

THE PLACE OF SCIENCE IN KANT'S UNIVERSITY

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I

Pointing out the need for understanding the relations between the enlightened centre, England and France, and peripheral regions such as Prussia's eastern provinces, Jan Golinski remarked sixteen years ago that it is not possible any longer to perceive the Enlightenment as a coherent intellectual entity and to articulate the centrality of science to its existence. One is rather "left only with a multiplicity of specific contexts, each one constituted by numerous (local and temporary) social factors".¹ Golinski appealed to scholars to dedicate their energies to reconstructing the individual contexts that made the production of science possible. Today, much of Golinski's appeal remains unfulfilled, although attempts at establishing sets of "Enlightenment geographies" have been presented recently by Golinski himself together with William Clark and Simon Schaffer, in *The sciences in enlightened Europe*, a volume that contains among others a paper by Clark on physics, astronomy, anthropology and metaphysics in eighteenth-century Prussia. In that paper, Clark considers three epochs and three cities: he begins by dealing with Christian Wolff at Halle while documenting the diffusion of his textbooks; he discusses Leonhard Euler's years at Berlin's Royal Academy of Sciences; finally, he arrives at Königsberg and offers some remarks on Immanuel Kant's innovative views on cosmology, rational theology, and anthropology.²

This paper concerns the third part of Clark's paper, and focuses on the intellectual life of the medium-size peripheral university of Königsberg, the *alma mater Albertina*,³ as it is mirrored by its course announcements.⁴ The latter are documents in which the place of science is illuminated in the most elementary manner, that is, first by indicating the requirements of each discipline and secondly by answering questions such as: Who was teaching what at Königsberg? What textbooks were prescribed for the courses? What textbooks were the most successful? And finally, what authors and what books were seldom or never mentioned?⁵

The data regarding course textbook prescriptions (in the sense that professors used to mention in the course announcements authors and titles of the textbooks of their choice) are especially valuable insofar as they are both qualitative and quantitative — they are qualitatively different, because of the traditions to which each textbook belonged, and they can be quantified, because each textbook can be rated in terms

of the number of mentions it received. On the other hand, evidence that reveals few or even no adoptions, should be considered with particular care. For instance, Isaac Newton and Gottfried Wilhelm von Leibniz were mentioned at Königsberg only a few times. This does not mean, however, that people were not studying Newtonian fluxional calculus and celestial mechanics, or Leibnizian differential calculus and natural philosophy. Plenty of evidence shows that Newton and Leibniz were studied, mostly using Wolff's or Wolffian textbooks. As Mordechai Feingold has argued concerning the example of seventeenth-century Oxford, "Any attempt to resurrect the course of studies implemented by the individual colleges is complicated beyond measure by the discrepancy between the 'official' curriculum as set down in the college statutes and the 'real' course of studies in so far as it can be reconstructed from contemporary evidence".⁶

Besides, the analysis of course announcements provides us with no new knowledge about individual positions or approaches (the concise, impersonal prose of a course announcement makes this almost impossible). Instead, it helps revive networks of ideas and the contexts of reference in which one "Enlightenment region" becomes manifest decade after decade in its concrete praxis, rather than in its specific programs. The proper subject matter of this kind of analysis is therefore the history of institutions, and more precisely the history of the development that brought forth the aggregation and differentiation of individual disciplines, which, in the case of this paper, were taught within Königsberg's Philosophical and Medical Faculties.

In a word, this paper sheds light on the place of scientific research in Königsberg before Kant, during Kant's tenure, and before the constitution of the renowned Königsberg mathematico-physical seminar founded by Carl Gustav Jacob Jacobi in 1833.⁷ It aims at integrating the literature on science in Germany before and after Kant as exemplified in recent studies, as well as taking up Hans Erich Bödeker's ground-breaking suggestion of studying systematically all extant course announcements as a promising and underestimated means of investigating the place of science in German universities.⁸

II

In the first half of the eighteenth century, according to Fritz Gause, the *Albertina* was in decay. In 1717 there were only 400 freshmen, in 1729 they were 297, and in 1732 the bottom level was reached with 252; besides, the number of those who seriously studied was still smaller than that of the enrolled.⁹ In 1770, Minister Carl Joseph Maximilian von Fürst und Cupferberg, the Obercurator sämtlicher preußischer Universitäten from 1763 to 1771, instituted a university reform that included issuing a new course guide to be distributed to each new student entitled *Methodologische Anweisungen für die Studirenden in allen 4 Facultaeten*.¹⁰ According to this guide, all courses of the Philosophical Faculty were prerequisites for advancing to any other faculty, although one could also get an M.A. and, later, the *venia legendi* in any discipline taught in that faculty. In the guide, each of the four faculties of Philosophy, Medicine, Law and Theology received an overview followed by details about the

courses to be taken according to a “Partition of the Sciences during the Academic Years”.¹¹

The Philosophical Faculty was called the “lower faculty” because of its propaedeutic function to the “higher faculties” of Medicine, Law, and Theology, and it constituted what today is called a Faculty of Arts and Sciences. Besides philosophy (physics was then a part of philosophy), it offered the full program of philology, mathematics (pure and applied), history, and economics. It is important to remember that the students of the Medical Faculty were in principle expected to spend four semesters in the Philosophical Faculty, those of the Juridical Faculty only two semesters, while the students of the Theological Faculty had to go through the whole six semesters of the program of the Philosophical Faculty.¹²

