

Cruz, Oswaldo, 1872-1918.

MD ANNIVERSARY

In the latter half of the 19th century Brazil was shunned as "the land of death." Ships bypassed the great ports, emigrants settled in other countries, and commercial, industrial and property losses were beyond calculation. The chief villain was yellow fever, which a Rio newspaper called "the ruin, shame, infamy and curse of our land."

It struck Brazil in 1849, when a vessel from New Orleans docked in Bahia with one victim aboard. Brazilians by the thousands contracted the disease and year after year it spread. Four percent of the population of Belém died in 1850. There were 15,000 cases in Rio de Janeiro between 1891 and 1894. The weakened survivors often fell prey to bubonic plague and smallpox.

During this terrible period, Brazil's health authorities sought help from the greatest scientists in the world, but these still attributed yellow fever either to miasma or contagion. Some noted men urged quarantine precautions, others advised Brazilian leaders to correct unsanitary conditions. Both types of advice were partially right, but the periodic ravages of the disease continued until war was declared against the real villain, the Stegomyia mosquito (*Aedes aegypti*) after 1900.

The leader of this campaign was Dr. Oswaldo Gonçalves Cruz, who is the most honored physician in the field of public health and sanitation in Latin America. His conquest of yellow fever rested on the discovery by Cuba's Dr. Carlos Finlay of the role of the mosquito, and on the techniques of Dr. Walter Reed in Cuba and Dr. William C. Gorgas in Cuba and Panama. But he

BRAZILIAN PIONEER



Dr. Oswaldo Cruz (1872-1918) cleared Rio de Janeiro and other leading Brazilian cities of yellow fever, bubonic plague, smallpox.

Dr. Cruz' wife Amalia and five of their six children. Two of his sons followed him into medicine: Oswaldo, Jr., professor of bacteriology and head of the institute named for Cruz; and Walter Oswaldo, professor of hematology. Opposite, Dr. Cruz is seen in his laboratory at the institute which he headed.



had to apply their eradication and control techniques to a country larger at that time than the United States.

Cruz also had to fight conservative medical circles, politicians of various stripes and an apathetic, often hostile population. When he widened the war to include compulsory vaccination against smallpox, he almost started a revolution.

Circumstances had transformed Oswaldo Cruz from a shy researcher, who won fame early for his pioneering work in experimental pathology and serum therapeutics, into a ruthless public health officer who did not hesitate to blow up entire city blocks to prevent the spread of infection.

YOUTH. Oswaldo (or Osvaldo) Gonçalves Cruz was born a century ago, August 5, 1872, in the village of São Luiz do Paruhytinga in southern Brazil, the fifth child and only son of Dr. Benito Gonçalves Cruz and Amalia Taborda Bulhões. His father, once the national director of hygiene for Brazil, had become a country doctor, who sometimes rode many miles on horseback to visit patients.

The son was so precocious that the parents decided to move back to Rio, their former home, so that he could have a better education. He entered the school of medicine in Rio at 14 and graduated with honors at 20 on December 24, 1892. He had taken extra courses in public health, microbiology and bacteriology; his doctoral thesis was "The Transmittal of Bacteria through Wa-

ter." When his father died of a coronary occlusion earlier that year at 47, Oswaldo took over his practice and worked as a researcher in the National Institute of Hygiene.

At 21 he married Amalia da Fonseca, daughter of a wealthy businessman, who set up a laboratory for his son-in-law in the basement of his home. Three years later he provided the funds for him to enter the Pasteur Institute in Paris, then the most famous center for bacteriologic studies.

PARIS. The staff of the Pasteur Institute took the shy and dedicated young man under their wing and offered warmth and stimulation to cure his initial homesickness. He studied public health, microbiology, pathologic histology and biologic chemistry with experts; his goal was to return to Rio and introduce the most modern techniques for the diagnosis and treatment of contagious diseases.

He was particularly interested in yellow fever and in the experimental studies done by Finlay of Cuba, whose work indicated that the disease was carried by the common mosquito.

