
Feature



Oswaldo Cruz and the Flowering of Public Health in Brazil¹

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Humanity's penchant for neglecting the unpleasant has helped us to forget that as recently as 1900 the city of Rio de Janeiro was a running sore. Sanitation was poor, medical knowledge limited, public health weak.³ There, as elsewhere in Brazil, the ordinary run of diseases like tuberculosis, diarrhea, and measles took their toll, while certain more dramatic killers like smallpox and bubonic plague were rife.

But the great terror of Rio in those days, the ill that slew waves of immigrants and really gave the city its bad name, was yellow fever. Also known as the "black vomit," yellow fever reached Rio in 1849, erupted into a fearsome epidemic that killed some 4 000 residents, and for the next half-century lingered as a shadowy assassin claiming hundreds or thousands of lives a year. In time it became well known that all who survived a yellow fever attack (including a mild or unnoticeable childhood attack) were immune

from further harm; but all vulnerable adult visitors, immigrants, and nonimmune residents afoot in Rio during yellow fever season ran a high risk of quick and horrid death.

While it may seem surprising that this health picture has been forgotten, the really surprising thing is how it changed. Beginning in 1903, a broad public health campaign began. Some measures, like widening of narrow streets and improved sanitation, were fairly general. Others, like destruction of plague-bearing rats and yellow fever mosquitoes, were more specific. All in all, the results were startling. As if some enchanter had waved a magic wand, plague retreated, yellow fever vanished, the death rate fell, and Rio's health, happiness, international prestige, and self-esteem began to rise.

The person who spearheaded this transformation was a quiet, strong-willed young man named Oswaldo Cruz. When he became director of Brazil's diminutive public health department in 1903, Cruz took the bull by the horns. In three years he vastly expanded the department, planned and managed large national campaigns against various problems including plague and yellow fever, and established a permanent beachhead for

¹This is the sixth in a series of profiles on individuals who have made outstanding contributions to public health in the Americas.

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³Bacellar RC, p 237.

Pictures taken of Oswaldo Cruz in 1903 (right) and in 1911 (below, left). The 1908 cartoon at lower right appeared over the caption "This is the way the country receives its sons that honor and love the nation; it crowns and blesses them." (Drawing by Klixto, *Fon-Fon* magazine, Rio de Janeiro, January 1908; photos courtesy Casa de Oswaldo Cruz Archive.)



medical research in Brazil. In the process he roused fiery political controversy, achieved spectacular success, and became his country's first and greatest public health hero.

It is true that Cruz, trained in microbiology and aware of key public health discoveries abroad, was a man in the right place at the right time. But he also started in 1903 as a virtual unknown with limited experience in medicine, laboratory science, public health administration, and politics. He worked so fast that his feats seemed the stuff of legend—like medical sleight of hand. And no other Latin American country ever experienced such a swift, self-generated public health revolution, though at least one other, Argentina, was medically more advanced. So it is worth looking closely at who Oswaldo Cruz was and what he did.

EARLY YEARS

Oswaldo Gonçalves Cruz was born in the small Brazilian town of São Luís de Paraitinga on 5 August 1872. Perhaps partly because he was an only son (he had six sisters but no brothers), from early childhood he tried hard to follow in his father's footsteps. That took him interesting places—because his father, Bento Gonçalves Cruz, was a private physician with uncommon dedication to learning, medical science, and public health.

In 1877, when Oswaldo was five, Bento and his wife Amália moved their family from São Luís to Rio de Janeiro so the children could get a regular education. There they lived in Jardim Botânico, then a poor neighborhood, where Bento got a morning job as physician at a textile factory, the *Fábrica de Tecidos Corcovado*, and ran a private practice in the afternoon. As time passed his reputation grew. Nine years later, in 1886, Emperor Dom Pedro II made him a member of the country's public health board (the *Junta Central de*

Higiene Pública); by 1890 he was assistant to Brazil's top public health officer, the Inspector General of Health; and in 1892, a few months before his death at the age of 47, he himself became Inspector General of Health.

In those days, of course, the scope of Brazilian medical science and public health was limited. Medical laboratories and basic tools like microscopes were rare. Medical schools existed in Bahia and Rio, but these had serious shortcomings. As Nancy Stepan reports in her excellent book *The Beginnings of Brazilian Science*, there was no chair in microbiology anywhere until 1901, and as late as 1904 the lone professor of microbiology at the Rio de Janeiro School of Medicine "was attempting to instruct one hundred and fifty students with a single microscope. The situation in histology and pathology was much the same."⁴

Public health laws existed in these years, but ignorance of disease origins, effective quarantine rules, and appropriate sanitary measures prevented such laws from being effective. The resources at the command of public health authorities were few. And despite the explosive growth in medical knowledge then under way outside Brazil, principally in Europe, the circle of Brazilians directly involved with public health was very small.

Oswaldo Cruz, who grew up within that circle, was quiet, studious, and precocious. His mother taught him to read at age 5. He then proceeded to finish school in 9 years. After that, at age 14,⁵ he began university studies equivalent to college plus medical school at the National School of Medicine in Rio, the same institution his father had attended.

At the university, Cruz came in close contact with several well-known clini-

⁴Stepan N, *Beginnings of Brazilian science*, p 55.

⁵Moreira M, pp 29–30.

cians. One of these, Professor Rocha Faria, supervised the medical school's first microbiology laboratory. Cruz, who worked for some time as an assistant there, found himself increasingly drawn to microbiology and wound up doing his medical thesis under Rocha Faria on transmission of microbes by water.

That could have been the end of his involvement with research. By 1892, when Cruz received his medical degree, he had exhausted the training available in Brazil. His father's death the same year left him with scant resources. And his marriage in 1893 to a girl named Emília Fonseca, with whom he ultimately had six children, obliged him to settle down. So he took his father's old job at the *Fábrica de Tecidos Corcovado* and for some years pursued a career in clinical medicine.