The main conclusion to be drawn about philosophy at Königsberg on the basis of the course announcements is the recognition of a permanence of Aristotelianism in the first half of the eighteenth century followed by a Platonic renaissance in the second half. Rather than Cartesianism, Eclecticism, and Wolffianism, it was post-Tridentine Aristotelianism, particularly its scientific re-foundation by Jacopo Zabarella,¹³ that provided the background from which Kant's philosophy originated.¹⁴ The works on *dialectica* and *analytica* by Melchior Zeidler, Andreas Hedio, and Paul Rabe, provided a stronghold for Aristotelianism, which explains the fact that the Aristotelian formula *collegium dialectico-analyticum* was still used in Winter 1729/30 (*VUK* [see ref. 4], 62) for designating courses on logic.¹⁵ The local Aristotelian tradition explains the eleven references to Aristotelian works (among them the *Organon*, *Ethica Nicomachea*, *Politica*, *Poetica*) in courses from 1720 to 1746; while new editions and translations into German, especially the editions by Johann Erich Biester (1749–1819) of the *Dialogi IV*, *Meno*, *Crito*, *Alcibiades uterque* (Berlin, 1780; *VUK*, 457), revived Plato, whose works (specifically the four dialogues just mentioned and the *Phaedo*) are mentioned forty-three times from Summer 1770 to Winter 1803/04. Controversial authors are named but once, for example Hobbes in Summer 1721 (*VUK*, 9) and Spinoza in Winter 1751/52 (*VUK*, 193). Even Descartes and Leibniz receive no more than four references between 1720 and 1804. The course announcements reveal that the works most frequently prescribed were those by Wolff, the inventor of aesthetics Alexander Gottlieb Baumgarten, and Christian August Crusius, who maintained an original mixture of empiricism and metaphysics. The course announcements indicate also that the Wolffian pietist Martin Knutzen initially prescribed Wolff for his logic course, but turned to his own *Elementa philosophiae rationalis* (Königsberg, 1747) when they appeared. Johann Friedrich Buck, a disciple of Knutzen and Kant's antagonist of many years, announced from Summer 1767 to Summer 1770 courses “in philosophicis scientiis Knutzenium cum Crusio collatum” (*VUK*, 293). Kant, who (contrary to Buck) never declared himself a follower of Knutzen, chose among others Baumgarten's *Metaphysica* (Halle, 1739) and the *Auszug aus der Vernunftlehre* (Halle, 1752) by Georg Friedrich Meier, who was Baumgarten's most famous disciple.

A number of anti-Cartesian works on method were in circulation in Germany

during the first half of the eighteenth century. One of them was the *Methodologia nova atque scientifica* (Berlin, 1708) by Rabe, in which the primacy of Zabarella's *regressus* over Descartes's analytic approach is extensively advocated. The view that Aristotelianism was still unrivalled in early eighteenth-century Königsberg is suggested by the fact that in 1709 the then extraordinary professor of physics, Heinrich Lysius, found himself ostracized by his colleagues for favouring Copernican and Cartesian thought.¹⁶

Curiously, Newton is mentioned only once in the course announcements, in Summer 1745 (*VUK*, 154). There he is cited for the *Opticks*, not his mechanics, and for a medical, not a physics course. This supports the hypothesis that Newton's *Opticks* was better known than the *Principia* in the eighteenth century. Noteworthy works prescribed in astronomy are Christiaan Huygens's astronomical writings in Winter 1747/48 (*VUK*, 170), Lothar Zumbach von Koesfeld's *Planetolabium* (Leiden, 1691), which was both a textbook of astrology and astronomy, in Summer 1748 (*VUK*, 173), and Johann Elehrt Bode's works in Summer 1778, Winter 1794/95, and Summer 1798 (*VUK*, 415, 624, 665).¹⁷ In addition, Johann Friedrich Gensichen — the editor of Kant's mathematical and astronomical writings — was a member of the Königsberg faculty. The above-mentioned Sanden, a Königsberg physician and philosopher familiar with the works of Harvey, Descartes, Gassendi, Locke, and Wolff, gave instructions in physics from 1720 to 1740.¹⁸ Later, other physics professors of the Philosophical Faculty pursued research, among them the Wolffian Johann Gottfried Teske and Knutzen, both of whom taught at Königsberg when Kant was a student. The physics textbooks Teske and Knutzen read in class were the ones the young Kant studied. The course announcements from Summer 1720 to Winter 1803/04 show that physics was invariably taught in two sections: *physica dogmatica* or *theoretica* and *physica experimentalis* or *specialis*. Until Winter 1771/72 (*VUK*, 326) the most widely-used textbooks for dogmatic physics were Wolff's *Vernünfftige Gedancken von den Wirkungen der Natur* (Halle, 1723), which was prescribed sixteen times, whereas for experimental physics Georg Erhard Hamberger's *Elementa physices* (Jena, 1727), which contained both Wolff's *a priori* argument for the heterogeneity of light and Newton's experiments on light, was prescribed eleven times, and Jean Antoine Nollet's *Leçons de physique expérimentale* (Paris, 1743–48), which were particularly innovative as regards the conduction of electricity, ten. The course announcements also offer the following information: both Teske and Knutzen prescribed Wolff's and Hamberger's physics textbooks, Wolff for dogmatic physics and Hamberger for experimental physics. A plurality of approaches is witnessed at the end of the century by the references to the physics textbooks of Friedrich Albert Karl Gren, whose *Grundriß der Naturlehre* (Halle, 1788) was prescribed on seven occasions, of Johann Christian Polycarp Erxleben's *Anfangsgründe der Naturlehre* (Göttingen, 1775), prescribed six times, as well as of Julian Konrad von Yelin's *Lehrbuch der Experimental-Naturlehre* (Ansbach, 1796), prescribed eight times in the short span between Winter 1799/1800 and Winter 1803/04. At Königsberg, in the years before Kant's death, there is little said about romantic natural philosophy (*Naturphilosophie*),

which originated at Jena in the writings of Johann Gottlieb Fichte, Friedrich Wilhelm Joseph von Schelling, and Johann Wilhelm Ritter. Indeed, the course announcements show no references to these names. It must be noted, however, that throughout the nineteenth century Königsberg philosophers considered their faculty a stronghold of Kantianism and opposed both romanticism and idealism.¹⁹

The star work of mathematical instruction at Königsberg is very clear: Wolff's abridged textbook, *Auszug aus den Anfangsgründen aller mathematischen Wissenschaften für die Anfänger auf Schulen* (Halle, 1717). With ninety-five prescriptions of its fourteen editions (three of which appeared after Wolff's death), it held sway at Königsberg from Summer 1734 to Winter 1803/04 because of its axiomatic-deductive approach (from definitions and axioms to problems and theorems and to the corresponding corollaries) and the wide range of its applications (trigonometry, hydraulics, ballistics, etc.), which made it a mandatory work for a number of subjects. The second most used textbook was the *Erste Gründe aller mathematischen Wissenschaften* (Stuttgart, 1759) of the Tübingen mathematician Heinrich Wilhelm Clemm, prescribed fifty-five times. The author of the third most used textbook was the prominent eighteenth-century Königsberg mathematician Johann Schultz, a close friend of Kant's. Schultz's mathematical textbook, *Anfangsgründe der reinen Mathesis* (Königsberg, 1790), was prescribed thirty times, but his shorter version, *Kurzer Lehrbegriff der Mathematik* (Königsberg, 1797) was only once made a course text-book before Winter 1803/04. The *Mathematische Anfangsgründe* (Göttingen, 1759–69) of the renowned Göttingen mathematician Abraham Gotthelf Kästner, was prescribed only four times, as was the textbook written by the interpreter of Euclid, Georg Simon Kluegel, *Anfangsgründe der Arithmetik, Geometrie, Trigonometrie* (Berlin, 1782). The book used by Kant himself in his mathematics courses, Wenzeslaus Johann Gustav Karsten's *Lehrbegriff der gesamten Mathematik* (Greifswald, 1767–77), was prescribed only twice, as was the *Cursus mathematici libri tres* (Halle, 1756–61) of Wolff's successor at Halle, Johann Andreas von Segner. Johann Peter Eberhard's *Beiträge zur Mathesi applicata* (Erfurt, 1756), who was also professor at Halle, was prescribed only once.²⁰

