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## THE EARLY HISTORY OF YELLOW FEVER

DR. PEDRO NOGUEIRA

Outstanding authority in the field of preventive medicine and public health in Cuba. His avocation for many years has been the history of yellow fever. Chiefly instrumental in bringing about the erection of the monument to the heroes of the yellow fever experiments at the site of Camp Lazear.

It is quite fortunate that posterity, which will never again experience this abyss of pain, may regard our narrative as a fable. Thus wrote Petrarch with reference to the plague epidemic in Florence in 1348. The gay adventurers who first explored America may have regarded yellow fever in a similar light. It was an affliction which took lives indiscriminately and mysteriously. Certainly for centuries it appeared that the treasures of the tropics were guarded and protected by a monster. Yellow fever maintained its threat.

What can be said of the origin of yellow fever? There are two schools of thought. The first theory is that the disease and its urban vector were imported to the Americas from the Guinea coast of Africa. The second possibility, and to this the writer adheres, is that this pestilence had existed endemically in the Americas, perhaps for untold time before the Conquest.

Yellow fever did not originate in Europe. Hippocrates does not mention it. There are no descriptions of this striking disease entity by any European writer of the Pre-Columbian period. It surely did not originate in Africa as believed by Audourd and Carter. The nationals of several European countries visited the west coast of Africa, nowadays an endemic area, but no description of this disease was recorded. If such a disease had been encountered, the writers of those days would have mentioned it. Neither did the Portuguese navigators, such as Bartholome Diaz, Albuquerque, or others, refer to it.

In 1879, J. Jones (Proceedings of the Louisiana State Association, p. 59) was unable to find the disease or its symptoms in the works of Herodotus, Strato, Cornelius, Justin, Virgil, Floro, Veleyo Paterculo, Caesar, Horace, Cicero, Xenophon and Tacitus. Nothing about yellow fever appeared in the papers of the writers of the Middle Ages until the discovery of America. Finally, the American origin of the disease is supported by the discovery of jungle yellow fever in South America.

### Ancient Times

The study of the Mayan codices "CHUMAYEL" and "TIZIMIN," made by the Bishop of Yucatan, Crescencio Carrillo Ancora, proves beyond all

doubt—as pointed out by Finlay in his 1897 paper “CONFORMITY BETWEEN THE PHILOLOGY AND THE HISTORY OF YELLOW FEVER”—that before the discovery there were epidemics of yellow fever, or of “Black Vomit,” in the coastal areas of Central America. As described by Carrillo, in folios 16 and 17 of the Tizimin Codex, handed down to us by the Indians of Tizimincah, there is a note on the fourth epidemic of black vomit in Yucatan in 1648, which conforms with what is described in the Chumayel Codex. The writer pointed out there is no other report of the disease until that year. Since the peninsula was not discovered until 1517, it must be concluded that the other three epidemics were suffered before 1517.

The first accurate description of yellow fever seems to be the one written in the year 1495, after the battle known as Vega Real or Santo Cerro, fought by Columbus in Hispaniola against the Indians. After that, the expeditions of Ovando, Nicueza, Hojeda et al., ended in dreadful disasters. There can be no doubt that before that battle yellow fever exerted its lethal influence in the Antilles and in the Spanish Mainland under the names of MODORRA, MODORRA PESTILENCIAL and FIEBRE MALIGNA PUTRIDA; in Mexico under the names of PESTE and PESTILENCIAS, MATZLAHUATT and COCOLITZLE; in Yucatan under the name of XEKIK, and among the Caribbeans under the name of POULICANTINA.

Santo Domingo was scourged in 1495 and later in 1554, 1560, 1567, 1580, 1583 and 1588, the last named date coinciding with the expedition of the pirate Drake which was totally annihilated. According to the Spanish writers Hernandez Morejon and Hurtado de Mendoza, Cadiz and Malaga were visited in 1507 and 1582.

### 17th and 18th Centuries

In the year 1635 the Island of Guadeloupe was scourged. There is a superb description of this epidemic by Father Dutertre. There was a second attack in 1648 when the epidemic reached Yucatan.