Fortunately, Oswaldo's interest in microbiology got strong backing from his father-in-law, whose wedding present was the cash Oswaldo needed to build a small home medical laboratory. Dr. E. Sales Guerra, a prominent physician and head of the Internal Disease Service of the General Polyclinic of Rio, was impressed by the laboratory and asked Oswaldo to set up and run a diagnostic laboratory for the polyclinic. Another leading clinician, Dr. Francisco de Castro, was also impressed and aroused Cruz's interest in continuing his scientific training at the Pasteur Institute in Paris.

Cruz followed up on both suggestions. He set up the diagnostic laboratory at the polyclinic, where he and Sales Guerra became close friends; and in due course he applied to the Pasteur Institute, was accepted, and with his father-in-law's financial support took his family to Paris and began two-and-a-half years of study.

Cruz did not choose France and the Pasteur Institute by chance. From the early 19th century onward France and Brazil had enjoyed close cultural ties, to a point where French was the educated Brazil-

ian's second language. Moreover, the Emperor Dom Pedro II had invited Louis Pasteur to visit Brazil in 1883; and though the invitation was declined on account of Pasteur's ill health and age, Dom Pedro remained unabashedly impressed by Pasteur's work against rabies and contributed generously when the Pasteur Institute was founded in 1885.

When Cruz applied—around the time Louis Pasteur died in 1895—the Pasteur Institute was impressive. Organized to combine basic research, applied research, and student training, it consisted of five departments—one dealing with rabies, one with microbe morphology, and three with microbiology. Its department heads, charged with pursuing research in their own areas while working as fully as possible with others, included some of the most original scientific minds in Europe. And its approach to advanced medical research, combined as it was with student training, tended to forge close associations between researchers and students.

When Cruz began his Paris studies in 1896, excitement about serum therapy was high, and the institute's work was strongly focused on developing immune sera and vaccines. So Cruz received extensive training in the most advanced techniques emerging within this branch of medicine.

But he also planned to return to Brazil; he knew his country's research underpinnings to be weak, and so he studied many other things. He put on a workman's blue shirt and learned glass-blowing techniques used to make scientific glassware at a local factory; he kept up with published research on various ills, most notably yellow fever, which he likened in his letters home to "an invisible stain that disgraces and humiliates us";⁶ he at-

⁶Brazil, Congresso Nacional, *Annaes da Câmara dos Deputados*, 1903, vol 6, Sessões de 1 à 31 de outubro, p 168, as quoted in Stepan N, *Beginnings of Brazilian science*, pp 72–73.

tended courses at both the Pasteur Institute and the Paris Municipal Laboratory; and he wrote Salas Guerra that besides microbiology he was studying histology, pathology, hygiene, and chemistry with the aim of establishing a laboratory for the diagnosis of morbid diseases on his return to Rio.⁷

The end result was that when Cruz arrived home in 1899 he came as a fully trained bacteriologist highly attuned to modern medical discoveries. However, his immediate situation was not drastically changed. Brazil was essentially the same. Medical research was limited, advanced research in microbiology unknown. So at first there seemed no option but to pick up his work more or less where he left off at the factory and polyclinic and to reopen his private clinical practice, which is what he did.

THE SEROTHERAPY INSTITUTE AT MANGUINHOS

What interrupted this routine was the bubonic plague. An ancient scourge harbored by rats, transmitted by fleas, and encouraged by poor sanitation, plague had been a classic disease of Europe and Asia that was utterly unknown in the New World. But a plague pandemic that began in the Far East in 1894 found its way to Brazil in 1899 and struck Rio in 1900. That year it killed at least 295 people in the capital, and city authorities asked the federal government to help build a laboratory that could blunt the crisis by producing antiplague immune sera and vaccines.

The original suggestion to build this laboratory had come from Baron Pedro Afonso de Carvalho Franco, a talented

surgeon famed for his promotion of vaccination against smallpox and diphtheria, who in 1900 was chief of the federal government's vaccination institute. It soon turned out that municipal funds for the antiplague laboratory were lacking, so the federal authorities took over the project in May 1900 and put Baron Afonso in charge. The Baron looked around for technical personnel to help him, and among others asked Oswaldo Cruz to join his team.

The choice was logical. The Baron may not have known that Cruz's training at the Pasteur Institute had taught him about plague and had steeped him in the world's latest knowledge of immune sera and vaccines. But he knew Cruz had helped the government to confirm the first suspected plague cases in Brazil, and he knew him to be one of the few available experts in this field.

Cruz, who saw the offer as a chance to use his training, decided to accept, and soon the project started. A city-owned farm named Manguinhos, some miles outside of Rio, was chosen as the laboratory's site; conversion of Manguinhos' ramshackle physical plant got under way; and on 25 May 1900 the facility was inaugurated as the Federal Institute of Serotherapy. Soon after that the Baron set off for France to recruit a technical director with the high skill needed to direct safe production of sera and vaccines from *Yersinia pestis*, the deadly plague bacillus.

The Baron found no French bacteriologist of repute willing to take the job. That was not surprising—because, aside from the dangers posed by *Yersinia pestis*, Brazil was a distant backwater, the government was only offering a 6-month contract, and yellow fever had everybody scared. But Afonso, who had already recruited two bacteriologists in Brazil (Cruz and Col. Ismael da Rocha, an army doctor), did recruit a veterinarian named Carré in Paris. And he heard about Cruz's abil-

⁷Stepan N, *Beginnings of Brazilian science*, p 72, based on Brazil, Congresso Nacional, *Annaes da Câmara dos Deputados*, 1903, vol 6, Sessões de 1 à 31 de outubro, p 166.

ities from Professor Emile Roux, a distinguished pupil of Louis Pasteur and Vice-Director of the Pasteur Institute, who remembered Cruz and praised him highly. Thus reinforced, the Baron returned to Manguinhos determined to proceed with his mostly local staff.

