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Edited by Robert Fox and George Weisz

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Introduction: The institutional basis of French science in the nineteenth century

ROBERT FOX AND GEORGE WEISZ

1. The legacy of Napoleon

When Napoleon I undertook the re-organization of French higher education between 1806 and 1811, he generally respected the centralized structure handed down to him from the revolutionary period. Fashioned in the Ancien Régime and consolidated, in its essentials, in the troubled decade of the 1790s, it was a structure that gave primacy to the training of experts.

At the highest level, the training was provided in the professional schools which have come to be known collectively as the *grandes écoles*. Each of these was closely controlled by one or another of Napoleon's ministries, and each had a clearly defined role in the preparation of recruits for one of the civil or military services. The École Polytechnique, the best-known and most prestigious of the schools, provided a grounding in engineering and science, which was then built upon in the more advanced *écoles d'application* – such as the École de l'Artillerie et du Génie at Metz (for artillery officers and military engineers) or the École des Ponts et Chaussées (for civil engineers). By the same principle, the École Vétérinaire at Alfort produced veterinary surgeons; the École Normale Supérieure, resurrected by Napoleon in 1808, after its fleeting existence in 1795, prepared the élite of the secondary teaching profession for service in the *lycées*; and the faculties of law and medicine, which were *grandes écoles* in function if not in name, trained men for the traditional liberal professions.

It was only in his plans for a university system that Napoleon departed significantly from the model which existed at the time of his accession to power in the late 1790s. To the extent that his Université Impériale¹ incorporated faculties of sciences and letters – roughly the functional equivalent of the old faculties of arts – as well as the schools of law, medicine, phar-

1. The Université Impériale embraced secondary as well as higher education. Hence both *lycées* and faculties were part of a single centralized system, controlled at first by the Conseil de l'Université Impériale (subsequently renamed the Conseil Supérieur de l'Instruction Publique – see below, note 14) and later in the century by the Ministry of Public Instruction. In this volume, the term Université is used in this broader sense, with the description *universitaire* being applied equally to teachers in the secondary and higher sectors of education. The term 'university' refers to the institutions which Louis Liard formed by grouping the existing faculties in 1896.

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macy, and Protestant and Catholic theology, it seemed to be resurrecting a structure which had been swept away with the closure of the universities of the Ancien Régime in 1793. It appeared, at the same time, to be making a concession to an educational theory which the National Convention and the Directory had rejected: the theory, expounded most notably by Condorcet in his report to the Legislative Assembly in 1792, favoured breadth and personal cultivation, imbibed in multi-disciplinary institutions, as opposed to the narrow vocational training disseminated by the *grandes écoles*.² However, Napoleon's concession to this alternative ideal of higher education was, at best, perfunctory. The faculties of science and letters, which might in principle have provided a liberal education in the best traditions of the *Encyclopédie*, scarcely functioned at all. By the time of the Bourbon Restoration in 1815, fewer than half of the projected faculties of science had actually been opened (see Table 1). And, unlike the 'professional' faculties of law and medicine, which were well attended, the faculties of science and letters had few students (see Table 2).³ Still less were they conceived as centres of research in the manner of the German philosophical faculties: research, in accordance with the traditions of the Ancien Régime, was a function of specially designated institutions – most notably the Collège de France, the Paris Observatory, and the Muséum d'Histoire Naturelle.⁴ In so far as the faculties of science and letters did have a role, it was above all the bureaucratic one of providing examiners for the hierarchy of qualifications that regulated teaching and other professional careers: the *baccalauréat* (in essence, the leaving certificate for the *lycées*), the *licence* and the *agrégation* (both intended primarily for schoolteachers), and the doctorate (a research degree which, in principle from 1810 and in practice from the 1820s, was required for the tenure of a chair in a faculty).⁵ The duties of a faculty professor, in fact, were those of a high-level functionary.

