International Cooperation in Health in the Interwar Period: The Rockefeller Foundation's Worldwide Anti-Yellow Fever Campaign and its Implementation in Brazil (1918-1939)

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Introduction

The focus of this study is to analyze the Worldwide Anti-Yellow Fever Campaign launched in 1914 by Wickliffe Rose, the first Director of the International Health Board (IHB) of the Rockefeller Foundation (RF). This campaign was developed between the 1910s and 1930s and continued after World War II, under the auspices of the Pan American Sanitary Bureau (PASB) with a new name, "Continental Campaign for Eradication of *Aedes aegypti*." At this time the PASB was directed by Fred L. Soper (1947-1959), a U.S. sanitarian, physician, and former regional director for the IHB in Brazil (1927-1942). Soper led the anti-yellow fever and malaria campaigns launched by both the Brazilian government and the RF beginning in the 1920s through the 1930s. During the first semester of 2012 I visited the Rockefeller Archive Center (RAC) twice in order to gather research material for the above-mentioned study that integrates into my Ph.D. project. The first visit was in January, and the second visit, supported with an RAC Grant-in-Aid, occurred in the first two weeks of April.

Through the analysis of the campaign I intend to discuss the international cooperation in health between the Brazilian government and international organizations such the RF and the PASB before and after World War II. I am also interested in the impact of this cooperation on the field of public health in Brazil and the United States, as well as the

scientific, sanitary, and political relations maintained between the governments of these two countries and other republics of South America around yellow fever.

During the month and a half I spent doing research at the RAC I was able to collect a considerable amount of material, thanks to the excellent organization of the collections, the detailed description of the sources, and the valuable assistance of RAC staff members. I started my research in the "Papers of Individuals," a broad body of sources from individuals who worked for the RF. Collections I consulted included the "Wickliffe Rose Papers, (1902-1933), 1958," and the "George K. Strode Papers, 1910-1953," two important figures in the struggle against yellow fever. I also researched the papers of Hugh H. Smith, 1927-1988, Nelson C. Davis, 1913-1933, J. Austin Kerr, 1925-1974, John C. Bugher, 1926 - (1950-1966), and Kenneth C. Smithburn, 1922 - (1938-1959) - 1974.

Despite being less known than Strode and Rose, the sources of these RF staff members revealed the key role played by them in the anti-yellow fever campaign in Brazil and South America organized between the 1920s and 1940s. Some of them even worked in the RF's yellow fever laboratories located in Brazil, Colombia and Africa, and were responsible for the development of research of the disease, making an intense interchange of discoveries and knowledge between the three labs that I have been trying to map.

I also researched the RF Archives, composed of nineteen record groups from which I have analyzed Record Groups 1.1 and 1.2 (Projects), series 100 (Reports), 300 (South America), 305 (Brazil) and 311 (Colombia), followed by the extension "O" (Yellow Fever); Record Group 2 (General Correspondence), series 100 O, 300 O, 305 O and 311 O; Record Group 3 (Administration, Program and Policy); Record Group 5 (International Health Board / Division), Series 1 (Correspondence), 2 (Special Reports) and 3 (Routine Reports); Record Group 6.2 (Belem, Brazil Field Office), Series 1 (Belem Virus Laboratory); and Record Group 12 (Officers' Diaries).

Finally, I examined the "Collected Papers on Yellow Fever by Members of the Staff of the International Health Division of the Rockefeller Foundation, nine volumes of articles written by RF staff members. This material is so rich that I believe it is possible to describe the history of the development of yellow fever research—including its mistakes and discoveries—just based on it.

Based on these sources, the present report will examine the origins and developments of the RF's Worldwide Anti-Yellow Fever Campaign in the interwar period, as well as its implementation in Brazil.

