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Jonathan Simon, *Chemistry, Pharmacy and Revolution in France, 1777-1809*. Aldershot and Burlington: Ashgate, 2005, vi + 196 pp. Bibliography and index. \$89.95 U.S. (pb). ISBN 0-7546-5044-8.

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There are many books about Antoine Lavoisier and the chemical revolution, its roots and its diffusion among various chemical communities, and it has long been assumed that not only did this episode provide a paradigm shift but that it was also critical in establishing the autonomy of chemistry. It is Jonathan Simon's great merit to reexamine this crucial period from the dual perspective of the history of chemistry and the history of pharmacy. Rather than adopting an insider's point of view, Simon looks at chemistry from the outside. Nevertheless, for him outside is not a chemical no-man's land; it is the territory and tradition of pharmacists. He challenges the concept of the "identity of chemistry" promoted by Bensaude-Vincent and Stengers who offer a positive characterization of the nature of chemistry.^[1] By contrast, Simon works from a "definition by exclusion" based on the question, what is *not* chemistry (p. 2)? Indeed, for him, the question quickly becomes, what is pharmacy? In attempting to provide an answer, Simon describes the complex interactions between pharmacy and chemistry, paying attention not only to theoretical aspects but also to practical and institutional ones, thereby arriving at a denser and richer historical narrative of this celebrated episode in the history of science.

The chronology adopted is clearly drawn from the history of pharmacy. For Simon two dates are critical: 1777, the year of the foundation of the Collège de Pharmacie, is presented as the birth date of pharmacy in France, while 1809, marks the date of the founding of the *Bulletin de pharmacie*, the flagship journal for a new breed of scientifically-oriented pharmacists. After an introductory chapter, Simon describes how apothecaries left the guild of grocers and spicers and founded the Collège de Pharmacie in 1777. This Parisian institution of pharmacy, however, remained dominated by the medical faculty until 1780, at least in the domain of chemistry teaching. Autonomy from physicians was obtained in 1780, when pharmacists were allowed to teach public courses to train pharmaceutical students.

This first step towards autonomy was deeply affected by the coincidence of both the chemical revolution and the French revolution. The Collège was reorganized in 1797 under the name of the Société Libre des Pharmaciens, and an École Gratuite de Pharmacie was founded where chemistry was taught. During the opening ceremony, Antoine-François de Fourcroy—who was not a pharmacist—clearly stated that chemistry, which was until then considered to be principally an ancillary science of pharmacy, had become a model for pharmacy to follow.

Through the reform of the French educational system partly conducted by Fourcroy, the law of Germinal year XI (11 April 1803) established Schools of Pharmacy (Écoles de Pharmacie) which placed pharmacists instruction under the control of the state. With the teaching of Fourcroy's brilliant pupil, Nicolas L. Vauquelin, pharmacy became an autonomous discipline, but this autonomy was more apparent than real, since pharmacy was seen by many as now constituting a sub-discipline of the new chemistry. Finally, in 1809 the process of creating a scientific discipline of pharmacy culminated with the publication of the first regular pharmaceutical journal, the *Bulletin* (later *Journal*) *de pharmacie*. Interestingly, this journal, which changed its name to the *Journal de pharmacie et de chimie* in 1848, is still published today.

For Simon, this process, which was strongly determined by local circumstances, can be seen as a “Pharmaceutical Revolution.” By intertwining the histories of chemistry and pharmacy, Simon has opened up a new pathway in the history of science. Up until now, the history of pharmacy has usually been disconnected from the history of chemistry. Although a few historians have included some episodes of pharmacy and an experimental dimension in their narratives, most of them have focused on theoretical issues (composition, element) in order to interpret the chemical revolution.[2] Thomas Kuhn’s notion of paradigm shift has become the standard model for describing the chemical revolution, with the introduction of the oxygen theory as the landmark event. Nevertheless, determining the precise moment of such a paradigm shift is rather difficult (somewhere between 1770 and 1789) and has long been a matter of debate among historians of the chemical revolution.[3]

