

Tropical Medicine and Bacteriology in Boston and Peru: Studies of Carrión's Disease in the early Twentieth Century

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Recent historical studies on medicine as a tool of empire have underlined the importance of local perceptions and responses when analysing the strategies and impact of European and North-American powers in various regions of the globe.¹ These studies have suggested that the development of tropical medicine has not been a one-way street, that the rich texture of local societies occupied a central place in this process, and that authority had to be negotiated and accommodated by recipients who were able to redefine imported ideas and institutions.² This article adds to this literature by using comparative history and by suggesting that developments in the so-called “periphery” provide crucial insight into the work of the metropolitan scientific centres.

This article analyses the achievements and difficulties confronted both by Peruvian researchers trying to reinforce a local medical culture in a poor country and by U.S. investigators endeavouring to persuade philanthropic sponsors of the need to establish tropical medicine as an independent academic subject. The story takes place in early twentieth-century Peru, a country that in the wake of its defeat in the War with Chile (1879–1883) initiated a process of national reconstruction and modernization based on an agreement with foreign bondholders. This included ceding control of its railroads for sixty-six years, the arrival of major U.S. investments which displaced the dominant

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¹ Some examples of the literature are: David Arnold, *Colonizing the body: state medicine and epidemic disease in nineteenth-century India*, California University Press, 1993; Mark Harrison, *Public health in British India: Anglo-Indian preventive medicine 1859–1914*, Cambridge University Press, 1994; Nancy Stepan, *Beginnings of Brazilian science: Oswaldo Cruz, medical research and policy, 1890–1920*, New York, Science History

Publications, 1981; Julyan G Peard, ‘Tropical medicine, society and race: the case of the Escola Tropicalista Bahiana, Brazil, 1860–89’, in Antonio Lafuente (ed.), *Mundialización de la ciencia y cultura nacional*, Madrid, Doce Calles, 1993, pp. 563–72; Steven C Williams, ‘Nationalism and Public Health: the convergence of Rockefeller Foundation Technique and Brazilian Federal Authority during the time of yellow fever, 1935–1930’, in Marcos Cueto (ed.), *Missionaries of science: the Rockefeller Foundation and Latin America*, Bloomington, Indiana University Press, 1994, pp. 23–51; and Marcos Cueto, ‘Sanitation from above: yellow fever and foreign intervention in Perú, 1919–1922’, *Hispan. Am. hist. Rev.*, 1992, 72: 1–22.

² On a related perspective, for a study of how eugenics varied in content and form in Latin America, Nancy Leys Stepan, *“The Hour of Eugenics”: race, gender, and nation in Latin America*, Ithaca, Cornell University Press, 1991.

position of British interests in the country, the export of a variety of both agricultural and mineral products that reduced its vulnerability to international price fluctuations, and the emergence of a civilian political elite that ruled the country between 1895 and 1919 under a democratic system of controlled elections.³

During the early twentieth century, Peruvian bacteriological research occurred almost exclusively in Lima, the capital city, and concentrated mainly on native illnesses, particularly human bartonellosis, a puzzling disease unique to the Andes, also known as Carrión's disease. These studies became an important ingredient of an emerging medical culture.⁴ The findings of Peruvians were challenged by Harvard scientists, members of an ephemeral School of Tropical Medicine in Boston, who organized two expeditions to Peru. This controversy also reveals the different role played by tropical studies in two countries with very different degrees of economic, social and scientific development, and the contingency and validation of knowledge in tropical medicine in Boston and Peru during the early twentieth century.

Carrión and the Disease

The eponym Carrión's disease was used to honour a medical student who was interested in understanding two diseases which were considered to be different clinical entities: verruga peruana (literally Peruvian wart) and Oroya fever. The former had been known since pre-Hispanic times, and was recognized as a nodular eruption on the skin which might last from a few weeks to several months. These skin eruptions were unlike those produced by other types of warts found in the rest of the world (hence the name verruga peruana).⁵

Factual data on Oroya fever dated from 1870, when an epidemic of fever and anaemia killed thousands of workers who were building the trans-Andean railway from Lima to La Oroya, a major mining town. Because the epidemic was not followed by a geographical spread of the disease, medical authorities named it "Oroya fever".⁶ The delay in recognizing Oroya fever (in contrast with verruga) is attributed to the fact that its main symptoms, fever and anaemia, could be confused with many diseases.

The government, the British Central Railroad Company, which operated all trains in the country, and, after 1901, the U.S. Cerro de Pasco Cooper Corporation, which used the Andean Central Railway to get its minerals to Lima, were very much concerned by Oroya

³ For an overview of this period, see Rosemary Thorp and Geoffrey Bertram, *Peru 1890–1977: growth and policy in an open economy*, New York, Columbia University Press, 1978, pp. 21–111.

⁴ See Myron G Schultz, 'A history of bartonellosis (Carrión's disease)', *Am. J. trop. Med. Hyg.*, 1968, 17: 503–16; David Weinman, 'Bartonellosis', in David Weinman and Miodrag Ristic (eds), *Infectious blood diseases of man and animals*, New York, Academic Press, 1968, vol. 2, pp. 3–24.

⁵ The first full clinical description of the disease was Tomás Salazar, 'Historia de las verrugas', *Gaceta Médica de Lima*, 1858, 2: 161–4. For the pre-Columbian origin of the disease, see M J Allison, A Pezzia, E Getzen, D Mendoza, 'A case of Carrión's

disease associated with human sacrifice from the Huari culture of southern Peru', *J. physical Anthropol.*, 1985, 41: 295–300; Raoul d'Harcourt, *La médecine dans l'ancien Pérou*, Paris, Librairie Maloine, 1939; and Pablo Patrón, *La verruga de los conquistadores del Perú*, Lima, *La Crónica Médica*, 1889.

⁶ The disease did not exist in La Oroya, the name simply reflected the final point of the railroad. R P Strong, C E Tyzzer, C T Brues, A W Sellars, and J C Gastiaburu, 'Informe preliminar de la primera expedición del Departamento de Medicina Tropical de la Universidad de Harvard a Sud América', *La Crónica Médica*, 1914, 31: 3.

fever because the Central Railway was the chief artery of transport between the coast and the mining centres in the central Andes. Many lives were lost to the disease every time the line was repaired or rebuilt.

Verruga peruana and Oroya fever attracted the attention of students and professors of the School of Medicine in Lima which was part of Peru's main University, San Marcos, and the only medical school in the whole country. In August 1885, a medical student, Daniel A Carrión, seeking to understand the pre-eruptive symptoms of verruga peruana, asked a fellow student to inoculate him with blood from a hospital patient afflicted with the disease. After an incubation period of twenty-one days, Carrión showed no sign of warts, but he began to suffer from fever and anaemia, the two main symptoms of Oroya fever. A few days before he died, Carrión claimed that both diseases had the same origin.⁷ Other Peruvian doctors had previously maintained that verruga peruana and Oroya fever were manifestations of the same disease, but these statements appeared only as comments made in medical circles.⁸

Initially, some authorities reacted to Carrión's death negatively.⁹ This was partly because Carrión did not use in his inoculation any of the scientific resources available at the time, such as microscopic observation of the inoculated blood or bacteriological blood cultures. A delayed autopsy produced insufficient evidence to conclude whether Carrión died of Oroya fever or of a form of septicaemia.¹⁰ In response to the criticism, and to the threat of a lawsuit by the sub-prefect of Lima, Carrión's fellow students launched a campaign extolling him as a hero of science who had demonstrated that the two native illnesses shared the same origin.

Within a few years, Carrión's experience became an exemplary component of an emergent medical culture in Peru. Carrión's behaviour was presented as similar to that of famous European researchers of the nineteenth century who had experimented on themselves and their associates with virulent microbes.¹¹ Thus Carrión was converted into a "martyr" of Peruvian medicine and his inoculation became a "sacrifice" for science.¹² Subsequently, Peruvian physicians used the term "Carrión's disease" rather than verruga peruana or Oroya fever, and elaborated a so-called "unifying" (in Spanish *unicista*) explanation of the origin of the two diseases.

⁷ The literature on Carrión is abundant and usually repetitive. See Luis Antonio Eguiguren, *El Estudiante de medicina Daniel A. Carrión (proceso judicial sobre su gloriosa muerte)*, Lima, Editorial Aurora, 1941; Juan B Lastres, *Daniel A. Carrión*, Lima, Editorial San Marcos, 1957; Francisco Linares Cabrera, 'Influencia de la vida y obra de Daniel A. Carrión en la historia de la medicina peruana', BA thesis, Universidad de San Marcos, 1958; José B Peñalosa Jarrín, 'Daniel A. Carrión, hombre de ciencia (con documentos inéditos)', BA thesis, Universidad de San Marcos, 1958; David Frisancho Pineda y Oscar Frisancho Velarde, *El Estudiante, la verruga y la muerte*, Lima, Editorial Los Andes, 1986, and Oscar G Pamo Reyna, *Daniel A. Carrión*, Lima, Editorial Visión Peruana, 1987.