The Launching of the Worldwide Anti-Yellow Fever Campaign

In July 1914, William Gorgas, Surgeon General of the U.S. Army, and Wickliffe Rose, Director of the IHB, had a meeting at which they began to develop a program to combat yellow fever worldwide. Gorgas was noted for the organization of campaigns to eradicate the disease in Havana in 1901, and in the Panama Canal between 1912 and 1914. In 1909, he declared that, through the application of adequate sanitary measures and the systematic elimination of outbreaks that "yellow fever will disappear from the Western Hemisphere in two years."[1] Rose, in turn, had just returned from a trip to the East, during which he noted the fear of British and Asian sanitary authorities about the possibility of yellow fever spreading through the Far East after the opening of the Panama Canal, which would be inaugurated on August 15, 1914.[2] Although the tropical regions of Asia had remained free of the disease, they had all the conditions for an epidemic if they were connected to the infected areas in the Caribbean.[3]

Also in 1914, Gorgas and Rose had a series of meetings with notable experts in yellow fever, such as Dr. Henry Carter—whose epidemiological research had helped determine the role of mosquitoes in the transmission of the disease—and Dr. Joseph White, both members of the Public Health Service of the United States. As a result of their meetings

in the following year, the Yellow Fever Commission was created, composed of Gorgas, Carter, White, and also Dr. Juan Guiteras, Director of the Cuban Department of Public Health.[4]

In October 1914, Rose wrote a memorandum in which he outlined the parameters of a campaign to eradicate yellow fever worldwide and, for the first time, the postulates of the key focus theory, developed by Carter.[5] According to this theory, between two yellow fever epidemics, its agent continued to exist in a limited number of endemic areas—the key focus—usually cities where the number of people not immune to the disease would be sufficient to ensure its transmission from a person to another through mosquitoes.[6] Therefore, the RF's experts believed that the elimination of the *Aedes aegypti* mosquito from a small number of cities considered the "key focus" of yellow fever would result in the disappearance of the disease from the Americas.[7]

The outbreak of World War I prevented the immediate implementation of the plan proposed by Rose. Not until June 1916 did the members of the Yellow Fever Commission begin the identification of the American continent as the key focus. That year Gorgas, Carter, Guiteras, White, W. Wrightson and the majors T. C. Lyster and E. R. Whitmore left New York bound towards various countries in Central and South America.[8] By the end of the expedition, they concluded that the port of Guayaquil was the only endemic focus of yellow fever active in the continent.[9] They suggested that the RF implement an extensive campaign to eradicate the mosquitoes in the localities affected by the disease and continue with the surveillance of suspected areas, among them the Brazilian coast and the southern coast of the Caribbean.[10] On January 23, 1917, the IHB appointed Gorgas director of the campaign. Thereby, the glory of eliminating the disease belonged to the General.[11] However, the campaign could not be started immediately because U.S. entry into World War I, which

forced Gorgas to assume his activities as Surgeon General of the U.S. Army until his retirement in 1918.

In the same year, the RF sent to Guayaquil another expedition to investigate unknown aspects of yellow fever related to its etiology and diagnostics.[12] A member of the expedition, the Japanese bacteriologist Hydeo Noguchi—a researcher at the Rockefeller Institute—announced that he had discovered that the bacterium *Leptospira icteroides*, named by him, was the etiologic agent of yellow fever. He also described an immunological test that, as he believed, was capable of detecting the disease, and developed a curative serum.[13] These discoveries however, would be challenged by Max Theiler and other experts on the disease and discarded in 1928 due to the development of the animal model of the disease. In that same year, Hideyo Noguchi would die of yellow fever in Africa.[14]

The fact is that when the campaign began in Guayaquil, on November 25, 1918, all biomedical aspects of yellow fever "seemed to be equated scientifically."[15] Subsequently, under the guidance of Michael Connor, an attack on the breeding sites of *Aedes aegypti* was launched through the placement of fish in the water tanks. Regular inspections also began to be carried out in the residences in order to eliminate the mosquito larvae in tanks and other containers.[16] The results of the campaign were considered spectacular.[17] Six months after its beginning, the last case of yellow fever had been registered in the country.[18] Over the next seventeen years, no new cases of the disease were diagnosed in Ecuador, which seemed to confirm the principles set by the Yellow Fever Commission. Through having the elimination of the vector larvae in key focus, the mosquito was extinguished and the yellow fever spontaneously disappeared from cities and towns.[19]

It quickly became clear, however, that Guayaquil was not the only endemic focus of yellow fever in the continent.[20] Thereby, in the following years studies, campaigns and services directed to combat the disease were organized by the RF in Guatemala in 1919, in

Peru from 1920 through 1922, in Central America from 1921 through 1922, in Mexico from 1921 through 1923, and in Colombia and Brazil in 1923; Brazil being the last country to receive aid from the RF and where the cooperation in the struggle against yellow fever was more lasting, totaling sixteen years.