Rather than considering a theory-based paradigm or a “Lavoisier-centered vision”, Simon has opted for a more historical approach (p. 11). Instead of searching for an elusive causal interrelation between the French Revolution and the chemical one, he argues that “the political event was constitutive of the scientific revolution” (p. 18). For Simon, the building of “philosophical chemistry” as a discipline is a “gradual and non-linear process that took place across the eighteenth century” (p. 8). In this context, the so-called “chemical revolution” can be seen as an outcome, a “crystallization” followed by a diffusion made possible by the French Revolution. This historiographic interpretation is consistent with current research.[4]

In the third chapter, Simon examines the gradual shift from pharmacy to topics of “philosophical chemistry” that become totally separate from practice by the time of Lavoisier’s *Traité élémentaire de chimie* (1789). Relying on the textbooks of eminent chemists of the seventeenth century—Nicolas Lemery’s *Cours de chymie* and Christophle Glaser’s *Traité de la chymie* in particular—Simon shows how fundamental the practical dimension was in these authors’ works.[5] The analysis of the “mixts” (natural compounds) into the “simples”, i.e. useful or active parts of a plant, in order to produce medicines was the main purpose of their enterprise.

These books were very popular. Founded on the direct educational experience of the authors, texts like these developed a form of pharmaceutical chemistry where theory was accessory: “in Lemery’s relatively theory-rich work, the corpuscular explanations of reactions were inessential additions to the step-by-step instructions for preparing any medicine” (p. 79). Gabriel-François Venel’s article “*chymie*” in the *Encyclopédie* (1753) can be read as an attempt to separate chemistry from pharmacy based on the work of Lemery and Glaser. According to Simon, however, it was more a polemical work than an attempt to create an independent science of chemistry, since the separation was virtually impossible at the time. In the eighteenth century Pierre-Joseph Macquer’s *Éléments de chymie théorique et pratique* (Paris, 1749-1751) replaced Lemery’s *Cours de chymie* in the training of chemists. Simon finds here the first attempt to present chemistry in an axiomatic form or geometric style: from simple (four elements and phlogiston) to complex (the mixts). Indeed, the order of presentation changes, with the practical preparations and description of the laboratory coming after the theory. But the weight of pharmacy is still present in Macquer’s work since in the popular *Dictionnaire de chymie* (1766) he includes chemical medications. Total separation, Simon argues, was accomplished by the new chemists. The *Méthode de nomenclature* (1787) and Lavoisier’s *Traité élémentaire de chimie* (1789) leave “no place for pharmaceutical chemistry” and the volumes on chemistry for the *Encyclopédie méthodique* (1782-1832) completed this separation (p. 88).[6]

In spite of this shift from pharmacy to “philosophical chemistry,” the autonomy of pharmacy and its scientific orientation would certainly have failed without the multiple interventions of the prominent figure of Fourcroy. Simon explores his crucial role in the fourth chapter. Fourcroy’s success in the task of bringing the new chemistry to pharmacy is the result of his threefold status: scientist, statesman, and

teacher. As one of the reformers of the nomenclature he became one of the most active propagandists of the new chemistry. His “evangelical spirit” spread over the whole French medical system (p. 95). In his books, he followed Lavoisier’s lead by never mixing pharmacy with chemistry. He also “actively spread the gospel of the new chemistry wherever he could” (p. 101). The audience of his lectures at the Muséum d’Histoire Naturelle was becoming more diverse, drawing in bourgeois women according to contemporary accounts. He was the publisher and founder of two specialized journals: *La médecine éclairée par les sciences physiques* (1791-1792) and the *Journal de pharmacie* (1797-1799) where he “presented a relationship of complete subordination in which chemistry was to dictate the nature of pharmacy” (p. 108). As a member of the Convention, Fourcroy joined the Committee for Public Instruction, and he became a Councilor of State during the Consulate, when he established a national training system for pharmacists in 1803.

This new system established two categories of pharmacist: those admitted after eight years of apprenticeship, and those who chose a three-year training period (and the same length of apprenticeship) in one of the six schools of pharmacy. Simon sees in this two-category system a theory-versus-practice dichotomy that flows from Fourcroy’s vision of pharmacy as a sub-discipline of chemistry. Another dichotomy appears in the organization of training and qualification: pharmacists trained in a school would be allowed to practice anywhere in France (they later became first-class pharmacists), whereas those who only qualified after a test by a jury would be confined to the department in which they had been examined (later second-class pharmacists).

