

Let me in the second place state the exordium concerning science.

In Europe generally, the French establishment predominated throughout the half-century and more of which the Revolution was the centerpiece, from the 1770s through the 1820s. The chemical revolution, analytical and celestial mechanics, the rigorization of the calculus, the mathematicization of physics, botanical systematics, comparative anatomy, experimental physiology, clinical medicine—French scientists were the prime movers and French institutions the initial loci of all these new departures along the road of modernization.

It would appear, indeed, that for a time the vigor of high culture in France had passed from arts and letters into science. In a graph of the importance of French literature, of French art, of French music, the quarter century between 1789 and 1815 would show a dip, not to say a trough, between the peaks of the Enlightenment and of the nineteenth century. What writers in that interval are still read for the quality of their language? Two, André Chénier and Chateaubriand. What painters stand out? Two again, David and, later, Ingres. What composers wrote music that lives, other than the Marseillaise? One, Cherubini—an Italian whose name has failed to find its way into the *Nouvelle Dictionnaire de Biographie Française*. In Germany and England, on the other hand, the literary landscape was anything but barren.

The paucity of French talent expressing itself in the humanities in our period is to be contrasted to the galaxy of leading scientific lights who constitute the *dramatis personae* of this book—Lavoisier, Laplace, Lagrange, Berthollet, Cuvier, Jussieu, Lamarck, Fourier, Legendre, Cauchy, Ampère, Geoffroy Saint-Hilaire, Pinel, Bichat, Magendie, Fresnel, Poisson, Gay-Lussac, Monge, Sadi Carnot—some twenty stars of the first magnitude, not altogether arbitrarily singled out from among another two to three dozen luminaries of second and third magnitude and as many more practitioners, in sum a larger scientific population than in the rest of Europe put together.

The wellsprings of vigor manifest in comparable ways in the politics and science of revolutionary France lie in cultural strata deeper than the surface layer of either and issue through different channels. It is not through following the occasional political activities of scientists that we will get at them, however, nor is it through considering the involvements of science in the arena where parties, classes, and interests compete for momentary power. Such episodes there were, often interesting and occasionally momentous. We will need to mark them, but in the last analysis their importance was incidental rather than systematic.

With respect to politics, indeed, historiography may possibly have occupied itself too exclusively with the turbulence at the surface. For a striking feature of the Revolution is the contrast between the magnitude of the events and the stature of the participants. Until Napoleon Bonaparte gave

his measure, and by then the merely political dynamism was exhausted, not a single great man stood forth within the forum. No one was to the French Revolution what Solon and Pericles were to Athenian democracy, what Luther and Calvin were to the Protestant reformation, what Washington and Jefferson were to the American Revolution, or what Lincoln and Lee were to the Civil War. Mirabeau, Lafayette, Barnave, the two Lameths, Duport, Roland, Brissot, Vergniaud, Desmoulins, Marat, Pache, Hébert, Carnot, Danton, Robespierre, Couthon, Saint-Just, Barras, Boissy d'Anglas, Reubell, LaReveillière-Lépaux—of the whole lot, and dozens more, one feels that it was only by slight accidents of circumstance that they, instead of almost any other among hundreds of deputies, occupied the positions they did. And of the deputies to all the legislative bodies, one feels the same thing relative to almost any others among tens of thousands of intelligent, educated Frenchmen, newly awakened politically. The leaders came and went, mostly after a very short interval at the forefront. The policies they implemented were not so much their own creations as items in the logical set of possibilities, eventually exhausted. The events produced the men, and not the men the events.

Neither the passions of politics nor the force of ideologies were what made the Revolution all it was historically. Its enduring features have not been the outcome of disputes in the National Assembly between constitutional monarchists and republicans, Girondists and Montagnards, Jacobins and Thermidoreans. Nor do they derive from the larger configuration of leftward movement culminating in the rule of the Committee of Public Safety followed by Thermidorean reaction, political bankruptcy during the Directory, and military receivership under Bonaparte. Ideas lead little further. Condorcet's belief in the perfectibility of man, Marat's friendship for the people, Robespierre's ideal of civic virtue—such notions have played an altogether negligible role in the daily life of citizens of France in the nineteenth and twentieth centuries (though the same may not be said of Napoleonic glory).

No, the changes that mark off modern polity from the old regime transpired at a level deeper than the political or ideological. The factors differentiating the lives of Frenchmen in the nineteenth and twentieth centuries from the lot of their ancestors in the old regime were those that realized the principles affirmed in 1789, and that were not afterward in dispute among the factions: sovereignty of the nation, liberty of conscience and opinion, freedom of the press, national unity, equality before the law, presumption of innocence until proof of guilt, absolute right of property, equitable rules of inheritance, universal and secular education, access to health care, public responsibility for the disadvantaged, universal obligation for military service, a standard system of weights and measures. These matters are intrinsic to the lives people lead. Once the principles were established, and the Declara-

tion of Rights of Man and Citizen accomplished that at the outset, provision for realizing them came out of administrative and institutional practice, not out of politics, though politics had to make the provision possible.

More generally, the French Revolution was the surface manifestation of something like a seismic shift relieving pressures that had been building throughout the Enlightenment. For a century and more, if a tectonic metaphor is permissible, the philosophic plate carrying the value structure shifted past the plate of social and juridical structure until convocation of the States-General in 1789 triggered the release in all directions of enormous political energies. A society in which roles were defined by status then gave way to a society in which roles are defined by function. What matters in a civic sense is what one does, not who one is, the person one comes to be, not the person one was born to be. These are fundamental determinants of attitude which, along with the modernization of their institutional and juridical embodiment, transcend, or rather underlie, the battle of revolutionary politics. On these, the fundamentals, there was no difference between constitutional monarchists and republicans, between Girondists and Montagnards, between Thermidoreans and surviving Jacobins under the Directory, eventually between Bonapartists and the onetime democrats of the year II. The fundamental shifts were irreversible. They survived restoration of the Bourbon monarchy in 1815. The disputes throughout the preceding quarter-century had been over means, not ends. The difference over ends, and it was unbridgeable, was between pre-modern and modern polity in general, between the Old Regime and the Revolution, between status and mobility, between subjects of the King and citizens of the Republic.