The Island of Cuba, a land favored by nature, was the most beautiful possession of the Spanish Crown, as it has all the necessary means which make for human happiness. Bathed by the Caribbean Sea, it sparkled in the distance as an emerald carved in a silver setting, and it served as a trading center to several world powers, thus being favored by great immigration currents. However, as if everywhere God wanted to remind man of his misfortunes, the cup of bitterness being behind apparent happiness, He placed among the delights of this paradise the exterminating disease of the Black Vomit. According to Pezuela, in the year 1649 our country “was pitilessly attacked by an unknown and horrible epidemic, imported from the American continent, one third of its population being devoured by a sort of a putrid fever.” From that date on the bonfire of which the yellow flame was kindled in the West-Indian Archipelago, and the mass of new European visitors made the fire

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inextinguishable. In the years 1653, 1667 and 1668 Cuba was attacked again and this condition lasted until Gorgas applied the principles of Finlay early in 1901.

Barbados suffered an attack in 1647 for the first time, and in 1695 Admiral Wheeler's fleet was destroyed before he could attack Martinique. In 1697 Admiral Neville suffered similarly.

Santa Lucia was visited in 1664. There, 1,411 soldiers were killed out of a garrison of 1,500 men. In 1690, Martinique suffered one of the most fatal epidemics, known as *Oriflamme*, this being the name of the ship which brought it. As this ship came from Siam, making a call in Brazil, the disease was called the "Siamese Illness."

According to Rocha Lima, the first appearance of yellow fever in South America took place in 1658, in Pernambuco; it appeared in New York in 1668, in Boston in 1691, in Philadelphia in 1669 and in Charleston in 1699. It cannot be doubted that by the end of the century yellow fever was the owner of the American soil, and that outbreaks recurred each time a European expedition tried to penetrate into the West-Indian ring. Perhaps the Caribs played an important role in keeping this fire alive, by their numerous warring expeditions to the different islands.

However, from the 18th century on, because of the great military expeditions and the facilities in the passenger routes, intensive yellow fever epidemics broke out. According to Griffith Hughes' "*HISTORY OF BARBADOS*," the name yellow fever originated in that island. The English speaking countries adopted that name, while the Spanish speaking ones called it "*Black Vomit*," after the paper by the Spanish physician Juan Jose Castelbondo, a resident in Cartagena of Indias, which was published in 1729.

In the 18th century Havana was brutally attacked several times, but we will mention only the epidemic of 1762, when the victorious army of the Earl of Albemarle saw his triumphant capture of Havana blurred by the havoc played in his ranks by yellow fever. Out of his 15,000 men only 7,000 came out alive. The seven Spanish regiments which arrived in Cuba in 1780, for the purpose of strengthening the forces of General Bernardo Galvez in Louisiana, were swept away and the same happened to the fleet of General Aristizabal when it returned from Santo Domingo.

Admiral Graydon in Guadeloupe in 1703, and Admiral Vernon facing Cartagena in 1741, experienced the power of yellow fever. The latter, who had sailed from Southampton with 27,000 men to conquer Mexico and Peru, lost 20,000 men in his ill-fated enterprise. Gray's army in Martinique, and another one commanded by Abercrombie intended for the conquest of the other small islands, saw their 13,000 men dwindle under the impact of yellow fever.

Santo Domingo was a permanent focus during the whole century, and there were times when yellow fever was so intense in the Greater and Lesser Antilles, that it is hard to say who was the infected and who the infector.

If we move to the African Continent we find records of an invasion in Senegal in 1740, and in Sierra Leone in 1764.

Spain paid a high price for its trading monopoly because Malaga suffered five epidemics, causing the death of more than 3,000 human beings in 1741. Cadiz was scourged several times, and the Canary Islands suffered their first severe attack in 1771.