That staff soon shrank. Col. da Rocha was called away to deal with a plague outbreak in the army; and the veterinarian Carré, citing health reasons, cut his contract short and returned to France. However, by then the Baron was sufficiently impressed with Cruz to leave him in charge of all technical operations; and so, with the assistance of a technician from the Vaccination Institute, two medical students, and a number of service personnel, the work progressed.

Fortunately, besides knowing what he was about, the quietly assertive Cruz turned out to be a gifted manager and teacher. So the work proceeded quickly despite inexperience, scarce funds, poor equipment, and a rudimentary physical plant. By October, less than 6 months after the project started, the first boxes of plague vaccine were ready. In nine months, by February 1901, antiplague immune sera were also ready. And by the end of 1903 the institute had supplied the government with immunizing products worth an estimated 324 000 milreis (equivalent to about US\$ 80 000 then, or roughly US\$ 800 000 now).

By then the Baron had departed. His relations with Cruz had proved uneasy, partly because he could be an irascible administrator, partly because he knew little of advanced vaccine and serotherapy techniques, and partly because Cruz wanted to make Manguinhos a beachhead for medical research in Brazil—a role far beyond anything the Baron had in mind. Then too, the Baron had done his work gratis for nearly 3 years, and indeed had sometimes provided the project with money from his own pocket when

funds ran short. So, seeing the work well managed, having had some clashes of temperament and will with his technical chief, and wishing to travel to Europe, the Baron resigned in December 1902. Early the next year Cruz was named director.

That proved only the beginning of Oswaldo Cruz's meteoric rise. On 15 November 1902 Francisco Rodrigues Alves became President of Brazil. Previously, as Governor of São Paulo State, Alves had been intimately involved with combating yellow fever, so he knew about the yellow fever work of the Reed Commission in Havana confirming that the mosquito *Aedes aegypti* transmitted the disease. What's more, he had founded his campaign for the presidency on a "renovation" platform that stressed the need to sanitize Rio de Janeiro and its port of Guanabara.

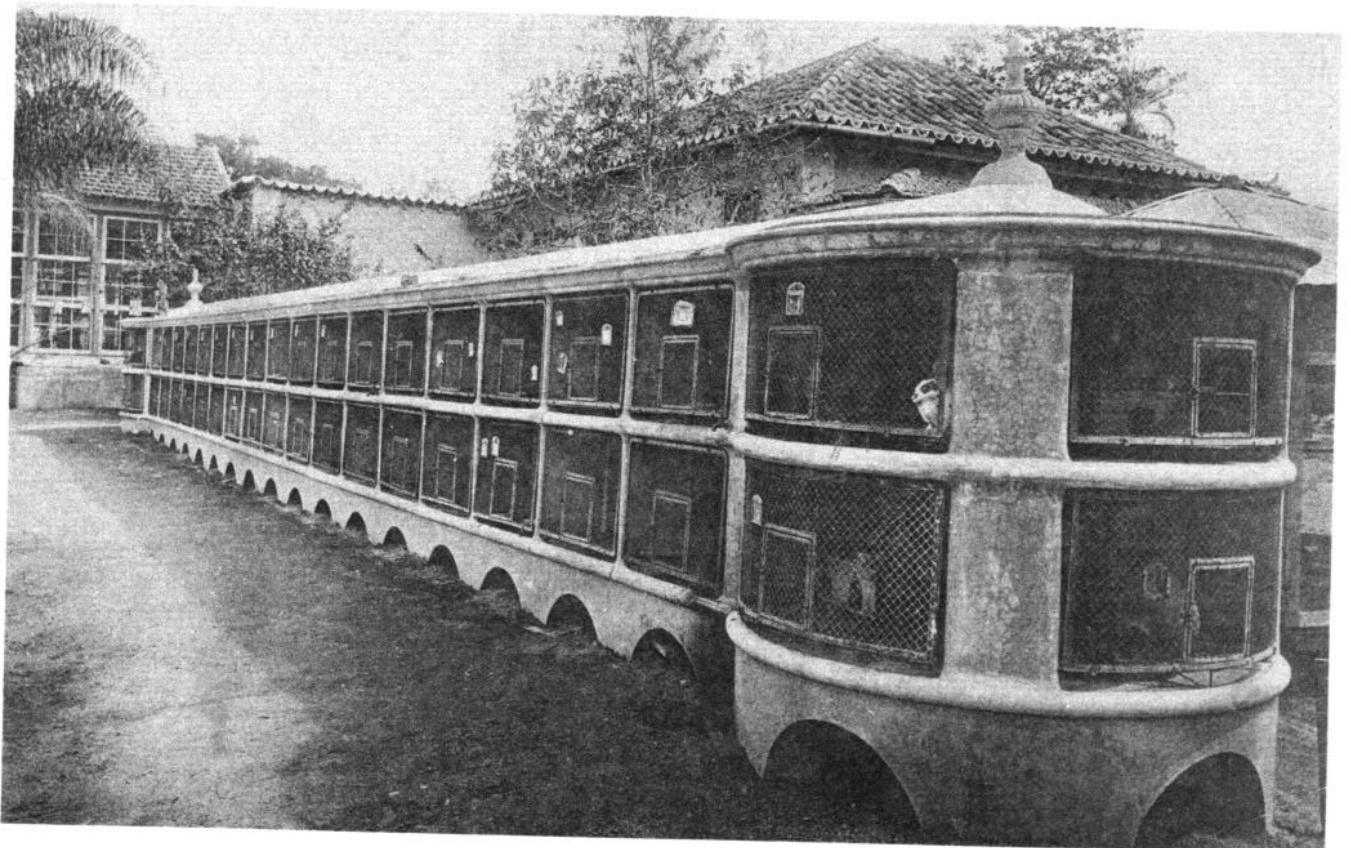
In early 1903 Alves was still looking for someone to direct the federal department of public health, which in those days was under the Ministry of Justice and Interior. The new Minister of Justice and Interior, J.J. Seabra, knew Dr. Sales Guerra, had been one of Sales Guerra's patients, and was generally impressed by the eminent clinician. So one day, soon after taking office, he asked Sales Guerra to be the new public health director.