Indicative of the change in ethos was universal acceptance of the bourgeois axiom that careers, whether in the public or private sector, should be open to talent, not birth. Clearly, the proposition is one with which the norms of the scientific community are altogether congruent. More broadly than that, however, indeed much more broadly, political and social sensibility shifted toward the orientation characteristic of science, toward shaping the future, rather than conserving the past.

Characteristic of science, but of what science? For a comparable shift, at bottom the same shift, occurred there. In the long half-century of French scientific predominance, from the 1770s through the 1820s, we are in the presence of two generations of scientists, well marked off from each other by the crisis of the Revolution. In the earlier, leadership of the old Academy belonged to Lavoisier, to Condorcet, to Vicq d'Azyr. They and their colleagues had had their general education in the excellent clerical colleges of the eighteenth century, and beyond that were largely self-taught in a culture dominated by letters. Their successors consisted of the first set of scientists formed in the new, professional institutions: the Museum of Natural History, the Faculty of Medicine drawing on the clinical facilities of the Hôtel-

Dieu and other hospitals, the École Polytechnique. Only five careers of great note spanned the divide—those of Laplace and Lamarck, and less fully so of Lagrange, Monge, and Berthollet.

We are concerned here not merely with the succession of generations, although that certainly, but also with two distinct modes of doing science. The one, the earlier, is encyclopedic. The other, its successor, is positivist. By encyclopedic is meant the science done according to the method defined by Condillac. Analysis orders a complex sector of experience—in the global case of the *Encyclopédie* itself, *all* experience—by identifying its elements. Science then arranges those elements according to the natural connections inherent in the phenomena, whether chemical, botanical, mineralogical, mathematical, technological, social, economic, political, or whatever. Thus, Lavoisier's chemistry only begins with an explanation of combustion. That was merely the theory. The actual ordering of the science is a tabulation arranging the fifty-five known simple substances laterally by class and species while the columns show the relation of compounds to the action on each species of the principles of caloric, oxygen, acidity, and non-acidity.

The approach is also that of the Jussieu system of natural classification, in which flowering plants are ranged in genera and families according to their relations in nature. This was no mere taxonomy. The Botanical School at the Jardin du Roi and the Trianon garden were actually planted that way. Thus does Romé de l'Isle, and after him René-Just Haüy, classify minerals on the basis of the cleavage forms of their crystals. Thus does Gaspard Monge classify geometric surfaces according to their mode of generation. Thus does the technology of the *Encyclopédie* amount to a natural history of industry.

Many practices deriving from the encyclopedic mode of science are still with us, of course. Chemical nomenclature is the most obvious, but the most widespread is also the most characteristic. The metric system based weights and measures on dimensions drawn from nature. For the natural sciences, in a word, the general problem is to find where things belong, their status in nature, and for the human sciences to show how we fit, our status in society. Application then consists in reforming practice in conformity with principles that are true to the nature of things physical and social.

The science of the next generation, by contrast, is functional, a positive science of how things work. By positive is meant the actual practice from which Auguste Comte abstracted his philosophy, a philosophy—be it noted—of politics as well as science, though not a political philosophy. The phenomena investigated are actions in nature, and indeed on nature, rather than arrangements. Thus, to anticipate, Fresnel's problem is the interference of the light waves, not the waves themselves, and his integrals predict the illumination of the shadow of a refracting diskette. Thus, too, Malus polarizes light, and his formulas predict the relative intensities of rays of ordinary

and extraordinary refraction. Thus, Ampère makes magnetism consist of electricity in motion. Thus, Fourier performs mathematical investigations of the conduction, not the nature, of heat, and Sadi Carnot analyzes the conditions of maximum yield of a heat engine. The thrust is similar in other sciences. Berthollet initiates a fully physical chemistry with the study of mass action. Cuvier bases comparative anatomy on the relation between the functioning of the organism and its mode of life. Lamarck makes the life processes the constitutive factor in the economy of nature. Bichat and, much more, Magendie intervene in the functioning of the organism.

But apart from these indications, it will be best to reserve a characterization of that science until we have set forth an account of the revolutionary transformation of the context, which is the main purpose of this book.¹

¹ Earlier treatments of the subject of this book, in whole or in part, and from various points of view, will be found in Biot (1803), Cuvier (1809), Delambre (1809), Despois (1868), Pouchet (1896), Fayet (1936), Dhombres and Dhombres (1989). Spary (2000) on natural history came to my attention while this book was in production. Alder (2002) on the metric system appeared during that interval.

CHAPTER I

Science and Politics under the Constituent Assembly

1. SCIENCE AND POLITICS IN 1789

In the history of science, narrowly speaking, the year 1789 is notable for several events, foremost among them publication by Lavoisier of *Traité élémentaire de la chimie*. That supremely lucid manual draws together the oxygen theory of combustion, the gravimetric method of analysis, and the modern denotative nomenclature into a coherent foundation for a reformed chemistry. Lavoisier and the associates who had gathered round him thereupon launched *Annales de chimie*, the earliest journal consecrated to a single discipline. The first three volumes were approved for publication by the Academy of Science respectively in April, June, and September 1789.¹

Equally important for the ordering of the life sciences, Antoine-Laurent de Jussieu completed the classification of flowering plants according to the natural method that he and his uncles Antoine and Bernard had developed at the Jardin du Roi over the preceding half-century. *Genera plantarum secundum ordines naturalis disposita*, published in July, was one of the last major treatises in any science to appear in Latin and the first to define the principle of subordination of characters. Extended to zoology, the approach guided the taxonomic program of the revolutionary *Muséum National d'Histoire Naturelle* for the next thirty years.