The RF's Anti-Yellow Fever Campaign in Brazil

The resurgence of yellow fever in Brazil in 1923 motivated the Brazilian government to sign an agreement with the RF for the eradication of the disease in the north and northeast of the country.[21] The RF was responsible for funding the campaign, with which it wanted to repeat the success achieved in other Latin American countries, and at the same time continue the continental eradication of yellow fever planned by Gorgas and Rose in 1914.[22] The results appeared soon. In 1925, the number of cases of yellow fever had decreased considerably, unleashing a wave of optimism about the imminent eradication of the disease. Not even cases of the disease that occurred in 1926 in the states of Bahia and Sergipe were able to undermine the optimism of the American and Brazilian authorities.[23] In his message to Congress in late 1926, President Artur Bernardes held the position that the disease was eradicated from the Brazilian coast, arguing that the cooperation with RF would not be needed next year.[24]

Convinced of the success of the campaign, Dr. Michael Connor—who, in 1926, replaced Joseph White in the position of director responsible for the RF's activities in Brazil—and other American experts came to believe that yellow fever could already be declared extinct in the country and on the continent; and that soon, the RF could direct its efforts to eradicate the disease from Africa.[25] In fact, in early 1928, yellow fever had almost disappeared from Brazil. The RF viewed this fact as a confirmation of the assumptions of the key focus theory.[26]

In 1928, however, Rio de Janeiro was also suddenly stricken by a severe epidemic of yellow fever, after twenty years without the presence of *Aedes aegypti* and when there was no

endemic region close to the city. In addition to the Federal Capital, more than forty other localities in the state were also affected. The epidemic was controlled in the following year, but left in its wake more than eight hundred cases of the disease and four hundred six deaths.[27]

While the epidemic plagued Rio de Janeiro and other cities in South America,[28] the RF's campaign against *Aedes aegypti* was able to keep the northeastern cities relatively immune to the disease, which helped to strengthen its position in Brazil. The RF and some Brazilian authorities have interpreted this fact as a sign that it needed more power to put in practice sanitary measures across the country. Therefore, in December 1930, under the administration of Getúlio Vargas, the agreement with the RF was revised so as to provide the transfer of most of the cost of the campaign to the federal government (eighty percent), which includes a larger area of intervention (all the national territory, with the exception of the state of Rio de Janeiro) and assure full freedom for the RF's officials to manage the activities of the Department of Prophylaxis of Yellow Fever.[29]

The review of the agreement was preceded by the replacement of Michael Connor by Fred Soper, as chief of the RF's regional office in Brazil, in May 1930, and as Inspector General of the Department of Prophylaxis of Yellow Fever in June. A 1918 graduate of the Rush Medical College of the University of Chicago, Soper obtained his doctorate a few years later at the Johns Hopkins University School of Hygiene and Public Health. Both institutions received support from the RF which quickly hired Soper to its International Health Board.[30]

Once sworn in, Soper expanded the anti-yellow fever activities to rural areas of Brazil, maintaining close contacts with doctors and health workers of the country and undertaking a complete administrative reorganization of the Department of Prophylaxis of Yellow Fever, which helped to increase its effectiveness. The RF employees started to produce maps of the extent and endemicity of the disease in large parts of the country,

population surveys and cartographic representations of the areas where cases of the disease had been reported, as well as reports on the conditions and the way of life of the populations of rural areas. These measures aimed to identify more precisely the main outbreaks of yellow fever in order to increase the effectiveness of the eradication activities.[31]

The new operating model implemented by Soper was favored by the adoption of two new laboratory techniques, which were quickly incorporated into the methods of diagnosis of yellow fever, increasing its visibility and the accuracy in identifying its symptoms. The first was the viscerotomy, in which the introduction of a sharp blade into the liver of cadavers removed a sample from the organ, and allowed the lab confirmation that the death had actually occurred as a result of yellow fever.[32] The second technique was the protection test in mice, which was able to reveal the presence of neutralizing antibodies against yellow fever in certain individuals.