Salas Guerra declined. As he explained, he was mainly a clinician and was not especially well versed in public health. But he knew from personal experience that Oswaldo Cruz was an able manager in close touch with the fast-moving health science frontier and dedicated to improving public health in Brazil. Among other things, Cruz had recently brought Sales Guerra an article describing measures taken to rid Havana of yellow fever and had argued forcefully for applying the same measures in Brazil. So Sales Guerra recommended him.⁸

⁸Moreira M, pp 45–47.



Above: The Federal Institute of Serotherapy (laboratory in center and stables at right) in 1903.
Below: Cages for small animals used in the institute's research, constructed in 1904. (Courtesy Casa de Oswaldo Cruz Archive.)



That came as a surprise. The minister, and later the president, had to ask "Who is Oswaldo Cruz?" But when interviewed, Cruz impressed them both as an able man of science deeply committed to the cause of public health. Cruz also outlined ambitious plans for controlling smallpox, plague, and yellow fever, plans that must have fit well with what the president already knew of yellow fever. So despite his youth, at the age of 30 Oswaldo Cruz became Director of the Federal Department of Public Health.

THE PUBLIC HEALTH CAMPAIGNS OF 1903–1907

As we have seen, in those days public health was small potatoes. Before Alves, the whole federal department had consisted of the director, five aides, one sanitary inspector, five servants, and a coachman. Reasons were not hard to find. First, past public health measures had generally failed, so enthusiasm for big programs was lacking. Beyond that, each Brazilian state bore responsibility for health within its borders, while the municipality of Rio de Janeiro was responsible for health in all parts of the city outside the Federal District. Therefore, the jurisdiction of the federal department extended only to the Federal District within Rio and to certain activities directed against foreign diseases—mainly imposition of quarantines at major ports.

With Alves' support, Cruz set out to change all that. On 15 May 1903, less than two months after his appointment, the government presented the legislature with a comprehensive health reform bill. This called for (1) expansion and reorganization of Manguinhos; (2) unification of the federal and municipal health services of Rio de Janeiro; (3) a large and costly campaign against yellow fever in Rio based on recommendations of the Reed Commission in Havana; and (4) a uniform san-

itary code for the whole country that among other things made vaccination against smallpox compulsory.

Cruz was very firm about the prospects for knocking out yellow fever. "The extinction of yellow fever is a problem which has already found a practical solution," he told Minister Seabra. "We can ... consider the question solved.... Yellow fever will end in Rio de Janeiro when Congress gives us the means."⁹

Despite this prognosis, however, the proposed law caused an uproar. It was expensive. It emerged from the office of a medical unknown. It appeared to propose unproven measures against yellow fever (even in Reed's own United States of America the Reed Commission recommendations were controversial). And it cut deeply into what many congressmen regarded as the cherished right of each state to set its own health policy. For these reasons, the ensuing debate was long and bitter.

But Cruz didn't wait for the debate. Well before the bill was even proposed, his campaign against yellow fever in Rio had begun. He sent an observer to Havana to view the work of the American authorities; he issued new yellow fever regulations; and he used funds already authorized to create a Yellow Fever Prophylaxis Service. By mid-April 1903 the prophylaxis service had set to work sectoring Rio de Janeiro into health districts, policing suspected zones of infection, destroying mosquito foci, and identifying, isolating, and registering yellow fever patients.

The intensity of all this provoked resistance. People barred their doors to sanitary inspectors. Special tribunals had to be established to force compliance with the rules. Announcements from Cruz's office explaining the need for strong

⁹Bacellar RC, p 247.

measures were commonly ignored. And Cruz himself became the butt of newspaper jokes and cartoons showing him as a "monster ruthlessly imposing the cruel techniques of science upon a cowering population." In a way Cruz could not have wanted, "his name became a household word."¹⁰

This hostility had several causes beyond the yellow fever measures and the challenge to states' rights. Among them: The Alves Government, determined to clean up Rio's open sewers and narrow unpaved streets, had embarked on a major street widening and improvement program that disrupted business, irked commercial interests, and upset those who owned and occupied the buildings being torn down. The Positivist Church in Rio, a powerful religious body, threw its weight against compulsory smallpox vaccination on grounds that it limited free choice. And a hodgepodge of many different groups opposing Alves saw the public health campaign as an opportunity to discredit the government.

As the tide of dissension rose, legislators called Cruz an idiot and worse. His plans for the Manguinhos Institute were termed self-serving. The former federal director of public health, Dr. Nuno de Andrade, openly questioned the mosquito theory of yellow fever transmission—a theory Nuno de Andrade had espoused the year before. And a cloud of opposition to compulsory vaccination grew threateningly dark. Seeing this, a decision was made to jettison the compulsory vaccination proposal; Congress dumped most of the proposed changes for Manguinhos; and in this reduced form the bill was passed in December 1903.

Perhaps regrettably, the struggle for compulsory smallpox vaccination did not end there. Convinced they were correct,

Cruz and Alves continued to press the issue. Then a smallpox epidemic struck, causing some 130 deaths a week in July 1904, and a bill requiring compulsory smallpox vaccination became law that October. This law evoked a thunderous response from the positivists and other opposition elements, one that soon flared into a military revolt against the government. The uprising, which took several lives and posed a serious threat, was put down quickly. However, it showed once and for all how strongly people felt about compulsory vaccination. So the government backed off; the new law was not enforced. Smallpox vaccination remained a matter of individual choice, and the disease continued to assail Brazil for nearly seven decades before being finally eradicated in 1973 following mass vaccination campaigns.