Also in 1789 the Academy of Science printed a memoir by Laplace on Saturn's rings. He there stated the basic equation of spheroidal attraction theory in a form that later became the potential function of mathematical physics. A second memoir, on the secular variation of planetary orbits, appeared in the same volume. At the meeting of the Academy held on 18 July, four days after the fall of the Bastille, Laplace read a paper on the inclination of the plane of the ecliptic.²

In none of these writings would one expect to find, nor does one find, the slightest indication that the financial plight of the monarchy had forced Louis XVI to convoke the Estates-General of France, the first meeting since

¹ The "authors," or board of editors, consisted of Guyton de Morveau, Lavoisier, Berthollet, Fourcroy, Dietrich, Hassenfratz, and Adet, in that order on the title page.

² "Mémoire sur la théorie de l'anneau de Saturne," MARS (1787/89), pp. 249–267. For a complete Laplace bibliography, see Gillispie (1997a).

1614, and that the opening ceremony took place in Versailles on 4 May 1789. Three members of the Academy of Science were elected to the Estates-General, all from Paris. The not-very-eminent astronomer Jean-Sylvain Bailly was chosen by the electors of the Third Estate, while the nobility selected the foremost honorary member, Louis-Alexandre duc de La Rochefoucauld d'Enville, together with the jurist Pierre-Achille Dionis du Séjour. An astronomer and mathematician of considerable note, the latter was not in his element in politics and maintained the lowest possible profile. In addition, Lavoisier was named an alternate by the nobility of Blois. Two more academicians, the botanist André Thouin and the engineer Constantin Périer, were alternates for the third estate of Paris. Otherwise the principal figures who would now be described as intellectuals were Constantin-François de Volney, Pierre-Samuel Dupont, and the abbé Emmanuel Sieyès. Volney, a historian in the making, had a certain reputation for his *Voyage en Égypte et Syrie* (1787) and for the liberal journal he founded and edited, *La Sentinelle*. Dupont, an economist, had been Turgot's chief of staff in the ill-starred attempt to liberalize the grain trade and commerce in general in 1774–76. He now added the appellation de Nemours to distinguish himself from a deputy of the same name from Bigorre. Sieyès had become famous at one stroke through the manifesto that asserted the right of commoners to constitute the nation. His powerful pamphlet is less notable for the political theory it presupposed than for the opening rhetoric: “What is the Third Estate? *All*. What has it been until now in the political order? *Nothing*. What does it wish? *To be Something*.”³

Nevertheless, although natural science and formal knowledge in general had little or nothing expressly to do with the opening events of Revolution, the expectations of the participants are unthinkable except with reference to the participation of science in forming, however ambiguously, the mentality of the Enlightenment. Its central feature was the dual conviction that the human mind had achieved the capacity to know the nature of things, and that nature is the norm to which human arrangements should, nay must, conform. In no way was confidence impaired by the inconsistency, readily apparent in hindsight, between the nature investigated by scientists, the repository of what is, and the nature invoked by moralists, the wellspring of what ought to be. The fissure appears in literary form in the conflict between Voltaire and Rousseau. Nor was passion for reform in any way diminished by incompatibilities which they, and many another, manifest between temperaments that respect science and those that love nature, or more generally between rationalism and romanticism. These entwined but contradic-

³ Roberto Zapperi has published an edition of *Qu'est-ce que le Tiers état* with an interesting commentary from a Marxist perspective (Geneva: Droz, 1970).

tory strains are the intellectual taproots of the great paradox posed by the French Revolution en bloc, which is that liberty failed to coexist with equality and fraternity, that assertion of the rights of man gave way within four years to the reign of terror and within ten to military dictatorship.

Appeal to the talisman of nature was more characteristic of the Enlightenment in France than elsewhere. A difference with America, for example, may be noticed in a comparison of those otherwise very similar documents, the Virginia Declaration of Rights of 1776 together with the American Declaration of Independence on the one hand, and on the other the French Declaration of the Rights of Man and Citizen of October 1789. Nature was not absent from American political thinking, of course. The opening sentence of the Virginia Declaration asserts that “All men are by nature equally free and independent, and have certain inherent rights.” The word does not occur again, however. George Mason seats the legitimacy of government rather in a social contract. Jefferson, too, refers to nature only in passing in the Declaration of Independence. The briefer French Declaration, by contrast, invokes nature prescriptively. In the preamble, the rights of man are “natural, inalienable, and sacred”; in article II they are “natural and imprescriptible”; in article IV the “exercise of the natural rights of man has no limits except those which assure to other members of society enjoyment of the same rights.”

Most telling is the difference in diagnosis of the incorrigibility of the existing regimes. The Virginia Declaration blames specific illegitimate actions on the part of the British government, the same as those that the Declaration of Independence personifies in the bill of particular misdeeds ascribed to George III. In the French Declaration, by contrast, “Ignorance, disregard, or contempt of the rights of man are the sole causes of public misfortune and governmental corruption.”⁴ What is the cure for such ignorance? In the eyes of the philosophes, in the sensibility of the cultivated people who had absorbed their writings and discussed them in provincial academies, masonic lodges, literary societies, cosmopolitan salons, and other forums all over France, the answer was obvious. It was knowledge of nature, which is to say science, not in a professional but in a cultural sense. Whether true science was to be attained intuitively in the manner of Rousseau and the romantics, or analytically in the mode of Condillac and the rationalists, was not at issue in the inculcation of intellectual instincts. The process was a literary one in large part, and its monument is the *Encyclopédie*.