The individual responsible for its development was Max Theiler, the same researcher who had refuted Noguchi's thesis. In 1930, Theiler inoculated the yellow fever virus into mice brains and passed it from one animal to another through an intracerebral injection. Theiler also demonstrated that the sera from an individual who had survived a yellow fever attack could neutralize the virus transmitted to mice and prevent the development of the disease in animals.[33] Theiler's protection test in mice also revealed the existence of the yellow fever virus in a particular locality in the present or in the recent past.[34]

The new political and institutional context of Brazil also favored the activities of the RF in the country and the new strategies implemented by Soper for the eradication of yellow fever. The fight against the major endemic diseases of the country was part of the modernization project that Vargas sought to implement since he came to power in October 1930. In line with this project, in December 1930 Vargas signed Decree Number 19541,

which gave a tax exemption on equipment and materials imported by the RF for the anti-yellow fever campaign in the country.[35]

In 1932, however, a discovery related to yellow fever would definitively change the course of the RF's campaign in Brazil. That year, an epidemic of the disease in Canaan Valley—a region in the state of Espírito Santo, where the *Aedes aegypti* had not yet been found—led some RF experts to suspect that yellow fever could occur even without the presence of mosquitoes. In an article published in 1933, Soper and his collaborators tried to explain this outbreak. In their opinion, the virus of the disease was introduced in the region regularly from nearby areas where there was the mosquito *Aedes aegypti*, causing endemic foci of the disease nearby. Once present in the Canaan Valley, the virus was transmitted by one or more vectors which were very widespread but inefficient, since the cases never reached a number comparable to those of urban epidemics.[36]

This explanation did not last long, since almost all the cases of "yellow fever without *Aedes aegypti*" in the region were found in people who had a close link with the forest, such as families living in its vicinity or workers who performed their activities in the jungle. It was assumed then that the disease came from a natural reservoir from the virus among wild animals, most likely monkeys.[37] This observation was not surprising however, because, since 1914, some researchers had already considered this hypothesis.[38]

Histological analyzes of liver tissues of the fatal victims of the disease refuted once and for all the theory that the mosquito *Aedes aegypti* is the only vector of yellow fever and that human beings are the only hosts of the virus. The antiquity of the virus found in the region—confirmed by tests of protection in mice—and their capacity for survival in monkeys injected with the blood of local patients led Soper and his colleagues to state that yellow fever could occur even in the absence of *Aedes aegypti*.[39] Thus, in the mid-1930s, other insects and even wild animals came to be considered as potential vectors of the disease.[40]

The discovery of jungle yellow fever changed the course of the research of the RF's zoologists and entomologists who, until the 1950s, tried to describe the natural-life cycle of the yellow fever virus in insects and wild animals. It also changed the very perception of the disease. From a disease that victimized only human beings, yellow fever came to be considered a typical disease of wild animals which contaminated man accidentally and whose epidemics occurred because the virus was easily transmitted by mosquitoes that lived close to human habitations. In addition, the conviction that the virus of the disease had a natural reservoir in wild animals had decreased the enthusiasm of the RF's leaders on the possibility of eradicating it. The campaign goal was then reoriented to the control of the virus in regions where it was endemic through vaccination.[41]

During the 1930s, the full support of President Vargas allowed the RF to continue intervening in Brazil's health problems under extremely favorable conditions. The eradication of *Aedes aegypti* from most of the country, the production and mass distribution of a vaccine against yellow fever, and the eradication of *Anopheles gambiae* (the vector of malaria brought from Africa) from north of the country; three of the most important activities carried out by the RF in the field of public health in Brazil, would not have been possible without the decisive support of the Brazilian government. In this sense, there was no exaggeration in Soper's statement that "Dr. Vargas is the father and mother of the new Service of Yellow Fever."[42]