⁸ David Matto, 'Discurso leído en la sesión del 5 de Octubre de 1886', *La Crónica Médica*, 1886, 3: 376–80.

⁹ According to a former dean of the Medical Faculty: "Science has gained little, discredit of the profession has increased and the precious existence of an unwary young student has been snatched away." Ignacio La Puente, 'Una víctima de la ciencia', *El Campeón*, 6 Oct. 1885, reproduced by Casimiro Medina (ed.), *La verruga peruana y Daniel A. Carrión*, Lima, Imp. del Estado, 1886, pp. 67–8.

¹⁰ Myron G Schultz, 'Daniel Carrión's experiment', *New England J. Med.*, 1968, 278: 1323–6.

¹¹ On self-experimentation, see Lawrence K Altman, *Who goes first?: the story of self-experimentation in medicine*, New York, Random House, 1986.

¹² For an illuminating account of the process of the glorification of Carrión, see Uriel García Cáceres, 'Historia crítica de Daniel A. Carrión y de la medicina de su época', PhD diss., Universidad Peruana Cayetano Heredia, 1970.

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The appearance of such a hero contributed much to the professional identity and public legitimation of Peruvian medical doctors. During the late nineteenth century in the major Peruvian cities, San Marcos' physicians had to compete with Indian healers (the occupations of herbalist, healer and sorcerer were not strictly separated in the Indian culture), itinerant quacks (who were sometimes Europeans) and Chinese herbalists (who were part of an urban Chinese colony created by the importation of Chinese indentured labour during the nineteenth century). The assumption that modern medicine and western science was superior to any other form of knowledge was instrumental in displacing those health practitioners who were foreigners or who were not members of the upper and middle classes. Furthermore, Carrión's experience gave physicians a hero, casting around them an aura of civic virtue.

After Carrión, Peruvian doctors regarded the two diseases as the severe and the mild forms of the same illness. The development of a wart eruption was regarded as an indication of a favourable outcome, and irritants were applied to the skin of patients with Oroya fever to induce early appearance of the skin lesion. The first comprehensive description of Carrión's disease, written in French and published in Paris by the Peruvian physician Ernesto Odriozola, drew the attention of European scientists to a peculiar disease believed to occur only on the western slopes of the Andes at altitudes of between 800 and 1,500 metres.¹³

Odriozola's book was a landmark for Peruvian physicians who championed a French-influenced medical culture based on a combination of clinical and geographic observations that did not seek to integrate the medical systems used by indigenous healers.¹⁴ This culture emphasized the specific climatic characteristics of Peru like the fact that, despite its location in a tropical latitude, the coast is mostly arid, has a mild temperature and little rainfall because of the combined effects of the Andes and cold Pacific currents. The book was also instrumental in underlining the beliefs of Peruvian physicians that the understanding of the unique medical geography of Peru demanded prolonged clinical practice and observation and that usually foreign physicians were ignorant of the crucial relationship between Peruvian topography and illness, partly because they came with preconceived medical ideas or remained only briefly in the country.

Odriozola's work sustained the belief in the etiological unity of the two illnesses using only clinical and geographical evidence (the two conditions occurred in the same locations). In addition, he and other Peruvian physicians, such as Edmundo Escomel, noted that persons who contracted verruga did not suffer from a second attack; nor did they contract Oroya fever, and vice versa. Despite the fact that Escomel had trained in France as a bacteriologist, most of his studies on Carrión's disease were of an anatomical

¹³ Ernesto Odriozola, *La Maladie de Carrión ou la verruga péruvien*, Paris, Carré et Naud, 1898. Later studies established that Carrión's disease can also be found on the eastern side of the Andes. See David Weinman, *Infectious anemias due to bartonella and related cell parasites*, Philadelphia, American Philosophical Society, 1944, p. 273.

¹⁴ On medical geography, see Henry E Sigerist, 'Problems of historical-geography pathology', in

Henry E Sigerist on the sociology of medicine, ed. Milton I Roemer, New York, M. D. Publications, 1966, pp. 299–307. The Peruvian medical culture that emphasized the uniqueness of its medical geography can be traced to a physician of the turn of the nineteenth century, Hipólito Unanue. See John E Woodham, 'The influence of Hipólito Unanue on Peruvian medical science, 1789–1820: a reappraisal', *Hisp. Am. hist. Rev.*, 1970, 50: 693–714.

and clinical nature.¹⁵ The perception of Carrión as a medical hero and the local tradition that emphasized clinical observation and medical geography contributed to the main assumption of Peruvian bacteriology, namely that Oroya fever and verruga peruana had the same etiology.¹⁶

The Reception of Bacteriology

Local resources in bacteriology appeared in Lima at the turn of the twentieth century as a result of European influence in the school of medicine and a more sophisticated response to a plague epidemic. At this time, various Peruvians were trained in Paris and London, such as Ricardo Flores, who donated a bacteriology laboratory to the Faculty, and David Matto, who was hired in 1890 on a permanent basis to fill the chair of bacteriology, a position he held until 1914.¹⁷ At least as important for the rise of bacteriology, was the bubonic plague epidemic that attacked the Peruvian coast in 1903. Plague provided the immediate stimulus, and political occasion, for the creation of new state and municipal-supported institutions concerned with bacteriological research.¹⁸

The fragile margin between basic and applied research in their specialty permitted bacteriologists to attract support for research by arguing that science was a powerful tool in the detection, prevention and cure of infectious diseases which ravaged the country. More regular support was given to bacteriology because of the need to produce sera and vaccines, study native illnesses, and control the use of insecticides and disinfectants. These measures were considered necessary to protect the urban and port populations, to attract coveted European immigrants, and to foster trade and investment in the rising export economy of Peru. Thus, by the early 1900s bacteriological laboratories existed at the Instituto Nacional de Vacuna y Seroterapia (which depended upon the Dirección de Salubridad Pública, a branch of the Ministry of Development); the Instituto Municipal de Higiene, which was directed by the Italian bacteriologist Ugo Biffi; and in some hospitals including the magnificent Hospital Dos de Mayo, used for clinical instruction, and the Hospital Guadalupe at Callao, the chief seaport of Peru located eight miles west of Lima.

Some of the physicians trained in bacteriology by Matto at San Marcos University found positions in these new institutions. Oswaldo Herculles, whose thesis was an histological study of Carrión's disease, became, in 1906, director of the bacteriological laboratory of the Dos de Mayo hospital, where he was able to form a small staff of researchers. Herculles' career suggests the lack of specialization of the first Peruvian bacteriologists and their combination of different medical paradigms since, in addition to his position as chief bacteriologist at the hospital, from 1910, he was also professor of pathological anatomy at San Marcos.¹⁹

¹⁵ Edmundo Escobel, *Anatomie pathologique du verruome de Carrión*, Paris, Masson, 1902.

¹⁶ Uriel García Cáceres and Fernando U García, 'Bartonellosis, an immunodepressive disease and the life of Daniel Alcides Carrión', *Am. J. clin. Path.*, April 1991, 95: 58–66.

¹⁷ David Matto, 'Bacteriología, lección de apertura del curso', *La Crónica Médica*, 1892, 9: 179–84; and

'David Matto, 1859–1914, noticia necrológica', *La Crónica Médica*, 1914, 31: 353–9.

¹⁸ See Marcos Cueto, 'La ciudad y las ratas: la peste bubónica en Lima y en la costa peruana a comienzos del siglo veinte', *Histórica*, 1991, 15: 1–26.

¹⁹ On Herculles, see Jorge Avendaño, *Perfiles de la medicina peruana*, Lima, Universidad de San Marcos, 1983, pp. 33–4.

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Early Peruvian bacteriologists displayed originality and perseverance in their work. By the turn of the century, bacteriological research could be undertaken at the centres mentioned above, each of which possessed such essentials as microscopes, glassware, bacteriological stains, specialized literature and trained staff. Peruvian scientists allocated these resources to the study of native illnesses, in particular Carrión's disease. Solving its etiology offered the opportunity to associate the name of the discoverer with an emerging national medical tradition. Peruvians were aware that European, American and Japanese scientists were determining the etiology of many infectious diseases, but the search for the causative agent of verruga peruana and Oroya fever was a research area where competition was initially limited to Peruvians. As in other cases of emerging disciplines in Latin America, the bacteriology of a disease specific to a country became the focus of a local research tradition because of the comparative advantages enjoyed by local scientists.²⁰

The medical theses of San Marcos stand out among the first bacteriological studies of Carrión's disease. Notable among them was that of Alberto Barton, born in 1871, a son of British immigrants, who became the key figure among local bacteriologists. In his 1901 thesis, Barton identified and described foreign bodies in the red blood cells of Oroya fever patients. Barton considered these bodies to be the causative microbe of Carrión's disease, and they became known as the "Barton bacillus".²¹

However, Manuel O Tamayo, who studied at the Pasteur Institute in Paris and replaced Biffi as chief bacteriologist at the Instituto Municipal de Higiene in 1903 when the Italian returned home, demonstrated that although the so-called "Barton bacillus" existed, it was not the pathogenic agent of Carrión's disease.²² Later research proved that Barton had described an already known bacteria of the coli-typhoid group.²³ For years, Tamayo and Julio César Gastiaburu, his colleague at the Instituto, argued that Barton's bodies were red cell alterations, of value in the diagnosis of Oroya fever, but not the causative agent.²⁴

Barton recognized his mistake, and decided to complement his training by seeking a government fellowship to study at the School of Tropical Medicine in London. In 1905 he was back in Lima, working again on the etiology of Carrión's disease. Based on new studies, Barton announced in 1909 the discovery of the causative agent.²⁵ This time Barton was certain that the filamentous bodies he had identified in the blood of Oroya fever patients, in the form of bacilli, were different from any other known organisms. It is interesting to note that the central aspect of Barton's work was its morphological

²⁰ A similar case is the work of the Brazilian Carlos Chagas's on *Trypanosoma cruzi*. See 'Carlos Chagas', in Charles Coulston Gillispie (ed.), *Dictionary of scientific biography*, New York, Charles Scribner's sons, 1976, vol. 3, pp. 185–6.