2. On these opposing educational philosophies, see Louis Liard, *L'enseignement supérieur en France, 1789–1889 [1893]* (2 vols., Paris, 1888–94), vol. 1, especially pp. 166–8.
3. In this respect, the data in Table 2 reflect the imbalance between faculties very clearly. However, they should be taken as only rough approximations, for enrolment statistics in the faculties of science and letters were not kept in a rigorous fashion until 1878 (which itself suggests that students occupied a minor place in faculty life). Even in terms of the number of degrees awarded – a significantly different statistic, since formal study was not required for degrees in science and letters – a marked imbalance existed.
4. On the Collège de France and the Paris Observatory, see the introduction to Part III of this volume, p. 209. The Muséum is discussed in the contribution by Limoges, 'Development of the Muséum d'Histoire Naturelle' in *The organization of science*, pp. 211–40.
5. The *agrégation* differed from the other qualifications in that it was competitive, organized specifically to fill teaching posts in the Université. Hence the number of successful candidates in any year was determined by the number of openings that were available. Although there were *agrégations* leading to appointments in the faculties, the term was (and is) most commonly applied to the various *agrégations*

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As it was *conceived* by Napoleon, the system was one of Cartesian simplicity. It was a bureaucrat's dream in which a central administration prescribed almost inviolate career patterns and enforced them through closely supervised institutions, each with a narrowly defined function which the administration took care not to duplicate elsewhere. It is arguable that, in reality, the functional fragmentation was never quite so great as Napoleon wished it to be, but the logic of the system was clear and it survived virtually unchanged until the 1880s. Even a certain amount of diversification and expansion left the basic structure intact, with change tending to come through the establishment of new institutions rather than the modification of existing ones. It is entirely characteristic of this period that whenever the need for a new kind of specialist was felt, it was met by the creation of another *grande école*. There are good examples of this in the École Centrale des Arts et Manufactures (founded by private initiative in 1829 to train industrial engineers) and the École Supérieure de Télégraphie (founded in 1878). It was by precisely the same logic that the extension of research facilities was effected in 1868 by the creation of yet another administrative unit, the École Pratique des Hautes Études.⁶

The pattern, then, was one of growth within an essentially stable structure. The consequence of this form of development was that, until quite late in the nineteenth century, there was an orderliness in the French system of scientific and technical education and research which make summary easier than it would be for, say, Britain or Germany at this time. Broadly, we can distinguish four different sectors:

1. *Professional training for the scientific liberal professions.* Here the relevant institutions were the faculties of medicine, the schools of pharmacy, and, feeding secondary education, the École Normale Supérieure. The faculties of science too belong in this category, though, like the faculties of

for posts in the *lycées*. Since the 1820s, when the provisions of the Université in this respect were eventually implemented, only *agrégés* have been able to hold permanent appointments as *lycée* professors. The number of subjects for which there were *agrégations* varied greatly in the nineteenth century. When the first examinations were held, in 1821, there were three: in science, letters, and grammar. The number had risen to seven by 1848, was reduced to two under Fortoul in 1852, and was gradually increased again, beginning with the reforms of Rouland.

For a short history of the *agrégation*, see Charles Jourdain, *Rapport sur l'organisation et les progrès de l'instruction publique* (Paris, 1867), pp. 87–104. On the *baccalauréat*, see P. Meuriot, *Le baccalauréat, son évolution historique et statistique, des origines (1808) à nos jours* (Nancy, 1910), and J. B. Piobetta, *Le baccalauréat* (Paris, 1937). The titles of theses presented for the doctorate in science are given in Albert Maire, *Catalogue des thèses de sciences soutenues en France de 1810 à 1890* (Paris, 1892).

6. The École Pratique des Hautes Études was created by Victor Duruy. It was a federation of existing laboratories and research facilities (at the Collège de France, the Muséum, and the Sorbonne, for example) rather than a separate institution with facilities of its own.

Table 1. The dates of foundation of faculties of science and medicine and some related institutions, 1808–1914