In the second half of the 1930s, however, RF activities in Brazil experienced a reorientation, with its main goal being the development of activities related to medical education, research on the disease, and the preparation of vaccines at the Institute of Manguinhos, rather than the struggle against major epidemics.[43] In fact, the roots of this reorientation occur in 1927 when the RF underwent a deep reorganization which gave a prominent place to scientific research and relegated public health to second place in its

philanthropic activities. Evidence in this regard is found in the initiative of its director—Dr. Frederick Russell—to establish a central laboratory of the IHB, at this time renamed the International Health Division (IHD). Russell also encouraged the opening of regional laboratories dedicated to the study of yellow fever in Uganda, Colombia, and Brazil. Subsequently, the central laboratory began to conduct research on the yellow fever virus and, from 1937, to produce a vaccine against the disease.[44]

In accordance with its reorganization in 1939, the RF undeniably transferred the responsibility of the anti-yellow fever campaign to the Brazilian government, focusing on research activities on the etiology of yellow fever and its patterns of transmission, the production of vaccine and the vaccination campaigns against the disease, which had begun in 1937. These activities continued until the closing of the IHD in 1951.

On January 23, 1940, Vargas enacted the decree number 1975, which established the National Yellow Fever Service (SNFA), a new agency under the Ministry of Education and Health and the National Department of Public Health.[45] With its creation, the Brazilian government took the responsibility for the activities to eradicate *Aedes aegypti*, the organization of national vaccination campaigns, and the coordination of health surveillance through a network of viscerotomy stations. Thereby, ending a sixteen year partnership (1923-1939) between the RF and the Brazilian government, in the struggle against yellow fever, during which important points of its etiology, transmission, and control measures were unveiled. The anti-yellow fever campaign, however, would be resumed several years later under a new starting point and in a new international context.

Conclusion

The termination of the RF's activities in the struggle against yellow fever in Brazil did not mean the end of its Worldwide Anti-Yellow Fever Campaign. Between the late-1930 and the mid-1940s, the RF yellow fever laboratories located in Brazil and Colombia carried out a

series of entomological investigations and mapped the extent of yellow fever in South America in order to identify the real extensions of the disease and to develop more effective ways to combat it.[46] These activities kept the anti-yellow fever campaign active in South America during World War II and contributed to its reorganization in 1947. In that year, during a meeting of the Directing Council of the Pan American Sanitary Bureau (PASB), held in Buenos Aires, the Brazilian representative and director general of the National Department of Public Health, Dr. Hector Praguer Froes, proposed that the campaign be resumed, now under the direction of PASB and under the new name, which was the Continental Campaign for Eradication of *Aedes aegypti*.[47]

With the approval of his proposal, the Worldwide Anti-Yellow Fever Campaign launched by the IHB in 1914 under the guidance of Wickliffe Rose, continued in post-World War II under a new beginning and in a new international context characterized by an atmosphere of sanitarian optimism, by the emergence of plans and ideas of development in the Americas, the continent's presence in the Cold War context and the birth of new international organizations, especially the World Health Organization (WHO). As I demonstrate in my Ph.D. dissertation, the Continental Campaign for Eradication of *Aedes aegypti* was a continuation of the RF's Worldwide Anti-Yellow Fever Campaign and synthesized the important transformation of the post-World War II era and reflected a new pattern in the relationship between international organizations and the U.S. Government and Latin American countries, especially Brazil. In my opinion, the Continental Campaign pointed out the beginning of this transition phase which coincided with Fred Soper's term (1947-1959) as head of the PASB.

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who have visited the Archive Center, many of whom have received grants from the Archive Center to support their research.

The ideas and opinions expressed in this report are those of the author and are not intended to represent the Rockefeller Archive Center.

ENDNOTES:

[1] Gorgas, William C. (1909) "Sanitation of the Tropics with Specific Reference to Malaria and Yellow Fever." *The Journal of American Medical Association*, 52: 14, pp. 1.075-77. See also letters exchanged between Wickliffe Rose and Gorgas between July and October 1914, Folder 64, Box 4, Series 1 (Correspondence), Sub-series 1 (General), RG 5, Rockefeller Foundation (RF) Archives, RAC.

[2] "Conference between Surgeon-General Gorgas and Rose at Rose's Office on the afternoon of Tuesday, October 26, 1915," Folder 65, Box 4, Series 1 (Correspondence), Sub-series 1 (General), RG 5, RF, RAC.