III

The Medical Faculty lacked the prestige of the two other 'higher faculties' of Law and Theology, because its enrolment was traditionally small. According to the 1770 course guide, the program of the Medical Faculty comprised the whole of medicine, botany and chemistry. Obviously, the students were expected to have taken courses in philosophy, physics, natural history, zoology, and mathematics during the four semesters they were required to spend in the Philosophical Faculty.²¹

Throughout the century the most used textbook was Herman Boerhaave's *Institutiones medicae* (Leiden, 1708), prescribed sixty-three times between 1720 and 1788. While adhering to no single tradition and combining the best features of the iatrochemical and iatromechanical schools in his own brand of eclecticism, Boerhaave's textbook revived the Hippocratic method of bedside instruction; instituted

the clinico-pathological conference; and insisted on post-mortem examination of patients in the demonstration of the relation of symptoms to lesions.

Also of significance was the impact of Hyeronimus David Gaub's *Institutiones pathologiae medicinalis* (Leiden, 1758), prescribed thirteen times; this took a more modern approach than Boerhaave. Latin editions and German translations of works by William Cullen, the inventor of the notions of "nervous energy" and "neuroses", were prescribed fourteen times, while the theory of excitability (which classified diseases according to whether they had an over- or an understimulating effect on the body) advanced by John Brown is mentioned in the course announcements only at the very end of the period considered by this paper, namely in Winter 1803/04 (VUK, 725). The attention given to Cullen and Brown testifies to an interest that goes beyond the boundaries of the Medical Faculty and involves the general public. For instance Kant, who never taught in the Medical Faculty, based himself on these authors for his views on the brain–mind problem and on physiognomy.²² Finally, it is worth mentioning that the Königsberg physician Johann Daniel Metzger contributed to physiology, epidemiology, and public health with works that were relevant for the German Enlightenment.

Among the botanical works mentioned in the course announcements, none of the most important European textbooks went unnoticed. For example, the *Institutiones rei herbariae* (Paris, 1700) of Joseph Pitton de Tournefort, the author of a system of classifying plants based on the form of the corolla, which was in high repute up to about 1750, was prescribed thirteen times; the *Philosophia botanica* (Stockholm, 1751) of Linnaeus, eight times; and the *Anfangsgründe der Botanik* (Munich, 1785) of the director of Munich's botanical garden, the Austrian Franz von Paula von Schrank, seven. In addition, Linnaeus's botanical and zoological masterpiece, the *Systema naturae* (Leiden, 1735), was prescribed seven times. On the other hand, Johann Friedrich Blumenbach's *Handbuch der Naturgeschichte* (Göttingen, 1779–80), which proposed that zoological classifications be based on structures associated with an animal's specific functions, was prescribed only three times, which is a surprise, given that Kant mentions Blumenbach several times in reference to the organization of nature.²³ Besides, Kant ignored completely the *incunabulum* of embryology, namely Caspar Friedrich Wolff's *Theoria generationis* (Halle, 1759), which contains the first systematic exposition of generative processes. In fact, Wolff's work was never prescribed by any course teacher at Königsberg, notwithstanding its translation into German in 1764.

In 1786, in the preface to the *Metaphysische Anfangsgründe der Naturwissenschaft*, Kant declared bluntly that chemistry was not a "science" but rather a "systematic art". In other words, he did not consider chemistry as a discipline that investigated the outside world for its own sake, but rather as an enterprise that analysed nature for the sake of production.²⁴ Chemistry was a discipline taught within the Medical Faculty because of the role it played in pharmacology, the science of preparing *materia medica* and of assessing the efficacy of ailments on the human body. All through the eighteenth century, interactions occurred between Paracelsio-chemical

and herbal pharmacology. Among the most prominent Paracelsian chemists referred to at Königsberg is Johann Joachim Becher, whose *Physica subterranea* (Frankfurt, 1669) was noted in Summer 1726 (*VUK*, 40).²⁵ This reflects the fact that most work on chemical science in the eighteenth century was still carried out by physicians. In compliance with the provision that the production of medicine should follow government regulations, the course announcements mention the two editions of the Prussian *Dispensatorium regium et electorale Borusso-Brandenburgicum* (Erfurt, 1744; Berlin, 1781) on twenty-one occasions, and the *Pharmacopea Wirtenbergica* (Stuttgart, 1741) on eight occasions. The name of the inventor of the *phlogiston* and of the theory of combustion, Georg Ernst Stahl, is mentioned only once, in Winter 1744/45 (*VUK*, 151), notwithstanding the fact that all members of Königsberg's medical faculty were Stahlian. A speculative "chemical philosophy" was in contrast to the empirical approach of herbal pharmacy, which was preliminary to Antoine-Laurent Lavoisier's development of chemistry as an empirical science relying on theoretical principles as well as on new symbols and nomenclature.²⁶ The most-frequently mentioned author of pharmacological textbooks was Johann Friedrich Carthäuser, whose *Elementa chemiae medicae dogmatico-experimentalis* (Halle, 1736) were prescribed five times, his *Pharmacologia theoretico-practica* (Berlin, 1745) once, and his *Fundamenta materia medica tam generalis quam specialis* (Frankfurt an der Oder, 1749–50), three times. Also worthy of notice is the fact that Erxleben's *Anfangsgründe der Chemie* (Göttingen, 1775), which had appeared in several editions (one of them edited by Georg Lichtenberg), was prescribed only once,²⁷ and that Christian Ehrenfried von Weigel's *Grundriß der reinen und angewandten Chemie* (Greifswald, 1777) was prescribed thirteen times. Finally, the prompt German translation (Berlin, 1784) of Richard Kirwan's *Elements of mineralogy* (London, 1784) together with its abridgment edited by Friedrich Wilhelm von Leysser under the title of *Mineralogische Tabellen, nach Kirwans Mineralogie entworfen* (Halle, 1787) were discussed in Winter 1789/90, Summer 1788, Winter 1788/89, Winter 1789/90, and Winter 1790/91 by Karl Gottfried Hage (*VUK*, 546, 552, 564, 576). Kirwan was one of the leading analytical chemists of his time, being engaged in carrying out accurate analyses of minerals and mineral waters. During his studies on affinity he also determined the equivalent weights of mineral acids and some metals. In 1780, Kirwan had drawn up the first table of specific heats, assuming that phlogiston was identical with hydrogen. Interestingly, Hagen read Kirwan during the period when the latter adhered to the phlogiston theory, which, however, Kirwan abandoned in 1791 in favour of the new approach of Lavoisier. It is perhaps no coincidence, then, that the course announcements show that Hagen, himself a Stahlian, stopped mentioning Kirwan as of 1791 and that Lavoisier's name never occurs amongst his prescribed textbooks.

