

3. The Birth of a Modern Discipline – Medicine as *Wissenschaft* in German Romanticism

The categorization that was first used to classify medicine as a modern academic discipline was “medicine as *Wissenschaft*” (Reil 1804, 1910, Schelling 1805). The key concept gained popularity during the founding of the University of Berlin in 1809/10. Berlin’s first university (the precursor to today’s Humboldt University) acts as a paragon of the modern research university, established in the spirit of Romantic educational reform associated with the names Wilhelm von Humboldt, Johann Gottlieb Fichte and Friedrich von Schleiermacher (see Schelsky 1971, Tenorth 2012). For the idea of science, the Age of Romanticism constituted a considerable breach with the preceding Enlightenment utilitarianism. Enlighteners followed an ideology of social progress, which valued knowledge mostly for its usefulness. Effectively, this resulted in the levelling of knowledge from university-educated people and “amateurs” towards practical goals. For actors that identified with academic qualities, this posed a great threat to their professional identity. Toward the end of the eighteenth century, therefore, circles of academically learned natural researchers began defending their trade. They distinguished more clearly between theoretical and practical areas of scientific knowledge to separate their work from immediate utility and requirements of the state and society (Phillips 2012). In the course, a new concept emerged: *Wissenschaft*; the idea of a pure form of academic science devoid of any immediate concerns for usefulness. The term had become widely used by the turn to the nineteenth century and stood for the systematic unity of scientific knowledge, which preceded all practical interests (Kaldewey 2013: 283, Stichweh 2007: 213f.).

The concept of *Wissenschaft* became a central item in arguments, which stated that science had to be pursued entirely for its own sake. As I will explain further down, the use of *Wissenschaft* in the singular deviated from common references to the *Wissenschaften*, or “sciences” in the plural, as the broad denominator for all kinds of knowledge. In contrast to the English term “science”, which describes the natural (and technical) sciences more narrowly, the word “*Wissenschaft*” meant the unity of all academic knowledge taught and pursued at the university (including philosophy

and the humanities).³⁵ Engagement with *Wissenschaft*, Romantics argued, would not only provide practitioners with a thorough understanding of natural and cultural phenomena; it would also contribute to the *Bildung* – understood as both formation *and* education – of a person's character, making him (higher education was restricted to men in the early nineteenth century) naturally prone to contribute to the common good of society and to cultural progress. However, in the case of the natural sciences, the condition was that nature had to be studied in its entirety and as a unity,³⁶ and not only in aspects that made it suitable for application, as the Enlightenment knowledge systems proposed. "Practical men who studied practical problems knew only bits and pieces of nature; only the learned man knew nature as a whole" (Phillips 2012: 90).

For members of the medical elite, learnedness constituted a crucial marker of their professional identity. From the late Middle Ages until the Age of Enlightenment, the traditional professions of law, theology and medicine were based on the qualities that came with higher education. Symbolized in erudition, Latinity, an academic character and lifestyle, these qualities "surrounded the local practitioner with an aura of honorific distinction, before which considerations of function or social utility paled" (Turner 1980: 108, see also Phillips 2012: 27–39). For a Doctor of Medicine, the ability to practice derived more or less automatically from his identity as a scholar, from his membership in an academic community – certified by his university degree – that possessed a broad knowledge of the philosophical and medical tradition (in contrast to the clinical proficiency required today). But the later eighteenth century brought what R. Steven Turner has aptly characterized as a shift from an emphasis on "learned expertise" to "functional expertise" (1980: 109). This shift sent shockwaves through the university world, forcing academic researchers to redefine their highly theoretical pursuits in face of public demands for applicability. Works in the social history of medicine have shown how the traditional image of the academic physician as a learned man (there were also no women doctors at the time) came under pressure in the eighteenth century, since the Enlightenment's ideology valued knowledge, instead of for its academic qualities, primarily for its practical utility and benefit for

35 For issues when translating *Wissenschaft* into English see Phillips (2012: 3–6, 2015).

36 What this exactly meant in the context of medicine will become apparent in this chapter.

social progress (e.g., Frevert 1984, Huerkamp 1985, Lindemann 1996, see also Turner 1980).

The explanations offered by the literature, however, are predicated on modern ideas of professionalism (Broman 1996). Accordingly, academically trained physicians are portrayed as having organized themselves so that they could make exclusive jurisdictional claims to healing practices and expulse non-academic medical services from the marketplace.³⁷ Academic science, some historians argue, served mainly as an emblem, which distinguished the learned physician from the wide range of craft medicine practitioners, such as surgeons, barbers, midwives or apothecaries. Other authors have critiqued that this view casts an anachronistic image of early modern physicians and of early modern professions more generally (Broman 1996: 4ff., Lindemann 1996: 168f., 372f.). It reduces physicians' identities to practical qualities – something that does not sit well with historical ideas of medicine – although they thought of themselves in the main part as members of the learned estate and only secondarily referred to their identity as healers. What, then, happened to the academic identity of physicians during and after the Enlightenment?

Historian Thomas Broman (1996) has moved explanations a step further. He notes how, drawn between the demands of the idea of “pure science”, introduced by the Romantic reformers, and the delivery of medicine to society, two occupations effectively came out of the medical profession: one tended to medical research in universities and the other concerned the practice of healing in local communities (Broman 1989, see also Broman 1996: 161). As academic medicine was transforming into the experimental study of organic nature on the one side, and the clinical aspect of medicine was evolving on the other, the identities of the physician as academic scholars *and* as practical healers were becoming increasingly incompatible (ibid: 48). Consequently, Broman argues, a new type of medical professor developed, with a self-conception that distinguished him (again, only men in the early-nineteenth century) from former ideas of the physician, in that they “removed themselves as far as possible from [medical] practice” (ibid: 51). These new professors subsequently began organizing their work towards ends that would later become the laboratory research of animal morphology, Broman argues.

37 For historian Thomas Broman, this is an anachronistic argument. Such “claims about early modern physicians arise from the same problem: the inappropriateness of applying criteria of modern professionalism to its early modern version” (Broman 1996: 6).

For many authors writing about German science and medicine in the late eighteenth and early nineteenth century, this development marks the starting point for the purported change from a medical to a biological identity of full-time researchers working in the medical faculty. The idea is that, while physicians outside the faculty acquired a primarily practical identity, those that remained in the university, since they factually cut their ties to medical practice, must have consequently become pure researchers in biological areas. From this standpoint, however, portrayals of the scientific developments in academic medicine at the time are predetermined by our current views of biology. In short, the scientific developments in medicine are depicted as the prelude to the biological developments that came later in the century. But the modern academic discipline of biology was still in its infancy at that point and largely characterized by eighteenth-century approaches in natural history and the tradition of taxonomic practices in botany and zoology. Morphological studies, which Borman refers to, were pursued as part of the *medical* faculty and research community (Nyhart 1995). How did these new professors of medicine, who devoted their professional life entirely to research, maintain their intimate ties to medical institutions? How were they able to also retain the right to practice and teach under the roof of the medical faculty? And how were these actors, with an interest in understanding living nature rather than in the practice of healing, furthermore able to sustain their professional trajectories if no institutions for laboratory research in biology existed at the time?

My answer to the questions above takes on the perspective of medicine as a genuine academic discipline. The general concept of disciplines that emerged with the modern research university was that of the unity of research and teaching (Stichweh 1994b). Even though practitioners henceforth devoted themselves to biological questions in research, as will become apparent, they were nevertheless still obliged to teach medical students. Against the arguments in the literature, I argue that, although henceforth devoted to laboratory research on phenomena of organic nature, these actors retained their medical identity in order to not jeopardize their newfound professional trajectories, i.e., access to future recruits that could continue their laboratory culture of medical science. Chairs in biology were not installed until the mid-nineteenth century, meaning that no study curriculum yet existed that taught experimental research to understand biological phenomena. Even the subsequent development of biology as a laboratory science depended on the institutional basis laid by academic medicine at the start of the century (Nyhart 1995).

Therefore, instead of a clear separation between the institutions of medical practice and laboratory research, between profession and science, I want to show how the discipline of medicine functioned doubly: it provided the opportunity for immersion into an intellectual culture seen as required for both medical practitioners *and* researchers. The idea of an academic discipline that was formed under the rubric of medicine as *Wissenschaft* simultaneously satisfied the requirements of the scientific community for intellectual autonomy and the interests of the state for educating practitioners that provided health care. Rather than oppose academic ideals with state ideals of practical utility, the concept of medicine as *Wissenschaft* opened a conceptual space in which different existing institutions of the university and of medicine came together to form the modern institution of education in the natural sciences for physicians. In a sense, the discipline was a territory for two future tribes (biology and medicine) or sustained an academic *habitus* that was presented as suitable for both medical education and laboratory practice. Crucial to this early development was that actors began pressing for laboratory research as fundamental for future physicians, applying the Romantic arguments of character formation and the need for a holistic understanding of nature. In a diachronic perspective, this analysis can help explain why medical students ever since are required to take intensive training in laboratory courses and it can also indicate why basic laboratory research is so tightly linked to ideas of biomedicine today.

In this chapter, I want to reconstruct the conceptual and institutional developments of academic medicine in the context of Berlin's university founding. For this purpose, I will be concentrating on texts by Johann Christian Reil on the organization of medical education in Berlin. Reil, initially physician and professor of medicine at the University of Halle, is a key player because he served as advisor to Humboldt during the academic reforms of Prussia and was later appointed as professor to the new University of Berlin (Broman 1996: 183, see also 1989: 46f.). He was also an important protagonist to prominently employ the new concept of medicine as *Wissenschaft* in his texts (Reil 1804, 1910). Using this category, Reil conceptually differentiated between theoretical and practical areas in medicine to make medical science a subject pursued purely for its own sake. He furthermore proposed reorganizing existing academic medical institutions according to the principles of Romantic science, thereby opening a conceptual and institutional space into which medicine as a scientific discipline could be inserted.