Anterior to the readings that occupied a literate person’s maturity, how-

⁴ Robert R. Palmer (1959–64) prints passages from the Virginia and the French declarations side by side (I, Appendix IV, pp. 518–521). For the complete text and a fine appreciation of the French declaration, see his translation of Lefebvre (1947), appendix.

ever (and this has been appreciated only in the light of recent scholarship),⁵ minds were prepared in a manner favorable to scientific culture in the very schools that educated the generation of the High Enlightenment and its revolutionary successor. In contrast to the sclerotic teaching of the humanities, which prescribed rules of conduct drawn from classical morality and Christian doctrine, the emphasis in natural philosophy, even in the strictest of clerical colleges, and perhaps especially there, was on changes in knowledge, on novelty, on justification by reference to fact. Only in science did systematic knowledge put a premium on innovation. Only there did the content, though not the discipline, of education point the way to a future different from the past. The road might be traveled, not only by the small minority who would do science, but by all participants in a culture where it flourished.

It was not the intent of its teachers that science should thus be felt as a force for reform. Neither, though for quite different reasons, was that the effect among people outside the educated class who were excluded from its procedures for lack of talent, opportunity, or means, or who felt threatened by the inexorable extension of its grasp over traditional domains of skill, practice, and understanding. Such ambiguities attending the place of science in the Enlightenment were institutional and political as well as cultural. On the one hand, science made for progress and reform. On the other hand, it was housed in the Royal Academy of Science, a privileged body jealous of its prerogatives.

In this respect, the place of the scientific establishment in the political process was similar to that of the juridical nobility, though of incomparably less moment in the crisis of the old regime. The aristocracy exerted its leverage and forced the calling of the Estates-General in the expectation that the summoning of representatives of the nation would curb royal absolutism and preserve the vested rights and legal exemptions of privileged persons in a constitutional regime. Its miscalculation precipitated the French Revolution. The anticipations of the scientific community, if more constructive in character, were no less severely dashed. The Academy of Science was dissolved early in the Terror. Of the five members most widely involved in public affairs under the Constituent Assembly, all perished: Bailly and Lavoisier guillotined, La Rochefoucauld assassinated, Condorcet hounded, and Vicq d'Azyr driven to their deaths.

Seen from outside the Academy of Science, Jean-Sylvain Bailly, J.-A.-N. Caritat marquis de Condorcet, Antoine-Laurent de Lavoisier, Louis-Alexandre duc de La Rochefoucauld d'Enville, and Félix Vicq d'Azyr had in common membership in that body and general visibility as champions of its definition of the public welfare. Bailly grasped every opportunity to identify

⁵ Brockliss (1987).

himself with the civic interest in the 1780s. He served as chairman of the three blue ribbon commissions appointed by the Academy at the behest of the government to investigate abuses posed by the vogue of Mesmerism, by the dismaying conditions in the Hôtel-Dieu and other hospitals, and by the unsanitary location of slaughter houses near Les Halles. Lavoisier presided over a fourth commission charged with inquiry into the state of prisons. Bypassing the bookish Faculty of Medicine, Vicq d'Azyr founded the Royal Society of Medicine in 1776 with the dual purpose of mobilizing the medical profession in the control of epidemics and of bringing scientific resources to bear upon problems of public health. The appalling task of exhuming millions of cadavers in the centuries-old Cimetière des Innocents fell to a commission of the Society headed by Marc-Augustin Thouret, as did the even more unsavory cleanup of the huge sewage disposal plant at Montfaucon. The ducal cousins La Rochefoucauld d'Enville and La Rochefoucauld-Liancourt, twins in point of noblesse oblige, were patrons of the Academy of Science and the Society of Medicine, respectively. Almost indistinguishable from one another in doing good from on high, they participated in the work of a number of these commissions alongside other leading members of both bodies.⁶

Condorcet, Permanent Secretary of the Academy, was responsible ex-officio for communicating with both government and the public in regard to all its enterprises. Not every undertaking improved what would now be called the image of the Academy. Its report on Mesmer and animal magnetism in 1784 offended fashionable Paris by its arrogant dismissal of what everyone found fascinating.⁷ Science also shared in the odium incurred by Lavoisier when the corporation of tax farmers, acting on his initiative, obtained the authority to erect a wall around Paris in order to thwart traffickers smuggling dutiable commodities into the city by way of many side streets.⁸ Several of the elegant customs houses designed by Nicolas Ledoux, through which their wagon loads were to pass, may still be admired, one flanking the Lion de Belfort at Denfert-Rocherau, a second in Place de la Nation, a third at La Villette.

Seen from inside the Academy, the five members most in the public eye had very little in common. Affable and generally well liked, Bailly had made useful astronomical observations at the time of his election and afterward in the 1760s, but was no longer taken seriously by his colleagues on scientific grounds. He had done nothing in science proper following a 1771 paper, of real though limited importance, on the intensity of light reflected by the

⁶ On science and civic reforms, see Gillispie (1980), pp. 244–256.

⁷ *Ibid.*, pp. 261–289.

⁸ Poirier (1993), pp. 184–187.

moons of Jupiter and on their respective diameters.⁹ In the ensuing years Bailly turned to literary activities and to writing about the history of astronomy. Montucla's history of mathematics and Delambre's of astronomy are evidence that works of enduring value in the historiography of science might be produced by capable scholars of their generation.¹⁰ Not so Bailly's treatment, especially of antiquity, which has the interest of a high-flown and occasionally eloquent compilation of astronomical legend. He wrote in the persuasion that the various fragments of astronomy known to Babylonians, Egyptians, Greeks, Chinese, and Indians, which is to say the germs of modern science, represent the relics of a perfect knowledge of the heavens possessed by the pristine civilization that had united all humanity prior to its collapse into the barbarism we know as ancient history.