Cruz worked with Alexandre Emile Yersin, the French bacteriologist who discovered the bubonic plague bacillus (independently of Kitasato) and with Waldemar Haffkine who developed vaccines against the plague made from live or heat-killed organisms.

Cruz' best friend was the under-director of the institute, Russia's Elie Metchnikov, many years his senior. Gentle and solicitous, Metchnikov spoke

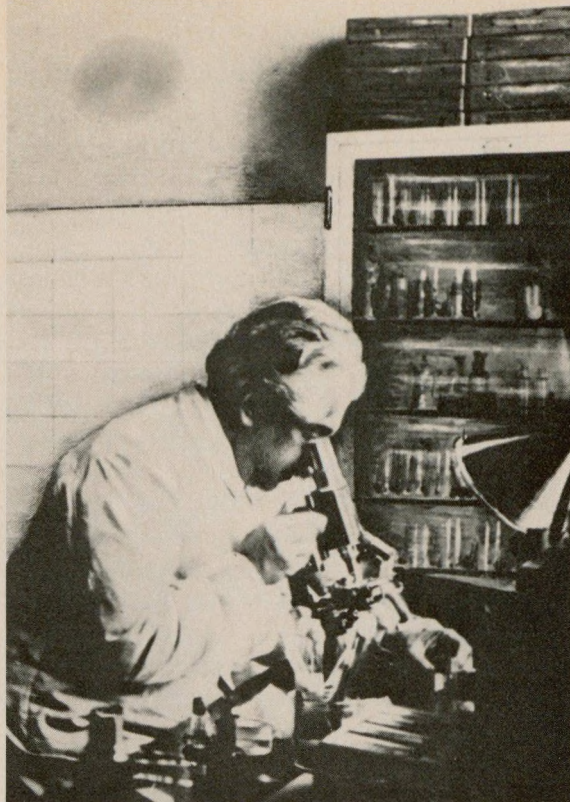
fair Portuguese because he had lived for some time in Madeira. Another friend was Pierre Emile Roux, who with Yersin demonstrated that the diphtheria bacillus produced a toxin, which led to the production of an antitoxin. Cruz worked closely with Roux on toxins and serums.

In the toxicology laboratory in Paris Cruz became interested in the histologic changes caused by various poisons, an area no one had explored before. He wrote several monographs on this subject, after which he was called in as an expert in cases of poisoning. One case, in which it was unclear whether the victim had died from lighting gas or charcoal gas, became a landmark in forensic medicine because it involved a great deal of money. According to French law, the heirs would receive a large indemnity if lighting gas was the cause and nothing if it was charcoal gas. Cruz found the answer and published his results in 1898 under the title "Studies on the Research of Poisoning by Lighting Gas."

He also published papers on the toxicity of the castor oil bean, a special problem in Brazil because children ate the bright colored seeds of the plant and died horribly. The Brazilian government later gave him a special award for this work. Among his other studies in toxicology was the development of a more efficient method of using the Florence reaction, a test for the presence of spermatic fluid. At night he worked in a factory that made glass laboratory equipment, with the idea of introducing this art to Brazil.

PLAGUE. Shortly after Cruz returned to Rio in 1899 bubonic plague broke out in the port of Santos and threatened to spread to other cities. The municipality of Rio provided funds for the preparation of antiplague serum, and Professor Pedro Alfonso, director of health, set up a small

In Paris at the Pasteur Institute Cruz became a friend and worked closely on toxins and serums with Pierre Emile Roux, left, and became interested in yellow fever and the experiments performed by Dr. Carlos Finlay of Cuba, right.



laboratory on an abandoned plantation in Manginhos, a suburb of Rio. But having no one to do the work (he himself was a surgeon), he cabled to the Pasteur Institute for a French specialist to come to Rio at any price to fight the plague. Roux replied that a specialist at hand was his own countryman Oswaldo Cruz.