Academy ^a	Faculty of Science	Faculty of Medicine	School of Pharmacy	<i>École de plein exercice de médecine et de pharmacie^b</i>	<i>École préparatoire de médecine et de pharmacie^b</i>	<i>École préparatoire à l'enseignement supérieur des sciences et des lettres^c</i>	Observatory ^d
Paris	Paris 1808	Paris 1808 ^e	Paris 1803 ^f	—	Orléans 1843 ^g Reims 1853 Marseille 1841	—	Paris 1672 Meudon 1875 Marseille 1700 ^h
Aix	Marseille 1854	—	—	Marseille 1875	—	—	—
Besançon	Besançon 1808 and 1845 ⁱ	—	—	—	Besançon 1841	—	Besançon (La Boulois) 1878
Bordeaux	Bordeaux 1838	Bordeaux	Bordeaux 1874 ^j	—	Bordeaux 1842	—	Bordeaux (Floirac) 1878
Caen	Caen 1808	—	—	—	Caen 1841 Rouen 1841	Rouen 1855	—
Chambéry	—	—	—	—	—	Chambéry 1861	—
Clermont	Clermont 1854	—	—	—	Clermont 1841	Moulins 1856 ^k	—
Dijon	Dijon 1808	—	—	—	Dijon 1841	—	—
Douai	Lille 1854	Lille	Lille 1875 ^j	Lille 1874	Amiens 1841 Arras 1841 ^l Lille 1852	—	—
Grenoble	Grenoble 1811	—	—	—	Grenoble 1841	—	—
Lyon	Lyon 1808 and 1833 ⁱ	—	—	—	—	—	—
Montpellier	Montpellier 1808	Montpellier 1808 ^e	Montpellier 1803 ^f	—	Lyon 1841	—	Lyon (Saint-Genis-Laval) 1878

Nancy	Nancy 1854	Nancy 1872 ^m	Nancy 1872 ^m	Nancy 1843	—
Poitiers	Poitiers 1854	—	—	Limoges 1841 Poitiers 1841 Tours 1841	—
Rennes	Rennes 1840	—	Nantes 1876 Rennes 1895	Angers 1855 Nantes 1855	—
Toulouse	Toulouse 1808	Toulouse 1890 ^j	Toulouse 1887	Toulouse 1841	Toulouse 1872 Pic-du-Midi 1873 ⁿ
Algeria	Algiers 1909	Algiers 1909 ^j	Algiers 1888	Algiers 1857	Algiers (La Vigie) 1858
Strasbourg ^p	Strasbourg 1809	Strasbourg 1808 ^e	Strasbourg 1803 ^f	—	Mulhouse 1855

Notes: In addition to the institutions listed above, 'free' faculties of science were established from 1875 as part of the Catholic universities (soon to be renamed the Catholic institutes) which were founded at Angers, Lille, and Lyon; at Lille there was also a 'free' faculty of medicine and pharmacy. The Catholic university in Paris had an *école libre des hautes études scientifiques et littéraires*.
a. At its foundation in 1808, the Université Impériale was divided into twenty-six academies; these covered the whole Empire and corresponded in each case to the area served by an appeal court. At the head of each academy, presiding over its Academic Council, was a Rector, appointed by the head of the whole system, the Grand Master of the Université. The number of academies underwent several changes as a result of administrative reforms, until in 1870 it stabilized at seventeen; thereafter the number remained unchanged until the first world war. The seventeen academies of the period 1870–1914, together with Strasbourg (see note *p*), are the ones given here.
b. The *écoles préparatoires de médecine et de pharmacie* were created, in accordance with a decree of 13 October 1840, to replace the 'secondary' schools of medicine (which had existed since the early years of the century and had been attached to the Université since 1820). Like the schools they replaced, the *écoles préparatoires* were financed exclusively by municipal and departmental funds and they taught only part of the syllabus for the doctorate. Their function was to train rather low-level practitioners of medicine and pharmacy (*officiers de santé*). Representatives of the larger *écoles préparatoires* campaigned constantly to become faculties (with the right to grant the degrees of the Université), but the professors in the faculties managed to prevent this from happening until 1874. Thereafter, between 1874 and 1890, four new 'mixed' faculties of medicine and pharmacy were created — at Bordeaux, Lille, Lyon, and Toulouse — from what had once been *écoles préparatoires*.

The *écoles de plein exercice* were created from existing *écoles préparatoires*. Although they were still financed by local authorities, the range of their chairs and the facilities they possessed had to conform to rigorous standards set by the Ministry of Public Instruction. They offered virtually all the instruction required for the doctorate, though they did not grant the *degré*.

