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Jonathan Simon, *Diphtheria Serum as a Technological Object: A Philosophical Analysis of Serotherapy in France 1894-1900*. Lanham, MD, and Boulder, CO: Lexington Books, 2017. x + 158 pp. Photos, tables, bibliography, and index. $90.00 U.S., £60.00 U.K. (print) ISBN 978-1-4985-3147-4; $85.50 U.S., £60.00 U.K. (eBook). ISBN 978-1-4985-3148-1.

Review by Michael A. Osborne, Oregon State University.

'Is medicine a technology?' Jonathan Simon's new book, a techno-philosophical study of pharmaceutical history and of a novel therapeutic agent, demonstrates how the medicine of microbes, and ideas about specific diseases, led to an array of technologies, both social and scientific. The study draws on archival research in Parisian institutions and municipal or departmental archives in Nancy, Lyon, Grenoble and elsewhere. At center stage is diphtheria, a disease striking all demographic groups, but weighing heavily on children and those over forty years of age. Diphtheria's main clinical signature, not always manifest, is a false membrane in the upper respiratory system capable of suffocating its victims and causing respiratory paralysis.

In some ways the book is indeed the *a*historical and philosophical book the author claims, but there are many details about French and German medical history, and about the pharmaceutical industries pivoting around the Pasteur Institute in Paris and Robert Koch's Institute for Infectious Diseases in Berlin. The book's trajectory resides somewhere between the French *épistémologue* tradition and Andrew Feenberg's philosophy of technological objects.[1] It evaluates the denaturing of blood, the animals used in serum production, the transformation of serum into a therapeutic agent, and serum production, distribution, and marketing. Thus Simon, like Feenberg and to some extent Thomas Parke Hughes focuses on the instrumentalisation of technological objects as well their multiple valences in technological systems and their social impacts.[2] A special merit of Simon's work is to treat German, French and some English aspects of the story and to do so without much reference to the scientific efficacy of the multiple diphtheria serums administered. He is interested in the medical profession's adoption of the technique, how it was labeled and branded, the iconography of how it was portrayed in the public sphere, and how it played out in the French legal regime at both the national and provincial levels.

The story is set in the last decade of the nineteenth century when the Dreyfus affair was claiming headlines. It charts from multiple angles the history of a therapeutic object born of the new sciences of bacteriology and immunology. The central research node of the story, the Pasteur Institute of Paris, had opened in 1888 as a foundation supported by international subscription. The celebrity of chemist Louis Pasteur's successful creation of a human rabies vaccine in 1885 lay behind this institutional innovation in French medicine, and by the 1890s the Institute provided training for foreign and French military and civilian researchers in bacteriology, microscopy, and an emergent science of virology. Notably, in 1894, the Swiss-born physician Alexandre Yersin, who had trained at the Pasteur Institute and Robert Koch's Institute for Infectious Diseases, isolated the plague bacillus in Asia. Koch's institute had opened in 1891 in the aftermath of the Tenth International Medical Congress. Yersin's rival in plague research, Shibasaburo Kitasato, also had a role in diphtheria research. In Berlin, Emil Behring and Kitasato had

published a fundamental study demonstrating how to induce immune reactions to diphtheria and tetanus in animals. The two men experimented on rabbits and mice and showed how these two diseases might be prevented by immunizing rabbits with attenuated tetanus or diphtheria microbes. They then collected blood serum from the animals that recovered and, crucially, transferred immune rabbit blood serum to mice which subsequently developed immunity. They also showed that the immune reactions to tetanus and diphtheria serum were specific. By 1891, experiments on three castrated rams had produced enough serum to treat a child at a Berlin clinic, and by 1893 a German chemical company had scaled up serum production using horses and was selling the serum. The French were about a year behind the Germans and produced large amounts of serum only in 1895. Franco-German scientific and medical rivalry had intensified after the French defeat in the Franco-Prussian War. Serum therapy played into the politics of the moment, and some French journalists, including one in the prominent newspaper *Le Figaro,* celebrated the discovery as an exclusively French achievement originating at the Pasteur Institute.

The Pasteur Institute did not have a pharmacist on staff in 1894 so it had no legal right to produce and distribute a serum defined more or less as a drug having curative properties. A law of April 25, 1895, designed as a stop gap measure pending comprehensive reform of French pharmacy, circumvented this issue by sanctioning distribution of serum without involvement of a pharmacist provided the phials were labeled as intended for the indigent. Yet pharmacists were not entirely absent from the distribution network. They retained the right to sell the therapy upon presentation of a prescription although physicians might administer it in emergencies without consulting a pharmacist. In 1896 the French Ministry of the Interior became the gatekeeper of production and distribution. Emile Roux, the co-founder of the Pasteur Institute who had worked on diphtheria since the early 1880s, had hoped the Pasteur Institute of Paris would be the sole French producer of serum. However, the Ministry of the Interior approved production for the Pasteur Institutes of Paris and Lille as well as for institutions and centers in Le Havre, Nancy, Lyon, and Grenoble. It later added centers in Marseille and Bordeaux to the approved list. Although the Pasteur Institute in Paris did not retain a monopoly over serum production, it was clearly the major player and was closely identified with serotherapy.