In sum, the notion of medicine as *Wissenschaft* allowed academic physicians to define their professional identity as distant from actual medical practice, while simultaneously framing their research culture as foundational for the practice of medicine. To provide modern medical science with a distinct disciplinary culture within the academic system, moreover, actors in medicine reinvented physiology to make it the core of medical science's research culture. In the process, the pre- and early modern idea of physiology as comprising theoretical doctrines about organic nature was turned into a practical science, which appropriated practices traditionally associated with anatomy (Cunningham 2002, 2003). Structurally, a relationship to the medical faculty was retained by framing an immersion in these practices as a requirement for the academically trained physician.

I will first try to give a brief overview of the institutional *status quo* prior to the opening of Berlin's university. Then I want to reflect on the conceptual innovation "medicine as *Wissenschaft*". Placing Reil's ideas in the wider context of scientific concepts as well as the existing institutions of academic medicine (in Berlin), I demonstrate how he reorganized them to argue for the need of a medical science discipline. I ask how it is distinguished from precursor concepts and evaluate its institutional ramifications for academic medicine.

I. Medicine Between Art and Learnedness – The Conceptual Background

This section and the next are devoted to providing the necessary context for understanding the conceptual and institutional innovations that occurred at the start of the nineteenth century. Naturally, what Reil and his conspirators proposed was not constructed into a vacuum. Rather, in important instances they made use of the existing institutions and conceptions and transformed their meanings, next to introducing genuinely novel concepts. To give a thorough background would require writing a book of its own. Here, I can only provide a quick pass-through of pinnacle events and changes from the classic period until early modernity. My purpose is to, in very broad strokes, sketch major shifts in conceptual relations between medical theory and practice in order to appreciate the ingenuity of the categorical changes introduced by Reil and the Romantic reformers.

Since Greek antiquity, beginning with Hippocrates (2012), the defining marker of medicine had been the concept of "art" or *techne* (table 3.1). In the Classical world, the term *techne* comprised a large spectrum of activities that ranged from rhetoric to carpentry. The basic tenet of the

arts was that their results were deliberate and artificial products, which “would not have existed without the intervention of a technician, a practitioner of *techne*” (Schatzberg 2018: 18). Greek society, therefore, made no explicit distinction between occupations that were highly theoretical or predominantly practical. But the concept of *techne* did imply a relationship between theory and practice that was determined by the fact that the arts required *logos*, rational thought about cause and effects (ibid: 20). It is therefore important to note that at its inception medicine was defined from its *practical* side, while its characterization from the *scientific* side is a decidedly modern phenomenon, picking up especially with the Romantic reformers. Before, however, as I will show further down, medicine would receive a composite academic identity, which in the eighteenth century would begin to be expressed in the vernacular terms of “science” and “art” (*Wissenschaft* and *Kunst*).

The Middle Ages witnessed the introduction of the concept of the “mechanical arts”, which led to the distinction of artisanal from the scholarly activities of the “liberal arts” (ibid: 30–41). Since medicine came from a tradition of *techne*, and therefore fell outside of the range of Classical conceptions of either philosophy or politics, it was initially classified as a “mechanical art” in the emerging academic canon (ibid: 34, see also Amundsen 1979: 55ff., Bylebyl 1990: 30f., Kaldewey 2013: 327f.). Accordingly, to receive a place in the higher studies of the university, medical actors fought “to make the lowly and manual craft of medicine part of a properly instituted *studium generale*” (French 2003: 80). After Scholastic scholars rediscovered Aristotle’s philosophy from Arabic translations in the twelfth and thirteenth century, the strategy involved framing the formerly only implicit theoretical part of the medical art as explicitly dependent on the study of nature; that is, particularly on Aristotle’s natural philosophy (ibid: 107–113).

As a result, medicine received its identity as a learned subject, in which the Latin term *scientia* expressed its conformity with logic and philosophical reason and *ars* retained its identity as a practical art. In the process, however, the concept of medicine shed the practice of surgery, which had been an integral part of its ancient identity but conflicted with the idea of an intellectual enterprise due to the associations with manual labor (Amundsen 1979, see also Bylebyl 1990: 40). Since notions of production associated with the Greek term *techne* moved to the background, the “practical” side of the academic physician now not only became restricted to internal medicine (something that could be practiced in discourse, without the use of hands), but also superimposed with features of rational judge-

ment and prudent behavior inherent to Aristotelian philosophy (Bylebyl 1990: 32–40). Until about the eighteenth century, according to medical historian Roger French, the physician therefore comprised the image of a “Learned and Rational Doctor”, which primarily meant the possession of a great deal of knowledge of the ancients and of skills for arguing dialectically and philosophically (French 2003: 2). By that time, their identity of medieval learnedness had also become complemented with ideals of early modern gentility (ibid: 200ff., see also Huerkamp 1985: 34).

	medical theory	medical practice
400–200 BCE	[<i>logos</i>]	<i>technē</i>
12.–13. century	<i>scientia</i>	<i>ars</i>
17.–18. century	<i>Wissenschaft</i>	<i>Kunst</i>
	pure science	applied science

Table 3.1: Concepts for distinguishing between medical theory and practice in premodern times (from 400 BCE to c. 1800) (my depiction).

During the eighteenth century, medicine was talked about in connection with the terms “science” and “art”. However, using these concepts, one did not draw a clear line between medicine’s purely theoretical parts, on the one hand, and the practice of healing, on the other. Sciences and arts in the eighteenth century, as historian of technology Eric Schatzberg notes, “existed on a continuum defined by the purity of reason, with substantial overlap between the two extremes” (2018: 57, see also Phillips 2012: 35ff.). Accordingly, descriptions of medicine as a “healing” or “medicinal science” (*Heilwissenschaft* or *Arzneywissenschaft*), or as a “healing” or “medicinal art” (*Heilkunst* or *Arzneykunst*), were largely interchangeable before 1800.³⁸ The *Deutsche Encyclopädie*, for example, published in twenty-three volumes between 1778 and 1804 as a “dictionary of all arts and sciences”, speaks of the “medicinal art [*Arzneykunst*]” as “a science [*Wissenschaft*]” that teaches how to preserve health and heal diseases (Höpfner 1778: 839). Therefore, in obvious Enlightenment fashion, all medical knowledge, whether theoretical or practical, was organized towards the end of healing. Consequently, the dictionary portrays the doctor as the individual who

³⁸ Nevertheless, the difference in wording did tend to highlight either the theoretical or practical side, when used in conversation.

performs “the medicinal art [*Arzneykunst*]” and who must be versed in the “practical” just as much as in the “theoretical sciences [*Wissenschaften*] of medicine [*Arzneykunde*]” (ibid: 851).

The rise to popularity of *Wissenschaft* by 1800 introduced not only a clear distinction, but also a hierarchy between theoretical and practical knowledge. The term denoted the unified organization of scientific knowledge and made the study of natural phenomena the exclusive domain of academic research. While previously everybody who collected and contributed what today would be called “data” about the natural world could be a natural researcher,³⁹ recourse to *Wissenschaft*, as a unified science of nature, drew a clear boundary between university-educated and other “lay” natural researchers (Phillips 2012). Historian Denise Phillips demonstrates how the whole range of natural scientific academic practitioners in early nineteenth-century Germany pursued the aim of creating a “general natural science” (2012: 86). The term *Wissenschaft* serves today mostly as an epitome for the pure science ideal of the Prussian reformers, the ascent of the philosophical faculty within the university system, and as a path leading to *Bildung*. On a broader scale, as Phillips argues, the category was employed as a social project for protagonists, such as the actors of *Naturphilosophie*, to defend the scientific enterprise against usurpation by the functional ideology of the Enlightenment.

Since practical sciences proved highly popular well into the nineteenth century, the strategy of academics to defend their learned identity involved “separating theoretical from practical intellectual forums”, which resulted in increasing the relevance for societies and media that devoted themselves exclusively to learned subjects (ibid: 89). As Phillips shows, the concept was therefore at the heart of the strategy of learned professionals to remove themselves from the responsibility for practice. “Once this new ideal of *Wissenschaft* rose to prominence,” she notes, “older descriptions of the learned ‘*Wissenschaften und Künste*’ came to seem quaint and dated [...]. In the early nineteenth century, *Wissenschaft* finally shed its more expansive early modern meaning. It was no longer used to designate just ‘knowledge’ (both academic and nonacademic) in general; more important, it lost its

39 In a related vein, Stichweh (1994a: 59f.) has characterized the early-modern scientific system as allopoietic, i.e., the expansion of scientific knowledge by inclusion and indexing of things from the system’s environment, instead of the construction of the scientific system via self-produced elements, e.g., epistemic objects or traces created in laboratory experiment (see also Hacking 1992, Rheinberger 1997).

early modern partner, the learned 'Künste,' a term that also sometimes functioned as its synonym" (ibid: 98). Accordingly, now the idea of the university professor was to confer upon students the broad moral and intellectual education that leads to *Bildung* (Turner 1980: 127ff.). "By distinguishing between merely 'useful' and truly 'learned' knowledge," Phillips concludes, "elite *Naturforscher* neatly exempted themselves from thorny, complicated questions about their practical relevance" (2012: 113). In the case of medicine as *Wissenschaft*, the idea also implied an occupational separation – a division of labor that distinguished between the scientific and practical tasks of medicine.