On other fronts, however, the public health campaign did very well. The gigantic work of cleaning and remodeling Rio made marked inroads against the unsanitary conditions and rat reservoirs that harbored plague. To strengthen the work against plague, Cruz did several things. He made doctors report plague cases. He set out to inform the public about the problem, so that afflicted people would not hide the disease and would seek treatment. He carried out appropriate serotherapy and vaccination. And he began a large program in plague-ridden neighborhoods to trap and destroy rats.

Cruz was under no delusions that any of these measures offered perfect answers, or that he could eradicate the rats. But he persisted, and he got results. In 1903 there were 360 reported plague deaths in Rio; in 1908 there were 54; and in 1912, three years after Cruz stepped down, there were none.

A bigger and more challenging target was yellow fever. Besides unifying the health services of Rio, the new public health law formally released funds to pay

¹⁰Stepan N, *Beginnings of Brazilian science*, p 90.

yellow fever workers. By then the Yellow Fever Prophylaxis Service already had a technical director, medical inspectors, carpenters to build patient isolation rooms, and squads of workers to kill mosquitoes. But now the pace quickened. A laboratory was set up to diagnose suspected cases; isolation wards were installed in hospitals; cases were rigorously reported and isolated; and throughout the city mosquito-killing brigades staffed by up to 2 500 men, roughly 1% of the city's work force, became a common sight.

Under terms of the new law, Cruz had 3 years, until President Alves' term expired, to control the yellow fever epidemic or face revocation of the law. Happily, that never became an issue because the campaign worked. Despite a resurgence in 1905, yellow fever deaths declined precipitously—from 548 in 1903 to 42 in 1906. That year Cruz reported to incoming President Afonso Pena that "yellow fever no longer exists in epidemic form in Rio."

But the campaign did not end there. Cruz kept his post, kept the work going, and kept gaining. In 1907 there were 39 yellow fever deaths; in 1908 there were 4; and in 1909, the year Cruz stepped down as public health director, there were none.

Of course, this feat did not eradicate yellow fever elsewhere in Brazil, or even ensure its permanent banishment from Rio. Nor did it eclipse work spearheaded by Cruz on many other fronts. But it defeated Rio de Janeiro's greatest terror, fundamentally altered Brazil's self-confidence and international image, and transformed Cruz in the public mind from something of a scientific tyrant into a public hero. In this vein, one of many 1908 political cartoons reversing his "mad scientist" image showed Cruz with a hero's garland above an adoring caption reading "This is the way the country re-

ceives its sons that honor and love the nation; it crowns and blesses them."¹¹

MEDICAL RESEARCH, 1903–1917

While all this was going on, Manguinhos was not forgotten. Ever since his years in Paris, Cruz had dreamed of creating an institute in Brazil that would provide a strong base for health research, and Manguinhos gave him an opportunity to do it. So all during his years with the public health department he remained director of the Serotherapy Institute, and even during the intense congressional battles he typically worked there three mornings a week.

His 1903 proposal to revamp Manguinhos showed what he wanted. That proposal called for expanding the Serotherapy Institute, then technically attached to the federal public health department, into a place "for the study of infectious and tropical diseases along the lines of the Pasteur Institute of Paris."¹² Under this plan the revamped institute would teach and conduct original research in bacteriology and serum and vaccine production. It would be separated from the public health department and put directly under the Justice and Interior Minister. It would also be accorded status equal to that of the medical schools of Rio and Bahia, and would be supported by a special research endowment fund that would free it from the vagaries of federal budgets.

When Congress rejected most of these proposals, Cruz went ahead anyway. The public health department began sending a growing stream of microscopes, glass-

¹¹Stepan N, *Beginnings of Brazilian science*, p 91. For other laudatory political cartoons of this nature, see Oliveira V, *Oswaldo Cruz*, pp 72 and 74.

¹²Brazil, Congresso Nacional, *Annaes da Câmara dos Deputados*, 1903;5:586, as quoted in Stepan N, *Beginnings of Brazilian science*, p 93.

ware, and experimental animals to Manguinhos. Books and journals were purchased for a new library collection. Technicians hired for the public health campaign went to Manguinhos for training and to help prepare sera and vaccines. Students from the Rio Medical School were sent there to prepare their medical theses.

Altogether, this influx of talented people and supplies was such that by 1905 Manguinhos was bursting at the seams. As Cruz pointed out in a report to the Interior Minister that year,

It is unbelievable that, in this small house (sic), which is no doubt unmatched in its poverty even by the most useless of provincial laboratories, we are trying to do the same work as that being carried out in the large and comfortable European or American institutions. The real wastage and sacrifice this effort entails, and the danger, can only be appreciated by those who know how an institute such as ours works.¹³

To remedy that situation before President Alves' term expired, Cruz had a Portuguese architect draw up plans and in 1906 proceeded to construct new buildings at Manguinhos. The key addition was a new main building, probably modeled after the Montsouris Meteorologic Observatory in Paris, that was tall and ornate with patterned tiles and Moorish cupolas. Overlooking Guanabara Bay from the Manguinhos site, this bizarre but striking structure made an impressive statement, came to serve as the institute's hallmark (it still appears on its stationery), and dwarfed every other building on the site.

