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Aro Velmet, *Pasteur's Empire: Bacteriology and Politics in France, its Colonies, and the World*. New York: Oxford University Press, 2020. xiv + 306 pp. Notes, bibliography, illustrations, maps, and index. \$74.00 U.S. (hb). ISBN 9780190072827.

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Pasteur's Empire is a well-researched book exploring the circulation of disease and frames of hygienic modernity in the French empire from the mature Third Republic to the 1930s.[1] It asks how Pastorian methods and programs influenced politics and enabled French trajectories of colonial development inclusive of *mis-en-valeur* strategies. The linkages between what the author terms “bacteriological technoscience” (p.1) and imperial governance were many, and the study examines in detail strategies for the suppression and control of plague, tuberculosis, and yellow fever. It does not probe deeply into the disease conceptions of colonized peoples, some of whom, for example, combined notions of the germ theory of disease with spiritual etiologies.[2]

Chapter one focuses on the activities of Alexandre Yersin and concludes with Albert Calmette's thoughts on disease and empire. Both men served in Indochina and had followed Émile Roux's course on microbiology at the Paris Pasteur Institute. In 1891, a mere four years after the opening of the Pasteur Institute, the naval physician Calmette established a bacteriological laboratory in Saigon offering rabies vaccine and other services. Yersin joined him the next year, and in 1894, the same year France created an independent ministry of colonies, plague flared in Hong Kong and subsequently spread via British ships and other routes. Yersin traveled to Hong Kong where he criticized British containment methods and identified the causative agent of the disease (*Yersina pestis*) in a Chinese hospital. He soon distanced himself from broader ethnographic and geographical ideas of disease and general sanitation to focus on laboratory techniques undergirded by Koch's postulates and Pasteur's procedures. By 1898 a fellow Pastorian had identified the rat as a carrier of the plague bacterium. The result, according to Velmet, was a trio of technological solutions, “vaccination, steam disinfections, and deratization” (p. 31) which were transportable to other colonies. This elegant tripartite strategy held out the prospect of minimizing the quarantine of ships and goods, but, as with other diseases confronted by the Pastorians, suppressing plague proved difficult. Anti-plague serum had symbolic value as an aspect of the colonizer's power and knowledge, but producing it and other vaccines took time and resources. By the 1900s the Paris Pasteur Institute was the main producer of anti-plague serum. Further, Clayton machines for fumigation cost money and were not easily applicable in rural settings, and colonial governors could always point to tight budgets. Even the payment of bounties for catching rats in the sewers of Hanoi might be gamed by catching rats in the jungle and bringing in their tails for payment.

Chapter two investigates two lesser-known applications of Pastorian methods to agribusiness intoxicants: one directed at Vietnamese rice wine and another aimed at opium production. Both commodities became licensed monopolies controlled mainly by French corporations. They also garnered substantial tax revenue, and Calmette acted as a consultant for the distillation of alcohol and for the purification of opiates. Colonial decree required rice wine to contain at least 35% alcohol to be licensed, a goal not easily achieved by indigenous or some Chinese distilleries. This effectively created a patchwork of French-controlled monopolies throughout Southeast Asia, but as Velmet notes, at least some Vietnamese consumers did not like the new scientific and ostensibly pure rice wine. Calmette had been interested in opium production since 1891 and was able to reduce the time of fermentation in the laboratory, but the process failed in the factory. Both industries became the focus of a policing regime directed at contraband, and opium production and its problems, including the spread of its use to colonial troops, signaled a failure of the French colonial mission.

In 1992 Anne Marie Moulin signaled the patriarchal nature of the overseas Pasteur Institutes, and chapter three extends this theme by examining gender and scientific personae in the careers of Yersin and Charles Nicolle.[3] Velmet draws on Robert Nye's studies of French masculinity and honor and Gerald Geison's biography of Pasteur, which contrasted his public pronouncements with conflicting evidence found in his notebooks.[4] The norms of what counted as a scientific persona varied between metropolitan Paris and colonial postings and even among different colonial postings. French colonies were of varied origins and operated under different legal regimes and legacies. Algeria, for example, really the only settlement colony, had been governed as an army colony prior to the Third Republic. The varied geographical elements of French Indochina, in contrast, had been under the control of the navy. According to Velmet, the public values of the Paris Pasteur Institute and presumably the scientific personae displayed by researchers in its community, stressed asceticism, restraint, and in the case of Émile Roux, Pasteur's successor, a modest demeanor. One journalist likened the Paris operation to a disciplined scientific factory laboring for the good of humanity. The Paris Pasteur Institute would eventually produce many pharmaceuticals, yet Roux, in particular, feared that commercial activity would compromise the science and reputation of the institute. The very structure of the institution enhanced its patriarchal and monastic elements as many researchers lived on site but would move out upon marriage.