II. The Institutional Environment in Prussia's Capital

The institutional context into which the reform plans and the new language of academic medicine was born was complex. The University of Berlin was founded into a landscape that already harbored a well-established system of medical education. Historian Arleen Tuchman (2000) has characterized the institutional environment that developed with the birth of the University of Berlin as a "confusing triangle". By this she is especially referring to the tensions that formed between the new medical faculty and the existing medical schools, especially the competition over resources, facilities and the general orientation of academic medicine. The landscape at the time comprised, first, the *Collegium Medico-Chirurgicum*, a practical training school for military and civilian medical personnel established in the early-eighteenth century, and later, the *Pépinière*, an elite military medical academy founded in 1795, as well as the *Charité* hospital (Hess 2010a, Tuchmann 2000). Medical doctors who began devoting their professional life mainly to research, and exempted themselves from practice, had to therefore make a strong case for establishing theoretical medicine as a research discipline. Despite the new classification of medicine as a purely academic pursuit, they had to nevertheless link their discipline to the predominating practical interests of the local medical community and the Prussian state. The idea of a medical research discipline that emerged from the concept of *Wissenschaft* was therefore not strictly anti-practical. Instead, it retained a strong bond to medical practice, although by arguing that only physicians trained under the pure science ideal will possess the professional and personal qualities for the adequate treatment of patients. Before moving on to important conceptual and institutional developments, I

want to set the stage for my inquiry by briefly sketching the relationships between the different institutions that existed at the time.

Prior to the founding of the new university, medical education in Berlin was predetermined by Enlightenment thinking, especially by the military interests of the Prussian state. Under the reign of Friedrich Wilhelm I., who induced reforms in medical education in the early eighteenth century, the city first received an anatomical theater in 1713 for performing dissections and later, in 1725, saw the establishment of a *Collegium medico-chirurgicum* (Broman 1996: 53f., Tuchman 2000: 38f.). These practical medical schools, which could also be found in other German cities, were erected to rear a new caste of military and civilian medico-surgeons (Bonner 1995: 53ff.). The model of medical education they represented, was exemplary of how in the ideology of the Enlightenment knowledge was being combined and taught to be both systematic and useful. In the eighteenth century, “new practical sciences” developed inside and outside of academia to improve agriculture, forestry, mining and other trades. The aim was to increase the productivity of society and thereby foster state powers. Many formerly purely academic subjects thus became conjoined with topics from economy or the crafts, recasting the ancient distinction between theory and practice and thereby turning many learned teachings into useful arts and sciences (Phillips 2012: 35, see also Broman 1996: 46f.).

The new medical academies furthermore broke the monopoly that guilds held over surgical training and contributed to the rapprochement between medicine and surgery by transgressing their intellectual and disciplinary boundaries (Bonner 1995: 56ff.). Already in the Middle Ages, after its separation from academic medicine, and despite the common image of a lowly craft, some actors began employing arguments for the requirement of academic credentials for surgery in framing it as a learned and rational enterprise (Wallis 2018: 58f.). In the early modern German territories, elite surgeons exhibited “academic standards in their training and lifestyle”, although maintaining “an identity of ‘medical artisans’” (Rabier 2018: 83). Surgeons argued extensively for the scientific foundation of their craft, especially by appropriating for it the subject of anatomy. These precursory developments fed into the idea of the practical medical schools by, on the one hand, combining an academic curriculum with practical instruction and, on the other, educating practitioners in both internal medicine and surgery.

Universities tried to intercept these developments in the eighteenth century by also orienting themselves towards practical requirements, but they were generally no match for the new academies favored by rulers

for their military relevance. Even though surgery had been the subject of lectures by the medical faculty before, universities also began offering clinical and theoretical surgery courses by the end of the century. “The old distinction”, as medical historian Thomas Bonner observes, “between the ‘medical surgery’ of the university and the ‘practical surgery’ outside them was beginning to fade” (1995a: 58). As a result of the integration of theoretical and practical medical knowledge, the professional distinction between medicine and surgery turned into a disciplinary distinction within the same medical curriculum (Weisz 2006: 196–203). Additionally, an edict by the Prussian government later in 1825, which set completely new rules for medical licensing, effectively abolished the legal distinction between the practice of surgeons and academic doctors (Huerkamp 1985: 45–50, see also Turner 1980: 117–120).

Thus, the medical education system of the Enlightenment undermined the clear distinction of medicine into an academic science and a practical art. The *Collegium* in Berlin, for instance, had seven full professors and aimed at combining theoretical with practical teaching: “One could listen to lectures in anatomy, surgery, physiology, pathology, pharmacology, physics and mathematics, while attending the anatomical and surgical exercises in the anatomical theater” (Tuchman 2000: 38). Whereas everybody eligible for higher education could study at the institution, its express goal was to produce military surgeons, and most students were in fact enrolled in this track (Hess 2010a: 62, Tuchman 2000: 38). Students received a thorough education, comparable in quality to that at universities, but with a stronger emphasis on practical training. The only thing that distinguished them effectively was the lack of a doctoral degree. The *Collegium's* faculty was comprised of court physicians, the leading surgeons and physicians of the military and further medical experts (some of which would later also become part of the medical faculty of Berlin's university). According to Volker Hess, “it thereby represented the medical elite of the capital” (Hess 2010a: 62). Next to the anatomical theatre, the school also had access to the Berlin Academy of Science's botanical garden and the chemical laboratory of the Court Apothecary – a luxury that distinguished it from the existing Prussian universities (Broman 1996: 53). Since the *Collegium* far surpassed any medical faculty in Prussia in both facilities and importance, Broman even argues that it acted as “a sort of shadow medical faculty” (ibid.).

Developments toward the end of the eighteenth century aggravated the situation of academic medicine even further. In 1795, Friedrich Wilhelm II. agreed to establish the *Pépinère*, an elite military academy for the rearing of medical personnel. As I will show next, the *Pépinère* featured

prominently in Reil's plans to reform medical education. However, the academy was established clearly in the spirit of the Enlightenment and its teaching faculty was the same as that of the *Collegium medico-chirurgicum*. As Tuchman notes, "There was no idea of *Wissenschaft* and freedom to learn here" (Tuchman 2000: 64). The express aim was to educate medico-surgeons to serve in the Prussian army. Students could study at the academy free of charge and even receive a small stipend if they afterwards committed to serving in the military for eight years.⁴⁰ Education at the P pini re was far more encompassing than at universities of the time. "Its curriculum combined instruction in medicine and surgery, courses in science and basic medical subjects, clinical teaching in the amphitheater, and bedside learning at the Charit " (Bonner 1995: 124). Students of military surgery and medicine had a far greater access to practical training than any university student of medicine could dream of (Hess 2010a: 63). But through its status and the influence of its faculty, the institution represented an idea of academic medicine that opposed any ideals of freedom to teach and learn or the idea to pursue science for its own sake, as the Romantics envisioned it. Reil made use of the academy's practical orientation to argue for the conceptual and institutional separation between medicine as a practical profession and an academic *Wissenschaft*.

The Charit , established in 1727 as a general hospital and teaching clinic, was also dominated by the practical interests of the Prussian state and the King's army. Until well into the first half of the nineteenth century, the hospital remained more or less exclusively for clinical training of students from the military academy. Clinical training as such was a relatively new concept. It dates back only to the second half of the eighteenth century, when the Dutch physician and professor of medicine Herman Boerhaave invented the idea as a form of instruction to practical medicine (Broman 1996: 59–66). By the start of the nineteenth century, the model of the teaching clinic had spread throughout many countries in Europe and began informing important medical centers, such as Berlin or W rzburg. The general idea was to provide medical students with an understanding of their future trade through practical demonstrations on real-life patients (Bonner 1995a: 103–141). Practical instruction existed mainly in the form of apprenticeship prior to the introduction of clinical training. Our knowledge of the history of university clinics remains sketchy (Bleker 1995, Hess 2010a), but there were different modes in which beginning physicians

40 Notable alumni, who later moved on to academic science and medicine, include pathologist Rudolf Virchow and physiologist Hermann von Helmholtz.

could receive their practical training: outpatient and polyclinics, where patients were visited and treated in their homes, as well as stationary clinics (Bleker 1995: 91). University clinics would begin to settle on the latter model. As already mentioned, this did not necessarily mean that university students acquired practical hands-on training. University students were graduated to treat patients with virtually no clinical experience. The academic discipline compensated for this lack by redefining the foundations of medical practice, as I will show further down.