IV

Bödeker has showed that during the eighteenth century the constitution of a public sphere for scientific discussions underwent a radical change.²⁸ At the beginning of

the century, the Philosophical Faculty had a primarily propaedeutic function; but when Kant published the *Streit der Fakultäten* in 1798 (which, it might be argued, he wrote as a direct consequence of his engagement in his academic context²⁹), the lower faculty was on the verge of taking on the higher faculties. It had proved to be the proper place for the constitution of public opinion, and Frederick Gregory is right to remark that by the end of the eighteenth century in Germany there had been “an internal reshuffling of the roles of the individual faculties, from which the Philosophical Faculty emerged with renewed respect”.³⁰ One can say that at the time of Kant’s death on 12 February 1804, the place of theology as the crown of the sciences had almost been taken over in German universities by the sciences taught in the Philosophical Faculty. It was in 1810, when the idea of the Humboldt-Universität was realized, that these sciences were to assert their institutional primacy over Medicine, Law, and Theology.³¹

From a mere propaedeutic, the Philosophical Faculty became the place for a public discussion of scientific issues. The Faculty, as Kant argued in the *Streit*, was subject only to reason. In contrast, the three higher faculties were subject, first, to government legislation insofar as they had been entrusted with teaching approved medical, legal, or sacred texts, and, second, to the legislation of reason, that is, to the members of the Philosophical Faculty itself insofar as they search for truth. And when a higher faculty engages the Philosophical Faculty in a discussion, this discussion can be conducted only in the public forum.³²

Michael Clarke has pointed out that it is wrong to interpret the *Streit* as an anticipation of Germany’s nineteenth-century theories of the university.³³ True, Fichte, Wilhelm von Humboldt, Georg Wilhelm Friedrich Hegel, and Schelling all paid homage to Kant — principally as an extension of their commitment to the neo-humanist ideal of personal cultivation through science. However, one must bear in mind that what differentiated Kant and Humboldt, on the one hand, from the Idealists on the other, was that Kant never asked for Humboldt’s “freedom of research and teaching” for all faculties. Nor did he ever question the government’s general right to control teaching, curriculum, and university appointments. Only for the public use of reason did he ask exemption from government control. By the public use of reason, Kant understood the theoretical use that a person make of reason “as a scholar before the reading public”, which, he added, “must always be free, and it alone can bring about enlightenment among men”.³⁴ Kant’s distinction between a “public” and a “private” use of reason, as Thomas Broman has pointedly remarked, originated

in part for pragmatic reasons. Free public criticism required a stable social order, and maintenance of such an order demanded obedience to the law by the members of the civil society. At the same time, a mature and just society was one in which the law-giver’s will harmonized itself with public opinion.³⁵

It is well known that in *Was ist Aufklärung?* Kant quoted Frederick II’s remark, “Argue as much as you will, and about what you will, but obey!”³⁶ In other words, the monarch invited each scholar to discuss publicly truths on the stage provided

by the sciences of the Philosophical Faculty — assuming, of course, that they were abiding by the rule of law for their civic commitments, when fulfilling their obligations if they were members of the Philosophical Faculty; but if the scholars were members of one of the higher faculties, the monarch expected them also to abide by the specific instructions issued by the government.

Obviously, Kant saw no incompatibility between university teachers being allowed the exercise of the public use of reason and their conformity to the state that supported them in their private use of reason. If one reads the *Streit* with *Was ist Aufklärung?* in mind, the conclusion is inescapable. For Kant, academic freedom is possible only in the Philosophical Faculty, where the professors are expected to argue freely in public on all issues. He did not extend the claim to the higher faculties, for he assumed that their professors were bound by the civil-law contract they signed upon being hired to expound that which the government enjoined them to teach.

It can be said that the work done at German universities such as Königsberg during the eighteenth century was neither extensive nor sustained, thus marking a sharp difference with German nineteenth-century universities. It must be conceded that German universities were conservative and did not aim at being centres of innovation, yet they were to be centres of innovation beginning with the nineteenth century. How did, then, the transformation from the still decidedly conservative university of the eighteenth century to the innovative and unrivalled university of the nineteenth century come about? Evidently, some of the work accomplished at Königsberg was original (Kant comes to mind first of all), and it was certainly a necessary step toward the developments to come, but the fact that in Königsberg Lavoisier, Fichte and Schelling were ignored, points to its lagging behind the much more dynamic schools at Jena and Göttingen. Perhaps the main reason for this was Königsberg's peripheral location at Germany's farthest cultural border. This, however, brings us back to the original problem, namely Golinski's argument that science in the Enlightenment was dependent on a multiplicity of specific contexts, each one constituted by long- as well as short-range social factors. Besides, before Humboldt's effective plea for the unity of research and teaching, the scientific research done at universities such as Königsberg obviously did not rival that conducted at royal academies such as Berlin and Petersburg, which were located in the respective capitals.³⁷ In fact, for many scientists royal courts provided, as Bruce T. Moran remarked in his paper on patronage and institutions from 1550 to 1750, a "safe harbor from the intellectual constraints of universities".³⁸

One may wish to ask, however, what were these intellectual constraints and how effective were they? German universities in the eighteenth century were small in size and wholly dependent on their princes and ministers, but this does not necessarily imply, as has been suggested, that they were obsolete, scholastic relics, full of "mediocre hard working pedants totally without originality".³⁹ One can agree with Moran that in the first decades of the period examined in this paper German universities produced a "new style of learning, one oriented toward contemporary issues, practical disciplines, and public service".⁴⁰ Yet Königsberg professors did

not write only disputations and textbooks. One need only to look at the catalogues of the Leipzig and Frankfurt Bookfairs during the eighteenth century to see that professors published a number of scientific treatises (e.g., Kant's *Kritik der reinen Vernunft*), essays (e.g., Kant's *Streit der Fakultäten*) and popular books (e.g., Kant's *Anthropologie in pragmatischer Hinsicht*). It is true that Kant wrote four Latin dissertations. But it is also true that four dissertations was the required amount for an academic career (the last of them, *De mundi sensibilis atque intelligibilis forma et principiis*, was a major step toward the *Kritik der reinen Vernunft*).