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letters, they were still something of an anomaly at the beginning of the Third Republic. Since it was possible to receive any of the qualifications of the Université and proceed to a teaching post without actually studying in a faculty, the number of full-time students seeking degrees remained insignificant until 1877, when scholarships were introduced.⁷ And even the basic

Notes to Table 1 (*cont.*)

c. The *écoles préparatoires à l'enseignement supérieur des sciences et des lettres* were established from 1855 in towns which did not have faculties of science or letters but in which the municipal council had already organized courses of instruction at a sufficiently high level. The instruction, which lasted two years, was practical in orientation, adapted to the needs of young people entering industrial and commercial careers. Teaching in both the sciences and the humanities was provided. Like the *écoles de plein exercice* and *écoles préparatoires* in medicine, the schools were financed by local authorities.

d. Most of the observatories in this column performed meteorological as well as astronomical work, but the list does not include institutions established primarily for meteorological purposes. Before 1914 there were observatories of this type at Paris (at the Luxembourg, until 1878, and the Parc Montsouris), and at the Puy-de-Dôme, near Clermont. There were also meteorological stations attached to the Bureau Central Météorologique at the Parc Saint-Maur (Sceaux), Perpignan, Nantes, and the Mont Ventoux.

e. The faculties of medicine at Paris, Montpellier, and Strasbourg replaced the former *écoles de santé*, created in 1794. All three were the successors of medical schools which had existed under the Ancien Régime.

f. The three 'higher' schools of pharmacy established in 1803 replaced schools already functioning under the Ancien Régime. They only became fully part of the Université in 1840.

g. Closed in 1849.

h. The Marseille observatory, established to provide services to navigation, was administered by the Académie des Sciences, Lettres, et Arts de Marseille from 1781. In 1801 it was taken over by the Ministry of the Interior and in 1832 passed to the Ministry of Public Instruction.

i. The faculties of science at Besançon, Lyon, and Metz were closed in October 1815, to be reopened (in the case of Besançon and Lyon) at the dates indicated. At the same time, in 1815, seventeen faculties of letters were closed. For both types of faculty, the explanation given was one of economy; the faculties had not attracted a sufficient number of students to justify their expense.

j. New medical faculties created after 1874 combined the teaching of medicine and pharmacy; they bore the title *faculté mixte de médecine et de pharmacie*.

k. Although the *école préparatoire* at Moulins was formally established, no appointments were ever made.

l. Closed in 1883.

m. In 1872 the faculty of medicine and the school of pharmacy in Strasbourg were transferred to Nancy. From 1872 to 1876, the two institutions were united as a *faculté mixte* (cf. note *j*), but thereafter they were separated.

n. Founded privately in 1873 and taken over by the state in 1882.

o. In the case of Algiers, separate schools for science and letters were established.

p. The academy of Strasbourg, covering the departments of Haut-Rhin and Bas-Rhin, was lost to France in 1870, following the Franco-Prussian war.

7. From 1877, 300 scholarships of 1,200 francs were offered each year to candidates studying for the *licence* in the faculties of science or letters. In 1881, a further 100 scholarships were established for candidates for the *agrégation*: at first worth 1,200 francs, the value of these scholarships was raised to 1,500 francs in 1882. By the mid 1880s, the number of scholarships awarded each year to candidates for the *licence*

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task of the faculties – examining – was distributed unevenly. While the examinations for the *baccalauréat* were a heavy and growing burden almost everywhere, only the Paris faculty, at the Sorbonne, granted a substantial number of higher qualifications, as Victor Karady's paper in this volume makes clear. This situation encouraged a diversification of activities among the professoriate. As well as examining and teaching, many science professors offered public lectures, involved themselves in local learned societies, acted as advisors to government and industry, and in the larger provincial cities conducted applied research and provided elementary technical training. Despite its size, the faculty system as a whole was quite clearly overshadowed by the *grandes écoles*.

2. *Scientific research.* The institutions of research and erudition varied greatly in character and function. The Collège de France and the École Pratique des Hautes Études, for example, treated the entire spectrum of science and the humanities, providing facilities or financial support for research in subjects that were often too esoteric for teaching institutions. Like the Muséum d'Histoire Naturelle, which specialized in natural history and the life and earth sciences, the Collège also engaged in the diffusion of knowledge through the public lectures which chair-holders were required to give. The Academy of Sciences and the Academy of Medicine, by contrast, were not concerned with the practice of research or with instruction. At least in the case of the Academy of Sciences, the chief function was to provide a platform for the presentation of results and new ideas; this it did through its meetings and, even more effectively, through its weekly publication, the *Comptes rendus*. It also recognized scientific distinction by awarding a large number of prizes (a means of stimulating and guiding research, as Elisabeth Crawford shows in this volume) and by electing a chosen few (throughout our period the figure never exceeded eighty at any one time) to the coveted rank of academician. A somewhat different contribution to scientific life was made by the most active of the national disciplinary societies. The Société Chimique de France (founded in 1857) and the Société Française de Physique (1873) were two such societies which acquired at least a supportive role in the fashioning of academic careers in the later nineteenth century, chiefly by facilitating the publication of research. Finally, the Bureau des Longitudes (1795), the astronomical and meteorological observatories (provision for which was greatly expanded in the Third Republic – see Table 1), and the Bureau Central Météorologique (1878) served at once as centres for the conduct of research and as the providers of more immediately utilitarian services, most obviously to navigation.