²¹ The thesis appeared as a book, Alberto Barton, *El germen patógeno de la enfermedad de Carrión*, Lima, Librería E Moreno, 1901.

²² Manuel O Tamayo, 'Apuntes sobre la bacteriología de la enfermedad de Carrión', *Gaceta de los Hospitales*, 1905, 2: 516–29.

²³ According to one author Barton rediscovered the organism that caused typhoid fever, a microbe which had been already studied by Ebert in 1880. Hugo Vizcarra Franco, 'Contribución histórica en el

descubrimiento de la bartonella', PhD diss., Universidad de San Marcos, 1973, p. 147.

²⁴ Manuel Tamayo, 'Un ensayo de vacunación contra los tifosímiles de la verruga febril', *La Crónica Médica*, 1906, 23: 295–305; and Manuel O Tamayo and Julio Gastiaburu, 'Un ensayo de clasificación de los similitíficos de la verruga febril', *La Crónica Médica*, 1907, 24: 321–32. See also Ernesto Odriozola, *Estado actual de nuestros conocimientos acerca de la enfermedad de Carrión o verruga peruana*, Lima, La Opinión Nacional, 1908.

²⁵ Alberto Barton, 'Descripción de elementos endoglobulares hallados en los enfermos de fiebre verrucosa (artículo preliminar)', *La Crónica Médica*, 1909, 26: 7–10.

description of a new microorganism. Barton limited himself to describing the exterior characteristics of the bacilli and to indicating the most appropriate stains for their observation. He pointed out that the bacilli multiplied themselves in the Oroya fever victims, and decreased in numbers, until they almost disappeared, when the patients broke out in warts. From this observation he deduced that Oroya fever was an hypertoxic form of verruga peruana, in other words, that both clinical conditions were different manifestations of the same disease.

Later Barton was credited with establishing that Carrión's disease has a first, hematic, phase, known as Oroya fever, in which the intracellular bodies parasitize and destroy the red blood cells of the patient, who manifests extreme anaemia. Oroya fever was considered generally fatal (before antibiotics the mortality rate has been estimated at between 30 to 70 per cent of severe cases). Verruga peruana, the second phase, is characterized by cutaneous eruptions and is usually not fatal. This phase generally signifies the patient's recovery when the *Bartonella bacilliformis* bacteria in the blood reduce in number or disappear.²⁶

However, most contemporary Peruvian researchers did not accept Barton's findings. For many, the microbes reported by Barton in 1909 were no more than cellular degenerations, of value in the diagnosis of Oroya fever, but not the causative agents of the disease.²⁷ For example, Carlos Monge Medrano, who studied at the School of Tropical Medicine in London between 1911 and 1912, wrote in 1912, "Up to the present time no one has succeeded in finding the specific cause of the infection".²⁸ This conclusion can be understood as a result of the mistrust produced by Barton's earlier mistake and, even more important, his peripheral position in the fragile group of Peruvian bacteriologists. These scientists were all concentrated in Lima, they did not have a local specialized journal but used the main medical journals like *La Crónica Médica*, and never organized an independent scientific society but were members of general medical societies like the Academia Nacional de Medicina and the Sociedad Médica Unión Fernandina.

After returning from England, Barton was unable to find a position in the university and worked for years as the director of the laboratory of the Hospital Guadalupe of Callao, a second-class facility compared to other laboratories in Lima. Barton gave little importance to publication while other bacteriologists were remarkably overproductive. Barton's entire scientific work between 1901 and 1946 (mostly during the first two decades of the twentieth century) amounted to a total of 13 publications (including books, pamphlets and academic articles). By contrast, Edmundo Escomel, a contemporary who worked not only in bacteriology, had by 1929 a total of 354 medical and scientific publications to his credit. Monge Medrano, thirteen years younger than Barton, published between 1912 and 1925 a total of 54 articles. Monge's work was mainly related to tropical diseases and was done before the research in high-altitude physiology which made him well-known all over the

²⁶ On the mortality rate and other aspects of the disease, see Oscar Urteaga-Ballón, 'Carrión's Disease', in Kenneth F Kiple (ed.), *The Cambridge world history of human disease*, Cambridge University Press, 1993, pp. 631–5.

²⁷ A scientist recalled the scepticism that Barton had to confront: "no one wanted to believe in [Barton's bodies'] lively nature and even less to

suppose that they were the pathogenic agents of the Peruvian wart", Raul Rebagliati, *Verruga peruana: enfermedad de Carrión*, Lima, Imp. Torres Aguirre, 1940, p. 33.

²⁸ Carlos Monge Medrano, 'Carrión's disease or verruga peruana', *J. Lond. Sch. trop. Med.*, 1912, 1: 163–8.

world.²⁹ For Peruvian scientists such as Escomel and Monge Medrano overproduction was crucial to attract local recognition and support, although it was frequently achieved through studies of very specific clinical cases and repetition of data. Barton's low rate of publication reduced his visibility and made recognition more difficult. Around 1920, he abandoned research and medical practice to work in the soft drinks industry, becoming a successful entrepreneur in Peru.

While Peruvian bacteriologists were uncertain of Barton's findings of 1909, during the 1910s European and U.S. investigators became interested in Carrión's disease. One of the first Americans who worked on it was the entomologist Charles Townsend. He was hired by the Peruvian government in 1913 for a series of studies, including a search for the vector of Oroya fever. Some local physicians thought a mosquito was the carrier.³⁰ Believing that Carrión's disease and Rocky Mountain spotted fever had a similar mode of transmission, Townsend began by considering ticks and lizard mites as probable vectors.³¹ After obtaining negative results, he searched for an insect whose distribution and habits fitted the geography and night-time exposure of humans. Townsend identified a nocturnal sandfly, known as *titira*, which was the vector of Oroya fever (then named *Phlebotomus verrucarum* and today known as *Lutzomyia verrucarum*).³²

Another American scientist who became very interested in Carrión's disease was Richard P Strong. In 1913 a commission of Harvard scientists directed by Strong visited Lima and confirmed that the bacillus discovered by Barton was a new organism. Only then was Barton given local recognition for his finding of 1909. Strong was a leading figure of tropical medicine in the USA, and his involvement with a Peruvian disease is better understood against his wider background.

Strong and Harvard

Trained at Johns Hopkins Medical School, Richard P Strong was a physician serving as a first lieutenant in the Army when in 1901 he was appointed to head a board to investigate tropical diseases in the Philippines. His work was part of the military concern with diseases in occupied tropical and semi-tropical territories like Cuba and the Philippines. After finishing his investigation, he was induced to resign from the Army to organize and

²⁹ The number of publications is taken from the detailed accounts that appear in 'Bibliografía de Alberto Barton', *Anuario bibliográfico peruano 1949-1950*, Lima, Biblioteca Nacional, 1954, pp. 305-7; 'Títulos, comisiones y trabajos de Edmundo Escomel', in *El Libro de oro de los homenajes recibidos por el Dr. Edmundo Escomel*, Lima, Imprenta Torres Aguirre, 1928; 'Biobibliografía de Carlos Monge Medrano', *Anuario bibliográfico peruano 1970-1971*, Lima, Biblioteca Nacional, 1978, pp. 662-91. On Monge Medrano, see Marcos Cueto, 'Andean biology in Peru, scientific styles on the periphery', *Isis*, 1989, 80: 640-58.

³⁰ 'No hay verruga en Matucana: estudios y declaraciones del Doctor Barton', *La Prensa*, 21 April 1912, p.2; and Máximo Gómez, *Epidemiología de la enfermedad de Carrión o verruga peruana en las*

provincias de Yauyos y Cañete, contribución a la patología de este mal, Lima, Tipografía Nacional, 1912.

³¹ Charles Townsend, 'Two years' investigation in Peru of verruga and its insect transmission', *Am. J. trop. Dis. preventive Med.*, 1915, 3: 16-32.