First the cities of the British Colonies in North America, and later on those of the United States, were attacked on several occasions, making life practically impossible in some of the ports on the Atlantic coast and on the Gulf of Mexico. New York underwent no less than seven important epidemics from 1702 to 1800. Philadelphia was scourged on eleven occasions and we all know about the 1793 epidemic, so well described by Mathew Carey in his excellent exposition of the horrors suffered by the inhabitants of that city. On this occasion I wish to say a few words of remembrance of the 4,041 persons who died from August to November of that year, and to do homage to our colleagues Hutchinson, Morris, Linn, Pennington, Dodds, Johnson, Glentworth, Phile, Graham and Green, who were the victims of yellow fever while fulfilling the sacred duties of our profession to their very last minutes—here in Philadelphia they wrote a page full of heroism and sacrifice.

Charleston was attacked twelve times and New Orleans suffered impacts on several occasions. The New York 1798 epidemic killed 2,300 persons, in New Orleans 4,044 human beings were lost, and Philadelphia was similarly shaken by the death of 3,446 of its citizens. But this scourge reached other cities, such as Baltimore, Mobile, Norfolk, leaving death and desolation in its path.

In the 19th century, the devastating epidemic took hold among the men sent by Bonaparte to reconquer Santo Domingo. This expedition, 25,000 men strong, under the command of General Leclerc, was totally wiped out by Black Vomit.

Cuba suffered the sternness of this disease in more than twenty-five outbreaks in the period from 1800 to 1887, and we may point out that the Spanish Government lost more than 100,000 men in the two Cuban wars. Unquestionably, yellow fever was the best ally of my country.

In this century, the American cities along the Gulf of Mexico were the ones mainly visited. New Orleans had epidemic outbreaks from 1800 to 1878, and in one year alone, in 1853, 8,101 out of 29,020 patients died. Mobile, Houston, Galveston, Pensacola, Key West, etc., were attacked. We will not mention the total number of visits suffered by New York, New Jersey, Boston,



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Savannah, Norfolk, where in 1855 yellow fever killed 2,000 persons. Charleston had five big outbreaks, of which the one in 1866 took 4,565 lives. In Memphis, Tennessee, scourged no less than five times, the epidemic killed 5,150 citizens in 1879 out of a total of 17,600 cases.

If we cast a rapid glance over the Old Continent, we find Madrid shaken in 1878, and the epidemics recorded in that century in the cities of Cadiz, Cartagena, Jerez de la Frontera, Malaga and Barcelona were indeed horrible, as in Cadiz alone, a city which had 57,000 inhabitants at the time, 48,000 cases of yellow fever were recorded, with 7,307 deaths. Jerez de la Frontera had more than 14,000 deaths and its population was practically desolated. In 1821, Barcelona lost 20,000 lives and Cartagena, in 1804, some 12,000 of its citizens. Through the Canary Islands, it passed triumphantly on three occasions, leaving behind a wake of mourning and pain.

In 1856, Lisbon lost approximately 18,000 human beings and Livorno, Brest, Marseille and Saint Nazaire were invaded. It reached Gibraltar and Southampton. Dr. Graves left a great description of the havoc it played in Dublin in 1826.

In Africa the main epidemics took place in Senegal and Sierra Leone.

This brief historic outline of yellow fever epidemics brings us to the year 1878, when the disease invaded more than 100 cities and villages in the United States, mainly in the States of Louisiana, Mississippi and Tennessee. The number of cases reached the figure of 120,000 out of which 20,000 were lost. Besides taking a terrible toll in human life, it caused the country the economic loss of 100,000,000 dollars.

In view of this enormous destruction, the Congress of the United States passed a law in March 1879, setting up the National Board of Sanitation, appropriating the amount of \$50,000.00 for it. This amount was increased to \$500,000.00 on July 2nd. The first resolution passed by the Board was to organize a Commission to visit the West Indies, with the object of studying Black Vomit in the supposed source areas of the disease, with a three-month stay in Havana and then to carry on its work in Rio and other endemic areas. This Commission which I call the **FIRST AMERICAN COMMISSION FOR THE STUDY OF YELLOW FEVER IN CUBA**, was formed by Doctors Stanford E. Chaille, who presided over it, George Miller Sternberg, Secretary, Juan Guiteras, Engineer, Mr. Thomas Hardee, and Messrs. Rudolph Matas and Henry Marcel. (We are fortunate to have today in New Orleans that great figure Matas, the only survivor of that Commission.)