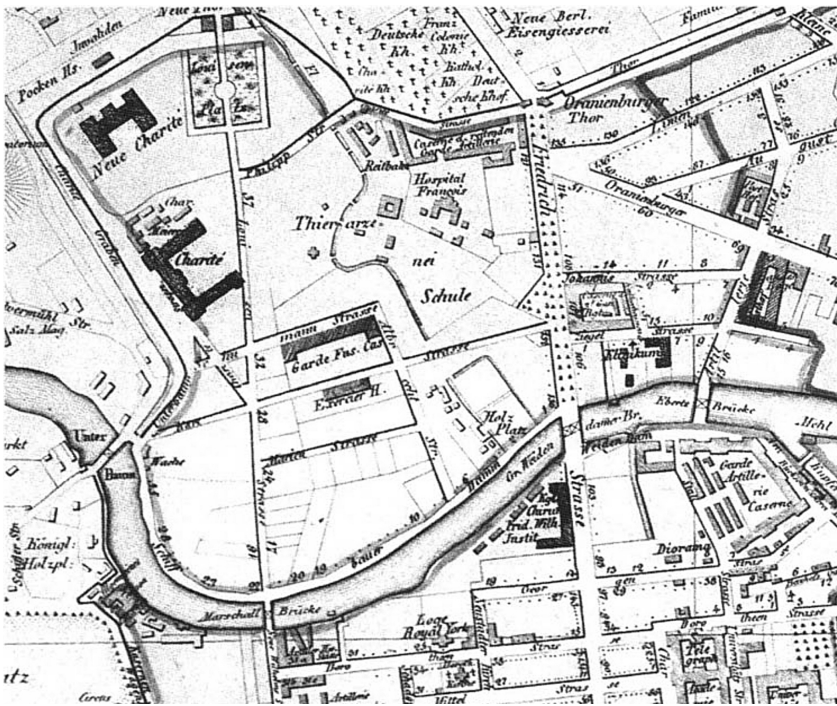


Figure 3.2: Detail map of Berlin (c. 1839), with the Charité hospital in the upper left corner, the university teaching clinic, center right, on the north banks of the Spree River ("Klinikum"), the Pépinière (aka. Royal Surgical Friedrich-Wilhelm's-Institute) on Friedrichstraße, south of the river, as well as part of the university in the lower right corner. (Source: Volker Hess. 2010. *Die Alte Charité, die moderne Irrenabteilung und die Klinik (1790–1820)*. Die Charité. Geschichte(n) eines Krankenhauses. Ed. Johanna Bleker, Volker Hess. Berlin: Akademie Verlag. p. 65).

All clinical instruction for students of military medicine and surgery took place at the Charité. And with the establishment of the Péripière in 1795, the Charité's role as a military teaching clinic was formally cemented (Hess 2010a: 63). The medical faculty of Berlin's new university tried repeatedly to establish strong ties with the Charité hospital for clinical education of their civilian students (Tuchman 2000: 42ff.). But neither King, ministers nor the "shadow medical faculty" would allow university professors of medicine to move their teaching clinics to the hospital. As a result, in 1813, the university faculty founded their own teaching clinic in a building on Ziegelstraße, on the north banks of the Spree River in Berlin (figure 3.2.). Here, Reil established a small "clinical-chemical laboratory", indicating that he wanted to use the clinic also for "higher scientific ends" (Bleker 1995: 96). Even when it was later in the century granted to university faculty to move their teaching clinics to the Charité, students of the military medical academy were still privileged over civilian students (Hess 2010a: 64ff.). However, clinics were still designed purely for instruction at the time. It would take until well into the first half of the nineteenth century until clinical research would become established. Then, the clinical setting would allow professors to study disease empirically and comparatively and thereby contributed to a new theoretical understanding of medicine, next to relaying the ideas of routine medical practice to their students (i.e., diagnosis, working out therapies, making prescriptions, observation and aftercare).

The official reasons given for rejecting inclusion of university clinics into the Charité hospital were that the medical treatment of soldiers had absolute priority over civilian medical care. Another reason was that graduates of the Péripière were furthermore obliged to an eight-year service in the Prussian army upon completing their studies – this was a clear benefit for the state. Academic physicians looked for employment in larger towns or cities and therefore often moved outside the state where they were educated (Lindeman 1996). A third argument was that military medico-surgeons had to be prepared to treat many wounded soldiers at the same time (Tuchman 2000: 45). In other words, the hospital provided the ideal grounds for equipping students for "mass medicine" (Tuchman 2000: 44); not so much, though, for physicians who were looking to treat bourgeoisie and upper-class clients.

In the eighteenth century (and before), most physicians took care merely of an elite of better-off patrons in the urban areas, while most medical practice of the licensed sort fell to surgeons of different ranks, who also

treated many of the acute cases (Huerkamp 1985: 44f.).⁴¹ In a still traditionalist vein, learned academic physicians needed to acquire the necessary “*Savoir faire*” for a successful practice, i.e., the bourgeois manners, the necessary tact and the rhetorical skills to defend a medical standpoint and intervention against a client and his kin (Hess 2010a: 66f.). Next to individual instruction, only a small stationary clinic with a few patients, like a separate ward in the hospital, could provide the appropriate context to learn these qualities, academic physicians believed. This difference in treatment of students and teachers attests to the strong intellectual and institutional divide that existed between the idea of medicine as a learned profession with academic qualities and as a practical profession, which’s aim it was to serve the state. A central question therefore is how the new concept of medicine as *Wissenschaft* was able to provide a ground that could harbor elements of both conceptions.

Reil criticized that the state did not have any real plans of how to proceed with the “great masses” (*großer Haufen*) that required medical attention. He lamented that this large bulk of the population was treated mostly by unskilled and only half-qualified practitioners, since they were never brought into contact with medical science in any way or form. However, he did not want to make learned physicians responsible for treating average citizens either (Reil 1804: 12). Instead, his plans revolved around making science or *Wissenschaft* the guiding principle for all of medicine. His ideas for the encompassing reorganization of the medical system thought it unnecessary to distinguish between military and civilian practitioners, and even between medicine and surgery (Reil 1804, 1910). Instead, the only distinction that mattered to him was that between individuals in possession of true science and those merely capable of executing protocols developed on a scientific basis. In the next section I want to highlight the general outlines of Reil’s argument.

III. Johann Christian Reil's Plan for Reforming Academic Medicine

Reil developed his plans for reforming academic medicine in Berlin in two pieces of writing: the controversial book with the bulky title *Pepinieren zum Unterricht ärztlicher Routiniers als Bedürfnisse des Staats nach seiner Lage*

41 Although non-licensed practitioners were most likely responsible for the bulk of health care of the lower realms of society in eighteenth- and nineteenth-century Germany (Huerkamp 1985: 36ff.).

wie sie ist, published in 1804, and in a memorandum on medical education he wrote in 1807. The latter was later forwarded to Humboldt for his plans to establish the new Berlin university. Humboldt references Reil's ideas in the exposé "On the Organization of the Medical System", written in 1809, which serves as an important document for the founding of the University of Berlin (Humboldt 1964). Reil appears to be performing a form of professional politics in the *Pepinieren*-book, intent on defending the traditional image of the physician as a person of high prestige and privileged to serve only a select few. Accordingly, he grounded his plans for reformation on the contentious assertion that "the learned physician and the wealthy citizen attract each other like amicable poles" (Reil 1804: 9). However, behind these traditionalist-seeming professional intentions lied the far-reaching reorganization of the medical system, which aimed at the institutional separation of the theoretical and practical work of medicine. Guided by the concept of *Wissenschaft*, Reil formulated his plans in the spirit of *Naturphilosophie*, a philosophical current of the Romantic era, spearheaded by Friedrich Wilhelm Joseph Schelling, which sought to place "man" in a universal system of nature.

Schelling's *Naturphilosophie* was decidedly anti-utilitarian and based on the idea of a holistic experience of nature. It combined several elements that made it fitting to argue for the primacy of science over all medical matters. Firstly, the philosophy was abstract enough to keep medical practice at a distance. Broman observes a "comparative absence of narrowly professional concerns in *Naturphilosophie*", although actors "wrote a good deal about health and illness as part of their more general treatments of nature" (Broman 1996: 99). Secondly, despite its transcendental rhetoric, the current was generally open to empirical investigations in a way that would become important for laboratory experiments. For protagonists of *Naturphilosophie*, the structures of reason were essentially equivalent to the structures of nature, and they argued that, with the help of philosophical reason, the science of medicine could bring "an external formal unity to the given and existing manifoldness" of experiences of organic nature (Schelling 1974: 130, see also Broman 1996: 92–96, Zammito 2018: 302–317). The term "organism" reappears in Schelling's and Reil's writings, for example, to simultaneously illustrate the wholeness of the scientific researcher's object of inquiry, namely, nature, but also to signal his own inclusion and participation in the being of nature. In other words, a truly enlightened Romantic natural philosopher could experience (and ultimately understand) nature in himself and through his connection with everything else in the world. *Naturphilosophie* was thus open to insights

from empirical sciences, as long as they were organized in a “systematic unity” that was “*prior* in the transcendental sense” (Zammito 2018: 303).⁴² As Lynn Nyhart writes about the *Naturphilosoph* Karl Friedrich Burdach: “Only an *Erfahrungswissenschaft* allows us to discover the ways in which the laws of the interior world are played out in the external world and to recognize the inner unity among the diverse particulars of the external world” (Nyhart 1995: 41).

Thirdly, moreover, *Naturphilosophie* incorporated a hierarchy among the sciences, which placed medicine at the top, above all other sciences. The argument was that true scientific physicians experienced the workings of the “God of nature” more closely and directly than any other of the natural sciences could provide (Schelling 1805: v). From 1805 until 1808 Schelling edited the short-lived *Jahrbücher der Medicin als Wissenschaft* together with the physician Adalbert Friedrich Marcus, which gave the program of the Romantic medical reformers its name. In the preface to the first volume, Schelling calls medicine the “crown and bloom of all the natural sciences [*Naturwissenschaften*]” and propagates that

“philosophers and natural researchers [*Naturforscher*] of all sorts, the chemist and anatomist [*Zergliederer*], the zoologist and physician [*Heilkünstler*], [be] united in a common work, the science [*Wissenschaft*] of the organism, and thereby elevate medicine [*Heilkunde*] to the pinnacle that it should occupy, and gradually advance it” (1805: vi, see also Zammito 2018: 336f.).