³² His first article published in Peru was: 'La Titira es transmisora de la verruga', *La Crónica Médica*, 1913, 30: 210-11. For an account of entomological studies on Carrión's disease see Marshall Hertig, 'Phlebotomus and Carrión's Disease', *Supplement to the American Journal of Tropical Medicine*, 1942, vol. 22, pages unnumbered. See also Hideyo Noguchi, *et al.*, 'The etiology of Oroya fever. The insect vector of Carrión's disease', *J. exp. Med.*, 1929, 49: 993-1008; and Telémaco Battistini, 'La verruga péruvienne (sa transmission par le phlébotome)', *Revue Sud-Américaine de Médecine et de Chirurgie*, 1931, 7: 719-24.

direct the first Philippine Biological Laboratory. Strong remained in Manila for the next twelve years, apart from a year's study in Berlin. At Manila, he became professor of tropical medicine at the University of the Philippines, director of the biological laboratories of the Philippines Bureau of Science, and chief of the medical department of the city's General Hospital. In 1911, he achieved international distinction as head of a commission that advised on the control of an epidemic of pneumonic plague in Manchuria.³³

The prestige of Strong attracted the attention of Frederick C Shattuck, the Jackson Professor of Clinical Medicine at Harvard, who in 1913 offered him a position at Harvard's Medical School as the first director of the newly created Department of Tropical Medicine.³⁴ The new Department was launched with a fund of \$25,325 which guaranteed its existence for only five years.³⁵ The main contributors were Harvard alumni and Boston companies and merchants who were recruited by an active fund-raising campaign organized by Shattuck. They included diplomats like Larz Anderson, who had served during the Spanish American War of 1898; physicians with a strong interest in Asia like William S Bigelow; prestigious lawyers like Henry B Cabot and Elliot Lee, who were on the boards of directors of several companies; prominent bankers and merchants like William Endicott and Wallace Pierce; and a former governor of the Philippines, Cameron Forbes.³⁶ After 1914, additional donors to the School included the United Fruit Company, which had a virtual monopoly on the production and distribution of Central American bananas and other important investments in Latin America.³⁷

These funds were crucial because financing tropical medicine lay outside the Medical School's regular budget.³⁸ Moreover, there was some covert opposition by other professors who saw tropical medicine as an exotic self-financing venture, directed by a professor with no tenure or full-time salary. Seeking to legitimate his department, Strong set out to publicize the need for tropical medicine. He emphasized the urgent need to protect United States commercial interests and citizens during a period of increased

³³ *In memory of Richard Pearson Strong*, Boston, Harvard School of Public Health, n.d., p. 7; and Eli Chernin, 'Richard Pearson Strong and the Manchurian epidemic of pneumonic plague, 1910–1911', *J. Hist. Med. Allied Sci.*, 1989, 44: 296–319.

³⁴ For an account of these years, see George C Shattuck, *Tropical medicine at Harvard 1909–1954*, Boston, Harvard School of Public Health, 1955. The first U.S. school of tropical medicine was created a few years before in Tulane University, New Orleans. Strong's desire to take the position at Boston appears in a letter to William Osler: "I decided that at the present time I would have here the best opportunity to develop the work in tropical medicine in this country and a good opportunity to do work in relation to the study of tropical diseases in South America." Strong to William Osler, 30 January 1913. Richard Pearson Strong Papers, Box 50, Folder 'Osler, Sir William', Francis Countway Library-Harvard Medical School (hereafter FCL-HMS).

³⁵ Edward H Bradford to Herey L Stimson, 11 January 1913, Strong Papers, Box 33, Folder

'Department of Tropical Medicine, Campaign for Funds-Organization', FCL-HMS.

³⁶ A list of donors appears in: Charles F Adams, 'Treasurer's statement for 1912–1913', in *Official register of Harvard University*, 20 April 1914, vol. 11, p. 48; *idem*, 'Treasurer's statement for 1913–1914', in *ibid.*, 1 March 1915, vol. 12, p. 45; and *idem*, 'Treasurer's statement for 1914–1915' in *ibid.*, 15 March 1916, vol. 13, p. 45. Biographical sketches of the donors appears in Albert Nelson Marquis, *Who's who in New England*, Chicago, Chicago A Marquis, 1909; and *idem*, *Who's who in America*, Chicago, Chicago A Marquis, 1914–1915.

³⁷ Also Shattuck made a gift of \$100,000 to be used for the maintenance of tropical medicine at Harvard. Richard Strong, 'The School of Tropical Medicine', *Official Register of Harvard University*, 1917, vol. 14, p. 191.

³⁸ Jean Alonzo Curran, *Founders of the Harvard School of Public Health: with biographical notes, 1909–1946*, New York, Josiah Macy, Jr. Foundation, 1970, p. 12.

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contact with the tropics.³⁹ The construction of the Panama Canal and the foreseeable marked increase in shipping reinforced this argument. With the advent of the Canal, yellow fever regions such as the Caribbean would be more fully integrated into the world's networks of commerce and travel. Tropical Asia, until then free of yellow fever, possessed all the preconditions needed for an epidemic of the disease. There was also a possibility of reinfection of the U.S. South itself, a sub-tropical region that had experienced epidemics of yellow fever until the first years of the twentieth century.

Strong believed that there was a growing professional market for graduates in tropical medicine. The argument was clearly explained by American missionaries (deeply involved in evangelical work overseas) who supported the establishment of tropical medicine at Harvard:

The services of physicians especially trained in the diseases more commonly encountered in hot countries are frequently sought by various commercial firms of different countries who do business in the tropics and who own mines or plantations or who employ a large amount of native labor . . . In addition, these firms pay good salaries . . . the [U.S.] government requires men well trained in these diseases for civil positions in Cuba, Porto Rico [*sic*], Panama, Hawaii and Philippines.⁴⁰

Strong also appealed to local pride, arguing that Boston should have a school of tropical medicine of the rank of those already existing in London, Liverpool, Hamburg, and Brussels. Following these arguments, Harvard University made an offer to President Woodrow Wilson to train government medical officers in the Department of Tropical Medicine before they were assigned to duty in the tropics.⁴¹

Finally it appeared that Boston and Harvard offered good opportunities for supporting tropical medicine. The city was one of the most important Atlantic seaports, receiving a considerable number of cruises from tropical regions of the world. It was also the headquarters of several American companies active in the tropics, including the United Fruit Company. In addition, Harvard had a number of professors and institutions with a strong interest in bacteriology, entomology, zoology, botany and other fields related to the tropics such as those at the Bussey Institute, the Gray herbarium, the Botanical Garden and Museum, the Arnold Arboretum, the Peabody Museum of Anthropology and other University museums. The Medical Faculty included leaders in public health and tropical science such as Milton J Rosenau professor of preventive medicine and hygiene, George C Whipple, the Gordon McKay professor of sanitary engineering, Harold C Ernst, the first professor of bacteriology, and Theobald Smith, the George Fabyan professor of comparative pathology. When the Department opened its doors, Smith, Rosenau, and Ernst were part of an advisory board to assist Strong, and courses in the new Department were offered by professors from the departments of zoology, entomology, botany, physics, bacteriology, pathology, comparative pathology, and hygiene.⁴²

³⁹ The rationale for the creation of a department of tropical medicine at Harvard is recounted in Richard Strong, 'The modern period of tropical medicine', *Am. J. trop. Med.*, 1937, 17: 1-14.

⁴⁰ The author of the letter was secretary of the American Board of Christian Missionaries. James L Barton to E H Bradford, 1 February 1913, Strong papers, no box, Folder B, FCL-HMS.

⁴¹ Franklin MacVeach to C D Hilles, 4 February 1913; and Bradford to Herry L Stimson, 11 January

1913, Strong Papers, Box 33, Folder 'Department of a Tropical Medicine Campaign to fund Organization, 1913-1914', FCL-HMS. Hilles was secretary to President Wilson.

⁴² Eli Chernin, *Tropical medicine at Harvard: the Weller years, 1954-1981*, Boston, Harvard School of Public Health, 1985, p. 1; and Richard Strong, 'Tropical medicine', *Official register of Harvard University*, 15 March 1916, vol. 13, pp. 184-6.