The French achievement became widely known in September 1894 after Roux announced it at a medical congress in Budapest. French mayors, physicians, and health officials quickly requested serum. Production in Paris fell short of these demands. The horse became the engine of serum production but meeting the needs of the provinces would have required dozens of horses and the Pasteur Institute had but a few. Roux restricted distribution of initial units to Paris hospitals. This meant that if individuals were wealthy enough to bring their children to Paris they might receive the treatment. Provincial physicians and civil officials were frustrated with Roux and pleaded for doses from Paris. His refusal was leveraged to build or enhance local institutions. This was the case in Lyon, where the head of a diphtheria ward at the city's hospital for children obtained a municipal bacteriological laboratory to diagnose diphtheria. Other provincial cities also furthered local agendas by capitalizing on the "scarcity" of diphtheria serum. In Nancy this led to the expansion of the teaching of bacteriology. Municipal authorities even pulled their subscription to the Pasteur Institute of Paris and redeployed the monies. To the south in Grenoble, a city which might have had some access to German vaccine via Switzerland, the municipality funded a new chair of bacteriology and serotherapy at its faculty of medicine and pharmacy. But production in Paris soon met and even surpassed demand and this caused something of a whiplash effect in the provinces. Few provincial institutes could compete effectively with Paris in terms of scale of production. After production ramped up in Paris, provincial serum production initiatives fell on hard times or were incorporated into civic medical schools or faculties. On balance the discovery of diphtheria serum promoted the teaching of medical microscopy rather than creating sustainable industries for serum production.

This book relates an entangled history of nationalism, bench research, and serum production. By 1889 Jules Simon in France had adopted a microbial definition of diphtheria, but not all clinicians had access to or used the tools needed to confirm the microbial nature of the disease. Moreover, the notion of the

asymptomatic carrier, someone who tested positive for the microbe but exhibited no symptoms, was not well established. This, and the cost, ensured the persistence of multiple diagnostic pathways for the disease. Even the definition of diphtheria itself was disputed; a variety of therapeutic options persisted for some time and laboratory manuals combined clinical symptomatology with Jules Simon's microbial definition. The situation gradually changed as elite French physicians took the Pasteur Institute's course in microbiology taught initially by Roux and Louis Martin.

So what was diphtheria's place in the health ecology of the French nation? Simon does not explicitly address this issue and most certainly tuberculosis killed more people. Diphtheria, however, claimed children in quantity, and one can read the disease as a destroyer of the innocent. Serum therapy for diphtheria was coded after the fashion of the rabies vaccine given to nine-year-old Joseph Meister. The science of vital statistics improved considerably over the long nineteenth century, but was it a sure indicator of health demography? It wasn't in the case of diphtheria. Records depended on how health authorities collected and summed up information. They also relied on what clinicians and health officials counted and reported as diphtheria. Even in the firmer corners of health statistics, mortality tables (as opposed to morbidity tables), were difficult to compare across borders. In 1881, for example, vital statistics from Paris tallied diphtheria's toll at 9.9 deaths per 10,000. London recorded a more enviable ratio of 1.7 deaths per 10,000 residents for the disease. The disparity, with Paris seemingly suffering nearly six times more deaths than London, may have signaled the need for French health actions against diphtheria. But as Simon points out a condition noted as "croup" was counted as diphtheria in France and likely inflated these figures. In contrast, mortality tables for London recorded "croup" as a separate disease. This circumstance signals again significant definitional problems for the disease itself and for determining its demographic footprint. It is indicative too of the myriad problems confronting medical quantification and nosology.

Diphtheria Serum as a Technological Object is a succinct book examining a pharmaceutical innovation and its dispersal and circulation across borders. It is clearly written and argued and merits inclusion in research libraries as well as in graduate seminars on the history of medicine, French institutional history, and the history of technology. It will also appeal to those interested in the scholarly turn toward object-based ontologies and how this perspective can illuminate pharmaceutical history.

NOTES

[1] Andrew Feenberg, *Questioning Technology* (London: Routledge, 1999).

[2] Thomas Parke Hughes, *Networks of Power: Electrification in Western Society, 1880-1930* (Baltimore: Johns Hopkins University Press, 1983).

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