Bailly went on to compose discursive writings on the supposed origins of this astronomy in India and of all knowledge in the lost continent Atlantis. Voltaire having been incautious enough to acknowledge the gift of the first volume appreciatively, Bailly inflicted these further speculations on him in the form of a public correspondence that the sick old man lacked the strength to ignore.¹¹ Bailly's main ambition in all this was to be the first triple academician since Fontenelle. In that he succeeded, though not without the help of intervention from Versailles in all three instances. Supplementing his membership in the Academy of Science (1763), he was named to the Académie Française in 1783 and to the Académie des Inscriptions et Belles-Lettres in 1785.

Bad blood between Bailly and Condorcet went back to academic politics in 1773, when d'Alembert prevailed over Buffon in securing the election of Condorcet rather than Bailly to assist, and in 1776 to succeed, the ailing Grandjean de Fouchy in the post of Permanent Secretary. Condorcet was thus strategically placed to serve as spokesman for science throughout the heady days of reform attempted by the Turgot ministry from 1774 to 1776. A letter to Voltaire in the latter year laments his mentor's fall from power: "We had a beautiful dream, but it was too short. I shall go back to Mathematics and Philosophy. It is cold comfort to work only for vainglory when for a time you have flattered yourself that you have been working for the benefit of the public."¹² Go back he did, albeit with an inelegance in mathe-

⁹ "Mémoire sur les inégalités des satellites de Jupiter." MARS (1771/74), pp. 580–667.

¹⁰ On Delambre's history, see below, chapter 4, section 3. On Montucla, *Histoire des mathématiques* (2 vols., 1758), see Swerdlow (1993).

¹¹ *Histoire de l'astronomie ancienne, depuis son origine jusqu'à l'établissement de l'école d'Alexandrie* (1775); *Lettres sur l'origine des sciences* (1777); *Lettres sur l'Atlantide de Platon* (1778). For bibliographical detail of Bailly's further works on the history of modern astronomy, see Chapin, "Bailly," DSB 1 (1970), pp. 400–402; and for a fair-minded account, E. B. Smith (1954), chapters 4 and 5.

¹² June 1776. See Condorcet, *Oeuvres* (12 vols., 1847–1849) 1, pp. 113–115.

matical style that cost him the respect of rigorously minded mathematicians at the time and ever since.¹³ A mathematician lacking creativity and skill in calculation suffers more keenly from comparison to colleagues who possess such attributes than do scientists with similar disabilities in other disciplines. The kindest judgment professionally comes from Sylvestre Lacroix. The preface to his 1810 textbook on the calculus says of Condorcet's contribution to the field, "We must see in it what he was capable of doing rather than what he did."¹⁴

Condorcet, in short, was a literate but innumerate mathematician. In later times the expression would be a contradiction in terms. It would not necessarily have seemed so to a d'Alembert, to a Leibniz, or to a Descartes, who also thought, perhaps with greater power of mind though not of character, to turn mathematics outward upon philosophy rather than inward upon itself. For Condorcet, *philosophe* and not philosopher, mathematical analysis would reach fulfillment in the reformation not so much of knowledge as of society.

Lavoisier existed on a different plane from the one inhabited by his fellow academicians. Tax farmer and chairman of the board of directors of the Caisse d'Escompte, he was a wealthy financier. Agronomist and experimental farmer, he was a landed proprietor with an estate at Freschines near Blois in the Beauce and a family property just north of Paris at Le Bourget. Administrator of the munitions industry, he along with his wife held scientific court at the Arsenal in an official apartment adjoining the laboratory where he revolutionized the science of chemistry. Chemist by calling, he collaborated with the leading mathematician, Laplace, in founding the study of calorimetry and also with a leading engineer, Jean-Baptiste Meusnier, in the pyrolysis of water. Beyond that he thought to confirm his theory of combustion by investigating the physiology of respiration. Among peers, Lavoisier aroused admiration, provoked jealousy, and won little or no affection. Among inferiors he inspired fear and even hatred. All of this was far from the intention of a scientist whose passion for getting things right simply took no account of the sentiments of others.¹⁵

One of the few who felt easy in Lavoisier's company was La Rochefoucauld d'Enville, for whom there was no question of competition. In April 1785 the duke collaborated closely with Lavoisier, then Director of the Academy, in effecting a difficult reorganization that increased the number of scientific sections from six to eight in order to accommodate the relatively recent

¹³ That judgment has been redressed, to a degree, in recent scholarship. See below, chapter 1 section 5.

¹⁴ Quoted from *Traité du calcul différentiel et intégral* (1810), xxiii–xxiv, in Crépel and Gilain (1989), p. 18.

¹⁵ The most recent, and by far the fullest, biography is Poirier (1993).

development of natural history and mineralogy and of general physics.¹⁶ As Gunpowder Administrator, Lavoisier welcomed La Rochefoucauld's initiative in conducting experiments on the extraction of saltpeter from chalk cliffs along the Seine near his ancestral property of La Roche-Guyon. La Rochefoucauld published several other papers of mineralogical and chemical interest.¹⁷

Scions of one of the greatest families of France, La Rochefoucauld and his cousin were, of course, influential rather for their position than for their science. Nevertheless, they were respected participants and not mere ornaments in the societies they honored with their membership. Liancourt, even like Lavoisier, turned his estate into a model farm in the 1780s, and beyond that created a trade school for the children of needy military families. It enrolled 130 pupils on the eve of the Revolution and eventually became the *École des Arts et Métiers* of Châlons-sur-Marne. Alleviating poverty was Liancourt's central preoccupation, and the health of the working poor his principal reason for involvement in the Royal Society of Medicine.