While all this was important, the key to Manguinhos' success was Cruz's personal attention. "As Director of the Institute, he followed all the research almost step by step, always stimulating personal initiative, noting every difficulty. When a student was confronted by a real problem, he would appear, charitable and serene, pointing out the road. When he himself could not make a decision, he indicated the books, sometimes the chapter, or personally would look for a way to help a student..."¹⁴

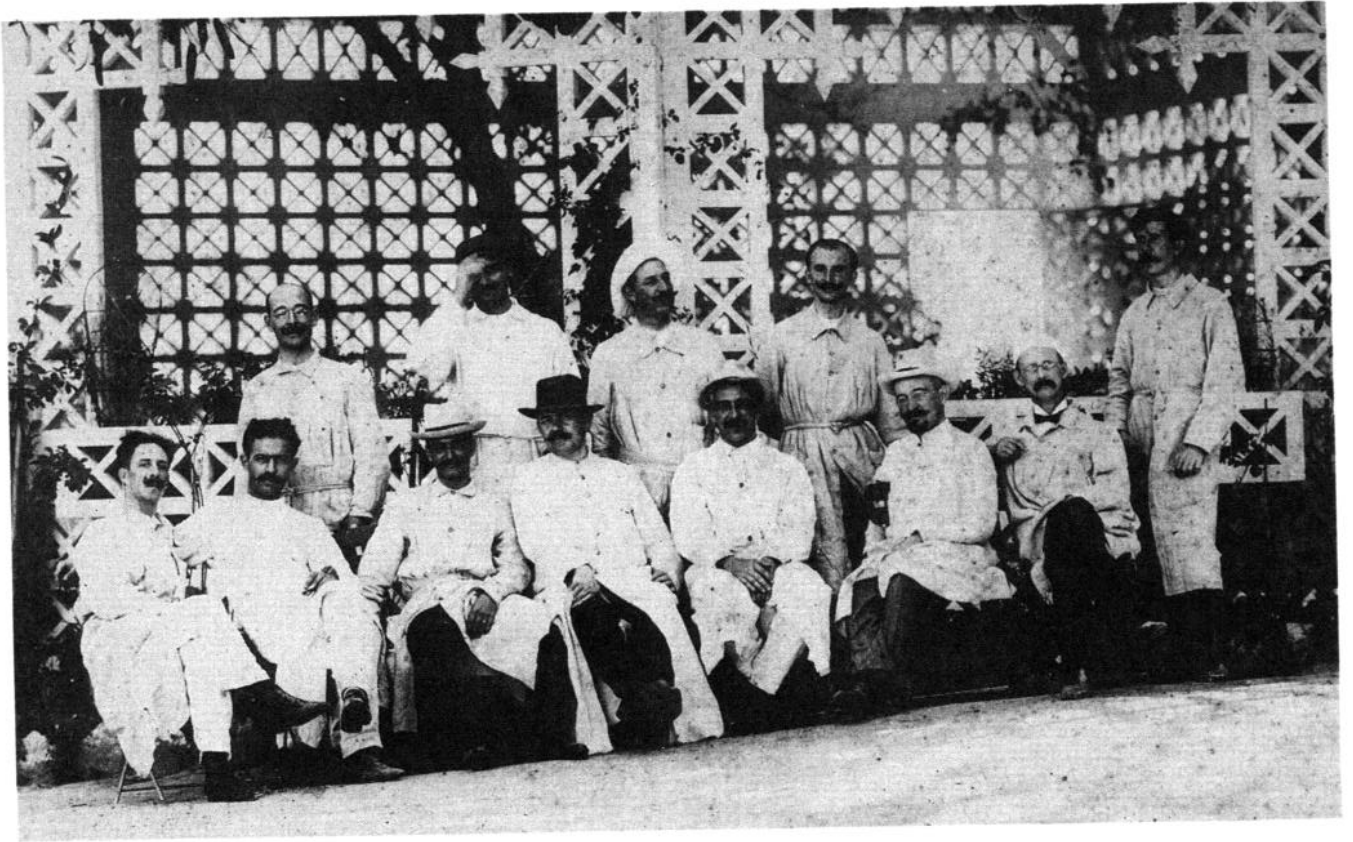
By the end of 1906, with the yellow fever campaign a recognized success and his political prestige at its peak, Cruz sent a bill to Congress similar to his 1903 proposal. At this point Congress found him hard to refuse. So, following debate, steps were taken changing the institute's name to the Institute of Experimental Pathology of Manguinhos, tripling its budget, and covering the cost of completing the new construction.

Other measures taken in 1907 gave the institute the autonomy and authority of a major research center. As Cruz had wished, it was detached from the public health department and made an independent science institute under the Ministry of Justice and Interior. Its director came to be elected by a special technical commission and appointed by decree. Its fiscal autonomy was ensured by a permanent fund of government bonds. And it was authorized not only to prepare vaccines and sera, but to study infectious and parasitic diseases, create a school of veterinary medicine, and organize scientific commissions of inquiry.