Finally, one may wish to ask whether there were any differences between universities and academies as regards the place of science and the constitution of a public sphere. A tentative answer might be that there was hardly any difference, insofar as a public sphere is, by definition, spatially and temporally limited. In other words, in eighteenth-century Germany the constitution of a public sphere depended on numerous local and temporary factors, first and foremost the cultural visions of the individual governments. It is true that monarchs had founded academies in Berlin, Göttingen, Munich, Greifswald, Brunswick and in several other towns, but (with the exception of Berlin) these academies were often small centres of learning. In fact, German regionalism prevented the concentration of research at great academies like those in Paris, London and Petersburg, and it dictated instead that universities be spread all over the territory. (In this respect, Göttingen had obviously a different profile in comparison to Königsberg because it was the seat of both a university and an academy of sciences.⁴¹) There are fundamental points of intersection between the university and a larger ambient culture and, again, Kant, who was both a university teacher and an academy corresponding fellow is a good node from which to view both. In sum, the picture of the progressive forces animating Berlin's eighteenth-century Academy of Sciences in antithesis to the reactionary forces dictating scientific enterprise in universities such as Königsberg is false, just as the contraposition of London's seventeenth-century Gresham College and Royal Society in antithesis to Oxford and Cambridge is inappropriate.⁴²

The predominance of scientific pursuits and courses in a setting profoundly dominated by institutional constraints such as Königsberg during the 148 semesters examined by this paper, between Summer 1720 and Winter 1803/04, is impressive. Yet the relative and apparent ignorance of certain great names in the course textbook prescriptions is surprising. Although this framework might seem obsolete, it nonetheless corresponds to the peculiar approach of the German Enlightenment, whose impact would never have materialized without the network of regional universities that contained institutions such as Königsberg. At the same time, and in addition to teaching, research was also advanced: Teske, Knutzen, Kant and Schultz contributed to physics and mathematics, and Kant's *Allgemeine Naturgeschichte und Theorie des Himmels* did not come out of the blue. The question that is left is, then, what was the relation between a university's institutional constraints, which gave the framework for what Kant called the "private" use of reason, and the "public" creativity of its professors? Such a question is not rhetorical, and the answers that cite scholasticism,

pedantry, or servility are not satisfactory. To this question, the present paper has given a first answer that is based on the interpretation of sources that to date have received little attention.

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1. Jan Golinski, "Science in the Enlightenment", *History of science*, xxiv (1986), 411–24. See also Thomas L. Hankins, *Science and the Enlightenment* (Cambridge, 1985), and the discussion provided by Thomas Broman, "The Habermasian public sphere and 'Science in the Enlightenment'", *History of science*, xxxvi (1998), 123–49, esp. pp. 123–5.
2. Cf. William Clark, "The death of metaphysics in enlightened Prussia", in *The sciences in enlightened Europe*, ed. by William Clark, Jan Golinski and Simon Schaffer (Chicago, 1999), 423–73. Clark asks whether it was the case that "Kant saved metaphysics by making it anthropology?" He answers that "Kantian humans were embodied rational beings condemned to pursue culture, as art and science, with a natural disposition to metaphysics, ultimately part of anthropology" (*ibid.*, 463). See also *Wissenschaften im Zeitalter der Aufklärung*, ed. by Hans Erich Bödeker (Göttingen, 1985).
3. As a matter of fact, prior to its unification in 1871, Germany had no capital and no clear boundaries except those established by the language. See *Universitäten und Aufklärung*, ed. by Notker Hammerstein (Göttingen, 1995), as well as the following collections dedicated to individual German university towns: *Zentren der Aufklärung*, i: *Halle*, ed. by Norbert Hinske (Heidelberg, 1989); *Zentren der Aufklärung*, iii: *Leipzig*, ed. by Wolfgang Martens (Heidelberg, 1990); *Gießen im 18. Jahrhundert*, ed. by Diethelm Klippel and Peter Marow (Marburg, 1995); *Zentren der Aufklärung*, ii: *Königsberg und Riga*, ed. by Heinz Ischreyt (Tübingen, 1995). See also D. M. Knight, "German science in the Romantic Period", in *The emergence of science in Western Europe*, ed. by Maurice Crosland (New York, 1976), 161–78, esp. p. 162; Allan Chapman, "The astronomical revolution", in *Möbius and his Band*, ed. by John Fauvel *et al.* (Oxford, 1993), 35–77, esp. pp. 45–46.
4. *Vorlesungsverzeichnisse der Universität Königsberg 1720–1804: Reprint mit einer Einleitung und Registern*, ed. by Michael Oberhausen and Riccardo Pozzo (Stuttgart-Bad Cannstatt, 1999; hereafter *VUK* followed by the page number). The reprint starts with the announcements for Summer 1720, twenty years before Kant's matriculation at the *Albertina*, and ends with Kant's death, which happened during winter 1803/04. On the history of the *Albertina* and on Kant as a student and a teacher see also Daniel Heinrich Arnoldt, *Ausführliche und mit Urkunden versehene Historie der Königsbergischen Universität* (Königsberg, 1746–56; repr. 1994); Fritz Gause, *Die Geschichte der Stadt Königsberg in Preussen*, 2nd edn (Cologne, 1996); *Die Albertus-Universität zu Königsberg und ihre Professoren: Aus Anlaß der Gründung der Albertus Universität vor 450 Jahren*, ed. by Dietrich Rauschnig and Donata von Nerée (Berlin, 1995).
5. The first assessment on the role played by Königsberg's course announcements for Kantian research was due to Emil Arnoldt's "Charakteristik von Kants Vorlesungen über Metaphysik und möglichst vollständiges Verzeichniss aller von ihm abgehaltener oder auch nur angekündigter Vorlesungen", in Kant, *Gesammelte Schriften*, v, ed. by Otto Schöndörffer (Berlin, 1909), 173–343. On course announcements at German universities see Konrad Schröder, *Vorläufiges Verzeichnis der in Bibliotheken und Archiven vorhandenen Vorlesungsverzeichnisse deutschsprachiger Universitäten*