As the first task of the Department, Richard Strong decided to organize a scientific expedition to study diseases along the Pacific coast of South America, especially in Ecuador and Peru. Using an argument parallel to that of many public health officers who stressed the economic advantages of sanitation, Strong contended that his investigation was crucial for U.S. economic expansion: "the nature of the diseases which exist in many of these pest-holes must first be investigated . . . labor and capital need only follow."⁴³ The expedition was planned for the summer of 1913, before the beginning of instruction, and during a period when the Department needed to show, according to the Dean, that "significant accomplishments" could be done "with a small amount of money."⁴⁴

Ecuador and Peru were chosen, first, because locations like the port city of Guayaquil in Ecuador were considered hotbeds of tropical diseases and provided opportunities to pick up materials for use in the instruction of Harvard students. Second, little was known about this region in contrast with other areas of Latin America, which had been studied by the U.S. Army and the United Fruit Company and by the active indigenous scientific community of Brazilian scientists.⁴⁵ Third, the mystery surrounding Oroya fever and verruga peruana represented a challenge and an opportunity to discover a new microorganism. Finally, Strong also underlined the potential interest of American companies in the Amazon region of Peru which comprised more than 60 per cent of the country and was the home of the rubber tree.⁴⁶ According to Strong the western side of South America was: "from a commercial standpoint the largest underdeveloped area of the Western hemisphere".⁴⁷

The other members of the expedition were also from Harvard: Ernest Tyzzer, assistant professor of pathology, Charles Brues, assistant professor of entomology, and A W Sellars, associate professor of tropical medicine. In Peru, the Americans included in their team the Peruvian bacteriologist Julio César Gastiaburu, then director of the laboratory of the Instituto Municipal de Higiene, who co-signed some of the final reports. Harvard provided some funds for the expedition and the United Fruit Company and Pacific Steam Navigation furnished free transportation from Boston to Peru. To reciprocate, Strong agreed to inspect some of the eight hospitals established by United Fruit in Latin America.⁴⁸ The expedition visited Jamaica, Panama, Colombia, Ecuador, and reported on the diverse diseases encountered. Their primary mission, however, was in Peru where they studied verruga and Oroya fever. They also gave some attention to the native version of leishmaniasis, locally known as *uta*, an infection caused by a flagellate protozoan that

⁴³ Richard P Strong, 'Recent development in relation to the study of tropical medicine in the U.S.', Lecture given at Johns Hopkins anniversary, 5–8 October 1914, Strong Papers, Box 15, Folder 'Johns Hopkins, 1914', FCL-HMS.

⁴⁴ Bradford to Herey L Stimson, 11 January 1913, Strong Papers, Box 33, Folder 'Department of Tropical Medicine Campaign to fund Organization, 1913–1914', FCL-HMS.

⁴⁵ See John Farley, *Bilharzia: a history of imperial tropical medicine*, Cambridge University Press, 1991, p. 117; Jaime Larry Benchimol and Luiz Antonio Teixeira, *Cobras, lagartos y outros bichos: uma historia comparada dos institutos Oswaldo Cruz e Butantan*, Rio de Janeiro, Editora UFRJ, 1993; and

Luiz Antonio de Castro Santos, 'Power, ideology and public health in Brazil, 1889–1930', PhD Diss., Harvard University, 1987.

⁴⁶ In the early twentieth century the Ford Motor Company and Goodyear were interested in obtaining better access to rubber trees in the Amazon so as not to be dependent upon the rubber production of the Far East. See Warren Dean, *Brazil and the struggle for rubber: a study in environmental history*, Cambridge University Press, 1987.

⁴⁷ Strong, op. cit., note 39 above.

⁴⁸ Edward Bradford to F H Dietz, 15 April 1913, and Strong to Francis Hart, 28 March 1913, Strong Papers, Box 4, Folder 'South American Expedition', FCL-HMS.

parasitizes the tissues (although the etiology of this disease became clear only in the late 1920s). In Lima, Peruvian authorities and physicians gave support, and the British Central Railroad Company provided facilities for studies carried out between Lima and La Oroya.

Strong and his associates worked at the laboratory of the Instituto Municipal de Higiene where they experimented with animals and an inmate from the insane asylum.⁴⁹ Interestingly, in the English version of the report the inmate was presented as a volunteer, probably because of concern about public reaction to the use of humans in medical experiments. Strong confirmed Barton's Oroya fever findings, and his observations further indicated that the red cell structures reported by Barton in 1909 could hardly be degeneration products, as Tamayo and Gastiaburu had argued, since they exhibited motility, i.e. independent movement. Later studies indicated that Barton's bodies also occurred in tissue cells not associated with red blood cells. In honour of its discoverer, Strong proposed the creation of a new genus and named the Oroya fever microbe *Bartonella bacilliformis*.⁵⁰ In the final report published in English, Oroya fever was fully described and elegantly illustrated.

The Harvard Commission vigorously questioned the Peruvian medical belief in the identity of the two illnesses involved in Carrión's disease. According to Strong, Barton had discovered the causative agent of Oroya fever, not the one that caused verruga peruana. Strong's experiments failed to find *Bartonella bacilliformis*, or any other microorganism, in the blood of persons suffering from verruga or in that of animals with experimental verruga. However, they did succeed in transmitting the "virus" of verruga to experimental animals and to the asylum inmate, concluding that the disease was inoculable, but they failed to obtain cultures of the organism.⁵¹ Strong's whole work was consonant with that of many bacteriologists of the time who placed great importance on standardized methods (basically the use of the Koch postulates), and who regarded it as unlikely that a single disease could manifest itself in two different ways.⁵² Only years later did new studies such as those on chicken pox and shingles, which are expressions of the same herpes virus, show the range of manifestations of a single pathogen. Strong believed that verruga must originate from a different, and still unknown, virus.

Even the validity of Carrión's experiment was contradicted because the asylum inmate, inoculated by Strong with tissue juice from a wart nodule, developed no symptoms of Oroya fever and had only a mild verrucous lesion at the site of the inoculation. According to Strong this experiment showed conclusively that verruga and Oroya fever were two different diseases. In his report, Strong carefully stressed that, although he admired Daniel Carrión, his death proved nothing. Strong suggested that Carrión probably died of "an acute form of septicemia", or that the patient whose blood Carrión had used might have

⁴⁹ The use of the patient was authorized by David Matto, then director of the hospital and professor of bacteriology at San Marcos. The information appears in Strong, *et al.*, *op. cit.*, note 6 above, pp. 1–12.

⁵⁰ Richard P Strong, E E Tizzer and A W Sellards, 'Fiebre de la Oroya, segundo informe', *La Crónica Médica*, 1915, 32: 213–17; R P Strong, C E Tyzzer, C T Brues, A W Sellars, and J C Gastiaburu, *Harvard School of Tropical Medicine report of the first expedition to South America, 1913*, Cambridge, Mass., Harvard University Press, 1915.

⁵¹ Richard Strong and E Tyzzer, 'Experiments relating to the virus of verruga peruana', *J. Am. med. Ass.*, 1915, 64: 1124–7.

⁵² Patricia Peck Gossel, 'A need for standard methods: the case of American bacteriology', in Adele E Clarke and Joan H Fujimura (eds), *The right tools for the job: at work in twentieth-century life sciences*, Princeton University Press, 1992, pp. 287–311.

been suffering from a concomitant infection of Oroya fever, making Carrión's diagnostic picture confusing.⁵³

Before returning to the States, Strong read in a local newspaper that Peruvian researchers had performed some of his experiments (such as the transmission of verruga to rabbits) without acknowledging his own earlier work. He hastily sent a cablegram to the Dean of the Harvard Medical School announcing his conclusions. The apparent tension between Americans and Peruvians was expressed more clearly in a letter written in Lima by Strong to Shattuck, his mentor at Harvard:

I felt it necessary to send the cablegram to ensure priority of our work for the University, as the Peruvian doctors here are watching our work very closely, and have apparently tried to repeat every experiment which they see us do . . . and of course would prefer that we should not have anything new which they were not able to report upon.⁵⁴

A version of the cablegram was promptly published in a Harvard magazine celebrating the "great step forward" in research and the "success [that] crowned the first enterprise" of Harvard's tropical medicine department.⁵⁵ In his annual report, the Dean of the Harvard Medical School applauded Strong's achievements.⁵⁶ Upon returning to Boston, Strong published articles in the *Journal of the American Medical Association* and a preliminary report, which appeared in 1915 as a handsome book, that stressed that "the discoveries made by the expedition should serve to emphasize the importance of sending from the School to the tropics other expeditions of this nature".⁵⁷ Strong sent a copy of the report to thirty-seven prominent Bostonians, thanking them for their support of the Department of Tropical Medicine "in its early struggling years".⁵⁸ Complimentary replies emphasized the value of Strong's work in terms of national interest and American largesse.⁵⁹

The perception of an early "success" for the Department of Tropical Medicine was instrumental in creating new alliances favouring academic tropical medicine at Harvard, at least for a while. In 1914, the Deans of the Medical School and the Graduate School, felt that "success in the development of the Department of Tropical Medicine was most likely to be attained if Dr. Strong is given as free a hand as possible to develop his ideas".⁶⁰ His main idea, approved in 1914, was the transformation of the Department of Tropical Medicine into an independent School offering doctoral degrees in tropical medicine.

⁵³ Strong, *et al.*, *Harvard School of Tropical Medicine report*, op. cit., note 50 above, p. 10.

⁵⁴ Strong to Frederick Shattuck, 14 July 1913, Frederick Cheever Shattuck Papers, Folder 2, FCL-HMS.

⁵⁵ 'News from the Harvard Expedition to South America', *Monthly announcement of the Harvard Graduate School of Medicine*, 15 August 1913, vol. 4, n.p.