[3] Cueto, Marcos. "Sanitation from Above: Yellow Fever and Foreign Intervention in Peru, 1910-1922." *Hispanic American Historical Review*, 72, pp. 1-22, 1992.

[4] "Suggestions as to Organization for Board to Investigate Yellow Fever," December 15, 1915, Folder 65, Box 4, Series 1 (Correspondence), Sub-series 1 (General), RG 5, RF, RAC; "Memorandum on the Yellow Fever Commission Appointed by the International Health Board," June 23, 1916, Folder 134a, Box 22, Series 2 (Special Reports), RG 5, RF, RAC; Letter from Rose to Gorgas, January 20, 1916, Folder 232, Box 14, Series 1 (Correspondence), Sub-series 1 (General), RG 5, RF, RAC; Letter from Carter to Rose, October 19, 1916, Folder 336, Box 19, Series 1 (Correspondence), Sub-series 1 (General), RG 5, RF, RAC.

[5] Rose, Wickliffe. "Yellow Fever: Feasibility of its Eradication," Folder 134a, Box 22, Series 2 (Special Reports), RG 5, RF, RAC.

[6] Carter, Henry (1931). *Yellow Fever: An Epidemiological and Historical Study of its Place of Origin.* Baltimore, Maryland: The Williams and Wilkins Company, 1931, pp. 18-23. Although Carter had just published this book in 1931, some parts of it were circulated privately among the members of the Yellow Fever Commission since 1923. See, for example: "History of Yellow Fever—Section 1: Epidemiology of Yellow Fever by Doctor Henry R. Carter," Folder 772, Box 84, Series 100 (Reports), Sub-series O (Yellow Fever), RG 1.1, RF, RAC.

[7] White, J. H. "The Method of Dissemination and the Possibilities of Elimination of Yellow Fever," 1915, by Joseph White, Folder 134a, Box 22, Series 2 (Special Reports), RG 5, RF, RAC.

[8] White, J.H. "Organization of Campaigns Against Yellow Fever," Folder 134b, Box 22, Series 2 (Special Reports), RG 5, RF, RAC.

[9] Letter from Lyster to Gorgas about the yellow fever situation in the Americas, October 17, 1919, Folder 628, Box 40, Series 1 (Correspondence), Sub-series 1 (General), RG 5, RF, RAC.

[10] "Preliminary Report of the Yellow Fever Commission," 1917, Folder 422, Box 64, Series 2 (Special Reports), Sub-series 899 (Scientific Reports), RG 5, RF, RAC.

[11] Letter from Rose to Gorgas, January 21, 1917, Folder 457, Box 26, Series 1 (Correspondence), Sub-series 1 (General), RG 5, RF, RAC.

[12] Letter from Gorgas to Rose about the expedition of the Yellow Fever Commission to Guayaquil, May 9, 1918, and Summary with details of the proposed expedition to study yellow fever in Ecuador, written by Arthur I. Kendall (president of the Yellow Fever Commission in Guayaquil), May 10, 1918. Folder 541, Box 32, Series 1 (Correspondence), Sub-series 1 (General), RG 5, RF, RAC.