Vicq d'Azyr, first and only Permanent Secretary of that Society, combined great personal charm with equally important seriousness of purpose. It was, no doubt, owing to the former attribute that he had the rare, perhaps the unique, good fortune to be equally popular at court and among the progressively minded heirs of the Turgot legacy who frequented enlightened salons in the capital. In Versailles, Vicq d'Azyr was personal physician to Marie Antoinette, who delighted in the company of her "philosophe." In Paris, he was an intimate of Condorcet, his counterpart and role model in the Academy of Science. There was, however, a difference in the public perception of the two institutions for which they spoke. The one was exclusive, the other inclusive. The Academy was an element in the structure of authority and made many enemies among would-be innovators whose ideas it judged. The Royal Society of Medicine, by contrast, was itself an innovation. Reforms it sought to effect were at the expense of privilege, seated in the Faculty of Medicine, which had always exercised over medicine an oversight comparable to, though not identical with, the Academy's over science.¹⁸

To turn the medical profession away from collective self-serving and toward responsibility for public health, that was the thrust of Vicq d'Azyr's reform. It was an effort that could scarcely be unpopular. The Society's network of correspondents might well be compared, though it does not seem to have been, to the Freemasons and the Mesmerist Societies of Har-

¹⁶ *Oeuvres de Lavoisier* (hereafter OL) 5, pp. 555–614, and Lavoisier, OL, *Correspondance* 4, Annexe V, pp. 311–316. See Hahn (1971), pp. 99–101.

¹⁷ "Mémoires sur la génération du salpêtre dans la craie," SE 11 (1786), pp. 610–624; "Examen d'un sable vert cuivreux de Pérou" (jointly with Fourcroy), MARS (1786–87), pp. 465–473. On the family, see Rousse (1892), and on La Rochefoucauld-Liancourt, Dreyfus (1903a, b), Weiner (1993).

¹⁸ On the Royal Society of Medicine, see Gillispie (1980), chapter 3.

mony in foreshadowing the revolutionary spiderweb of political communication linking the Jacobin Club of Paris with provincial affiliates. But Vicq d'Azyr was more than an organizer. He was a notable anatomist, and insisted on the importance of anatomy over Latin in the study and practice of medicine. For the new medicine was to be based on science. Hence his insistence on academic procedures within the Society of Medicine. Provision of care was to be inseparable from advancement of knowledge.¹⁹

Let us follow the trajectory of these, the most visible members of the Academy, throughout the first phase of the Revolution, from the Convocation of the Estates-General on 4 May 1789 until the dissolution of the Constituent Assembly on 30 September 1791. They began by sharing in the view, which was the consensus of responsible opinion until nearly the end of that period, that the stirring events underwritten by violence through which the country was passing should and would culminate in the transformation of an absolute into a constitutional monarchy.

It did not at first occur to them that irresponsible opinion would instead prevail at both extremes, in the Court at Versailles and in the streets of Paris.

2. BAILLY AND THE CONSTITUENT ASSEMBLY

Scientific habits of mind are not normally congruent with political reality. Both Condorcet and Lavoisier failed in their bids for election to the Estates-General, while the only scientist chosen by the Third Estate was the genial and superficial Bailly, who never sought a seat. Indeed, no record remains of his ever having raised his sights beyond the scourges of charlatanism and pollution to the political process in general prior to the intense discussions that occupied all Paris, indeed all France, in the interval between 8 August 1788, when the King's Order in Council convoked the Estates-General, and the ensuing elections held in April and May 1789. What is more remarkable, thrust by circumstance into the opening breach between the Assembly and the King, and forced to improvise, Bailly acquitted himself with style and distinction, indeed with bravery, and saved the day, or at least the dawn.²⁰

Elections to the Estates-General were indirect. In each constituency all higher prelates together with representative secular and regular clergymen

¹⁹ Vicq d'Azyr, "Nouveau plan pour la médecine," HSRM 9 (1788–87/1790), p. 150.

²⁰ The following account of Bailly's political debut is based mainly on his memoirs and on the minutes of the meetings of the Assembly of Electors of Paris. The memoirs were first published in 1805 under the title *Avant-Moniteur, ou tableau sommaire des huit premiers mois de la Révolution*. They were republished, with annotation, under the title *Mémoires de Bailly*, ed. St. A. Berville and Barrière, Collection des mémoires relatifs à la Révolution Française (3 vols., 1821–22). The proceedings of the electors, *Procès-Verbal des séances et délibérations de l'Assemblée Générale des Electeurs de Paris* (3 vols., 1790), were recorded by Bailly as secretary from 26 April through 21 May 1789 and by Duveyrier, his successor in that post, from 22 May through 22 July. For additional documentation, see Hahn (1955), and for secondary treatments, Brucker (1958), E. B. Smith (1954), Kelly (1982), Pt. IV.

chose the deputies of the First Estate and all noblemen those of the Second Estate, 300 in each order. As for the Third Estate, male taxpayers over twenty-five years of age elected delegates to local electoral assemblies, which were constituted differently in town and country. Those assemblies then selected the deputies to meet in Versailles, 600 in principle, a few of whom failed to appear. The King had yielded in the opening political struggle of the Revolution, and prior to the elections had agreed to doubling the representation of the Third to equal the combination of the privileged orders. Dispute continued over the question of whether the three orders would sit together in a single assembly, in which case the deputies of the Third Estate combined with liberal members of the First and Second might prevail, or whether the orders would sit separately in a tri-cameral body, in which case the two privileged orders could always outvote the commoners.²¹

Paris was a special case. Primary assemblies in each of sixty districts chose the members of an Electoral Assembly, which in turn selected deputies for the twenty seats allocated to the capital. Bailly tells in his memoirs of conversations at his club and at dinner parties amid the political ferment of the previous winter. Friends, among them the abbé Maury, kept predicting that his character and civic reputation would win him election to the Estates-General, a thing he would never have imagined for himself. Though he lived in the suburb of Chaillot, Bailly voted in the relatively well-to-do district of the Feuillants. A young passerby outside the Convent where voters were foregathering sized him up and volunteered, "You will be named an Elector."