3. *Local societies and academies.* These organizations, some of them relics of the Ancien Régime but the great majority of them creations of the nine-

had been raised to 350, that for candidates for the *agrégation* to 200, bringing the total expenditure to 720,000 francs a year.

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teenth century, numbered several hundred by 1914. With memberships dominated by enthusiasts rather than professional academics, they did little original work in the highly professionalized disciplines of mathematics and the physical sciences. But the best of them made important contributions to natural history through their publications and the organization of field work. Although the societies were nominally under the jurisdiction of the Ministry of Public Instruction from the time of the July Monarchy, they were emphatically, even aggressively, independent – with consequences that are examined in Robert Fox’s contribution to this volume. They were the source of constant tension between the champions of provincial autonomy and a central administration which, especially during the Second Empire (1852–70), feared both disorder and, more specifically, the legitimist and ultramontane ideals that inspired much of the movement for intellectual decentralization in the middle decades of the nineteenth century.

4. *Technical education.* Special schools for this purpose were administered by various ministries. By far the most prestigious were the *École Polytechnique*, controlled at different times by the Ministry of the Interior and the Ministry of War, and two of its related *écoles d’application*, the *École des Mines* and the *École des Ponts et Chaussées*, both of which came under the Ministry of the Interior and, from the 1830s, the Ministry of Commerce and Public Works (or Public Works). On a somewhat less elevated level, if only because they fed private industry rather than the state services, were the *École Centrale des Arts et Manufactures* (which was taken over by the Ministry of Commerce in 1856, nearly thirty years after its foundation as a private institution) and two schools with no ministerial attachments, the *École Municipale de Physique et de Chimie Industrielles* (founded in 1882) and the *École Supérieure d’Électricité* (1894).⁸ The rich and expanding provision for technical education was completed by the *écoles d’arts et métiers* and numerous other lower-level trade schools, most of them under the control of the Ministry of Commerce.

2. The reform movement, 1863–1914

Needless to say, this schematic summary does not convey the full complexity of the system. The major research institutions (including the Bureau des Longitudes as well as the Collège de France and the Muséum d’Histoire Naturelle) provided lectures for the general public, and most professors holding Parisian chairs in the faculties of science and medicine and in the *grandes écoles* were active in research and publication. Moreover, the rigorous

8. The *École Municipale de Physique et de Chimie Industrielles* was administered by the city of Paris; the *École Supérieure d’Électricité* by the *Société Internationale des Électriciens*, a society founded in 1883 to further the study of the industrial applications of electricity.

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division of institutions between separate domains was attenuated by the ability of individuals to accumulate posts and honours throughout the system (*cumul*).⁹ All of this gave the structure a degree of coherence missing at the level of formal organization.

So, even as applied to the first half of the nineteenth century, the model we have outlined, and the prevailing historiography of nineteenth-century French education which tends to adhere to the model,¹⁰ both require some qualification. The allocation of functions was not so rigid and tidy as has commonly been supposed – a situation which proved a constant source of friction between institutions. There is also evidence that centralization, though always the ideal of those in charge of the system, was less effective than Napoleon intended: as Ministers of Public Instruction, Guizot (1832–7), Salvandy (1837–9 and 1845–8), Cousin (1840), Fortoul (1851–6), Rouland (1856–63), and Duruy (1863–9) all had to struggle to impose administrative order and to strengthen their control over the institutions of science and learning. But, whatever degree of qualification may be necessary concerning the period up to the 1860s, it is slight by comparison with that which seems to be called for with regard to the later nineteenth century.

