

Commentary: The contribution and example of Carlos Chagas

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Accepted 26 May 2008

Brazilian science and technology had a phase of remarkable development in the period between the late 19th century and the early 20th century, particularly in the area of health. It is worth mentioning that this period witnessed the presence of distinguished researchers who knew, with great competence and creativity, how to combine health-related scientific and technological development with the most prevalent health problems in the country. At the time, as in other countries around the world, Brazil was undergoing severe health problems related to communicable diseases with impact on all levels of the country's social, economic and political life. In response, the Brazilian scientific health community launched itself into research programs that addressed major local problems and, in this manner, gained visibility in the global scientific community of the period.

Notable among this group of researchers was Oswaldo Cruz and one of his most gifted disciples, Carlos Chagas, whose important contributions gained domestic and international prominence. They promoted—with their scientific clear sightedness and political and social wit—scientific and technological developments in health, focusing on Brazil's needs. Furthermore, they generously provided technical and managerial contributions for implementing solutions to global and regional health problems. The credit for formulating and implementing health policies in Rio de Janeiro and São Paulo, important economic hubs in Brazil, is in itself one of the accomplishments of this group and ultimately responsible for the control of important health problems at that time, such as yellow fever.¹

Carlos Chagas provided in his early works, with his dedication and scientific qualities, a new understanding of the domiciliary transmission of some infectious diseases, which made it possible, for example, to lay the foundations for the introduction of the

intra-domiciliary application of insecticides to control malaria. However, his most outstanding contribution is related to the disease named after him: Chagas' disease (American trypanosomiasis). His achievement is unparalleled in the field of health science research. Having as his starting point a high prevalence of poorly characterized signs and symptoms in the small community where he went to live in order to conduct his studies and activities,^{2,3} a single researcher was responsible for identifying a parasite—the etiological agent (*Trypanosoma cruzi*, the name with which he paid tribute to his mentor Oswaldo Cruz), and in sequence its animal hosts, its mechanisms of transmission (through triatominae that feed on human blood) and its clinical implications, especially to the heart. Hence, he described all stages of this new disease, at a time when the technological resources and knowledge we have today were not available. He proved his hypothesis in the field and in the laboratory of the newly born Instituto de Manguinhos (today Instituto Oswaldo Cruz) in April 1909—almost 100 years ago—when he identified the parasite in the blood of a girl, Berenice, who had the acute form of the disease. To all of this, he added his humanitarian vision, stating the social relevance of the disease and the need to develop an integrated set of actions to control the problem.

These unprecedented contributions revealed his high-scientific competence, given that he used a sophisticated deductive method process in the design and proof of his hypotheses, thus providing this first time and unique contribution in the history of health sciences. His studies provided data on all the elements for the understanding of the disease in its many aspects, including its etiology, determinants, clinical aspects and prevention.

This work, along with the recognition in Brazil by the National Academy of Medicine, led him to receive, in 1912, the Schaudinn Prize from the Hamburg Institute of Tropical Diseases. This act represented the recognition of a researcher from a peripheral country by a first-class institution in the world of science, an unprecedented achievement in those days. Up to then, only one German scientist—Prowazek—had won that prize.

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His achievement was a clear demonstration that scientific and technological development is possible outside the central hub of countries with strong science, by local researchers acting on an independently. However, like John Snow when he described the mode of transmission of cholera, Chagas' work faced resistance for several decades, which supposedly hindered him from being awarded the Nobel Prize, for which he was nominated twice.⁴ The impact of his work gained even greater importance as American trypanosomiasis was proven to be disseminated throughout this continent, spreading from the south of the United States to the north of Argentina. Therefore, it is not by chance that the importance of his research is still used among Latin Americans as a great example of integration between scientific investigation and social policies in the field of public health, for which epidemiological thinking was one of the essential elements. His importance in this context can be compared to that of remarkable scientists such as Virchow and Snow in the European scenario. His memory remains alive and well-respected among Latin Americans. More than that, his scientific practice and thinking are still present. For instance, following his path and with the use of modern scientific methods, it has recently been possible, by examining the materials stored from his first case (the girl Berenice), to document that she was a carrier of two different strains of *T. cruzi*, the etiological agent of the disease, a fact that is important to understand its complex pathogenesis.⁵

After this remarkable achievement, Chagas became an example of a dedicated scientist concerned with building science and health policies at these pioneer times. With great dedication he held important position as the director of Instituto Manguinhos (today Fundação Oswaldo Cruz) and as the director of the National Department Of Public Health (today equivalent to the Ministry of Health) and as a professor of Tropical Diseases in the Medical School of Rio de Janeiro, thus fulfilling the example of a scientist who combined scientific investigation with action and the pursuit for solutions.

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Commentary: Chagas disease: 100 years since discovery and lessons for the future

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Accepted 3 June 2008

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On April 14, 1909, the 29-year-old Brazilian physician Carlos Ribeiro Justiniano das Chagas (1879–1934) examined Berenice, a 2-year-old girl with signs of an acute infection including persistent fever and swollen face. Based on research conducted over the previous months, Berenice came to be the first human case of a new disease entity and a new parasite.¹

In 1900, the Earth's human population was 1.7 billion, and most people lived in rural areas.^{2,3} Much of the world population lived in poverty and this continued to