In the colonies, some Pastorians adopted a more freewheeling, commercial, adventurous, and overtly masculine style. The study of human-parasite ecology demanded at least some study of tropical diseases in the field as well as in the laboratory. Publicized colonial geographical and ethnological expeditions and other heroics had value and lent credibility. Yersin, who obtained a camera from Paris and recorded his exploits and travels, leveraged these activities and could point to them in negotiations with local officials. Colonial Pasteur institutes like the one in Saigon relied on funding from colonial governments, and governors-general changed frequently. Yersin realized that this was perilous, and he acquired land for rubber plantations and eventually used the proceeds to support scientific research in Indochina. Both Roux and Calmette criticized these efforts. More entrepreneurial still was Charles Nicolle who became director of the fledgling Pasteur Institute in Tunis in 1902. Nicolle worked on many different diseases but especially on typhus where he identified lice as the vector of the disease and later won the 1928 Nobel Prize in Physiology or Medicine. He hoped to commercialize a typhus vaccine but hid the project from Roux and sought unsuccessfully to succeed him as director of the Paris institute.

The remainder of the book considers how Pastorians addressed tuberculosis in the colonies, the development of the BCG (bacillus Calmette-Guérin) vaccine, and French, British, and American actors working on yellow fever. Aided by industrialization and urbanization, tuberculosis became the largest cause of adult mortality in nineteenth century Europe. While generally neglected in earlier colonial contexts, by the 1920s Pastorians had linked it to Europeans acting as a main vector of the disease and to the dynamics of the colonizing process itself. Colonial contexts, then, came to be regarded as virgin soil for the expansion of tuberculosis. Paleopathology, of course, has shown us that this is not true, since some mummies from Egypt show advanced cases of tuberculosis. Yet the virgin soil trope was a powerful rhetorical device, and although Velmet does not mention it, earlier European studies of venereal disease and colonial demography also implicated Europeans as carriers of disease. The screening for tuberculosis of recruits in World War I and disease surveys of veterans and others opened up the view that the disease was vastly more prevalent than previously thought. It was also something requiring intervention on a grand scale. Velmet charts how Pastorians and agents of the Rockefeller Foundation's International Health Division refashioned the disease into a trans-imperial object of major concern. Calmette, in particular, called attention to the microbe. By 1924 Calmette and his collaborator, Camille Guérin, had developed BCG or tuberculin vaccine from an attenuated virus. He would later furnish free vaccine produced at the Pasteur Institute in Lille to colonial doctors. In this way colonial subjects became a resource for scaling up BCG production and for trials of its therapeutic efficacy.

Tuberculosis was an abiding problem in France and elsewhere, and a 1913 report signaled that mortality figures from tuberculosis in the city of Paris were twice that of New York. Yet the European medical market was slow to embrace BCG. Critics pointed to BCG's 1929 deployment in Lübeck which led to the death of seventy-two infants. A subsequent trial ensued and seemed to confirm not the efficacy of BCG but of social hygienic methods inclusive of disease avoidance. Calmette refused to go to the Lübeck trial and claimed his work had nothing to do with the disaster. The strategy worked but Calmette emerged with a sullied reputation. Anti-tuberculosis leagues, international organizations such as the League of Nations Health Organization, and medical professionals themselves brought additional attention to the recalcitrant disease. Tuberculosis was frequently treated by isolating sufferers in sanatoria, climatic therapies, and surgical intervention. As many as one in three sanatoria patients underwent a risky artificial pneumothorax operation designed to collapse a lung and give the diseased pulmonary tissue time to rest. Acceptance of BCG expanded in France but stalled in other European nations. What we would term medical ethics was at best a muddled affair in interwar France and the colonies, and colonized peoples opened up new vistas for vaccine trials. Whatever ethical norms were operant in the metropole were likely less functional in the colonies. The move to the colonies was also driven by fears of demographic decline and pro-natalist activities, both energized by the desire for French recovery from the Franco-Prussian War and World War I.