Only as the meeting got underway did Bailly begin to take the notion seriously: "Finding myself among the Assembly of the District was like breathing new air: To be something in the political order felt phenomenal."²² The sentimental style of his recollections recaptures the optimism of the moment, marked by a courteous give and take of messages among nobles and bourgeois, by reverence for the paternal image of a king needing only to hear the true voices of his people, by the illusion that the general will was good will. Articulate in speech and writing as befitted a triple academician, Bailly was named to the committee that drafted the cahier or statement of demands for the district. He and his colleagues repaired to a separate room between midnight and three in the morning and there produced a document containing "all the germs of liberty."²³ Proceeding to the choice of delegates, voted on one by one, the district assembly named Bailly first among its seven electors. All this occupied a twenty-four-hour session on 21–22 April 1789.

²¹ For detail on the arrangements, see Hyslop (1968).

²² Bailly, *Mémoires* 1, p. 9. The standard work on the Paris elections is Chassin (1888–89).

²³ *Ibid.* 1, p. 12.

Bailly's success repeated itself writ larger in the Assembly of Electors. Cahier and credentials in hand, he and his colleagues of the Feuillants presented themselves on the afternoon of the twenty-second in the great public room of the Hôtel de Ville, which he then entered for the first time in his life, there to rub elbows with electors of the other districts. The next morning all three orders assembled together in the hall of the Archbishopric to hear formal addresses by the royal officials. Bailly would have preferred that clergy, nobility, and Third Estate continue to represent the interests of the capital in a single assembly, thus setting an example to the Estates-General due to convene in Versailles in ten days time. That was not to be. The verifying of credentials, the recognition of electors from the suburbs, the swearing of oaths—all the formalities used up three more days until Sunday, 26 April. Clergy and nobility then withdrew unto themselves, leaving the Assembly of Electors of the Third Estate, 250 strong, to organize its procedures.

Time was very short. Deputies were to be presented to the King on 2 May. Suspicion was voiced that the authorities had deliberately dragged out the ceremonies in Paris in order to place the Assembly of Electors before a Hobson's choice: to commit irregularities in the preparation of cahiers and choice of deputies or else to fail in completing its work by the appointed day. In either event, the influence of the city would be nullified when the Estates-General opened in Versailles. The Electors refused to fall into the trap, if trap it was, and conducted careful deliberations. In so doing the Assembly won the respect of all Paris. Precedent dictated that royal officials should take the chair and keep the minutes. The Assembly would have none of that and chose its own officers. For a moment Bailly, inexperienced in parliamentary procedure, feared lest he be elected president. To his combined relief and gratification, he placed second and was thereupon named secretary. Serving on the commission that drew up the cahiers or revolutionary agenda were three members of the Académie Française, Jean-François Marmontel, Gabriel-Henri Gaillard, and Antoine Suard; two members of the Academy of Sciences, the chemist Louis Cadet and the botanist André Thouin; the publisher C.-L.-F. Panckoucke; the manufacturer of wallpaper J.-B. Réveillon; and the doctor Ignace Guillotin.

The ritual of the *procès-verbal*, formal minutes legitimating official proceedings of any sort, was among the tissue of ingrained practices that changed hands but not their nature in the Revolution. Bailly was as meticulous as the clerk of any court, but had to admit to one mistake, the more readily since it was fortunate. The Assembly decided early on that nobles and clergymen were ineligible to represent the Third Estate. The resolution to that effect passed late one night and seemed so matter-of-course that he failed to record it. On the last day, with nineteen of the twenty deputies chosen, there was strong sentiment in favor of naming the abbé Sieyès for

the remaining place. Impossible! To do so would flout the letter of the Assembly's own law. Or so it seemed until, looking back in the *procès-verbal* for the exact wording, Bailly found no record of the measure that everyone remembered passing. Owing to his oversight, it could have no effect. Legalism, as characteristic of French procedures in revolutionary as in normal times, had its compensations. Otherwise, Sieyès, champion of the Third Estate, would have had no seat in the Estates-General.

Bailly had sought to remove himself from consideration as a deputy before ever his name was put forward on the grounds that he had depended on the government for his entire career and virtually all his income. The renunciation was first applauded and then refused. His memoirs are frank about another, related matter, where too he felt himself the exception to the rule. "I noticed," he remarked, "that the Assembly held men of letters and academicians in great disfavor."²⁴ The dominant groups were merchants and lawyers, who also disliked each other. Merchants knew little of literary men, while lawyers were in the best position to appreciate them. By rights, lawyers and writers should have been at one. Theirs had been the freest of conditions in the old regime. The authorities had never dared silence a courageous lawyer, and had feared both the intelligence and the words of distinguished writers.