⁵⁶ Edward H Bradford, 'The Faculty of Medicine', and Horace Arnold, 'The Graduate School of Medicine', in *Reports of the President and the Treasurer of Harvard College 1912-1913*, Cambridge, Mass., Harvard University, 1914, pp. 130, 158.

⁵⁷ Richard Strong, 'Verruga peruviana, Oroya fever and uta', *J. Am. Med. Ass.*, 1913, 61: 1713-16.

Strong, *et al.*, *Harvard School of Tropical Medicine report*, op. cit., note 50 above, p. 7.

⁵⁸ Copies of the letters are kept in a folder labelled 'Department of Tropical Medicine. Report on expeditions. 1915, Donors', Strong Papers, Box 33, FCL-HMS.

⁵⁹ See for example Wallace Pierce to Strong, 8 December 1915, and William Wood to Strong, 2 December 1915, Strong Papers, Box 33, Folder 'Department of Tropical Medicine — report on expeditions, 1915-Donors', FCL-HMS.

⁶⁰ The quote appears in a document with the title '1914' in the Folder 'Department of Tropical Medicine Campaign for funds-Organization 1913-1914', Strong Papers, Box 33, FCL-HMS.

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Strong received further recognition in 1914, when he was appointed chief of a new sub-department of tropical medicine at the Massachusetts General Hospital, and consulting physician in tropical diseases at the Boston City Hospital. In the same year, he was elected President of the American Society of Tropical Medicine, and director of the laboratories of the hospitals and research-work stations of the United Fruit Company. As director he, and his students, could work in any of the hospitals that United Fruit managed in Costa Rica, Panama, Guatemala, Colombia, Cuba and Honduras. Strong was very pleased with the latter connection because it fulfilled his "desire to place candidates for the degree of Doctor of tropical medicine in . . . the United Fruit Company".⁶¹

However, the School began to face problems of funding because it depended mainly on private patronage. In 1915, a request signed by A Lawrence Lowell, the President of Harvard University, was presented to the Rockefeller Foundation for a grant of \$50,000 per annum for ten years for the School of Tropical Medicine.⁶² The Foundation was initially reluctant, because it was willing to consider a grant for the field of tropical medicine only in connection with the whole subject of public health. Lowell withdrew the original proposal before receiving a formal rejection and requested aid for an Institute of Hygiene at Harvard.⁶³ The new proposal indicated a change in emphasis which affected the development of tropical medicine at Harvard.

For some of the critics inside Harvard, other university institutions appeared to duplicate some of the functions of Strong's School. These institutions included the Department of Preventive Medicine and Hygiene created in 1909 (later known as the Department of Hygiene of the Harvard Medical School); and the joint venture School for Health Officers of Harvard and the Massachusetts Institute of Technology created in 1913 (later known as the Harvard-MIT School of Public Health). The latter emphasized industrial hygiene, which was perceived by some as more immediately relevant to the economic needs of the U.S. than tropical medicine. An additional problem for the School of Tropical Medicine was the small number of students enrolled at Harvard, and the difficulties involved in finding them positions abroad, partly because, unlike Britain and France, the United States barely possessed a formal empire, and because, according to one public health professor: "In many countries, public health positions are more or less pawns in the political game".⁶⁴

After the creation of the School of Hygiene and Public Health at Johns Hopkins University in 1916, which received sizeable donations from the Rockefeller Foundation, tropical medicine began to be perceived in the U.S. as an academic discipline that was not well defined and that did not merit independent institutional development because it

⁶¹ Strong to Frederick Shattuck, 22 July 1914, Strong Papers, Box 23, Folder 'Shattuck, F.', FCL-HMS. One of Strong's associates considered the co-operation with the United Fruit Company as "exceptional". Sellars to Strong, 2 July 1914, Strong Papers, Box 23, Folder 'Sellars, AW', FCL-HMS.

⁶² A Lawrence Lowell, 'Application for aid in the establishment and maintenance of a School of Tropical Medicine at Harvard, May 10, 1915', Rockefeller Foundation Archives, R.G. 1.1. Series 200, Box 181, Folder 2186, Rockefeller Archive Center (hereafter RAC).

⁶³ The terms in which the petition was amended appears in the letter of A Lawrence Lowell to the Trustees of the Rockefeller Foundation, 30 June 1915, and 'Memorandum regarding request to endow school for Tropical Medicine at Harvard University, June 29, 1915', Rockefeller Foundation Archives, R.G. 1.1. Series 200, Box 181, Folder 2186, RAC.

⁶⁴ David L Edsall, 'The School of Public Health', in *The development of Harvard University since the inauguration of President Elliot: 1869-1929*, Cambridge, Mass., Harvard University Press, 1930, p. 606.

overlapped with the fields of bacteriology and immunology, and, in dealing with problems of poor sanitation and malnutrition, looked into conditions not restricted to tropical areas.⁶⁵ As a result, in 1924, the School of Tropical Medicine became a Department in a new Harvard School of Public Health. Strong was appointed as its chairman. After his retirement in the late 1930s, tropical medicine disappeared as a separate academic unity when the Department of Tropical Medicine was fused with the Department of Comparative Pathology of the Medical School.⁶⁶

For years Strong used the materials collected in Peru on Oroya fever, verruga, and leishmaniasis to instruct students who were trained according to the principle that each disease responded to a single causative organism. The general course of tropical medicine was taught by Strong himself, who presented a comprehensive review of all diseases that might be considered tropical, including dysenteries, yellow fever, cholera, plague, malaria and verruga peruana. However, with the exception of an article dated 1924, Strong did not return to study Carrión's disease until the late 1930s.

After 1915, Strong was very active in organizing new expeditions to other areas of the world, such as Serbia, the Amazon, the Belgian Congo, and Guatemala, with the purpose of investigating new diseases and obtaining teaching materials.⁶⁷ These expeditions increased his academic prestige and validated his scientific claims among U.S. scientists. Meanwhile, Peruvian bacteriologists were digesting Strong's 1913 conclusions and Hideyo Noguchi, a Japanese-American scientist, appeared on the scene.

Noguchi and the Peruvians

Strong's conclusions had a contradictory impact on Peruvian medical circles. On the one hand, a senior prestigious foreign scientist had recognized excellence in a local researcher; on the other, Strong had denied the Peruvian physicians' belief in the etiological unity of Oroya fever and verruga peruana. The nationalistic and professional tradition partly based around Carrión's "sacrifice" held back Peruvian physicians from accepting the possibility that Carrión had died in vain. The bacteriologist Oswaldo Herccelles declared that Strong studied only one human case which was mistakenly diagnosed as verruga and declared that his conclusions "injured" the national pride of Peruvian doctors.⁶⁸

⁶⁵ The process is described in Elizabeth Fee, *Disease and discovery, a history of the Johns Hopkins School of Hygiene and Public Health, 1916–1939*, Baltimore, Johns Hopkins University Press, 1987, and in Curran, op. cit., note 38 above, pp. 236–59.

⁶⁶ Chernin, op. cit., note 42 above, p. 2.

⁶⁷ Some of the reports of these expeditions are: Richard P Strong, George C Shattuck, Joseph C Bequaert, and Ralph E Wheeler, *Medical report of the Hamilton Rice seventh expedition to the Amazon in conjunction with the Department of Tropical Medicine of Harvard University, 1924–1925*, Cambridge, Mass., Harvard University Press, 1926; Richard P Strong (ed.), *The African Republic of*

Liberia and the Belgian Congo: based on the observations made and material collected during the Harvard African Expedition, 1926–1927, Cambridge, Mass., Harvard University Press, 1930; and Richard P Strong, Jack H Sandground, Joseph Bequaert, and Miguel Muñoz Ochoa, *Onchocerciasis: with special reference to the Central American form of the disease*, Cambridge, Mass., Harvard University Press, 1934.

⁶⁸ Oswaldo Herccelles, 'Enfermedad de Carrión', *La Crónica Médica*, 1914, **30**: 67–72. Another adverse reaction came from Julián Arce, 'Algunas consideraciones sobre la nueva teoría dualista de la enfermedad de Carrión', *La Crónica Médica*, 1916, **33**: 377–91.