Although the detailed study of this later period has scarcely begun, the first elements in a reappraisal are already available, at least with respect to the faculties.¹¹ These point unmistakably to the fundamental character of

9. *Cumul* was the object of bitter complaints throughout the nineteenth century, chiefly because of the harm it did to the career prospects of young men. Despite attempts to limit the practice early in the Third Republic, it seems to have been quite as common in 1914 as it had been at the beginning of the nineteenth century. For a bitter protest showing that the issue was still a live one in the 1920s, see Henri Maillart, *L'enseignement supérieur. Enquête sur la situation de l'enseignement supérieur et technique* (Paris, 1925), pp. 92–7.

Among the most noted *cumulards* were Charles Dupin, Louis-Jacques Thenard, Joseph-Louis Gay-Lussac, and Jean-Baptiste Dumas. For a revealing analysis of the accumulation of posts and incomes by Gay-Lussac, both within and outside academic life, see Maurice P. Crosland, *Gay-Lussac. Scientist and bourgeois* (Cambridge, 1978), pp. 228–32.

10. An outstanding representative of this tradition is Joseph Ben-David. See, in particular, his book *The scientist's role in society. A comparative study* (Englewood Cliffs, New Jersey, 1971), pp. 88–107, or (for an earlier version of the material) his article 'The rise and decline of France as a scientific center', *Minerva*, 8 (1970), 160–79. Ben-David cites centralization (which curbed initiative and independent thought) and functional fragmentation (which suppressed healthy competition between essentially similar institutions) as causes of the relative decline of France as a centre of scientific activity in the nineteenth century. On this subject, see also his 'Scientific productivity and academic organization in nineteenth-century medicine', *American sociological review*, 25 (1960), 828–43 (833–40), and section 3 of this Introduction.

For a somewhat similar analysis to Ben-David's, which uses centralization to explain the supposed conservatism of French science in the later nineteenth century, see Robert Gilpin, *France in the age of the scientific state* (Princeton, New Jersey, 1968), pp. 77–123.

11. See, in particular, Terry Shinn, 'The French science faculty system 1808–1914:

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the reforms that came about between the last years of the Second Empire and the end of the century, and they are entirely consistent with the theme of change which recurs time and again in this volume. They also strongly endorse the analysis given in Peter Lundgreen's 'German perspective', which argues that the differences between the organizational structure of French science and that of Germany – a central point in traditional historiography – diminished markedly in the later nineteenth century.

Not to put too fine a point on it, the institutional structure of scientific research and higher education in France was transformed beyond recognition between the 1860s and 1914. The most fundamental changes occurred in the sprawling faculty system, which underwent massive expansion during this period. Student enrolment multiplied dramatically (see Table 2); throughout France new buildings and facilities were constructed; and, under an administration which at least paid lip-service to the ideal of decentralization, academics were granted a significant degree of autonomy in the handling of institutional affairs. At the same time, the faculties assumed an ever-increasing number of functions. They became multi-purpose institutions – a transformation that was consecrated symbolically in 1896 by the creation of universities, composed of groups of faculties in the same town. Although they never fulfilled the hopes invested in them by their architect, Louis Liard, these universities reflected current trends by cutting across existing institutional divisions and embracing all areas of human knowledge. For a brief period at least, they seemed to pose a real threat to the dominance of the *grandes écoles* and the official institutions of research.¹²

Among the many changes that affected higher education in the later nineteenth century, the development of two new functions was of outstanding importance. First, research became a primary responsibility of university academics. Craig Zwerling's paper in this volume describes the adoption of the research ideal at the *École Normale Supérieure* during the Second Empire, while the papers by Victor Karady and George Weisz examine some of the implications of its spread to the faculties of science and medicine. Even the official research sector was affected by the new spirit, as is suggested by Elisabeth Crawford's study of the evolution of the prize system at the Academy of Sciences and by Camille Limoges's discussion of the growth of

institutional change and research potential', *Historical studies in the physical sciences*, 10 (1979), 271–332; and George Weisz, 'Le corps professoral de l'enseignement supérieur et l'idéologie de la réforme universitaire en France, 1860–1885', *Revue française de sociologie*, 18 (1977), 201–32, and 'The French universities and education for the new professions, 1885–1914: an episode in French university reform', *Minerva*, 17 (1979), 98–128.

12. There is a good illustration of this point in the case of experimental zoology. As Limoges shows, by the end of the nineteenth century the science faculties were far more active in this field than the *Muséum d'Histoire Naturelle*, which had reverted to an older style of research in the tradition of natural history ('Development of the *Muséum d'Histoire Naturelle*' in *The organization of science*, pp. 233–5).