As *Wissenschaft*, medicine was thus defined as the queen of all the sciences of nature, from which the various physiological subcurrents and other biological specialties could and would spawn. Likewise, the science itself was composed of various previously existing scientific subdisciplines, which are now directed toward the discipline of medicine. This also shows how the institutional structure of the new university was still confusing. In medicine, professors had previously taught in all the mentioned areas (chemistry, anatomy, zoology), and pursued research individually only in some. Schelling's natural philosophers and the Romantic physicians that followed in his wake were referring to an idea of medicine as a unified science of organic nature and used the category of *Wissenschaft* like many

42 In the preface to the *Jahrbuch der Medicin als Wissenschaft*, Schelling argues for the right balance between an “abundance of classical erudition” and a “true experience based on [a] perception of nature [*Naturanschauung*]” (Schelling 1805: xvii).

others of the learned estate to defend a broad enterprise aimed at preserving the intellectual institutions of academic research and teaching (Phillips 2012).

Finally, Schelling's *Naturphilosophie* introduced the crucial distinction between those that (can) possess a true idea of science and experience of nature, and therefore can act autonomously, and those that merely perform tasks delegated to them by some higher authority. In the preface to the *Jahrbücher*, he argues that "he who lacks a thorough perception of nature [*Naturanschauung*] and to whom medicine [*Heilkunde*] has never appeared in relation to general natural research [*allgemeine Naturforschung*]" can hardly be deemed "a learned, or even experienced, physician", now that people have begun to regard the human organism as the "center of nature and the epitome of all its forces"; instead, such individuals can only be "dull *routiniers*", who have internalized the "empty formalism of a theory [...]" and thereby the experience of past physicians" (Schelling 1805: xviii).

In Reil's book on *Pepinieren*, the distinction between *routiniers* and true physicians constitutes one of the fundamental differentiations to argue for the establishment of the medical system on the Romantic idea of the natural sciences. He proposed that medical care of the larger part of the population ought to be the responsibility of an estate of medical auxiliaries that he dubbed *routiniers*. These auxiliaries could act both medically and surgically, were useful in both the military and the civilian world and possessed technical skill and mostly only a practicable knowledge of medical science (Heller 1975). Accordingly, the *routinier* "should be able to recognize diseases by their symptoms without really understanding them and to use appropriate medicine without deeper knowledge of their functions" (ibid: 326, see also Broman 1996: 120). These practitioners were effectively molded after the current caste of medico-surgeons, embodying the Enlightenment ideal of medicine as a practical science. And it was suggested that, eventually, "they would replace the practical surgeons, barber surgeons, and apothecaries who failed to meet the health needs of the Prussian people" (Bonner 1995: 24).

Reil's plans argued on two fronts: the pure science basis of medicine and the proper practical education, which would be based on scientific principles. In his book, he made clear demands towards the Prussian state, asking the rhetorical question: "The state sees itself obligated to maintain *academies*, on which *learned* physicians are educated for [treating] rich citizens. Would it then be an unreasonable demand that it also arranges for *Pepinieren*, at which *routiniers* are trained for service of the great masses

[*großen Haufen*]" (Reil 1804: 19)?⁴³ Admittedly, Reil's plans for two separate and differently oriented medical schools never saw it to fruition. But his ideas did prefigure the two-tier system of medical research and clinical care, characteristic of academic medicine today. Humboldt would make a similar recommendation to Reil's in his 1809 memorandum, speaking of the complementarity of academic medical institutions and practical training institutions: "Medical agencies [*MedicinalBehörden*] almost inevitably take a more practical [direction], appropriate for the local circumstances of their situation, and not a purely scientific [*rein wissenschaftliche*] one; the faculty-scholars [*FacultaetsGelehrten*] constitute the opposite case. Both together thus function immensely beneficial [*heilsam*]" (Humboldt 1964: 61).

However, Humboldt structured the medical education system in a three-fold distinction, which better matches the institutions that developed. He speaks first of universities as providing "theoretical-scientific [*theoretisch-wissenschaftlichen*] instruction in relation to the whole area of science [*Wissenschaft*], and with so much practical instruction as is necessary for the transition from theory to practice and for connection of the two"; second, of "medical-practical institutions" (*medizinisch-practische Anstalten*) for after completion of university studies (these included the teaching clinics that were established in both the Charité and in the university clinic); and third of "special medical training-schools" (*medizinische SpecialSchulen*), which include institutions like the current *Pépinière* in Berlin (Humboldt 1964: 62).

What characterized the medical system in Berlin subsequently, as Volker Hess argues, was a double structure, which, "on the one side, had the clinics of the Charité in a military medicine tradition, and on the other, the university clinics, which were erected in, and surrounding, the Ziegelstraße" (Hess 2010a: 68). Nevertheless, I want to show that the concepts underlying Reil's ideas predetermine our modern understanding of academic medicine and of medical science. It was not the actual schools that he envisioned, as we will see, but how he related the different key actors and the tasks he equipped them with. Hovering above it all, of

43 Literally, Reil speaks of making medical theory as part of the natural sciences the domain of the academies, which were until the nineteenth century the places for purely scientific concerns. But as has been shown, Stichweh argues that the academies experienced an exodus of science at the time, making the universities the actual places of scientific work (Stichweh 1984: 67ff.). In the onomasiological perspective, Reil was therefore using an old term for a new thing.

course, was the idea of medicine as a pure science. The rays of *Wissenschaft* came together in the figure of the learned physician, who was a teacher of science and a furtherer of scientific knowledge. Medical care laid mostly in the hands of medical auxiliaries or *routiniers*, who, although themselves separate from pure science, nevertheless attended scientifically founded educational institutions to acquire a proficiency for practice.

IV. *A Modern Division of Medical Labor*

The distinction between the figure of the *routinier* and that of the learned or scientific physician forms the basis for relating the medical institutions of theory and practice to each other in a uniquely modern fashion. Underlying Reil's (and Humboldt's) plans was the idea that academic physicians could have a medical identity even if they did not participate in treating patients. The bottom line was to frame their tasks in a way that it sustained the scientific practice of medicine and simultaneously contributed to the production of medical practitioners, which could then treat the bulk of the population. Accordingly, *routiniers* were envisioned to serve as auxiliaries to the university-reared physicians. The distribution of tasks between physicians and *routiniers* was based on the notion that the "art of medicine" consisted of two parts "knowledge and action" and that the "transfer [*Mittheilung*] of the art via instruction can only happen in a *double* fashion" (Reil 1804: 20). Either both knowledge and action are taught in its unity (as with learned physicians) or "only the mechanisms of action" themselves (as in the case of the *routiniers*), "without the reasons from which they spring" (Reil 1804: 20). All other distinctions, for instance, those between military and civilian, or medical and surgical schools, Reil condemned as either "unessential [*außerwesentlich*]" or even "senseless" (*ibid.*).

Consequently, for Reil, the *routinier* was characterized "partly by the *mechanism of action*, [and] partly by *his restriction to the respective sphere in which he is to serve as a tool*" (Reil 1804: 62). He calls them "psychological automata" that are aware of the rules according to which they act, but that are "without awareness [*Bewußtsein*]" of the "construction of the same from their [scientific] principles" (Reil 1804: 63). Though the phrasing of both Reil and Schelling would suggest a derogative understanding of these medical auxiliaries, both were in fact elevating them above all existing medical practitioners of the time – except university physicians. Reil even admits that it is difficult to draw a "clear boundary [*scharfe Gränze*]"

between him [i.e., the *routinier*] and the scientific physician” (Reil 1804: 62). The reason is that both are exposed in their own way to medicine as science, something that most of current practitioners lacked in the eyes of the reformers. If we were to map Reil’s distinction onto current circumstances, the roles of *routiniers* are conceptually precursory to those of today’s clinicians and physicians in private practice. These practitioners treat much of the population and practice based on scientific principles, but they do not themselves contribute actively to advancing the science of medicine. Reil’s academic physicians, in turn, would today resemble medical scientists holding MDs (or PhDs, respectively) and devoted entirely to research. It was this distinction – between those that actively furthered the science of medicine and those that merely acted on the scientific basis established thereby – that was at the heart of Reil’s reform ideas, rather than any concrete roles or institutions he described.

The relative proximity that Reil constructed between the physician and the *routinier* had implications for the organization of the medical system. He strictly opposed the idea that all medical practitioners should become learned physicians. In fact, a horde of academic physicians would not be favorably equipped to serve the bulk of the population in his opinion. In a revealing passage, he argues that too much “rationalism” hampers proper praxis and that “the tactful *routinier*, whom nature has given practical genius, so often acts far better than the superfine theoretician” (Reil 1804: 24, see also 93). Through this classification, he even grants *routiniers* qualities that were formerly restricted to practicing physicians. Reil admits to them the status of being better practitioners (at least when it comes to treating the large part of the population, as the state required it; but it would seem also for medical practice as such). While learned physicians were too caught up with their medical theories and rhetorical eloquence, the medical auxiliaries would instead recognize disease when they saw it and know how to act immediately. These practitioners should therefore have their proper place next to the academic physician, he demanded (*ibid.*).