- aus der Zeit vor 1945 (Saarbrücken, 1964); Horst Walter Blanke, "Bibliographie der in periodischer Literatur abgedruckten Vorlesungsverzeichnisse deutschsprachiger Universitäten 1700–1899", *Berichte zur Wissenschaftsgeschichte*, vi (1983), 205–27; x (1987), 17–43; xi (1988), 105–17.
6. Mordechai Feingold, *The mathematicians' apprenticeship: Science, universities and society in England, 1560–1640* (Cambridge, 1984), 34.
 7. On Kant's scientific background, Ronald S. Calinger, "Kant: The pre-critical period", *Isis*, lxx (1979), 349–62; *Immanuel Kant: Universal Natural History of the Heavens*, ed. by Stanley L. Jaki (Edinburgh, 1981); Hans-Joachim Waschkies, *Physik und Physikotheologie des jungen Kant: Die Vorgeschichte seiner Allgemeinen Naturgeschichte und Theorie des Himmels* (Amsterdam, 1987); Riccardo Pozzo, "Kant e Weitenkamp: Una fonte ignorata dell'*Allgemeine Naturgeschichte und Theorie des Himmels* e della prima antinomia della ragion pura", *Rivista di storia della filosofia*, xlviii (1993), 283–323; Eric Watkins, "The development of physical influx in early 18th century Germany: Gottsched, Knutzen, and Crusius", *Review of metaphysics*, xlv (1995), 295–339; Paolo Grillenzoni, *Kant e la scienza, I: 1747–1755* (Milan, 1999), 179–439.
 8. Hans Erich Bödeker, "Von der 'Magd der Theologie' zur 'Leitwissenschaft': Vorüberlegungen zu einer Geschichte der Philosophie des 18. Jahrhunderts", *Das achtzehnte Jahrhundert*, xiv (1990), 19–57, esp. pp. 29–31. Cf. also Regina Meyer, "Das Licht der Philosophie: Reformgedanken zur Fakultätenhierarchie im 18. Jahrhundert von Christian Wolff bis Immanuel Kant", in Hammerstein (ed.), *Universitäten und Aufklärung* (ref. 3), 97–124. On German universities see Fritz K. Ringer, *The decline of the German mandarins: The German academic community, 1890–1933* (Cambridge, Mass., 1969), 14–25; R. Steven Turner, "The growth of professional research in Prussia", *Historical studies in the physical sciences*, iii (1971), 137–82; *idem*, "The Prussian universities and the research imperative, 1806–1848", Ph.D. diss., Princeton University, 1972; Charles E. McClelland, *State, society, and university in Germany 1700–1914* (Cambridge, 1980), 27–149; R. Steven Turner, "The Prussian universities and the concept of research", *Internationales Archiv für Sozialgeschichte der deutschen Literatur*, 1980, 68–93; *idem*, "The Prussian professorate and the research imperative, 1790–1840", in *Epistemological and social problems of the sciences in the early nineteenth century*, ed. by Hans Niels Jahnke *et al.* (Dordrecht, 1981), 109–21; Notker Hammerstein, "Die deutschen Universitäten im Zeitalter der Aufklärung", *Zeitschrift für historische Forschung*, x (1983), 73–89; *idem*, "Universitäten und gelehrte Institutionen von der Aufklärung zum Neuhumanismus und Idealismus", in *Samuel Thomas Soemmerring und die Gelehrte der Goethezeit*, ed. by Gunter Mann and Franz Dumont (New York, 1985), 309–24; William Clark, "From the medieval *universitas scholarium* to the German research university: A sociogenesis of the German academic", Ph.D. diss., University of California Los Angeles, 1986; Rudolf Vierhaus, *Germany in the Age of Absolutism*, transl. by Jonathan B. Knudsen (Cambridge, 1988), 68–75.
 9. Gause, *Die Geschichte der Stadt Königsberg in Preussen* (ref. 4), ii, 112–13. For a general discussion of enrolment trends in eighteenth-century Germany see McClelland, *State, society, and university in Germany* (ref. 8), 65. As regards enrolment at Königsberg see Heinz Ischreyt, "Materialien zur Charakteristik des kulturellen Einzugsgebiets von Königsberg i. Pr. in der zweiten Hälfte des 18. Jahrhunderts", in *Zentren der Aufklärung*, ii: *Königsberg und Riga*, ed. by Ischreyt (ref. 3), 42: "The cultural basin of Königsberg in the second half of the eighteenth century can be defined as the strip about one to two hundred kilometers wide and about one thousand three hundred kilometers long along the Baltic Sea from the mouth of the Oder to the Botnian Gulf, although the power of attraction of Königsbergs distinctly diminishes with the distance."
 10. Universität Königsberg, *Methodologische Anweisungen für die Studirende in allen 4 Facultaeten* (4 parts, Königsberg, 1770). On this guide see Reinhard Brandt and Werner Stark, "Einleitung", in *Kant's gesammelte Schriften*, xxv (Berlin, 1997), pp. lxxx–lxxxii, and *VUK*, p. xxix.