[13] Letter from Noguchi to Victor Heiser reporting the success of his experiments with *Leptospira icteroids*, January 6, 1919, Folder 626, Box 40, Series 1 (Correspondence), Sub-series 1 (General), RG 5, RF, RAC.
[14] Lowy, Ilana. *Vírus, mosquitos e modernidade: a febre amarela no Brasil entre ciência e política.* Rio de Janeiro, Brasil: Editora Fiocruz, 2006; Benchimol, J.L., Sá, M.R., Kodama, K., Andrade, M. M., and Cunha, V.S. *Cerejeiras e cafezais: relações médico-científicas entre Brasil e Japão e a saga de Hideyo Noguchi.* Rio de Janeiro, Brasil, Bom Texto, 2009; *The RF Quarterly Bulletin, July, 1928*, Folder 809, Box 87, Series 100 (Reports), Sub-series O, Yellow Fever, RG 1.1, RF, RAC.
[15] Cueto, 1992, pp. 2-3.
[16] White, J. H. "Memorandum Descriptive of Method of Work against Yellow Fever," Folder 137, Box 23, Series 2 (Special Reports), RG 5, RF, RAC; "Working Plan for Ecuador," Folder 232, Box 14, Series 1 (Correspondence), Sub-series 1 (General), RG 5, RF, RAC.
[17] Sawyer, Wilbur A. (1937), "A History of the Activity of the Rockefeller Foundation in the Investigation and Control of Yellow Fever." *American Journal of Tropical Medicine*, 17: 35-50, 1937, pp. 40-41, *Collected Papers on Yellow Fever*, Vol. V, RF, RAC.
[18] "Memorandum of Yellow Fever Work in Guayaquil, Ecuador, by General W. C. Gorgas," February 4, 1920, Folder 707, Box 47, Series 1 (Correspondence), Sub-series 1 (General), RG 5, RF, RAC.
[19] Bechimol, Jaime. *Febre Amarela: a doença e a vacina: uma história inacabada.* Rio de Janeiro, Brasil: Editora Fiocruz, 2001, p. 7.
[20] Lyster, T.C. "Yellow Fever: Its Distribution and its Control in 1920," Folder 134b, Box 22, Series 2 (Special Reports), RG 5, RF, RAC.
[21] The negotiations between the Brazilian authorities and the RF, however, had already begun some years before. See: "YFC's Letter of Appreciation addressed to Carlos Chagas and Pedro Albuquerque, respectively, Director General of Public Health and Director of the Federal Sanitary Commission of the North," March 25, 1920, Folder 709, Box 47, Series 1 (Correspondence), Sub-series 1 (General), RG 5, RF, RAC.
[22] Letter from Rose to Carter about the activities of IHB for the year 1923, including the beginning of cooperation with Brazil, October 31, 1922, Folder 920, Box 65, Series 1 (Correspondence), Sub-series 1 (General), RG 5, RF, RAC.
[23] Franco, Odair. *História da Febre Amarela no Brasil.* Rio de Janeiro, Brasil: Ministério da Saúde, Departamento Nacional de Endemias Rurais, 1969, pp. 97-105.
[24] Acervo da Casa de Oswaldo Cruz, Departamento de Arquivo e Documentação, Documento—26.20.00 "Mensagem do presidente Bernardes ao parlamento brasileiro." Fundo Rockefeller.
[25] White, Scanell and Connor. "Yellow Fever—Brazil (1924 - 1927)." Folder 1452, Box 114, Series 3 (Routine Reports), RG 5, RF, RAC.
[26] Soper, Fred. "Rehabilitation of the Eradication Concept in Prevention of Communicable Diseases." Public Health Reports, 80, pp. 855-869, 1965.
[27] About the epidemic in Rio de Janeiro see: Fraga, Clementino. "Sobre o surto epidêmico de febre amarela no Rio de Janeiro." *Boletin de la Oficina Sanitária Panamericana*, 7: 12, pp. 1535-1546, 1928; Fraga, Clementino. *A febre amarela no Brasil: notas e documentos de uma grande campanha sanitária.* Rio de Janeiro, Brasil: Officina Graphica da Inspetoria de Demographia Sanitária, 1930.
[28] Since 1929, yellow fever reappeared in ships that sailed on the Rio de La Plata in the southern part of the continent, and in Manaus, in northern Brazil, and it seemed to be distributed along 4,500 miles of coastline. Many rural areas of Latin America, such as Socorro, Colombia, and Guaspati, Venezuela, both small centers away from any focus of infection and far from any big city, also reported cases of the disease. See: Cueto, Marcos. "Los ciclos de la erradicación: la Fundación Rockefeller y la salud pública latinoamericana, 1918-1914." In Cueto, M., editor, *Salud, Cultura y Sociedad em America Latina: nuevas perspectivas historicas.* Lima, Peru: IEP/OPS, 1996.
[29] Cueto, 1996.