Cruz installed an emergency laboratory in the Santos isolation hospital, and as soon as he confirmed that the five patients were plague victims he made an immunizing serum by using killed bacilli and gave repeated intravenous injections. Although he knew that serum, to be effective, should be administered before the symptoms of the disease were manifest, Cruz felt that nothing would be lost by this attempt; all the patients improved.

He urged local authorities to destroy all the rats in Santos, a directive that was not carried out as thoroughly as he had outlined.

He warned the authorities in Rio that the plague would probably reach the city because the Santos authorities did not have a good system of quarantine or of notification of cases. In 1900 there were 295 deaths from the plague in Rio and two years later the rate rose to 360.

Cruz gathered a small staff of dedicated young Brazilian scientists and medical students who spent days and nights producing antiplague vaccines and serums in the makeshift laboratory at Manginhos. He taught them how to blow their own glass ampules and other glass equipment



until the government could set up a factory. By the end of 1900, his first vaccines and serums, based on the European methods he had learned, were ready.

Cruz also urged the government to enforce prophylactic measures against the plague in the city and its environs. He gave the authorities detailed directions about the quarantine of ships, rat-proofing warehouses, destroying rats and fleas by poison and burning. He urged them to put leaflets under every door explaining the rat-flea-man transmission, and giving instructions for each citizen to kill rats and burn their flea-ridden bodies with kerosene. When this was not done, Cruz advertised in every available publication that he would pay for all rats delivered and destroy them himself. Tons of rats poured in and by 1904 the plague in Rio was under control, with only 97 deaths, the lowest in years. It was eliminated a few years later when Cruz' strict orders were made effective.

SERUMS. Cruz modified the European formula and dosage for antiplague sera, and also found that a combination of serum and vaccine produced longer and more effective immunity. He sent samples to the Koch and Pasteur institutes, where they were acclaimed as the best in the world and immediately adopted.

He published the details in "Anti-Plague Vaccine" (1901) and "Plague" (1906). In the second study he told how one of his colleagues was ac-

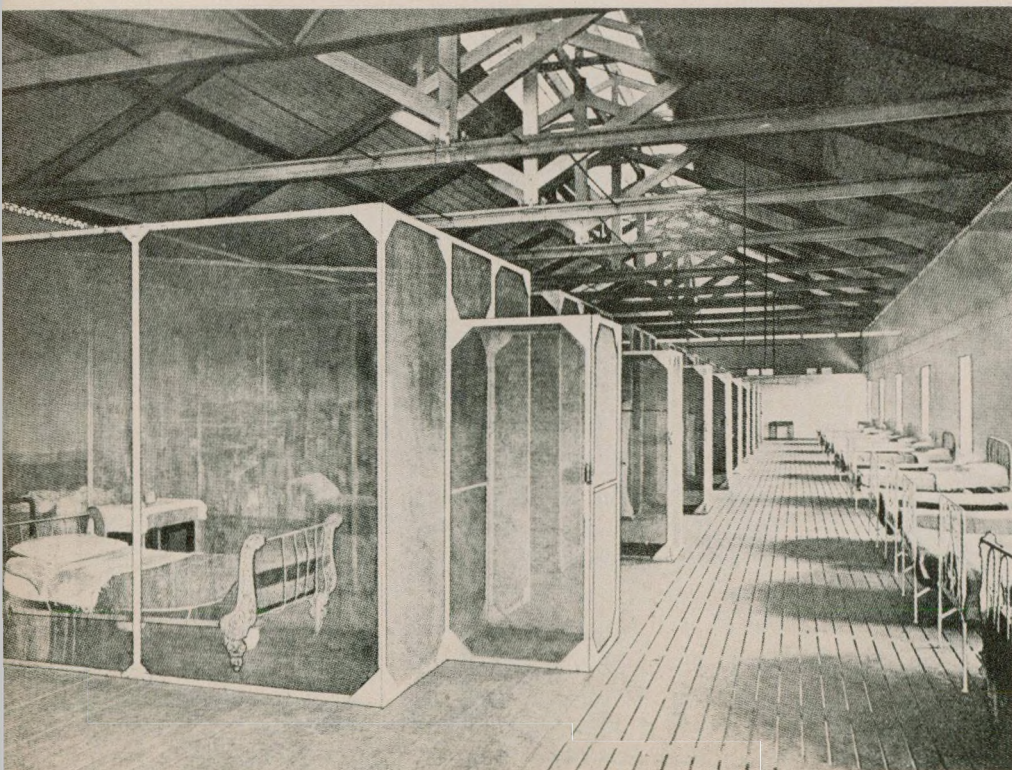
cidentally infected, developed a plague pustule and was cured with the Manguinhos treatment, while identical cases in Vienna and Berlin ended with the researchers' deaths because, Cruz claimed, they were treated in the old way.*