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Moreover, Strong's conclusions were considered an attack on the local medical tradition that believed that because of climate and topography some native diseases had particular manifestations. According to Odriozola, the "intervention of bacteriology" was disturbing "profound clinical notions", and he raised his voice against Strong's "dissociative crusade".⁶⁹ In addition, when in 1916 the physician Julián Arce inaugurated the new chair of tropical medicine at the University of San Marcos, he argued that Carrión's disease was the best example among tropical diseases of the "absolute dependency" of microorganisms and vectors on geographic distribution and local climatic conditions.⁷⁰ This attitude continued in a major work on the medical geography of Peru published in 1925 by the directors of the Dirección de Salubridad Pública and the Instituto Nacional de Vacuna and Sueroterapia, who argued that local surveys made a strong case in favour of the common origin of verruga and Oroya fever.⁷¹ In the same year, Monge Medrano wrote a general description of the disease for a German journal in which he emphasized that Strong had studied "one [human] case" for only three months and that his statements on a dual etiological origin were not sustained by the clinical and epidemiological observations of Peruvian physicians.⁷²

Most foreign scientists dismissed the Peruvian complaints as an indication of a backward scientific tradition in which nationalistic concerns took the place of research. An exception was Charles Townsend, who shared the Peruvian belief of a unified etiology for both diseases. His disagreement with Strong is understandable, considering he was exposed for longer to the environment where the disease took place—he spent two years in Peru—and where it was passionately discussed. In addition, Townsend followed the infection with, and recovery from, Oroya fever and verruga peruana of a Briton who had assisted his experiments in the Andes.⁷³

One reviewer from London's Tropical Diseases Bureau characterized Townsend's statements as "controversial", and another commented on the work of a Peruvian scientist in the following terms: "The author evidently does not accept the well-grounded conclusion of the expedition of the Harvard School of Tropical Medicine . . . Consequently it would tend to confusion to publish an abstract of his paper."⁷⁴ The clinical and geographical evidence cited by Peruvians was not considered enough to defend the assumption that Oroya fever and verruga had a single cause. Many foreign scientists believed that the Peruvians had to conform to the normative rules of bacteriology in order to prove their clinical arguments. This was the beginning, or rather a continuation, of a controversy over Carrión's disease that could be settled once and for all only by isolating the causative microorganism of both infections and comparing their immune reactions.

⁶⁹ Ernesto Odriozola, 'Unidad de la enfermedad de Carrión', *La Crónica Médica*, 1914, 31: 157–62.

⁷⁰ Julián Arce, 'La medicina tropical, lección inaugural', *La Crónica Médica*, 1916, 33: 239–48.

⁷¹ Sebastian Lorente and Raul Flores Córdova, *Estudios sobre geografía médica y petología del Perú*, Lima, Imp. Americana, 1925, pp. 189–90.

⁷² Carlos Monge Medrano, 'Verruga peruana o enfermedad de Carrión'. The article originally appeared in *Archiv für und Tropenhygiene*, 1925, 29: 244–52 and is reproduced in Carlos Monge Medrano, *Obras*, Lima, Universidad Peruana Cayetano Heredia, 1988, vol. 1, pp. 445–54.

⁷³ Townsend, op. cit., note 31 above.

⁷⁴ The reviews were signed with the initials P.W.B.S. and A.G.L. and appeared in *Trop. Dis. Bull.*, 1914, 1: 51, and 1923, 20: 810 respectively. The article by Townsend was 'On the identity of verruga and Carrión's fever (correspondence)', *Science*, 1914, 16: 99–100. The other article was Julián Arce, 'Apreciaciones generales sobre el diagnóstico y la clínica. La verruga peruana no genera esplenomegalia', *Anales de la Facultad de Medicina de Lima*, 1921, 4: 5–21.

Curiously, after the Strong expedition, Barton's findings of 1909 began to be accepted by Peruvian scientists. Local bacteriological research experimented with *Bartonella bacilliformis* under the assumption that it was the causative agent of both diseases. During more than a decade, however, these efforts proved fruitless. In 1924, a Peruvian bacteriologist reviewed the most important work that had attempted to obtain the *Bartonella* culture using Oroya fever and concluded: "Up to this point, all attempts to obtain the reproduction of the parasites outside the organism have been without results".⁷⁵

When Peruvian researchers were unable to show that *Bartonella* played a role in verruga peruana, Hideyo Noguchi, a Japanese-American scientist working at the Rockefeller Institute for Medical Research, became deeply interested in the debate and gave what is considered today the solution to the riddle. Noguchi was an compulsive worker who was proud of obtaining results where nobody else could, on subjects ranging from snake venoms, syphilis, trachoma, poliomyelitis, and bartonellosis to yellow fever. Noguchi's first encounter with Carrión's disease took place in 1919 when he travelled from his laboratory in New York to Peru as part of a Rockefeller Foundation commission that was studying yellow fever. Over the next few years, Noguchi was able to obtain Peruvian materials on verruga and Oroya fever thanks to his association with Telémaco Battistini, a Peruvian student at the Rockefeller Institute. In addition, both Herculles and Strong sent to Noguchi tissues from cases of Oroya fever and verruga.

With these materials Noguchi published in the mid-1920s a series of articles (some of them co-authored with Battistini) in which he described an artificial culture of *Bartonella bacilliformis* and the successful experimentation with animals. Noguchi found the characteristic bacilliform bodies present in the red cells, and cultivated a microorganism of similar appearance in 1925. The culture was inoculated into young monkeys and was found to be capable of inducing characteristic verruga peruana on the skin. Although these experiments already suggested that Oroya fever and verruga peruana were of common origin, it was also necessary to isolate the organism from human warts and test its behaviour on animals. Through the co-operation of Oswaldo Herculles, then professor of bacteriology at San Marcos, nodules excised from two cases of verruga were secured for Noguchi early in 1926.⁷⁶ From one of these, a culture was obtained which did not differ in any respect from that previously cultivated from the blood of the Oroya fever patient. This culture reproduced the characteristic Oroya fever as well as Peruvian wart in monkeys. Noguchi was able to recover the microorganism again from blood or warts of the inoculated animals. Those animals which did not succumb to the experimental infection recovered completely and became resistant to a second attempt to infect them.

Noguchi used this fact to explain the discrepancy between the result of Carrión's experiment and that of the Harvard Commission.⁷⁷ According to Noguchi, Carrión was susceptible to infection with bartonella, while the "volunteer" inoculated by the Harvard commission was resistant, probably because he had suffered from a earlier attack.

⁷⁵ Raul Rebagliati, 'Microbiología de la enfermedad de Carrión', *Revista de la Sociedad Médica Unión Fernandina*, 1926, 1: 13.

⁷⁶ The correspondence between Noguchi and Herculles appears in: Oswaldo Herculles, 'El germen de la verruga peruana', *Anales de la Facultad de Medicina*, 1926, 12: 248–50.

⁷⁷ In 1926, Noguchi and Battistini co-signed three articles on Carrión's disease, but the final and definitive report was signed only by Noguchi. See Hideyo Noguchi, 'The etiology of the verruga peruana', *J. exp. Med.*, 1927, 45: 175–89. In 1926 in a confusing incident Battistini broke abruptly with Noguchi and returned to Peru.

Noguchi's achievement provided Peruvian scientists with the bacteriological proof they were lacking.⁷⁸ As a result, the disease became internationally known as Carrión's disease (although the term human bartonellosis is also used today), Carrión's death appeared vindicated, and the local medical tradition reassured.

Nevertheless, this was not the end of Strong's work in Peru. In 1936, on retiring from his professorship at Harvard, he decided to organize a new expedition to Peru to confirm or refute Noguchi's work. There was no institutional pressure to return to a topic then considered of secondary importance, especially for somebody who was already a leading figure in U.S. medicine. However, Strong knew that this was the last field expedition he would carry out and probably wanted to end his career by returning to the topic that had fascinated him during his first year at Harvard. The new expedition to Peru faced severe difficulties and had to be supported by a private fund and by monetary contributions from members of the party, who paid for their own personal and research expenses, which included the shipment from India to Peru of fifteen Rhesus monkeys.

No new discoveries occurred during Strong's 1937 expedition, which confirmed Noguchi's finding that Oroya fever and verruga peruana had the same causative microorganism.⁷⁹ Strong was aware that nationalistic and scientific concerns were intertwined in the debate and tried to handle carefully the feelings of Peruvians. In a letter to a former officer of the Rockefeller Foundation Strong wrote:

The Peruvian doctors regard the form of anemia we are going to study as rather a private affair since it is not known to occur in any other country and our contacts will have to be made discreetly and diplomatically in order not to arouse any jealousy or antagonism. In fact, it is my plan to have at least one Peruvian physician associated with us in the work.⁸⁰

It is significant that the final investigations on Carrión's disease were carried out either abroad or by foreigners. The increasingly important role played by U.S. researchers was partly an outcome of the limitations of Peruvian bacteriology, and especially of its inability to create a permanent and independent institutional basis.

The visit of Noguchi to Peru coincided with a reorganization of the Peruvian state that changed the institutional basis in which bacteriology emerged. A civilian dictator, the businessman Augusto B Leguía, initiated in 1919 an era of heavy spending on public works, favourable conditions for foreign investment in export-producing areas, and small regard for democratic expression. Assuming that local resources and personnel were insufficient and inadequate, Leguía delegated several of the state's responsibilities (like education, sanitation and technological improvements for agriculture) to U.S. experts. The

⁷⁸ During the 1920s Noguchi and Strong were involved in another debate. Noguchi isolated a spirochetal agent, which he called *Leptospira icterooides*, believing it to be the cause of yellow fever. Strong wrote letters to Noguchi complaining that he could not repeat the experiment. Noguchi avoided Strong and other critics, attributing the uniqueness of his finding to his own ability. By the late 1920s it was clear that Noguchi was wrong. See Cueto, 'Sanitation', op. cit., note 1 above. Noguchi's work on human bartonellosis was one of his most outstanding contributions. His research on poliomyelitis, trachoma, and yellow fever for which

he initially received recognition proved to be erroneous. See Isabel Plessset, *Noguchi and his patrons*, London and Toronto, Associated University Press, 1980.