By elevating the practical qualities of the *routinier* above those of the learned physician, Reil was simultaneously making an argument for a division of labor within the medical system. Although it was granted that both university doctors and *routiniers* could actively function as healers (within their respective purviews), the true task of the physician, according to Reil, was nevertheless defined as pursuing *Wissenschaft* – without any regard for its practical potential or utilizing it for external ends. This also reflected in his ideas for the organization of medical education: “The learned physician must go to a *university*, which teaches science

[*Wissenschaft*] in its organic unity, whereas the *routinier* must be reared in a *Pepiniere*, which organizes the raw material according to its future purpose and teaches the mechanisms of action [*Mechanismus des Handelns*] solely for external purposes” (Reil 1804: 28). However, Reil implied that it would be the same faculty teaching future learned physicians and medical auxiliaries. This implication made any factual distinction between medical academy (*qua* university) and practical training school – to use Reil’s word – unessential.⁴⁴

A teacher at a training school had to be a “philosopher and scientific physician”, in order to be able to construct the subject of his teachings “in its entirety [*Ganzen*] and from the whole [*Ganzen*]” (Reil 1804: 93). This is a clear affirmation of *Naturphilosophie* ideals and of *Wissenschaft* as a holistic natural experience. Reil claimed that not the material taught, but the manner of education, distinguished between “true” medical students *qua* scientists and medical auxiliaries. “Whereas the presentation to medical students should be ‘learned’ and ‘critical,’ *Routiniers* should be taught in a manner that is ‘popular’ and ‘dogmatic’” (Broman 1989: 45, s. Reil 1804: 94). The boundary that Reil drew was supposed to correspond to the intellectual quality of the student and represented an idea of Romantic elitism that distinguished the free-thinking scientific “genius”, who could immerse himself (ingeniousness of this sort was also seen as restricted to the male population in the early nineteenth century) in *Wissenschaft*, from the confined mind that listened only to doctrine and accordingly was uncreative (Schaffer 1990, see also Tuchman 1993: 27f.).

This ideology subsequently became institutionalized in medical education in concrete terms. The first prominent generation of medical scientists like Johannes Müller,⁴⁵ manifested a practice in which they hand-picked individuals from the pool of medical students and offered them extracurricular training in medical research if they saw them fit for forming the future elite cadre of scientists (Coleman 1988: 39, see also Lenoir 1997:

44 Although in a very short paragraph he states that “The *Pepiniere* should not be at the same place as a university, so that the conceit [*Dünkel*] of the academic does not awaken the envy [*Scheelsucht*] of the *routinier* and tempt him to defect” (Reil 1804: 89).

45 Müller is best remembered as a rigorous experimental researcher, who trained a cadre of people in his Berlin laboratory in the 1830s and 1840s that would become eminent figures in nineteenth-century science and medicine – including Emil du Bois-Reymond, Hermann von Helmholtz, Jacob Henle, Theodor Schwann and Rudolf Virchow (Otis 2007). He will play a role again briefly in the next chapter.

103f.). But there is no need for further concern with the underlying philosophy, which had Reil convinced that the *routinier* “possesses *Wissenschaft* merely as an artifice and *in concreto*”, as opposed to the physician (Reil 1804: 64, see also Broman 1989: 45). What is central, though, is the idea that the two groups would receive and acquire different things from the *same* faculty and courses. Despite Reil's insistence on differentiation, all students, at least initially, had to be taught as equals. An education in *Wissenschaft* was thereby regarded as propaedeutic no matter if students would become practitioners or scientists. Refracted onto the circumstances of today, we can say that the plans of reformers like Reil prevailed not in the factual institutions that were erected in its aftermath, but in the inner logic of how they saw science, practice and teaching relate.

V. *The New Physiology as Modern Medicine's Scientific Culture*

How could *Wissenschaft* be taught at the turn of the nineteenth century? How did it act propaedeutically for medical students? And how were existing medical institutions reformed in the process? What was the scientific culture that henceforth determined the actions of learned physicians *qua* medical scientists? Reil and the Romantic reformers were still looking for answers to these questions prior to the founding of the University of Berlin. In his memorandum to Humboldt, he was lamenting the current state of medical education in Germany, described above. He wrote:

“*Medicine* is [the] natural science [*Naturkunde*] of organisms in their interrelations to the environment, applied to the end of healing their diseases. – Natural science is its *basis*, application its *specific nature*. [...] At no university is [the] natural science [*Naturkunde*] of organisms taught as a *pure science* [*Wissenschaft*]: systematically self-contained, removed from everything alien, and as an end in itself. It is always only taught as *medicine*, i.e., as an applied science [*Scienz*] towards the particular end of healing; thus, only those parts [are taught,] which are suitable for application – and these in a disgustingly meticulous detail and interspersed with rules that refer to the art [*Technik*]” (Reil 1910: 52).⁴⁶

He complained that medical education focused too narrowly on teaching those parts that are “suitable for application” or which refer only to the

46 Unless otherwise noted, all translations from the German are my own.

“art” or “technique”.⁴⁷ This neglected the crucial aspect of expanding the pure science or *Wissenschaft* of medicine. “Either one thus has to”, he suggested, “restrict medicine entirely to the art [*Technik*] (where it then loses its place within the organism of the sciences [*Wissenschaften*]) or to unite it with the subject of natural knowledge [*Naturerkenntnisse*]” (ibid: 53). As a scientific subject, in other words, medicine had to establish itself as a general and encompassing scientific discipline. It needed to be treated by practitioners as an end in itself, devoted solely to “cultivating the sciences [*Wissenschaften*]”, and not simply as a sideshow like it was for most professors (Reil 1910: 50, 58). It was common for them to be teachers of medicine at a university next to their practice. “This science [*Scienz*], which propounds the principles of the natural doctrine [*Naturlehre*] of all organisms as such, is the indispensable propaedeutic of every particular [science], therefore also of the natural doctrine [*Naturlehre*] of human nature” (ibid: 60).

What the rhetoric of the pure science ideal associated with the Prussian reformers admittedly tends to obscure, is that, though its proponents sought to liberate themselves from issues of practical relevance, it did not mean they abandon the relationship to practice altogether. To conform to the beliefs of their day, they rather reinvented the relationship by reversing the hierarchy that the Enlightenment had set up, so that activities in pure science became the precondition for practical life. What was essential in this regard, was that, as Phillips notes, the new category of *Wissenschaft* “contained folded within itself the essence of all practical knowledge” (2012: 105, see also Kaldewey 2013: 294–306). Seeing how medical physiologists began treating problems independently from clinical concerns, social historians of nineteenth-century German medicine and science regard that the identity of medical science turned into a biological one, separating it from the institution of medical practice. Rather than seeing how the emergence of the term *Wissenschaft* indicated the detachment of pure science inquiries from medicine, the question is how the subject allowed them to maintain their role as medical teachers.

The general organization of disciplines in the newly emerging university landscape followed the pure science ideal, the pursuit of scientific questions in freedom and unhampered by the expectation of practical outcomes. Stichweh shows that this included a reversal of the hierarchy between the philosophical faculty as a propaedeutic teaching institution

47 For the difficulties of rendering the German word ‘Technik’ in the late-eighteenth century into English see Schatzberg (2018: 11ff., 102f.).

and the traditional faculties of law, medicine and theology, which trained learned professionals (Stichweh 1984: 31ff.). This moved humanities fields like history, philology and philosophy to the top of the hierarchy, while the disciplines of the natural sciences began distinguishing between their pure and practical parts to secure a position in the disciplinary hierarchy. While disciplines in the philosophical faculty like chemistry or physics had often served as auxiliary sciences to the higher faculties, they now constituted their own autonomous disciplines with a research imperative. Stichweh argues that this reversal reflected in a new orientation of the disciplines to each other: The philosophical faculty became autonomous and, under the banner of *Wissenschaft*, the new locus for scientific research, giving birth to the modern system of academic disciplines. At the same time, the faculties of law, medicine and theology began to orient themselves towards “problems of professional practice and education” (Stichweh 1984: 36). As I have been arguing, however, the formerly higher faculties also need to be regarded – at least in the case of medicine – as becoming places of pure science. Rather than constituting a neat distinction between *Wissenschaft* and professional praxis, medicine began to form a scientific discipline that combined the interests of both. I will mention in the next chapter how one strategy to argue for the academic autonomy of the medical discipline was to borrow features from the natural sciences like physics or chemistry, which were now housed in the philosophical faculty.

None of the fields that developed after the turn of the nineteenth century had the clear distinctions that we know of academic disciplines today. And only few had their departments and granted disciplinary degrees. For instance, virtually all research in medical fields and in areas of organic biology was conducted by individuals holding doctoral degrees in medicine. As mentioned already above, as long as actors remained part of the medical faculty, they also remained academic teachers of medicine, even if their research interests shifted to problems that prepared those of the morphological zoologists. In the old academic system of early Modernity, what distinguished academic physicians professionally was their “license to both teach *and* practice medicine” (Broman 1996: 52, see also Broman 1989: 60). As teachers, they lectured to students on the theoretical doctrines of the medical tradition. Professors tried to move up from the lower philosophical faculty into a higher faculty and, within the medical faculty, through virtually the entire canon of medical topics in correspondence to seniority (from “practical” subjects like pharmacology or surgery through botany and chemistry up to the theoretical fields of anatomy, pathology and physiology). Now, at the start of the nineteenth century, in contrast,

this system was abolished for one in which they remained within a fixed subject orbit throughout their career (ibid: 177, see also Nyhart 1995: 53f., Stichweh 1984: 33). As a result, the professors who devoted themselves to the science of organic nature had to find a way to sell their function as medical teachers so that it would also conform with their developed set of specialized research interests.