YELLOW FEVER. In 1903 the dynamic new president of Brazil, Francisco da Paula Rodriguez Alves (1902-06), an admirer of Cruz, appointed him the country's director-general of health. Against the advice of older and more conservative physicians, Alves told Cruz he would give him authority to use any measures he deemed necessary and would make funds available to eliminate yellow fever. In turn Cruz gave his famous promise: "With these I will clear Rio of yellow fever in three years."

Both men were lampooned in the newspapers, Alves for appointing a "baby" as health director, Cruz for his "rash" promise, his youth, and the fact that he had no reputation as a yellow fever specialist.

A year passed before Alves could force an appropriation through congress, and the war against the mosquito did not begin until 1904. Meanwhile Cruz developed a plan based on the work of the American commission in Cuba and Panama and adapted it to Brazilian conditions. He divided the city and its environs into ten sanitary districts, each with a medical chief who had a staff of six

* The Brazilian victim, Dr. Henrique Aragão, lived to become a famous parasitologist.



Mosquito-proof isolation ward was established at the Hospital San Sebastiao under Dr. Cruz' direction during his yellow fever campaign.



or seven inspectors, physicians and medical students; under these would work a large force of paramedical personnel and laborers.

With Cruz at the helm, the government launched a campaign of eradication against the mosquito which had been identified by Finlay and proved by Reed to be the vector of yellow fever. Teams of inspectors and assistants dressed in distinctive uniforms (called the "mosquito brigade") combed the urban areas and suburbs for reservoirs, pools, puddles, rooftop gutters and other potential breeding places of the insects; all these were cleaned out and the larvae destroyed.

Part of the campaign was a massive public education program to persuade the independent *cariocas* (citizens of Rio) to let the inspectors into their premises. This was less successful, as many of them resented the men poking about their rooms for pots and bottles, and spraying with noxious chemicals.

Obligatory notification of all cases of yellow fever was part of the sanitary regulations of Rio, but this was loosely observed. Cruz designed a strict new sanitary code in which he asked the government to make notification enforceable by rigid penalties; this law was passed on March 4, 1904. Later that year he pushed through an addition based on Germany's vaccination code, providing for compulsory vaccination with re-vaccination every seven years.

The procedure for yellow fever included noti-

fication, isolation, disinfection and medical supervision. Cruz also added these diseases for notification: plague, cholera, all choleraform seizures, smallpox, diphtheria, puerperal fever, ophthalmia in the newborn, typhus, typhoid, leprosy, tuberculosis, malaria, beriberi, scarlet fever, measles.

In a single year every house in the federal district was disinfected and some were dynamited. Not a single open tank, fish pond or other deposit of stagnant water escaped the attention of the health crusaders: by the end of 1904 nearly 1.5 million reservoirs and other breeding places were cleaned and kept clean.

The public was infuriated by the ruthless tactics of the mosquito brigade, and when Cruz announced that compulsory vaccination would be done a mob besieged his home and forced him and his family to flee at night. Thousands marched on the presidential palace, including units of the army. The people were whipped on by Alves' opponents, honest and otherwise, who believed that the dictatorial operation of the sanitary code meant the end of their independence.

Military action by the government quelled the revolt and cooler heads did the rest. Publicity revealed that even as the people fought the government, the war on yellow fever was being won.