The report of this Commission was rendered on November 16th, 1879, and among its conclusions the main one reads: "Yellow fever is an epidemic, transmissible disease and the agent capable of transmitting the disease must be in the air." This conclusion, plus the microscopic preparations he had

obtained, led Dr. Carlos J. Finlay—who had participated in the work of the Commission—to think of the possibility that the causative agent should be looked for in the blood vessels. Thus, Dr. Finlay moved along a new route, giving up his ideas in connection with atmospheric alkalinity, which he had studied up to then. All the foregoing, the “Nest Theory” held at the time by Bemis, Stone et al., as well as the study of the evolutionary cycle of certain fungi, strengthened him in his new belief. He expressed himself at the International Sanitation Conference, held in Washington on February 18th, 1881, as to the three conditions necessary for the propagation of yellow fever, namely:

1. The existence of a previous case of yellow fever.
2. The presence of a subject capable of acquiring the disease.
3. The presence of an agent, independent of the disease as well as of the patient, but necessary for the transmission of the same.

The echo is still alive of the revolutionary ideas contained in Dr. Finlay's paper titled “The Mosquito Hypothetically Considered as the Agent in the Transmission of Yellow Fever,” read by him in the Academy of Medico-Physical and Natural Sciences of Havana, in its session on August 14th, 1881. In this paper, the third Washington conclusion carries name and surname, as he further points to the *Culex* mosquito, known today as the *Aedes aegypti*.

How was it to be believed what seemed a heresy? How could Finlay present a thesis introducing the intervention of a new element, insects, in the transmission of the disease to a healthy person? Being ahead of his time, it is natural that he was not understood. He remained so for over more than twenty years. Let us review what the status of yellow fever was at the time, in order to understand the greatness of his work.

What was it that explained this rapidly changing manner of attack? We are not going to discuss the diversity of etiologic conceptions which were uttered, full of vagueness and lacking scientific basis, but which were the object of bitter disputes among its originators, although these conceptions kept everything concerning yellow fever in a deep mystery.

The work of Pasteur opened a new field for the etiology of yellow fever, and germs and bacteria were described.

In view of the great diversity of bacteriologic opinions, the President of the United States, Grover Cleveland, issued an order dated April 29th, 1887, appointing Dr. George M. Sternberg, U.S. Army Surgeon, to go to Rio de Janeiro and Mexico to study matters connected with these diverse opinions. The findings were read by Sternberg before the College of Physicians of Philadelphia in April, 1888, and published in the Medical News of April 28th of the same year. It was evident that he had not found anything of importance in research on yellow fever.

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In the meantime, Dr. Finlay continued his tenacious work to prove his genial hypothesis, effectively assisted by the only man in Cuba who believed him, his inseparable companion Dr. Claudio Delgado, encouraged in his irrevocable faith by his teacher Weir Mitchell, one of your own sons, and backed by Rudolph Matas in the beautiful city of New Orleans.

Upon his return to the United States, Dr. Sternberg, an untiring man, asked to be sent to Cuba to continue his research. His request was granted by Special Order No. 93, of April 21st, 1888, issued by the Secretary of War, William C. Endicott. This is what I call the SECOND AMERICAN COMMISSION FOR THE STUDY OF YELLOW FEVER SENT TO CUBA. Because its means were limited and a report had to be submitted to the President before June 20th, he returned to the United States. This made it possible for him to go to Decatur, Alabama, to study yellow fever in the South of the United States.

Set on solving the enigma of the disease, he asked to be sent to Havana again, and his request was granted by Order No. 30, issued by the War Department in Washington on February 4th, 1889. His tenacious and persevering work succeeded in eliminating many germs claimed to be the cause of Black Vomit.