⁷⁹ The results appeared only in Peru, Richard P Strong, *et al.*, 'Investigación sobre la severa forma de anemia infecciosa en la enfermedad de Carrión y su estado eruptivo verrugas (nota preliminar de trabajo de la Universidad de Harvard en el Perú en 1937),' *La Revista Médica*, 1937, 267: 739-40.

⁸⁰ Strong to Jerome Greene, 30 December 1936, Strong Papers, Box 4, Folder 'Peru Expedition 1937', FCL-HMS.

new trend was clear when Leguía named two Americans in succession to direct the Dirección de Salubridad Pública. The Americans were followed by a Peruvian psychiatrist, Doctor Sebastián Lorente, committed to public hygiene, which he described as: “a science that is destined to do more good than all the other medical devices discovered or administered combined”.⁸¹ Under Lorente’s influence, Peruvian sanitation paid less attention to basic research, and fewer resources were allocated for the development of local scientific capabilities in bacteriology, which before the Leguía regime had been justified in terms of its potential benefit for public health.

Leguía’s emphasis on applied science increased routine work in the bacteriology laboratories because they were supported directly or indirectly by the State. The staff of the Instituto Municipal de Higiene of Lima, for example, became overloaded with routine tasks like the analysis of potable water and beverages, the extermination of rats, and the production of serums and vaccines. These duties were heavy because the city was growing rapidly while the staff and resources of the laboratory were diminishing. The reports of the directors of the Instituto Municipal during the 1920s and early 1930s complain of poor material facilities and the scanty and outdated materials for bacteriological research, all indicating this centre’s decay.⁸²

In the 1920s, there was less time and space for basic research because the romantic vision of the previous two decades that bacteriology alone would eradicate infectious disease seemed exaggerated. In Peru as elsewhere, serum and vaccine therapies, the great hopes of bacteriology of the late nineteenth century, were considered by many doctors a dead end.⁸³ The first Peruvian bacteriologists linked their research to the fight against infectious and tropical diseases which drained resources from the country. By 1920, however, the campaign against endemic and epidemic conditions seemed to the Peruvian authorities to be a matter of money and technique, and that additional research was not necessary.

Carrión’s disease, which was the centre of attention of Peruvian bacteriologists, was a rural disease of secondary economic importance, endemic only in narrow Andean valleys where the majority of inhabitants had developed a natural immunity. It was well-known that one way to avoid the disease was to use a mosquito net or to prevent strangers from sleeping in areas where the vector existed, since it was a nocturnal insect. In addition, the census of 1940 found a curious polarized distribution of the Andean population, i.e. the majority of people lived below and above the endemic areas of verruga. These facts reduced the economic relevance of Barton’s discovery and undermined Peruvian bacteriology’s claim to utility.⁸⁴

⁸¹ Sebastián Lorente, *Nuestros problemas médico sociales*, Lima, Imp. Americana, 1922.

⁸² The reports appeared under different titles in the annual municipal reports, an incomplete list is ‘Memoria de la inspección de higiene, desinfección, química y bacteriología’, *Memoria de la Municipalidad de Lima*, 1920, pp. 1–7; ‘Memoria de la inspección de higiene y vacuna’, *Memoria de la Municipalidad de Lima*, 1925, pp. 77–85; ‘Memoria de la inspección de química y bacteriología’, *Memoria de la Municipalidad de Lima*, 1928–1929, pp. 245–60; and ‘Memoria de la inspección de química y bacteriología’, *Memoria de la*

Municipalidad de Lima, 1932–1933, p. 389, Biblioteca de la Municipalidad de Lima.

⁸³ See John M Dent, ‘Two Views of bacteriology at Harvard’, Senior Honors Thesis, Harvard University, 1982.

⁸⁴ The distribution of the population is explained also by the fertility of the soil, see Aristides Herrero, *Epidemiología de la verruga peruana*, Lima, Gonzales-Mugaburu, 1990, p. 12. Another indicator of the relative unimportance of the disease is the fact that between 1923 and 1931 the Dos de Mayo hospital received 484 cases of Carrión’s disease. By contrast, during the same period there were 11,589

The young and dispersed group of bacteriologists was unable to respond effectively to the new challenges. The achievements of the earlier generation of Peruvian bacteriologists were more difficult to replicate and the work of foreign scientists ultimately surpassed local work.⁸⁵ The decay of Peruvian bacteriology during the 1920s also resulted from local institutional weaknesses present from the very beginning. The different locations in which bacteriology was practised were not primarily dedicated to research, but rather to developing cures, educating physicians, and performing sanitary tasks.

Bacteriology was originally carried on in centres such as hospitals, the Instituto Municipal de Higiene and the Faculty of Medicine. Initially, institutional dispersion was beneficial because it generated competition to resolve the etiological question of Carrión's disease. But in another sense, it discouraged the consolidation of a scientific community because work tended to be duplicated, there was no uniformity in scientific apprenticeship, and resources were not centralized. Dispersion partly explains the lack of a more ambitious research programme. The search for one causative agent, the concentration on morphological description, and the lack of advanced local studies in entomology, all revealed the absence of higher goals in Peruvian bacteriology.

Peruvian bacteriology remained in decay until 1936, when Telémaco Battistini created the Instituto Nacional de Salud. A new generation of microbiologists, with few ties to past traditions and little knowledge of the development of their discipline, was formed here. This was the beginning of a new cycle of boom and bust similar to that which characterized the emergent period of Peruvian bacteriology.

Conclusion

Carrión's self-experimentation became a central ingredient in the Peruvian medical tradition and in the assumptions of Peruvian bacteriology. His experience reinforced the belief that there was a medical geography unique to the country that could be best understood by local practitioners and scientists. Initially, Bartón's discovery of 1909 was not completely recognized, locally or internationally, until validated by the authoritative work and word of a Harvard scientist.⁸⁶ However, other dimensions of Strong's work were disputed by Peruvian physicians with arguments that partly reflected their preference for clinical and geographical frameworks.

The difficulties confronted by bacteriological research in Peru and even the perception of the success of Strong's expedition of 1913, suggest a more general process in which novel institutional structures and new knowledge in tropical medicine were attached to particular interests and validated by international networks, where scientists from

cases of malaria. Andrés Arana Sialer, *Estadística hospitalaria*, Lima, Imp. del Hospital Victor Larco Herrera, 1933, pp. 8, 10, 13, 16. In the 1940s, DDT controlled the sandfly and antibiotics treated the anaemia produced by Oroya fever.

⁸⁵ One exception was Pedro Weiss, 'Hacia una concepción de la verruga peruana', *Anales de la Facultad de Medicina*, 1926, 9: 279–99. A bibliography of medical studies on Carrion's disease from 1885 to 1935 indicated that after 1920 Peruvian

productivity declined, see Rebagliati, op. cit., note 27 above, pp. 191–204.

⁸⁶ Bartón's case resembles that of the Cuban Carlos J Finlay, who presented a basically correct theory of the mosquito transmission of yellow fever in 1881, which was not accepted for almost twenty years. See Nancy Stepan, 'The interplay between socio-economic factors and medical science: yellow fever research, Cuba and the United States', *Soc. Stud. Sci.*, 1978, 8: 397–424.

backward countries usually had little power and resources. This appears clear in Peru where science was carried out under adverse conditions such as a chronic lack of funds, scarce institutional continuity, irregular support from the state and changing public esteem. Partly because of this context, Peruvian bacteriologists had to be flexible, accommodating different and sometimes contradictory dimensions of the work of nationals and foreigners, and they resorted to both old medical traditions and new scientific paradigms. However, in this case, their efforts were insufficient to overcome the institutional and political obstacles that arrested the development of Peruvian bacteriology. Other Latin American examples, like the Instituto Oswaldo Cruz of Brasil, suggest that it was possible to sustain a balance between sanitary tasks and original basic research under adverse conditions.⁸⁷

A final question is why Strong did not find a permanent academic niche for tropical medicine at Harvard? Strong's energy and reputation and the support of a prestigious academic institution and of Boston's elite were enough to launch tropical medicine as an independent academic entity in Boston but not to sustain it. Although this result might be related to the scientific expeditions that Strong organized after 1913 and to U.S. developments that I have not presented here, I will suggest two complementary answers to the question. First, tropical medicine in Boston never achieved a permanent alliance between local needs, the interests of the government or of the military, and the goals of private philanthropy. Second, the U.S. governments of the first decades of the twentieth century were reluctant to recognize that they played an imperial role in the independent republics of Latin America. This might have been a major difference between the U.S. and those European countries that defined and supported academic tropical medicine as a crucial component of their formal empires.

⁸⁷ See Stepan, *op. cit.*, note 1 above, and Benchimol and Teixeira, *op. cit.*, note 45 above.