Both yellow fever and smallpox were eliminated entirely in 1907, well within the time promised by Cruz. Plague was curbed and the incidence of other infectious diseases was greatly

Horse drawn machinery resembling fire engines were used by Cruz "mosquito brigades" to clean out all potential urban and suburban breeding sites for mosquitoes and their larvae during his 1904-07 intensive campaign against yellow fever.



Cruz' "mosquito brigades" consisted of paramedical personnel and laborers who worked under a staff of physicians, medical students, health inspectors. So intense was their zeal that they came into conflict with a public enraged by their tactics.

Oswaldo Cruz Institute was built by the Brazilian government to replace Cruz' crude laboratory in Manguinhos as a reward for his dedicated service.



reduced. When these facts were distributed to every dwelling Cruz became a hero instead of a villain, and people named babies after him.

When offered a reward for exceptional public service, he asked for the expansion and modernization of the old farm at Manguinhos where he and most of Brazil's leading researchers still worked in shacks under deplorable conditions. The beautiful Moorish style buildings of the Oswaldo Cruz Institute for Experimental Pathology and Serum Therapeutics were built and named in honor of its director. Now standing in the center of the city, it is one of the few colonial style buildings in a glass-and-concrete city.

Brazil was invited to participate in the 14th International Hygiene and Democratic Congress in Berlin in 1907. There Dr. Cruz' exhibits depicting his country's public health activities and the research of his institute caused a sensation: the jury gave Brazil the first prize among 123 exhibitors and Cruz himself was showered with awards, including France's legion of honor.

Shortly after he extended the yellow fever control campaign through the rest of Brazil and strengthened local public health services. He personally carried out the work in Belém in the state of Pará, a particularly deadly center of the disease.

As the ports of Brazil gradually became known for their splendid health facilities, land values rose, immigrants poured in and rapid industrialization took place. As historian José Maria Bello

put it: "All Brazil seemed to take on new life, with greater confidence and pride in herself."

THE INSTITUTE. In 1909 Cruz resigned as public health director because the constant battles of the past six years had ruined his health. He suffered an attack of uremia in 1908 from which he could not recover, and he began to have problems in walking and seeing. Instead of reducing his schedule, he expanded the activities of the institute, which became one of the world's leading centers for the study of infectious and tropical diseases. It attracted gifted men such as Carlos Chagas, Sampaio Vianna, Adolfo Lutz, Henrique Aragão.

Alongside its laboratories, the institute contained a hospital for the study of tropical diseases and a school of experimental medicine where Cruz taught daily. There was also a large library and a museum rich in entomologic specimens. While he was still the director, the manufacture of biologic products for curative and preventive treatment of diseases in man and animals became an important part of its operations. Besides the plague serum, it prepared antitetanus and antidiphtheria products.

Another phase of its program was to send commissions to investigate epidemics, assist in organizing laboratories in other cities and undertake special studies. Cruz accepted an assignment in 1910 to visit the malarial zone of Madeira-Mamoré where a railway was being built between these two tributaries of the Amazon basin.

Although suffering from uremia, hyperazotemia and a detached retina Cruz outlined a sanitation project based on Gorgas' work in Panama, adapted to Brazilian conditions. Among the prophylactic measures proposed, two were put into effect at once: quinine to be administered by the foreman of each group of 50 workers, the obligation of workers to return to dormitories covered with mosquito nets at sundown.

Another attack of uremia felled Cruz in 1915, but he still refused to leave his institute. He was tricked into doing so by the president of Brazil, who appointed him mayor of Petrópolis, a delightful mountain resort town. Illness forced him to resign in January, 1917 and on February 11 he died of cardiorenal cachexia, at the early age of 44. He left a wife and six children, two of whom, the future physicians Oswaldo Cruz, Jr., professor of bacteriology, and now head of the Institute and Walter Oswaldo Cruz, professor of hematology, followed in his footsteps.

SUMMING UP. By a Brazilian historian: "His life was like that of a meteor: brilliant and brief."