11. On course requirements see Frederick Gregory, "Kant, Schelling, and the administration of science", in *Science in Germany*, ed. by Kathryn M. Olesko, *Osiris*, 2nd ser., v (1989), 17–35, p. 18: "Indeed, since late in the seventeenth century students had begun to matriculate directly into the professional faculties without any immediate contact with the philosophical faculty." For this reason, the Philosophical Faculty was not able to keep track of the courses the students of the professional faculties were expected to take.
12. See the program requirements in tabellary form in *VUK*, pp. xxxii–xxxv.
13. On Zabarella's philosophy and its impact see Antonino Poppi, *Ricerche sulla teologia e la scienza nella Scuola padovana del Cinque e Seicento* (Soveria Mannelli, 2001). On modern Aristotelianism see the volumes edited by R. W. Sharples, *Whose Aristotle? Whose Aristotelianism?* (Burlington, Vt., 2001), Gregorio Piaia (ed.), *La presenza dell'aristolismo padovano nella filosofia della prima modernità* (Padua, 2002), and Riccardo Pozzo, *The impact of Aristotelianism on modern philosophy* (Washington, D.C., forthcoming).
14. This adds new evidence to Tonelli's hypothesis of "a long survival of Aristotelianism in Königsberg", which would explain "Kant's familiarity with Aristotelian terminology at a time when it was almost completely obsolete, and for his partial revival in the *Critique of Pure Reason*", see "Conditions in Königsberg and the making of Kant's philosophy", in *Bewußt sein: Gerhard Funke zu eigen*, ed. by Alexius J. Bucher et al. (Bonn, 1975), 126–44, p. 128. See also the recent article by Giuseppe Micheli, "La terminologia aristotelico-scolastica e il lessico kantiano", in Piaia (ed.), *La presenza dell'aristolismo padovano nella filosofia della prima modernità* (ref. 13), 445–70.
15. On Königsberg logicians see Peter Petersen, *Geschichte der Aristotelischen Philosophie im protestantischen Deutschland* (Leipzig, 1921; repr., Stuttgart and Bad Cannstatt, 1964); Max Wundt, *Die deutsche Schulmetaphysik des 17. Jahrhunderts* (Tübingen, 1939); *idem*, *Die deutsche Schulphilosophie im Zeitalter der Aufklärung* (Tübingen, 1945); Wilhelm Risse, *Logik der Neuzeit* (2 vols, Stuttgart and Bad Cannstatt, 1964–70); Lewis White Beck, *Early German philosophy: Kant and his predecessors* (Cambridge, Mass., 1969); Siegfried Wollgast, *Philosophie in Deutschland: 1550–1650*, 2nd edn (Berlin, 1993).
16. On the incident that involved Heinrich Lysius see Heiner F. Klemme, "Immanuel Kant und seine Schule", in *Die Schule Immanuel Kants: Mit dem Text von Christian Schiffert über das Königsberg Collegium Fridericianum* (Hamburg, 1994), 1–60, esp. p. 18.
17. On Bode see Chapman, "The astronomical revolution" (ref. 3), esp. pp. 46–47.
18. As regards natural philosophy, Knight observed that the natural sciences were not taught "as 'normal sciences,' but as a genuine natural philosophy involved with a world-view and abounding in generalizations. Those learning the sciences had to learn more than a number of techniques; and conversely, those learning philosophy had to learn some science", see "German science in the Romantic Period" (ref. 3), 166.
19. That the reception of Kant's philosophy produced a significant differentiation within the currents of German science around 1800 has been ignored by Knight in "German science in the Romantic Period" (ref. 3), 163–4. In fact, Königsberg hardly fits into Knight's description of German scientific research around 1800 in terms of romantic *Naturphilosophie*. For a comprehensive investigation of German romantic science see Stefano Poggi, *Il genio e l'unità della natura: La scienza della Germania romantica (1790–1830)* (Bologna, 2000). The place of birth of romantic science was Jena, see Ilse Jahn, "On the origin of romantic biology and its further development at the University of Jena between 1790 and 1850", in *Romanticism in science: Science in Europe, 1790–1840*, ed. by Stefano Poggi and Maurizio Bossi (Dordrecht, 1994), 75–89. On natural sciences in Germany in the aftermath of Romantic *Naturforschung* and *Naturphilosophie* see Gert Schubring, "The rise and decline of the Bonn Natural Sciences Seminar", in *Science in Germany* (ref. 11), 57–93, esp. pp. 57–59.

20. On mathematical instruction at Königsberg see Dirk J. Struik, “Mathematics in the early part of the nineteenth century”, in *Social history of nineteenth-century mathematics*, ed. by Herbert Mertens *et al.* (Boston, 1981), 6–20; Gert Schubring, *Die Entstehung des Mathematiklehrerberufs in 19. Jahrhundert* (Weinheim, 1983); *idem*, “The German mathematical community”, in Fauvel *et al.* (eds), *Möbius and his Band* (ref. 3), 21–33; Hans Niels Jahnke, *Mathematik und Bildung in der Humboldtschen Reform* (Göttingen, 1990); the collection *History of mathematics and education: Ideas and experiences*, ed. by Hans Niels Jahnke *et al.* (Göttingen, 1996); Ronald S. Calinger, “The Mathematics Seminar at the University of Berlin: Origins, founding, and the Kummer-Weierstrass years”, in *Vita mathematica: Research and integration with teaching*, ed. by Ronald S. Calinger (Washington, D.C., 1996), 153–76. Specifically on Kant and Schultz see Antonio Moretto, *Dottrina delle grandezze e filosofia trascendentale in Kant* (Padua, 1999), and Cristiana Bonelli Munegato, *Johann Schultz e la prima ricezione del criticismo kantiano* (Trent, 1992).
21. The program requirements are reprinted in tabellary form in *VUK*, pp. xxxi–xxxii.
22. On Kant’s views on medicine see Massimo Marianetti, *Vivere, invecchiare ed essere vecchi: Kant e Christoph Wilhelm Hufeland* (Pisa, 1999).
23. On Kant and Blumenbach see Poggi, *Il genio e l’unità della natura* (ref. 19), 87–88. See also Clark Zumbach, *The transcendent science: Kant’s conception of biological methodology* (The Hague, 1984).
24. Kant, *Metaphysische Anfangsgründe der Naturwissenschaft*, in *Kant’s gesammelte Schriften*, iv ed. by Alois Höfler, 2nd edn (Berlin, 1911), 486. On Kant’s views on chemistry see Poggi, *Il genio e l’unità della natura* (ref. 19), 75–82.
25. On the controversy between chemical and herbal pharmacy see Allen G. Debus, *The chemical philosophy: Paracelsian science and medicine in the sixteenth and seventeenth century* (2 vols, New York, 1977); *idem*, *Chemistry, alchemy and the new philosophy: 1550–1700* (London, 1985); *idem*, *The French Paracelsians: The chemical challenge to medical and scientific tradition in early modern France* (Cambridge, 1991); *idem*, “Chemists, physicians and changing perspectives on the Scientific Revolution”, *Isis*, lxxxix (1998), 66–81. With reference to German universities see Hermann F. Kilian, *Die Universitäten Deutschlands in medicinisch-naturwissenschaftlicher Hinsicht* (Leipzig, 1828; repr., Amsterdam, 1966); Karl Hufbauer, *The formation of the German chemical community (1720–1795)* (Berkeley, Calif., 1982).
26. Knight, “German science in the Romantic Period” (ref. 3), 163.
27. On pharmaceutical instruction see Wolf-Dieter Müller-Jahncke and Christoph Friedrich, *Geschichte der Arzneimitteltherapie* (Stuttgart, 1996).
28. Bödeker, “Von der ‘Magd der Theologie’ zur ‘Leitwissenschaft’” (ref. 8), 29–31.
29. See Riccardo Pozzo, “Kant’s *Streit der Fakultäten* and conditions at Königsberg”, *History of universities*, xvi/2 (2000), 96–128.
30. Gregory, “Kant, Schelling, and the administration of science” (ref. 11), 17.
31. On Humboldt’s university reform and the principle of *Freiheit von Forschung und Lehre* see R. Steven Turner, “University reformers and professional scholarship in Germany 1760–1806”, in *The university in society*, ed. by Lawrence Stone (2 vols, Princeton, 1974), ii, 495–531; *idem*, “The *Bildungsbürgertum* and the learned professions in Prussia, 1770–1830: The origins of a class”, *Histoire sociale/Social history*, xiii (1980), 105–35; Gregory, “Kant, Schelling, and the administration of science” (ref. 11), 29–34.
32. Kant, *Streit der Fakultäten*, in *Kant’s gesammelte Schriften*, vii, ed. by Karl Vorländer, 2nd edn (Berlin, 1917), 21–22, 27–29 [transl. by Mary J. Gregor and Robert Anchor, revised by Allen W. Wood and George Di Giovanni in Kant, *Religion and rational theology* (New York, 1996), 250–1, 255–6].