Why, then—Bailly continues—should so few of the latter have come forward in the front ranks of the Revolution? He could not deny that certain writers might simply have been sitting on the fence, but a more general attitude may be thought to account for the hesitation of philosophic minds. Liberty and human dignity are indeed important to philosophers. Above all, however, they value peace. Let enlightenment indeed spread, let human beings recover their rights, but let these good things come about gradually, without shocks, without violence. Liberty will arrive of itself when a great people is ready. Better to accept a little less of it than to insist on an extra increment bought in the blood of our brothers. "Those exalted spirits who believe themselves the only sons of Liberty may treat as bastards all who engage in such calculations, but it has to be admitted that their thinking is reasonable enough. I always thought, and still do, that a little more of that philosophic spirit would not have been amiss in the Constituent Assembly."²⁵

Bailly recorded his memoirs while in seclusion in 1792 or early 1793. Whatever his private doubts, if any, in May 1789, he said nothing to rub his fellow electors the wrong way. He had the gift of allowing others to think well of themselves while participating in the forefront of all the proceedings he recorded. The unassuming urbanity that had charmed the court and brought him academic place was no less pleasing in this new, political com-

²⁴ *Ibid.* 1, p. 51.

²⁵ *Ibid.* 1, p. 52.

pany. Bailly came on as the very epitome of cultivated public spirit brightening the future while not thinking of himself. His was the first name put in nomination for the Estates-General. He won a majority on the initial ballot, and by virtue of seniority became the leader of the Paris delegation in the Third Estate.

What with the late start and correct procedures of the Assembly of Electors, the deputies of Paris missed the opening of the Estates-General on May 4 and arrived in Versailles three weeks late. Except for renunciation of fiscal privileges by clergy and nobility and acceptance of equality before the tax collector, nothing had yet been accomplished. The impasse over the crucial issue of organization continued. Should the credentials of individual deputies be verified by each order separately or by all three sitting together in plenary session? At stake in the niggling procedural question of powers was the fundamental constitutional issue of the locus of power, whether it would lie with the majority in a unicameral body or with the two privileged estates against the Third. Commissioners named by the three orders failed for the second time to reach agreement on 25 May, the day the three Paris delegations took their places among their peers.

The next weeks were critical. The deputies of the Third Estate represented a capable and civilized people deprived for centuries of any voice in their own political affairs. They were themselves devoid of parliamentary experience. Few of them knew each other, nor even the regions represented apart from their own. Nevertheless, the grass roots went deep. So clearly did the Third Estate know its interest, so astute were they in a politics none had ever practiced, that they prevailed against the weight of royal authority, against the prestige of a powerful nobility, against distant precedents not in their favor, against the menace of military force. They prevailed—and this perhaps was most difficult of all—despite the commitment of the great majority to the institution of monarchy and the patriotic and filial affection widely felt for the person, or at least the idea, of the King of France, a resource it took Louis XVI another two years to squander.

Sieyès was the strategist, Mirabeau the orator, but it was Bailly who presided over this triumph. On 3 June the Paris delegation nominated him, its senior deputy, to succeed the ailing d'Ailly as dean, in effect president, of the Third Estate. Tradition from earlier centuries was that the privilege normally accrued to Paris, and by right to the *Prévôt des Marchands*, and though neither privilege nor office now had claims, Bailly felt he must take the chair lest the influence of the capital go by default. His was now the delicate task of incarnating the dignity of the Third Estate by standing up to ministers and court officials while showing proper deference to the monarch himself.

The strategy, in effect, was to implement the rhetoric of Sieyès's clarion title, "What is the Third Estate?"—the answer being that it was to all intents and purposes the nation. Following a further week of stalemate, and

repeated refusal by the nobility of a compromise favored by Necker, the deputies of the Third Estate rallied to Sieyès's proposal that they proceed on their own to the verification of the credentials, not just of their order, but of all three. The clergy had so far not taken a position. Representatives of the lower clergy, many of whom sympathized rather with their parishioners than with their bishops, now began to come aboard, three of them on 13 June, six more the next day, notable among them the abbé Henri Grégoire.

A few days later, on the seventeenth Sieyès moved that the deputies of the Third Estate, representing 96 percent of the nation, declare themselves the "National Assembly." Acting like a responsible legislature, they at once took the first step into government and authorized the collection of taxes, subject to whatever fiscal reforms might be enacted in the future. On the nineteenth, the clergy, not to be left behind, voted by a narrow margin to join with the Third Estate. Should the declaration of a National Assembly be allowed to stand, the Estates-General would be superseded.

Early the next morning, Saturday the twentieth, word came to Bailly in his lodgings that the Hôtel des Menus Plaisirs was surrounded by the Guard and that a royal order had been posted closing the great hall and suspending any further meeting on the pretext that preparations needed to be made for a royal session to be convened three days hence. Bailly hastened to the entrance, completing his toilette in the carriage. Other deputies milled about in the avenue de Paris. Getting no satisfaction from officials on the scene, Bailly welcomed the general cry that the meeting must go forward in another place. Guillotin suggested the nearby tennis court, and Bailly led his colleagues thither through the rain to meet with a cordial welcome from the manager. The only furniture was a rough table and a few benches along the wall. There, crowded into a space like a giant squash court, with the public peering down from galleries normally occupied by spectators of the sport, the self-invented National Assembly some 600 strong stood through a day-long session. It culminated in the famous oath "never to separate, and to reassemble wherever circumstances required, until the constitution of the Kingdom should be established and settled on a solid foundation."²⁶ Reading the formulation in a stentorian voice that could be heard by the public massed outside, Bailly took the vow himself, inscribed the words in the register—no mistake in this *procès-verbal*—and administered the oath to every member except one, who refused. The session closed with "Vive le roi," for the pretense persisted that only his advisers, only the court, were ill disposed.

So they were, from the point of view of the commons, though it became more difficult to keep up the pretense that the King was merely the victim of bad advice. Meeting on the twenty-first, the Royal Council rejected all

²⁶ *Ibid.* 1, p. 190.

(continued)