After converting old chemists to new chemistry, the time had come to submit pharmacy to the same process. In chapter five, Simon studies the emergence of the “new pharmacists.” This evolution was not a natural one. Once again, the intervention of Fourcroy and Vauquelin was crucial. As a continuation of his publishing efforts, Fourcroy achieved the merger of the *Annales de chimie* with the *Journal de pharmacie* in 1800. But this was not accepted by all chemists. For it to be, pharmacists had to accept the logic of chemical training. The young Louis Jacques Thenard, then a “*préparateur*” (i.e. in charge of practical training) at the École Polytechnique, advocated theoretical training before receiving a practical one. This was opposed to the pharmacist Jacques-Philibert Delunel’s conception, which appears to be representative of the old tradition in pharmacy, favoring hands-on apprenticeship.

In fact, two categories of pharmacist existed alongside one another: those who retained their artisanal identity (mainly concerned with the preparation of medicines), and those who embraced the new chemical order. Obviously, neither chemists nor pharmacists were fully satisfied. Fourcroy, chemist and reformer, was not a model for all pharmacists. Rather, Vauquelin appeared as the prototype of the “new pharmacist.” Himself a pharmacist, he deliberately turned to the new chemistry with the help of his mentor Fourcroy. Together, they created a new style of scientific research that Simon terms “hybrid analysis.” The beginning of this new style of analysis is identified in an article published by Vauquelin in the *Annales de chimie* in 1790. In his analysis of tamarind, he mixed traditional techniques used in pharmacy (maceration, decoction, etc.) with a Lavoisian style of chemistry equating the weights of starting material with products. But instead of the Lavoisian quest for elementary principles (carbon, hydrogen, oxygen), Vauquelin’s aim was to isolate and identify organic plant acids. The teaching of Edme-Jean-Baptiste Bouillon-Lagrange and Vauquelin at the reformed École de Pharmacie in 1803 spread this new knowledge to a number of students. With the increasing demand, a new specialized journal, the *Bulletin de pharmacie*, was founded in 1809. These events became landmarks in the constitution of French scientific pharmacy.

In his conclusion, Simon pleads for the integration of the history of pharmacy into the current studies of science. In order to fully understand the “pharmaceutical revolution” that took place in France in the early nineteenth century, he recommends the adoption of an “inclusive history of pharmacy that

integrates social, institutional, practical, experimental and theoretical analyses” and a comparative study of the different national contexts (p. 170). The integration of the history of pharmacy into the history of chemistry, Simon concludes, would offer “cross-fertilization” and generate “hybrids with a great potential for innovative and enlightening research” (p. 172).

The theme of hybridization or mixedness in the history of chemistry is a recent one. But scholars do not all agree on its meaning. Ursula Klein speaks of a “mixed culture” or “technoscience” in chemistry in opposition to Simon’s view of a “pure” philosophical chemistry.[7] My own opinion stands between these two extremes. In spite of the quality of Simon’s demonstration, his thesis of subordination must be criticized. According to the author, the turning point of the modernization of pharmacy was the acceptance by the founders of the *Bulletin* of the “new place of pharmacy as chemistry’s institutional inferior” (p. 166). But, as he argued himself, the journal was the result of an equilibrium between practical and theoretical aspects. Furthermore, the concept of hybridity includes by definition some mutual interaction.

Rather than the total submission described by Simon or the total merger claimed by Klein, I think that there was a kind of compromise (if not consensus) between the communities sharing the same project—i.e., chemical analysis. This can be seen through the evolution of the hybridity of techniques.[8] In addition to the work of Vauquelin on tamarind, there is a second essential paper on hybrid analysis cited by Simon that had more resonance for the future of pharmacy. The *Analyse du Quinquina de Saint-Domingue* published by Fourcroy in 1791 became a model for the first generation of “new pharmacists” or *pharmacist-chemists* as they called themselves. Certain expert analysts like Joseph Pelletier and Joseph-Bienaimé Caventou, developed and enriched pharmaceutical analytical chemistry in the subsequent decades. Like their masters, they situated their analysis at an intermediate level or carried out *proximate analysis*. This can be seen as the new practical analytical paradigm, whose most significant result was the discovery of a series of alkaloids at the end of the 1810s. This event is a landmark in the history of pharmacy. Along with the manipulation of the theoretical “paper tools” from 1827, it opened the way to the foundation of a sub-discipline in the 1830s: organic or “carbon chemistry.”[9]