[30] Soper lived and worked in this position for over twenty years in Paraguay and Brazil between 1920 and 1942. During World War II he spent time in Egypt and Italy as a consultant for the U.S. Secretary of War and as a member of the North American Commission for Combating Typhus. Using DDT, an insecticide developed at that time, this Commission was responsible for controlling typhus effectively and at a low cost. For more information about Soper's life and career, see: Soper, Fred. *Ventures in World Health: The Memories of Fred Lowe Soper*. John Duffy, editor, Washington. D.C.: PAHO, 1977.
[31] "Yellow Fever Service —Brazil—Annual Report 1930," Folder 1456, Box 115, Series 3 (Routine Reports), RG 5, RF, RAC. See also: Benchimol, 2001, pp. 127-129.
[32] Rickard, E. R. "The Organization of the Viscerotome Service of the Brazilian Cooperative Yellow Fever Service," 1937, *Collected Papers on Yellow Fever,* Volume V, RF, RAC.
[33] Theiler, Max. "A Yellow Fever Protection Test in Mice by Intracerebral Injection." *Collected Papers on Yellow Fever,* Vol. III, RF, RAC.
[34] Sawyer, W. A. "El diagnostico retrospectivo de la fiebre amarilla por medio de la prueba protectora en el ratón," *Collected Papers on Yellow Fever,* Vol. III, RF, RAC.
[35] Diário Oficial da República de 4 de janeiro de 1931, citado por: Faria, Lina Rodrigues de. e Castro-Santos, Luiz Antonio de Castro. *A Reforma Sanitária no Brasil: ecos da Primeira República.* Bragança Paulista, São Paulo, Brasil: EDVSF, 2003.
[36] Soper, F.L., H.A. Penna, E. Cardoso, J. Serafim, Jr., M. Frobisher, Jr., and J. Pinheiro. "Yellow Fever without Aedes aegypti: Study of a Rural Epidemic in the Valle do Chanaam, Espirito Santo, Brazil, 1932," 1933. *Collected Papers on Yellow Fever,* Vol. III, RF, RAC; Soper, F.L. "Jungle Yellow Fever." *Collected Papers on Yellow Fever,* Vol. IV, RF, RAC.
[37] Soper, F.L. "Recent Extensions of Knowledge of Yellow Fever."*Collected Papers on Yellow Fever,* Vol. IV, RF, RAC; Soper, F.L. "The Newer Epidemiology of Yellow Fever." *Collected Papers on Yellow Fever,* Vol. V, RF, RAC.
[38] Ver, por exemplo: Balfour, A. (1914). "The Wild Monkey as a Reservoir for the Virus of Yellow Fever." *The Lancet,* 1, pp. 1176-1178. See also: Low, G.C. (1914). "Monkeys as a Reservoir for the Virus of Yellow Fever." *The Lancet,* 1, pp. 1334-1335.
[39] Soper et alii, 1933.
[40] Lowy, Ilana. "Representação e intervenção em saúde pública: vírus, mosquitos e especialistas da Fundação Rockefeller no Brasil." *História, Ciências, Saúde—Manguinhos* 3 (November 1998-February 1999), pp. 647-77.
[41] Lowy, 2006.
[42] Soper, 1977.
[43] Faria e Castro-Santos, 2003, pp. 98-99.
[44] Smith, Hugh. "DMPH Virus Program," June, 1954, Folder 43, Box 6, RG 1.2, RF, RAC; "Virus Research of the Rockefeller Foundation, 1954," Folder 43, Box 6, RG 1.2, RF, RAC.
[45] Franco, 1969.
[46] Soper, F.L. "The Geographical Distribution of Immunity to Yellow Fever in Man in South America," 1937, *Collected Papers on Yellow Fever,* Volume V, RF, RAC; Soper, F.L. "Yellow Fever: The Present Situation (October 1938) with Special Reference to South America," *Collected Papers on Yellow Fever,* Volume V, RF, RAC; Soper, Fred L. "Progresos en el estudio y control de la fiebre amarilla en Sur America. Las Actas de la X Conferencia Sanitaria Panamericana," 1939, *Collected Papers on Yellow Fever,* Volume VI, RF, RAC.
[47] Froes, Heitor Praguer. "Proyeto de Campaña Continental para la Erradicación del Aedes aegypti." *Boletin de la Oficina Sanitária Panamericana* (outubro de 1947), pp. 842-851.