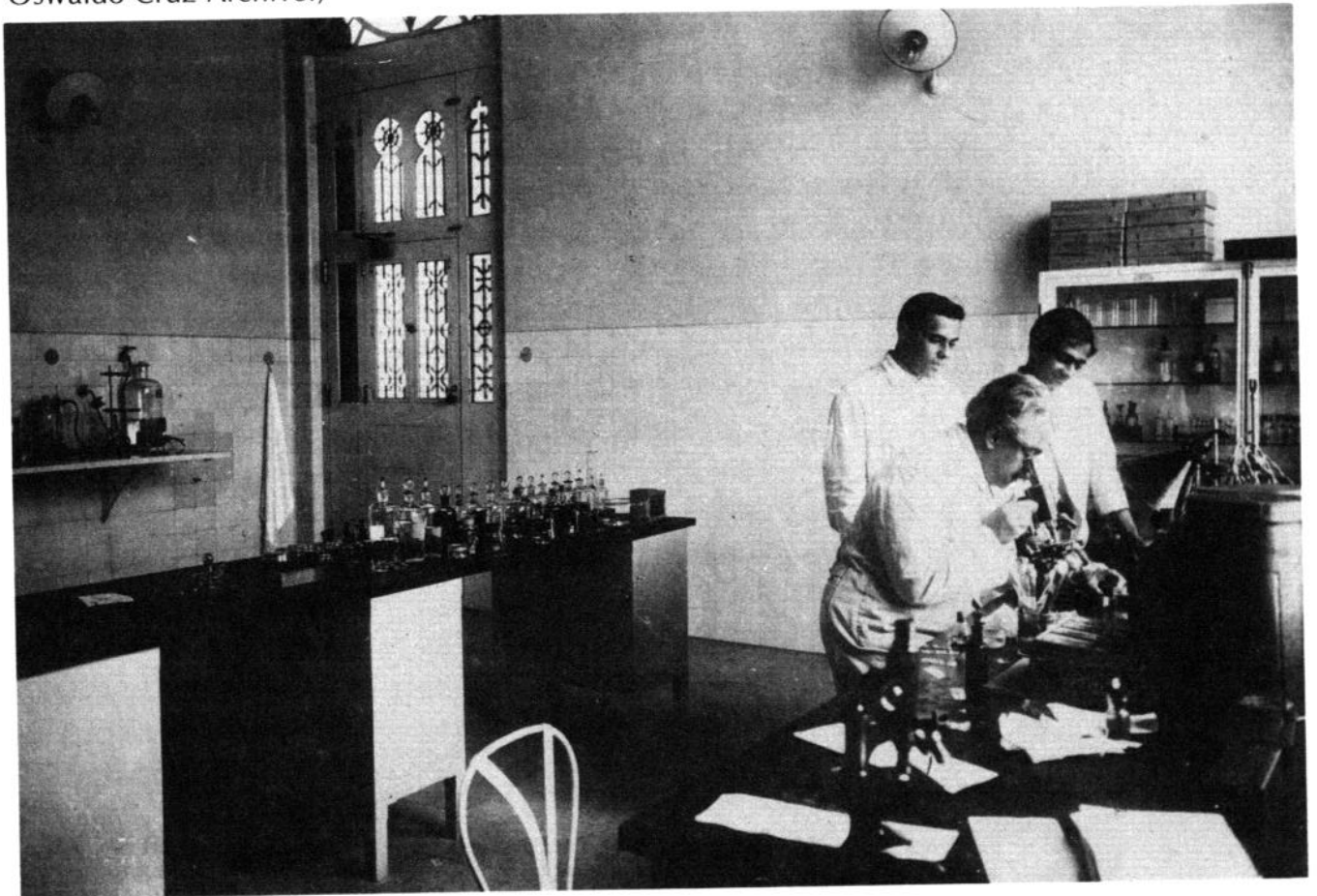
By then the high-quality research that these official measures sought to promote was already under way. The staff—including such rising names as Henrique Aragão, Antônio Cardoso Fontes, Carlos

¹³Stepan N, *Beginnings of Brazilian science*, p 96, from Brazil, Directoria Geral de Saúde Pública, *Relatório apresentado ao Exmo. Sr. Dr. J. J. Seabra, Ministro da Justiça e Negócios Interiores, pelo Dr. Oswaldo Gonçalves Cruz*. 1905, p 9.

¹⁴Bacellar RC, p 151.



Staff members of the Oswaldo Cruz Institute and visiting scientists (above) photographed in front of the institute's dining hall in 1908. Seated, from left to right: Carlos Chagas, José Gomes de Faria, Antônio Cardoso Fontes, Gustav Giemsa, Oswaldo Cruz, Stanislaus von Prowazek, and Adolfo Lutz. Standing, from left to right: Arthur Neiva, Henrique da Rocha Lima, Henrique Figueiredo de Vasconcellos, Henrique de Beaurepaire Aragão, and Alcides Godoy. Below: Oswaldo Cruz looking into a microscope at one of the institute's laboratories. (Courtesy Casa de Oswaldo Cruz Archive.)



Chagas, Alcides Godoy, Artur Neiva, and Henrique da Rocha Lima—was proceeding to develop various vaccines and sera, study diverse bacteria and protozoa, develop malaria prevention methods, and describe new mosquito species. In 1906 Alcides Godoy announced discovery of a vaccine against maquiara plague, a key disease of Latin American livestock; and in 1907 Henrique Aragão unraveled the life-cycle of a plasmodium parasitic in pigeons, leading the way to understanding the life-cycle of the malaria parasite in man.

This work depended on a successful system of recruitment linked to training, and of training linked to employment and research. It worked like this: As already noted, promising Brazilian medical students and health workers were encouraged to do work at Manguinhos. There, under Cruz's supervision, they were trained in glassware making, sterile technique, serum and vaccine production, and microbiology. In this way knowledge was passed from Cruz to the students, and from one student to another, as part of an informal cooperative venture. Eventually, the more routine tasks of serum and vaccine production were assigned to lower-level technicians, freeing the students and doctors for research.

International recognition came quickly. In 1907 Brazil became the only Latin American country invited to participate in the XII International Conference of Hygiene in Berlin. Cruz set his staff to work preparing exhibits for the conference that described the Institute of Experimental Pathology at Manguinhos and its role in research and public health—most notably its work against yellow fever and malaria. Highly impressed, the conference judges awarded their highest prize, a gold medal, to the institute for its role in advancing the health sciences.

News of this unprecedented award excited Rio, and Cruz was “practically

mobbed” when he came home from Europe. The next spring, in March 1908, President Afonso Pena issued an executive order renaming the Institute of Experimental Pathology the Oswaldo Cruz Institute in honor of Cruz's service to Brazil.

By then Cruz was getting ready to step down as public health director. Why he did so is not entirely clear. He may have felt that his work at the department was complete. He may have seen that the institute was coming of age and wanted to give it more attention. Or he may have felt physically spent and unable to manage the department and the institute together. In any case, for whatever reasons, in 1909 he left the public health department and gave all his remaining energies to the singular research center that bore his name.