Sternberg came to Cuba as the Secretary of the Chaille Commission, and in his eagerness to solve the riddle, he visited us later on, on two occasions. Sternberg was an experienced bacteriologist and he used the standard methods of bacteriology in finding the solution. He did not heed the counsel of Finlay, although on many occasions they had discussed man's impotency to defeat the terrible disease. Possibly no one had greater opportunity to apply Finlay's principles and thus solve the riddle than Sternberg. He had an additional occasion, when he visited Mexico, and made the acquaintance of Dr. Daniel Ruiz in Vera Cruz, who, in 1885, had inoculated blood of a yellow fever patient into a healthy person to determine whether thereby the infection could be transmitted. According to Sternberg's report: "At the time of my visit to Vera Cruz he expressed his complete willingness to repeat these experiments in my presence. This was exactly what I desired, and accordingly Dr. Ruiz made three inoculation experiments upon three unacclimated persons in the hospital."

These inoculations failed and he added: "I was therefore anxious to make other experiments before leaving Vera Cruz but the time fixed by my orders expired without my having had an opportunity to do so." Thus we see on that occasion that the time factor possibly prevented Sternberg from achieving what Welch was to recommend later to the Reed Commission.

What we have quoted above is contained on page 109 of the book by Martha Sternberg titled "GEORGE M. STERNBERG, A BIOGRAPHY." The lines quoted are preceded by the following words: "Dr. Finlay of Havana



believes that the disease is commonly transmitted by mosquitoes, which, after filling themselves from a yellow fever patient, transmit the germ by inoculation into susceptible persons."

It is really unexplainable why Sternberg, a man of proved medical culture, did not follow the ideas of Finlay, especially when he had failed to make any progress following his own ideas.

Let us now mention that Dr. Guiseppe Sanarelli in 1887 published a paper in the Annals of the Pasteur Institute, claiming that the cause of yellow fever was the icteroid bacillus, discovered by him. The publicity given to this organism was such that the Surgeon General of the United States Army, General Wyman, at the end of 1898 sent a commission to Cuba, made up by Doctors Wasding and Geddings, of the hospital service of the Navy, to verify the claim. This is the commission which I call the **THIRD AMERICAN COMMISSION FOR THE STUDY OF YELLOW FEVER IN CUBA**. Wasding and Geddings found the Sanarelli bacillus in thirteen patients out of the sixteen studied thus continuing the charlatanry prevalent at the time.

Sternberg, who had been promoted to the rank of Surgeon General, did not accept the ideas of Sanarelli, nor was he convinced by the conclusions of Wasding and Geddings. He decided to send Dr. Aristides Agramonte to Cuba with instructions and authorizations to do everything possible to clear up the question. In his paper titled "**RELATION OF THE ICTEROID BACILLUS TO YELLOW FEVER,**" Dr. Agramonte proved that there was no connection between the two.

It will be noticed that at the end of the century, the etiology of yellow fever was still an enigma except for Finlay, and we make an exception in his case because, after he expounded in 1881 his doctrine of the transmission of the disease by mosquitoes, he continued to work untiringly to prove to the world his scientific truth, studying in an exhaustive manner all the phases of it, namely, its etiology as well as bacteriology, epidemiology, clinical symptomatology, pathologic anatomy, prophylaxis, and describing minutely the anatomy of the *Aedes aegypti*, its habits and customs.

In the first period of Dr. Finlay's professional life connected with yellow fever, comprising the years 1865 to 1881, he wrote ten papers on the subject, and from the last named date to his death, he published eighty papers more related to the Black Vomit. His articles were written in several languages—English, French, German and Spanish, but mostly in English—and in them he shows his deep knowledge. We cannot mention his complete works here, but we believe it would be well to single out, in addition to the paper read by him on August 14th, 1881, in the Academy of Sciences, the paper he made known in that same place in two of its sessions, namely, those of January 31st and February 29th, 1884, titled "**EXPERIMENTAL YELLOW FEVER COMPARED WITH THE NATURAL ONE IN ITS MORE BENIGN FORMS.**"

