	E35: Hemophiliacs protected from injuries; Diabetes taking insulin daily
Risk of various diseases	E36: individual variations of body build and probability of cardiovascular disease or complications in childbirth; unusual beauty and mating success	
Extremal diseases		E37: hyperemia and anemia, hyperthyroidism and hypothyroidism, galactorrhea and agalactia; night blindness
Normal variation	E38: Normal man unable to lift a heavy weight	E39: strong man with Addison's disease unable to lift heavy weight; abnormality of microfunction, adrenocortical secretion, in Addison's disease
Structural disease		E40: congenital absence of appendix, dextrocardia, calcified pineal gland; minor deformities (nose, ear, hymen); some internal tumors; macacus ear
Universal disease		E41: benign hypertrophy of the prostate in old men

Note: Grey cells represent that Boorse does not give any explicit example.