As the foundational science of medicine, physiology was for many interested in pure science research the area of choice. However, physiology was not yet neatly distinguished as a homogenous discipline. Rather, the science comprised a row of different approaches and questions, ranging from human anatomy and pathology all the way to zoology. There were many different attempts to homogenize the discipline at the time. But it seems that the current of *Naturphilosophie* acted best to unify the natural sciences generally (Phillips 2012: Schauz 2020: 152ff.), and physiology especially (Zammito 2018: 318ff.). From tradition, physiology was ranked a primary academic subject of medicine because it had the highest philosophical appeal and laid the theoretical foundation for all the other medical subjects. Therefore, it was not (yet) a special method or set of fundamental questions that defined physiology. It was rather the idea of a holistic understanding of the true nature of organic life, which it was believed could be experienced through the study of natural *qua* physiological phenomena. In the first generation of medical researchers, many therefore held joint chairs and taught in different areas, which complemented and overlapped each other. Johannes Müller, for example, held the chair in physiology and comparative anatomy at the University of Berlin from 1833 onward. He taught students in anatomy, pathology and physiology, while publishing research in all three areas as well as in zoology and even marine biology.⁴⁸ This goes to show how ill-defined physiology was as a discipline at the start of the nineteenth century. Only in the second half of the nineteenth century did physiology begin to be properly institutionalized (Kramer 2009). When looking at physiology in the following, it needs to accordingly be kept in mind that it is the name for a collective field of medical sciences. What characterized the role of the new professors of medicine as teachers subsequently was especially the practical engagement with the science of physiology (in whatever concrete fashion or form).

The elevation of medicine to a pure science discipline, separate from all immediate practical concerns, thus became enshrined in a new un-

48 Nonetheless, he regarded himself primarily as an anatomist and is conventionally categorized as one (Otis 2007).

derstanding of the science of physiology, which acted as the unifying center of what Schelling called the “natural science of organisms”. To understand how the new professors maintained their relationship to practical medicine, requires drawing on the concept of disciplines, particularly in their socializing function. As I argued in the previous chapter, disciplines can be understood not only as communities centred around an epistemic object, but rather also as communities defined by a shared scientific culture and professional *habitus*. They combine the function of research and teaching – a concept introduced with the new ideology of *Wissenschaft* – which can be refined to mean the integration of scientific contemplation and practical education in a given scientific culture. Disciplines furthermore orient themselves towards certain societal or cultural demands, which they do by adhering to specific conceptual categorizations like “pure and applied science” or “science and art”. The question then is how the laboratory science of physiology was able to provide a culture for the discipline of medicine that could satisfy both the outlook to medical practice and to scientific research.

One angle of how this was possible, was in the transformation of the concept of practice (table 3.3). The idea of practice that defined the learned physician changed on the side of medical science – turning the professor's praxis from the practice of medicine into the practice of physiological research. While physiology thus became cognitively independent in terms of research, it was also framed as a form of practical engagement (and no longer as a set of theoretical doctrines) that could at the same time prepare the prospective practitioner and provide the basis for *Bildung*, the cultural (self-)formation of the student's character destined to devote a life to *Wissenschaft* (Coleman 1988, s. also Kremer 2009: 354). It is no coincidence, then, that by the 1820s many medical faculties in Germany were teaching physiology as an experimental science (Bonner 1995a: 154f.).

This new understanding of physiology can be traced to its origins in the *Archiv für Physiologie*, which Reil launched in 1795. The periodical is significant because it was the first European journal devoted to the specialty. Reil employed the *Archiv* to lay the theoretical foundations for a unifying science of medicine in the understanding of *Wissenschaft* and addressed a more or less clearly defined scientific community (Broman 1991, see also 1989: 39ff., 1996: 86f.). It can be disregarded here that the periodical was started first in a Kantian vein and that its protagonist only later adopted the stance of *Naturphilosophie* (ibid: 22f.). From my vantage point, it can nonetheless show how medicine changed from resting on physiological doctrines to being based on a complex scientific culture,

which gave medical students practical and cognitive qualities through experimental engagement with organic nature. For this purpose, I want to sketch how physiology, in relation to anatomy, transitioned into being an experimental science.

	learned and rational medicine		craft medicine
<i>Traditional medicine</i>	teaching (doctrines)	practice (internal medicine)	surgery
<i>Enlightenment medicine</i>	practical sciences —→ medico-surgery		
<i>Medicine as Wissenschaft</i>	teaching (scientific culture)	practice (pure science)	internal medicine, surgery
	medical science		clinical practice

Table 3.3: *Changes in theoretical and practical occupations of modern medicine prior to the nineteenth century (my depiction).*

According to historian of medicine Andrew Cunningham, who has uncovered what he calls the disciplinary identities of “old” physiology and anatomy in a pair of papers entitled “The pen and the sword”, the relationship between both until the end of the eighteenth century was that of a theoretical science and a practical art. This division of intellectual labor corresponded to the premodern conviction that mental work was noble and of high esteem, while manual work, in contrast, pointed to its practitioners lowly and humble status (Cunningham 2002: 635). Physiology, as the theory about the causes of living things, relied on the visual evidence provided by anatomy. Conceptually, it was not subjected to anatomical discoveries, but only to the general changes and fashions of the dominating natural philosophies (ibid: 641). Thus, while anatomy comprised the art of dissecting, physiological contemplation itself did not include such activities. Physiology was neither investigative, “nor an empirical discipline, nor an experimental discipline. It was, by contrast, a thinking and talking discipline – a discourse” (ibid: 645). Anatomy, in turn, constituted an investigative and experimental discipline, which complemented the physiological discourse with teachings of organic forms and structures (Cunningham 2003: 59f., see also 2002: 648). Its aim was to investigate and classify the parts of the body and it thereby could only suggest to physiology the viability of theoretical conclusions about an organism’s vital functions (Cunningham 2002: 658). The crucial point for Cunningham is

that, while physiology depended on anatomical experiments, it was itself not an experimental discipline before the nineteenth century.

However, by the eighteenth century, the premodern prejudices about the contrasting moral status of physiology and anatomy largely dissipated, as physiological work became evermore dependent on anatomical dissections and experiments. A famous example is the Swiss scholar Albrecht von Haller. For Zammito, Haller represented the indivisible unity of anatomical doctrines of organic structure and of physiological teachings of animation and he therefore constituted a crucial moment on the path toward the modern life sciences (2018: 79–91). Haller indeed had a reputation as an industrious and sophisticated experimenter. “The sheer quantity of animal experimentation that Haller undertook, and his dedication to experiment as his ‘oracle’, would seem to indicate that the experimental physiologist had [with him] at last arrived” (Cunningham 2002: 653). But Haller kept the two professional roles clearly separated and the disciplinary distinction between old anatomy and physiology clearly intact. On the one hand, he was engaged in physiological theorizing in such works as his *First Lines of Physiology*, published in 1751, about the forces inaccessible to the senses that were responsible for enabling organic function and movement (ibid: 654f.). On the other hand, a separate set of interests guided his *Dissertation on the Sensible and Irritable Parts of Animals* (1755), which concerned the anatomical activity of finding new ways to divide and classify the parts of bodies (Cunningham 2003: 66). Moreover, as Cunningham explains, Haller made the distinction between both disciplines explicit himself by placing an engraving depicting the activities of the anatomist and physiologist on the front of the second volume – published in 1760 – of his *Elements of Physiology of the Human Body* (figure 3.4). While the left side shows the “manual art of anatomy”, the right side depicts “the mental science of physiology”:

The anatomist cuts, the physiologist reflects. The anatomist is active, knife in hand. The physiologist writes, in the conventional philosopher's pose with cheek on hand. The anatomist deals with means, the physiologist with ends. The anatomising is about *what* and *how*, the physiologising is about *why*. The anatomist deals in *findings* and *experiments*, while the physiologist deals with *causes*, something not accessible to the anatomist” (Cunningham 2002: 655).



Figure 3.4: Depictions of the activities of anatomy (left) and physiology (right) – frontispiece to volume two of Albrecht von Haller's *Elementa Physiologiae Corporis Humanae* (1760). (Source: Andrew Cunningham. 2002. *The pen and the sword: Recovering the disciplinary identity of physiology and anatomy before 1800 I: Old physiology – the pen*. *Studies in History and Philosophy of the Biological and Biomedical Sciences* 33, p. 655).

For Haller, therefore, the physiologist of his time presupposed qualities of an anatomist since he theoretically deduced function from the sensible evidence of anatomical experiment. But philosophical ideas of function were not themselves induced through experiment. Since it was, in short, no longer inappropriate for a thinker to also get his hands dirty, Haller could engage in both the manual and the discursive activities without violating their boundaries. Irrespective of the historical issue whether Haller constituted the first experimental physiologist or not, Cunningham shows how the modern discipline incorporated elements of both old anatomy and physiology, art and science, or practice and theory, to form “a new and distinctive discipline, with new goals, standards, procedures, ideology and products” (Cunningham 2002: 661). His elaborations thus seem to echo my argument about the reinvention and reintegration into medicine of the distinctions between theory and practice.

Broman aptly observes that Reil's *Archiv* is the locus in which this recombination first publicly occurred. Whether or not understood as such at the outset, the periodical quickly evolved into a program for a unified *Wissenschaft* of medicine in the style of Schelling's *Naturphilosophie* (Broman 1991: 30ff., see also Zammito 2018: 283). Through the research program it cultivated, it reveals how the formerly distinct interests of function (physiology), and form (anatomy) became expressions of one

and the same transcendental natural process. While previously physiology provided the cause of anatomical form, or form represented the “formal or efficient cause of function”; after 1800, “*Naturphilosophie* provided the theoretical framework for examination of organic form for its own sake, as the external manifestation of physiological process” (ibid: 35). As a result, actors were able to integrate the practice of scientific experimentation into a general activity of theorizing about the form and function of organic nature without breaching disciplinary boundaries.