The early overseas Pasteur Institutes and French authorities were not particularly attentive to improving the health of colonial subjects, although they acted as conduits for rabies and smallpox vaccines and other therapeutics. An Assistance Médicale Indigène (AMI) was founded in 1905, and by 1924 the Minister of Colonies, Édouard Daladier, focused more closely on the health of colonized peoples, especially on maternal health, birth rates, and afflictions compromising the health of laborers and soldiers.^[5] Calmette and other Pastorians inserted BCG vaccine into Daladier's program. On balance, administrators in the colonial world regarded BCG as efficacious even while much of Europe remained skeptical. By the late 1920s Constant Mathis, director of

the Pasteur Institute in Dakar, was testing BCG on Senegalese troops destined for service in the metropole. After performing tuberculin skin tests on more than 1,800 men to detect the presence or absence of the disease, he divided the men into two groups: One group received BCG and the other acted as a control group. But follow up proved difficult and the only members of the group documented as contracting tuberculosis were from the vaccinated group. A subsequent test of BCG's efficacy, organized at the Algiers Pasteur Institute, involved about 40,000 subjects and ran for twenty-six years. But again, results were inconclusive. Indochina also hosted BCG trials that quickly became entwined with labor negotiations and criticism of the AMI's commitment to rural health. Only after World War II, when BCG was administered in Eastern Europe, did evidence emerge of the vaccine's efficacy.

A concluding section examines medicine, race, and yellow fever in West Africa from an outbreak in 1927 through the development of effective vaccines. It effectively leads readers through the complicated history of cultivating, attenuating, producing, and deploying the two effective vaccines. Here the story is very much of international actors including Pasteur Institute scientists, the Rockefeller Foundation's West Africa Yellow Fever Commission, and the Harvard Professor A. Watson Sellards, who acted as a go between. Dakar had become the capital of French West Africa in 1902 and was a dynamic international commercial hub peopled with Syrian traders, Africans, and French. Yellow fever, initially thought to strike primarily Europeans, had long tortured the region. Velmet argues that the 1927 outbreak raised concern by recalling the collective memory of a disastrous 1878 epidemic and offered Pastorians an invitation for study. More proximate touchstones of memory existed, and members of the Paris Pasteur Institute had been there before. For example, a 1901 Pasteur Institute mission to Senegal had yielded an extremely detailed report which noted times, dates, progression, and location of disease victims. Even the exact hospital beds where the victims died were mapped and recorded. The 1901 investigators in West Africa had no agreed upon vector for the disease, although the preliminary results of the Walter Reed Commission in Cuba, which identified the mosquito as the agent of transmission, were known by April 1901. [6] Once the mosquito was recognized as a vector, local commercial interests in Dakar seized upon the discovery and would argue that mosquito eradication would be less costly than general cleanup of the massive Dakar harbor. There was also danger to France itself, for when yellow fever erupted, steam ships filled up with fleeing passengers.

This book is an important and readable contribution to the literature on disease and empire. It is especially strong on the history of international health practices, the politics of the French empire, and the legacy left to global health. A minor quibble about the book is that readers who want to examine citations will have a hard time of it as the end notes are presented without chapter titles or headers indicating page ranges. That objection aside, the book is particularly valuable for understanding how colonial contexts modified metropolitan medical practices and how the focus of Pastorians on disease-causing organisms played into and could alter politics. In this telling Western medicine and disease were no mere subsets of the colonizing process but enlivening, problematic, and often gendered elements of it.

NOTES

[1] For pre-germ theory efforts to confront and suppress epidemic disease in the Mediterranean inclusive of colonial Algeria see Benoît Pouget, *Un choc de circulations: La puissance navale française face au cholera en Méditerranée, 1831-1856* (Rennes: Presses Universitaires de Rennes, 2020).

[2] On syncretism between bacteriological medicine and North African disease conceptions see Hannah-Louise Clark, “Of Jinn Theories and Germ Theories: Translating Microbes, Bacteriological Medicine, and Islamic Law in Algeria,” *Osiris* 36 (2021): 1-22.

[3] Anne Marie Moulin, “Patriarchal Science: The Network of the Overseas Pasteur Institutes” in Patrick Petitjean, Catherine Jami, and Anne Marie Moulin, eds., *Science and Empires: Historical Studies about Scientific Development and European Expansion* (Dordrecht, The Netherlands: Kluwer Academic Publishers, 1992), pp. 307-322.

[4] Robert A. Nye, “Medicine and Science as Masculine ‘Fields of Honor,’” *Osiris* 12 (1996): 60-79; Gerald Geison, *The Private Science of Louis Pasteur* (Princeton, NJ: Princeton University Press, 1995).

[5] Sokhieng Au, *Mixed Medicines: Health and Culture in French Colonial Cambodia* (Chicago: University of Chicago Press, 2011).

[6] Ilana Löwy, *Virus, moustiques et modernité: La fièvre jaune au Brésil entre science et politique* (Paris: Éditions des archives contemporaines, 2001), p. 70.

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