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In the first part of this paper he deals with its incubational period and discusses its diagnosis in benign cases in some of which albuminuria is present, while in others it is not. In the second part he deals with Experimental Yellow Fever, inoculated by mosquito bites, setting down the manner in which to perform the inoculations. He masterly describes the first ones carried out on Spanish soldiers stationed at Cabana Fortress, as well as those performed on Jesuit Fathers in the "San Jose" farm, in Marianao (where in 1900 the Reed Commission was to establish the Lazear Camp), and in his conclusions Finlay says: "From the fact that yellow fever is inoculable by mosquito bites, there follows the need of protecting the patients attacked by that affection from the stings mentioned in order to prevent the propagation of the disease." We find here, specifically pointed out, the fundamental principle in force today in the prophylaxis of yellow fever. In the part devoted to its diagnosis he deals with the so-called "acclimation fever," pointing out the ephemeral attacks of the disease which render immune those suffering from the ailment, a Finlayan concept now known as "INAPPARENT YELLOW FEVER." He also discusses the incomplete or abortive forms of yellow fever, in which the symptomatologic picture may be restricted to a feverish type characteristic of ordinary yellow fever, and its evolution within the limits pointed out, the other elements of the diagnosis being reduced to their slightest expression, or being completely absent.

In his paper read at the Convention of Hygiene and Demography, held in Budapest in September 1894, he emphasized: "To prevent yellow fever the following should be done:

1. Prevent mosquitoes from biting patients with yellow fever.
2. Destroy as many contaminated mosquitoes as possible.
3. To consider a place free from yellow fever, it must be kept in mind that mosquitoes fed on yellow fever patients may live from thirty-five to forty days under favorable conditions; therefore, prevention must last until that period has passed, as a contaminated mosquito is infectious during its lifetime."

Please consider the value of these postulates in the light of our present knowledge, and to what an extent that misunderstood man, who found no respect for his scientific truth, was a prophet.

In his memorable paper titled "REVIEW OF THE PROGRESS ACHIEVED IN THE 19TH CENTURY IN THE STUDY OF THE PROPAGATION OF YELLOW FEVER," published in 1901, he gathered with the help of his great companion, Dr. Claudio Delgado, the data on all experimental inoculations practiced thus far, a wonderful exposition of his tenacity and faith in his convictions. It may be argued that the results were not completely conclusive, but there can be no doubt that he established the

firm basis of a new doctrine, which would make possible the full confirmation of his ideals later on. It is my opinion that if his guiding lines to put an end to yellow fever had been followed, the disease would have been conquered years before, thus saving thousands of human lives.

Before bringing to an end this part of our paper relating to Finlay, it must be mentioned that yellow fever was not his only concern. He worked on cholera, filariasis, goiter, tetanus, ophthalmology, cancer, leprosy, tuberculosis, trichinosis, beriberi, glanders, etc., publishing more than fifty papers on subjects concerning public health other than yellow fever.

I do not want to tarry on the subject of the different opinions held in connection with insects prior to Finlay's nor on the ones which were formulated after that, as the majority of them deserves no special attention. We will limit ourselves to mention Nott and Beauphertuy, quoting from Dr. H. R. Carter's book, "THE PRACTICE OF MEDICINE IN THE TROPICS": "Neither Beauphertuy nor Nott, in spite of the ingenuity of the theories expounded by them, may be considered as predecessors to Finlay regarding the theory of the transmission of yellow fever by mosquitoes." However, I may add that at the Convention on the History of Medicine, recently held in Rome, Italy, this problem was definitely settled.

While Finlay was carrying out all that has been reviewed above, the drama in Cuba went on unfolding itself, was everlastingly present on its horizon. And yet no one paid attention to him—he was still the object of mockery. This gloomy picture led General Sternberg to appoint the Reed Commission, or the FOURTH AMERICAN COMMISSION FOR THE STUDY OF YELLOW FEVER. Thus, there arises Special Order No. 22, of the Headquarters of the Navy in Washington, dated May 24th, 1900. In the new Order we find new proofs of Sternberg's nonacceptance of Finlay's principles, quoting from the book "MEMOIRS OF WALTER REED," by General Albert Truby, who lived through the whole Cuban episode of 1900 (pp. 89 and 90): "Having for years given thought to this subject, I became some time since impressed with the view that in yellow fever, as in malarial fevers, there is an "INTERMEDIATE HOST." I therefore suggested to Dr. Reed, President of the Board, appointed upon my recommendation for the study of this disease to the Island of Cuba, that he should give special attention to the possibility of transmission by some insects, although the experiments of Finlay seemed to show that the insect was not a mosquito of the genus *Culex*, such as he had used in his inoculation experiments. I also urged that efforts should be made to ascertain definitely whether the disease can be communicated from man to man by blood inoculations." This was published by Sternberg in his paper titled "THE TRANSMISSION OF YELLOW FEVER BY MOSQUITOES," in "Popular Science Monthly" in July 1901. Ten years before, in "The American Journal of Medical Sciences," No. 102, 1891, Sternberg published a paper titled "DR. FINLAY'S MOSQUITO INOCULA-