Accordingly, someone like Ignaz Döllinger, as the last in a long tradition of forbearers to the nineteenth-century science of biology, could now hold the first modern chair for both anatomy and physiology in a German medical faculty – namely, at the University of Würzburg in 1806 – and link the theoretical study of animal form to the microscopic analysis of organic matter (Zammito 2018: 340–352).⁴⁹ His chair is thus a model for the one Müller would receive in 1833. For this reason, the *Archiv* is seen to have provided a platform for the rise of morphology, which constituted itself in a “self-conscious disciplinary community” and defended its research program “against the constraints of [medical] practice” (Broman 1996: 188, 1991: 29–36, Zammito 283ff., see also Nyhart 1995: 53ff.). Thus, although Reil initially intended to never lose “contact with the clinical and practice aspects of medicine”, his periodical nevertheless evolved into being devoted primarily to a research program for studying animal form (Broman 1991: 22). As Zammito notes, “the *Archiv* proved to be a journal dedicated to the special research program of physiology, apart from medical application” (2018: 285).

For scholars like Broman and Zammito this development thus acts as proof that physiology's identity transitioned from medicine to biology and not that its research culture enabled the establishment of medicine as an independent scientific discipline. The main reason for this assumption is that the medical theory the journal ended up propelling was apparently no longer designed to provide principles for clinical action. Zammito simply claims a general lapse in medicine's interest in *Naturphilosophie* in the first decade of the nineteenth century and a return to empirical grounds for forming clinical guidance (ibid: 339). But Broman thinks more specifically that, in the process of the discipline's transformation, “physiological writing in German Europe began to lose its intimate connection with medical pedagogy” (1991: 35). Given the occupational differentiation in medicine

49 As Lynn Nyhart shows, by mid-century efforts were made to again separate the disciplines of anatomy and physiology institutionally (1995: 67–80).

discussed above, he wonders how the medical profession was able to maintain a façade of professional unity at all (Broman 1996: 193). His answer is that as professors of medicine these practitioners of a *new* science also continued to lecture on *old* subjects like anatomy to students studying in the medical faculty – a situation that could not endure, prompting the institutional transition from medicine to biology later in the century (Broman 1991: 38). I want to suggest instead that, while physiology indeed acquired a new identity, this did not mean the loss of its identity as a science of medicine. By interlacing the former distinction between anatomy as an art and physiology as science, the theoretical discourse of physiology was now complemented by specific experimental practices – a scientific culture and *habitus* that medical research practitioners could clearly identify with. Therefore, to transmit this culture to following generations, the general form of medical pedagogy changed from disputations and lectures to the practical engagement of students in the laboratory with the research subject of physiology.

VI. *The Function of Medicine as a Modern Academic Discipline*

With this reformed sense of physiology as an experimental science, the modern discipline of medicine was now able to accomplish its combined research and teaching functions. Naturally, its medical identity not only implied the role of securing recruitment into the ranks of medical science practitioners; it at the same time meant remaining faithful to the idea of the medical professor as an educator of practicing doctors. However, the medical course was not yet divided into prospective researchers and physicians. In fact, physiological research would only become professionalized towards the end of the century, allowing for its own track of academic education and degree garneting programs (Kremer 2009: 345). In other words, professors were confronted with only a homogenous group of medical students, which acted as the resource for both a small elite of individuals they regarded as qualified to join the ranks of medical science and for the group that would move on to become practicing physicians. To fully understand how the discipline of medicine was able to serve this double requirement, I want to examine more closely the pedagogical ideology behind the ideas of the Romantic medical academics.

The connecting element behind the Romantic pedagogical ideology was the empirical experience of nature, as it was brought by laboratory science. For Reil's auxiliaries *qua* medical practitioners, this science could

contribute to “a system of rules, provided for living conception [*Anschauung*], which is formed to an organism on the lower sphere of the real as a regulative to action” (Reil 1804: 64). For those that fit the category of *Wissenschaft*, however, the experience would not only be in demonstration and academic discourse, but also in the self-consciousness of the learned student, in his experience of the wholeness of the transcendental being, which in *Naturphilosophie* was called nature or God. In his book on *Pepinieren*, Reil wrote that the scientific teacher “lets nature, as it were, emerge in front of the eyes of his pupils” (Reil 1804: 33) – both in himself, as an example of nature, but also in his demonstrations. More, the introduction to laboratory practice would also allow those hand-picked students aspiring to become professors themselves to keep the educational demonstrations in class going as well as to pursue their own philosophical questions with the aid of experiment. This form of holistic education was enshrined in the pedagogical concept of *Bildung*, as the formation and education of moral citizens, astute practitioners and truly enlightened minds.

Since the late eighteenth century, the concept of *Bildung* had encouraged the study of Classical – especially Greek – languages and thought as a model for moral and intellectual character development also in the “modern” world (Coleman 1988: 45). In contrast to learnedness, which had characterized embodiment of a higher profession essentially through a solitary and contemplative ideal since the Middle Ages, the category of *Bildung* suggested that a university education would produce graduates more generally directed towards an idea of the common good (Kaldewey 2013: 300). According to Koselleck’s historical analysis, the concept simultaneously emerged from the context of the Enlightenment and was a significant reaction against its ideology (2006: 110, 116ff., 327f.). As a child of the Enlightenment, *Bildung* was a category directed at society and public life: “Personal self-formation leads to action-guiding behavior”, Koselleck states; “*Bildung* does not lead to contemplative passivity, but compels one to communicative actions, forces the *vita activa*” (ibid: 119).

Still, the category departed from the Enlightenment’s strict pragmatic and vocational idea of university training and propagated the values of not specialized, but of a broad and more general education. “The *Bildung* of rational thinking,” Schelling wrote in his *Lectures on the Method of Academic Study*, “by which I mean not merely a superficial getting used to [*Angewöhnung*], but a *Bildung* that passes into the [very] essence of the human being, [...] is also the only [*Bildung*] toward rational acting” (1974: 31). Stated differently, natural researchers and physicians at the start of the

century stylized the holistic university education that resulted in *Bildung* as a at the same time the prerequisite for a mentality befitting the practicing doctor *and* as a source of innovation and novelty for the researcher. For physicians, the concept therefore helped secure their academic status, because *Bildung* and learnedness both worked similarly to make a university education the marker of the academic doctor's identity. "Only now", as Broman notes, "that education formed the foundation of physicians' corporate prestige not because of the erudition it conferred, but instead because of the depth of character and quality of insight it developed in the student" (1996: 72, see also Turner 1980: 118). Physiology, as a modern science combining experimental practices and theoretical knowledge, provided the possibility for the *Bildung* of a harmonious and integrated personality in the student, because it required the contemplation of an equally harmonious and integrated object – organic nature (Phillips 2012: 150).

I will wrap up this investigation of medicine's function as an academic discipline with a telling example of how physiology was seen as the appropriate science to offer such an education. For this purpose, historian William Coleman (1988) provides an excellent case study of Jan Evangelista Purkyně at the University of Breslau (today's Wrocław). In 1839, Purkyně created the first physiological institute for medical education in the German lands. But even before that, as Coleman shows, after his arrival in Breslau in 1823, he used physiology to institutionalize the training of aspiring physicians and researchers through practical engagement with organic nature, since it took "man as its principal subject" and represented a "synthesis of all the natural sciences" (Coleman 1988: 27). Coleman's case questions the conventional primacy of the philosophical faculty of the reformed German university and thereby also the change in physiology's identity from medical to biological. His study therefore allows realizing how physiology became reframed as an experimental science out of pedagogical reasons in the wake of restructuring medicine as *Wissenschaft*. This provided medical researchers with a professional mark and a means to install recruitment structures in the medical faculty, which had become itself a hub of pure science after the start of the nineteenth century.

Purkyně was a follower of the late-eighteenth century educational reformer Johann Heinrich Pestalozzi and believed, in contrast to the neo-humanists, "that individual development could, and emphatically should, follow upon close engagement with the natural world and the realia of daily life and should not be confined to or even emphasize the cultural ideals of ancient Greece" (ibid: 30). Textbook learning alone could never

be satisfying in bringing the subject of the natural sciences to students. Instead, Purkyně developed a hands-on understanding of training in science and research since he believed that a cultural self-formation could not be sufficiently achieved through textual exegesis alone. His innovation was to move the training of students “from an era of lectures and reading [...] to another world, to the world of the classic scientific institute, in which he who learns, the student, becomes the principal agent of his own instruction” (ibid: 27). As a result, an institute like that in Breslau was able to attend to the requirements of both of the new medical occupations: it provided, on the one hand, a proper education in the natural sciences for students, who would go on to enter medical practice, as most apparently did (ibid: 16). “The self-involvement of the student and the creation of an institutional basis for such involvement”, on the other, “opened the way to the possibility that the student might elect to follow a career in medical or scientific research” (ibid: 40, see also Olesko 1988: 313).

In sum, it can be said that the plan to reform the medical system under the category of medicine as *Wissenschaft*, as envisioned by Reil, laid the conceptual and institutional foundation for an academic discipline of medical science. From a research cultural point of view, which was exemplified by the pedagogical ideology of *Bildung*, the discipline functioned to provide different future practitioners with the necessary *habitus* for their individual roles in medicine, whether it was the learned physician or the medical professor, who was also a researcher on fundamental biological issues. The new physiology, as the central field of engagement for practitioners in medical science was able to provide the scientific discipline of medicine with occupational autonomy, while simultaneously securing for it a structural affiliation to the medical faculty at a time when a doctorate in medicine was still a requirement for both practicing physicians and medical scientists.