33. Michael Clarke, "Kant's rhetoric of enlightenment", *The review of politics*, lix (1997), 53–73, p. 66.
34. Kant, *Beantwortung der Frage: Was ist Aufklärung?*, in *Kant's gesammelte Schriften*, viii, ed. by Heinrich Maier, 2nd edn (Berlin, 1923), 37 [transl. by Lewis W. Beck in Kant, *On history* (Indianapolis, Ind., 1963), 5].
35. Broman, "The Habermasian public sphere and 'Science in the Enlightenment'" (ref. 1), 130.
36. Kant, *Was ist Aufklärung?* (ref. 34), 41 [transl., 10]. On the public sphere see Günther Bien, "Räsonierfreiheit und Gehorsampflicht: Die Universität und der Prozeß der Aufklärung in Kant staatsrechtlichen Schriften", in *Akten des 4. Internationalen Kant-Kongresses* (New York, 1974), ii/2, 617–32; Hannah Arendt, *Lectures on Kant's political philosophy*, ed. by Ronald Beiner (Chicago, 1982), 39–51; Onora O'Neill, "The public use of reason", *Political theory*, xiv (1986), 523–57; Lucian Hölscher, "Die Wahrheit der öffentlichen Meinung", in *Meinungsfreiheit*, ed. by Johannes Schwartländer and Dietmar Willoweit (2 vols, Kehl am Rhein, 1986), i, 51–64; Reinhart Koselleck, *Critique and crisis: Enlightenment and the pathogenesis of modern society* (Cambridge, Mass., 1988), 98–123; Anthony J. LaVopa, *Grace, talent, and merit: Poor students, clerical careers, and professional ideology in eighteenth-century Germany* (Cambridge, 1988), 291–306; Jürgen Habermas, *The structural transformation of the public sphere: An inquiry into a category of bourgeois society*, transl. by Thomas Burger with the assistance of Frederick Lawrence (Cambridge, Mass., 1989), 102–17; Kevin Davis, "Kantian publicity and political justice", *History of philosophy quarterly*, viii (1991), 409–21; *idem*, "Kant's different publics and the justice of publicity", *Kant-Studien*, lxxxiii (1992), 170–84; Stanley Rosen, *Hermeneutics and politics* (Oxford, 1987), 30–32; Allen Rosen, *Kant's theory of justice* (Ithaca, N.Y., 1993), 18–19, 181–6; Clarke, "Kant's rhetoric" (ref. 33), 53–56; Broman, "The Habermasian public sphere and 'Science in the Enlightenment'" (ref. 1), 129–33.
37. On Berlin's Academy of Science see Adolf von Harnack, *Geschichte der Königlich Preussischen Akademie der Wissenschaften zu Berlin* (Berlin 1900; repr., Hildesheim, 1970); Ronald S. Calinger, "Frederick the Great and the Berlin Academy of Sciences (1740–1766)", *Annals of science*, xxiv (1968), 239–49; Hans Aarsleff, "The Berlin Academy under Frederick the Great", *History of human sciences*, ii (1989), 193–206; Barbara Bauer, "Die Anfänge der Berliner *Académie Royale des Sciences* im Urteil der gelehrten Öffentlichkeit", in *Europäische Sozietätsbewegung und demokratische Tradition: Die europäischen Akademien zwischen Frührenaissance und Aufklärung*, ed. by Klaus Garber, Heinz Wismann, and Winfried Sieberts (Tübingen, 1996), 1413–53.
38. Bruce T. Moran, "Patronage and institutions: Courts, universities, and academies in Germany: An overview: 1550–1750", in *Patronage and institutions. Science, technology, and medicine at the European court: 1500–1750*, ed. by Bruce T. Moran (Rochester, N.Y., 1991), 169–83, p. 169. See also Richard van Dülmen, *The society of the Enlightenment: The rise of the middle class and enlightenment culture in Germany*, transl. by Anthony Williams (New York, 1992).
39. This is the opinion of Ringer, *The decline of the German mandarins* (ref. 8), 1–13, and of Wilfred Vernon Farrar, "Science and the German university system, 1790–1850", in Crosland (ed.), *The emergence of science in Western Europe* (ref. 3), 179–92, esp. p. 181 — both quoted by Moran, "Patronage and institutions" (ref. 38), 177–8. This paper is against those scholars who still think that German universities were only backwaters until Humboldt came to rescue them. Such a polemic, however, is not new, and it finds its origin in the revisionist approach proposed for sixteenth- and seventeenth-century Britain by Robert Frank, "Science, medicine and the universities of early modern England: Background and sources", *History of science*, xi (1973), 194–216, 239–69; Feingold, *The mathematicians' apprenticeship* (ref. 6), John Gascoigne, "Mathematics and meritocracy: The emergence of the Cambridge Mathematical Tripos", *Social studies of science*, xiv (1984), 547–84; *idem*, "The universities and the Scientific Revolution:

The case of Newton and Restoration Cambridge”, *History of science*, xxiii (1985), 391–434; *idem*, “A reappraisal of the role of the universities in the Scientific Revolution”, in *Reappraisals of the Scientific Revolution*, ed. by David C. Lindberg and Robert S. Westman (Cambridge, 1990), 207–60.

40. Moran, “Patronage and institutions” (ref. 38), 178.

41. On the place of science at Göttingen see *Naturwissenschaften in Göttingen: Eine Vortragsreihe*, ed. by Hans-Heinrich Voigt (Göttingen, 1988).

42. See Feingold, *The mathematicians’ apprenticeship* (ref. 6), 167.