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TIONS," in which he stated that such works were unworthy of consideration, which brought about Dr. Finlay's rejoinder sent to the Editor of the Journal at the time, Dr. E. F. Davis, who was later to be the brilliant professor of obstetrics at the Jefferson Medical College.

The Reed Commission started its work by conclusively eliminating the importance of the Sanarelli bacillus. The four members of the Commission, Reed, Carroll, Lazear and Agramonte, promptly did away with that charlatanry. In view of the negative results of this research, the Commission seemed in the process of engaging itself in the bacteriologic study of the intestinal flora of patients with yellow fever and of healthy persons. However the guiding hand of General Wood, the findings of Dr. Ross in regard to malaria, and the observations of Carter on the extrinsic period of yellow fever, perhaps all these happily led the Commission to follow Finlay's path.

Thus, the Reed Commission started its studies receiving from Dr. Finlay all the data which, according to his opinion, were of interest. Reed was forced to abandon his work in Cuba. He was called to the United States to report on an epidemic of typhoid fever in the army in the South, and he left Cuba on August 2nd, 1900. His departure brought about the following distribution of the remaining members of the Commission: Lazear was to work on the breeding and feeding of mosquitoes; Carroll on bacteriologic studies and Agramonte in Hospital No. 1. At the Board meeting of August 1st, held in Havana and presided over by Reed just before his departure, it was evident that Lazear was the only member who was enthusiastically for the mosquito theory. To prove this last statement we quote part of a letter Lazear wrote to his wife, dated August 23rd, contained in Hench's "DR. JESSE LAZEAR AND HIS CONTRIBUTION TO THE CONQUEST OF YELLOW FEVER": "Reed and Carroll have been at their bacteriologic work for a long time. . . . They are interested in the controversy with Sanarelli. I would rather try to find the germ without bothering about Sanarelli. The malarial work is my own."

Undoubtedly the plan of the Commission comprised experiments with human beings, so Lazear between August 11 and 25 applied infected mosquitoes to nine American soldiers, including himself and Drs. Carroll and Pinto. These experiments failed because the infected mosquitoes were not yet "ripe." On August 27th, Lazear inoculated Dr. Carroll who promptly developed yellow fever and on September 6, Private Dean developed the disease after inoculation also. Two days later Lazear wrote his wife (Sept. 8) the following: "I rather think I am on the track to the real germ, but nothing must be said as yet." According to Agramonte's book "THE INTERNAL HISTORY OF A GREAT MEDICAL DISCOVERY," when Dean took sick with yellow fever and the diagnosis was established by Dr. Roger P. Ames, a cablegram was sent to Dr. Reed reading: "The theory of the transmission of yellow fever by mosquitoes, so much questioned from the beginning and



the far-reaching importance of which we hardly appreciate, has been indubitably confirmed."

Shortly thereafter a lamentable happening took place: Lazear, infected by what appeared to be an experimental sting, died victim of the disease on September 25th, thus ending a life full of promise, the life of a man who, with masterly hands, guided the definitive experiments to confirm what Finlay had said. At that moment another name, JESSE LAZEAR, was offered as a sacrifice to save thousands of lives, and under the blue sky of our country the light of his reasoning was clouded. From our land there flew his last thoughts to his wife and daughters, and to his future boy who was to bear the honoring name of Lazear.