The history of chemistry, which is still underrepresented in the history of science, offers new perspectives for research around this issue of hybridization in analytical techniques and theory. Besides the problem of definition that I have tackled in this review, one horizon is full of promise for the future of the historiography of chemistry. The “cross-fertilization” mentioned by Simon gives a new and more consistent perspective to the identity of chemistry and its importance in society. Furthermore, some recent work connected with the history of education has shed new light on this rather neglected field of research.[10] By taking pharmacy out of the footnotes of the history of chemistry and giving it some well deserved visibility, Simon’s book represents a first step in this direction.

NOTES

[1] Bernadette Bensaude-Vincent and Isabelle Stengers, *Histoire de la chimie* (Paris: La Découverte, 1993).

[2] Only Frederic Holmes and a few other scholars give some importance to the experimental dimension of chemistry. See, Frederic L. Holmes, *Lavoisier and the Chemistry of Life. An Exploration of Scientific Creativity* (Madison : University of Wisconsin Press, 1985); *idem*, *Eighteenth-Century Chemistry as an Investigative Enterprise* (Berkeley: Office for the History of Science and Technology, 1989); Frederic L. Holmes and Trevor H. Levere, eds., *Instruments and Experimentation in the History of Chemistry*

(Cambridge, Mass.: MIT Press, 2000). See also Mi Gyung Kim, *Affinity, that Elusive Dream: A Genealogy of the Chemical Revolution* (Cambridge, Mass.: MIT Press, 2003).

[3] Thomas S. Kuhn, *The Structure of Scientific Revolution* (Chicago: The University of Chicago Press, 1970); Henry Guerlac, *Lavoisier--The Crucial Year: the Background and Origin of his First Experiments on Combustion in 1772* (Ithaca: Cornell University Press, 1961); Arthur Donovan, ed., "The Chemical Revolution: Essays in Reinterpretation," *Osiris* 4 (1988): 5-231.

[4] The chemical revolution is also defined by the spreading of the new nomenclature which depended strongly on the global/local dichotomy. An analysis of this issue can be found in Bernadette Bensaude-Vincent and Ferdinando Abbri, eds., *Lavoisier in European Context: Negotiating a New Language for Chemistry* (Nantucket: Science History Publications, 1995).

[5] Christophle Glaser, *Traité de la chymie* (Paris: Jean d'Houry, 1668); Nicolas Lémery, *Cours de chymie* (Paris: Lémery, 1675).

[6] Louis-Bernard Guyton de Morveau, Hughes Maret, François Chaussier, Jean-Pierre-François Guillot-Duhamel and Antoine-François Fourcroy, *Encyclopédie méthodique, chimie, pharmacie et métallurgie* (Paris: Panckoucke, 1786-1815).

[7] Ursula Klein, "Experiments at the Intersection of Experimental History, Technological Inquiry, and Conceptually Driven Analysis: A Case Study from Early Nineteenth-Century France," *Perspectives on Science* 13 (2005): 1-48.

[8] Sacha Tomic, *La pratique de l'analyse chimique et l'émergence de la chimie organique: une entreprise pluridisciplinaire (1790-1835)* (Rennes: Presses Universitaires de Rennes, coll. Carnot, forthcoming).

[9] Ursula Klein, *Experiments, Models, Paper Tools: Cultures of Organic Chemistry in the Nineteenth Century* (Stanford: Stanford University Press, 2003).

[10] Bernadette Bensaude-Vincent and Anders Lundgren, eds., *Communicating Chemistry. Textbooks and Their Audiences, 1789-1939* (Canton: Watson Publishing International, 2000); Bensaude-Vincent Bernadette, *Garcia Belmar Antonio, and Bertomeu-Sanchez José Ramon, L'émergence d'une science des manuels. Les livres de chimie en France (1789-1852)* (Paris: Éditions des archives contemporaines, 2003).

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