At the institute, this was an exciting time. Two noted European scientists, Gustav Giemsa (inventor of the Giemsa stain) and Stanislaus Von Prowazek (a top student of famed German bacteriologist Fritz Schaudinn), came to work there under contract. The first numbers of the institute's journal, *Memorias do Instituto Oswaldo Cruz*, were published. And on 14 April 1909 staff member Carlos Chagas discovered American trypanosomiasis, a revelation that sparked great medical interest and in 1912 won Chagas the Schaudinn Prize, an international award given once every 4 years for the best work in parasitology and tropical medicine in the world.¹⁵

But fate can be fickle. None of these things ensured permanence. Cruz had set out to build an experimental research institute—preferably one that would endure. Yet human history is littered with the bones of novel institutions that died when their powerful leaders perished—

¹⁵Leonard J, pp 233–34.

partly because nobody could fill the leader's shoes, partly because the leader's followers turned elsewhere. Here Cruz's own prominence worked against him. And so, despite his success in building the institute and staffing it with locally trained people, he had no assurance it would long survive his death.

This was no hypothetical matter, because Cruz's health was poor. As early as 1908 he began to suffer from debilitating kidney disease. This may have been brought on or aggravated by the stress of his two man-killing jobs, and it probably had something to do with his decision to leave the government. In any case, it sharpened awareness of the institute staff members and of Cruz himself that his time could well be short, underlining the need to plan for his death or early retirement in advance.

Those plans took several forms. During the years Cruz was with the health department, he had been forced to delegate many of the institute director's tasks to others. After the institute was reorganized in 1908, this arrangement continued, with the job of standing in for the director when he was absent being rotated monthly among the eight department heads. In this way experience in dealing with the institute's administrative problems was spread around.

Beyond that, Cruz made sure that his researchers got full credit for their work, while he himself adopted a self-effacing stance. For example, consider what Cruz did when Carlos Chagas discovered American trypanosomiasis. He first took the normal step of immediately announcing the discovery to Brazil's National Academy of Medicine. But he then took the unusual step of assembling a singular group, including some of the nation's most distinguished physicians, to make a pilgrimage. This group visited Chagas at the rural site where the discovery was made and personally reviewed his work.

One member of the group was Miguel Cuoto, commonly regarded as the father of modern clinical medicine in Brazil. Thanks to the careful preparations of Cruz and Chagas, Cuoto had no doubt about who deserved credit. As he explained afterward,

"On that day it was up to me to give a name to those traditional diseases of the Minas [Gerais] backlands, which were now unified as one disease with cause and development clearly established. To name it after only one of its symptoms would be to limit its description, and to name it for all its symptoms would be impossible.... And so, at dinner, while toasting Carlos Chagas, I ... chosen because of my age, standing with Oswaldo Cruz on my right and surrounded by the men most representative of Brazilian medicine of that era, with a gravity equal to a liturgical act in our religion, such as a baptism, gave the name of Chagas' Disease to that illness ... in the name of the entire delegation."¹⁶

As part of this general strategy, Cruz departed from the accepted Latin American practice of attaching his own name to his subordinates' published works. He could justifiably have claimed much credit; for although he did no research himself after 1902, he kept up with research trends and did a first-rate job of guiding work and suggesting research topics to students and staff members. But he was intent on directing attention to his people. So instead of crediting himself, he did the opposite; and from 1909 onward, while the *Memórias do Instituto Oswaldo Cruz* was gaining international prestige, none of the bylines on its myriad articles ever included the name "Oswaldo Cruz."

As the years passed, the institute continued to expand. It began teaching a formal course in microbiology based on a

¹⁶Remarks by M. Cuoto quoted in Kean BH.



Left: The main building of the Oswaldo Cruz Institute (front view). Below: The nearly completed main building in 1908 (rear view), showing Guanabara Bay in the distance and the remains of the original laboratory at Manguinhos on the right. (Courtesy Casa de Oswaldo Cruz Archive.)



similar course taught at the Pasteur Institute, for which students received credit from the Rio Medical School. By 1911 its library housed over 10,000 books and periodicals, the largest collection of specialized scientific works in South America.¹⁷ Its scientific interests continued to broaden, eventually coming to include a diverse array of disease agents and related microorganisms. And it continued to pursue a series of large health projects under contract—such as a campaign against yellow fever in Belém that began in 1910 and two major surveys of health conditions in the Amazon in 1910 and 1913.

By then Cruz was declining fast. Pictures taken of him in 1903, when he became public health director, show a dashing youth. But his appearance in 1911, a couple of years after his kidney problem surfaced, bears no trace of either dash or youth. And pictures taken in 1916 show a frail, white-haired, and prematurely aged man. In 1916 Cruz began having frequent kidney crises. In August 1916 he had a bout from which he never really recovered. A few months later he resigned as institute director, and on 11 February 1917 he died at the age of 44.

As he had intended, the Oswaldo Cruz Institute survived. Under Carlos Chagas, who became the new director and later head of Brazil's public health service, it continued to grow and to serve as a catalyst for health research in Brazil and other parts of the Americas. Indeed, largely because it was built so well, it has remained an active force in this field ever since.

Decades after Cruz died, in 1950, an elderly Henrique Aragão published an account of the institute's early years in

the *Memórias do Instituto Oswaldo Cruz* that aptly described what Cruz had done. But in 1917 it was the journal's policy to describe only scientific work, so not a word appeared to mark its founder's passing. That silence, reflecting the policy of self-effacement, is what Cruz would have wanted. Better than any printed statement, it stands as mute testimony to the staff's respect for him, to his own selfless dedication to science, and to the iron will of a quiet but precocious youth who sought to follow in his father's footsteps and who, in a brief span of years, succeeded in advancing Brazilian medical research and public health beyond his or anyone else's wildest dreams.

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¹⁷Instituto Oswaldo Cruz, museum document, *Biblioteca do Instituto Oswaldo Cruz: balanço dado em janeiro de 1911*, cited in Stepan N, *Beginnings of Brazilian science*, p 112.

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