Shortly after this loss, on October 3rd, Reed returned to Cuba and immediately thereafter, using the data tenaciously worked out by Lazear, he presented at the meeting of the American Public Health Association, held in Indianapolis on October 23rd, the paper "ETIOLOGY OF YELLOW FEVER. A PRELIMINARY NOTE," in which he called the attention of the scientific world to the fact that what had been held by Finlay since the year 1881 was a truth.

Walter Reed returned to Cuba in the first days of November and together with General Leonard Wood, planned the construction of a Camp in which to carry out the experiments which Lazear had already outlined, in order to prove conclusively the mosquito theory. He selected as its location the "San Jose" farm, in Marianao, where in 1883 Finlay had performed experimental inoculations upon Jesuit Fathers. We are of the opinion that Reed selected that place following Agramonte's suggestion, who knew that in spite of the yellow fever epidemics in Marianao, there were no cases of the disease on the farm, surely because the *Aedes aegypti* were not present. The Camp was named after Lazear, in honor of the hero.

Two cabins of identical measurements were built, and in one of them, bearing the number 2, experiments with infected mosquitoes were made on volunteers, while in the other, bearing the number 1, it was proved that the FOMITES had nothing to do with the transmission of the disease.

This group of volunteers—made up of Americans, Spaniards and Irishmen—showed to the world their greatness and courage in experiments carried out in a disciplined manner, and with sufficient resources. The results confirmed the greatest scientific truth, a truth our glorious Carlos J. Finlay had offered and the medical world had refused to accept.

In 1940, that spot of Cuban land which Hench correctly identified as Cabin No. 1 with the help of Moran, one of the great volunteers, was still kept as a symbol of that great event. The Cuban Government declared it a National Monument. This was not possible with Cabin No. 2 which had



## EARLY HISTORY OF YELLOW FEVER

been destroyed by the hurricane which attacked Havana in 1926. Cabin No. 1 was restored to its original status. A park was constructed around it in which bronze medallions of Finlay, Wood, Lazear, Reed, Agramonte, Carroll and Delgado were placed, with two bronze plates bearing the names of all those who volunteered and of the persons who contributed to the definitive conquest of yellow fever.

Shortly after the holding of the Third Pan-American Medical Congress in Havana in 1901, Reed presented the conclusions of the Commission, which permitted Gorgas (another unbeliever of the Finlay theory) to carry out the great work of making Havana wholesome which started on the 4th of February, 1901. We may call this the first brilliant work in Public Health, irrefutably demonstrating its results. In February, five deaths were recorded in Havana, one in March, none in April, May and June, one in July, two in August and two in September. What had been the brutal and ferocious scourge of its inhabitants over four centuries, finally disappeared. Indubitably, the definitive conquest of yellow fever alone justifies the Spanish American War, in spite of the fact that in the period between 1898 and 1900 the United States suffered 231 deaths of yellow fever out of total of 1,575 cases.

After his success in Havana, Gorgas, supported by the Governor of the Isthmus of Panama, General G. W. Davis, made possible the construction of the Canal which Lesseps was not able to build years before. To accomplish this he simply had to put into practice a campaign against the *Aedes aegypti*, which was the key to his great success. There can be no doubt that the disappearance of yellow fever in Panama, and his victorious campaign against malaria, are eloquent facts revealing Gorgas' scientific, sanitarian, diplomatic and moral qualities, as well as his organizing and executive abilities, which place him on the level of the first sanitarian of the world.

Now, let my final words express to the Jefferson Medical College, our joy and profound happiness for taking the initiative in honoring Dr. Carlos Finlay on the Centennial of his graduation.

Like a loving mother, this honorable institution molded the majestic figure of Dr. Finlay and today I feel and all of you must sense, his gigantic figure being projected all around us. To you, Jefferson Medical College, the esteem of my country and our profession must be shown for honoring one, who loved and honored you during all his professional life and for maintaining after 100 years a faith and confidence in his greatness as did his teacher, Dr. Weir Mitchell, while Finlay struggled to prove to a doubting world his great scientific truth.

I thank you.

