



Carlos Chagas: Biographical sketch

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ABSTRACT

Carlos Chagas was born on 9 July 1878 in the farm “Bon Retiro” located close to the City of Oliveira in the interior of the State of Minas Gerais, Brazil. He started his medical studies in 1897 at the School of Medicine of Rio de Janeiro. In the late XIX century, the works by Louis Pasteur and Robert Koch induced a change in the medical paradigm with emphasis in experimental demonstrations of the causal link between microbes and disease. During the same years in Germany appeared the pathological concept of disease, linking organic lesions with symptoms. All these innovations were adopted by the reforms of the medical schools in Brazil and influenced the scientific formation of Chagas.

Chagas completed his medical studies between 1897 and 1903 and his examinations during these years were always ranked with high grades. Oswaldo Cruz accepted Chagas as a doctoral candidate and directed his thesis on “Hematological studies of Malaria” which was received with honors by the examiners. In 1903 the director appointed Chagas as research assistant at the Institute. In those years, the Institute of Manguinhos, under the direction of Oswaldo Cruz, initiated a process of institutional growth and gathered a distinguished group of Brazilian and foreign scientists. In 1907, he was requested to investigate and control a malaria outbreak in Lassance, Minas Gerais. In this moment Chagas could not have imagined that this field research was the beginning of one of the most notable medical discoveries. Chagas was, at the age of 28, a Research Assistant at the Institute of Manguinhos and was studying a new flagellate parasite isolated from triatomine insects captured in the State of Minas Gerais. Chagas made his discoveries in this order: first the causal agent, then the vector and finally the human cases. These notable discoveries were carried out by Chagas in twenty months. At the age of 33 Chagas had completed his discoveries and published the scientific articles that gave him world recognition and a deserved high place in medical history. After the publication of his classic article the world paid homage to Chagas who was elected member of the National Academy of Medicine of Brazil on 26 October 1910, and at the age of 31, of other National Academies of the continent. The Committee of Hygiene of the Society of Nations, precursor of the World Health Organization, was created in 1929. Chagas was elected member of this Committee from its inception until 1933. The example of Chagas' life can be summarized in his interest that medical research should be translated into concrete benefits for human beings because he was convinced that disease had not only biological but social determinants as well. Carlos Chagas was a laboratory researcher, a clinician and a health administrator. For all these accomplishments he deserves our respect and admiration.

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The farm “Bon Retiro” where Carlos Chagas was born on 9 July 1878 was located some 20 km from the City of Oliveira in the interior of the State of Minas Gerais, Brazil. The family was well off, with high social standing and owned this farm for three generations. Carlos Chagas was the first of four sons and his father died leaving the mother in charge of the farm and in care of the young family. Since his infancy Chagas was raised in the simple country life without social barriers with other children in the neighborhood.

His secondary studies were completed in a religious high school, Colegio Sao Francisco, in San Juan del Rey, a city of the same state. Here, Carlos Chagas started his interest in biology through the observation of nature under the guidance of one of his teachers, Father Joao Batista do Sacramento, a liberal priest who also initiated Chagas in the reading of the classics and Brazilian literary authors.

At the end of his secondary studies, his mother wanted him to study engineering and he started professional studies in this field at the School of Engineering in Ouro Preto, founded by the Emperor Dom Pedro II, where Chagas remained for few months. Only after long family discussions, the mother accepted that Chagas studied medicine and he was registered as a student in 1897 at the School of Medicine of Rio de Janeiro,

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recently reformed by the Viscount of Saboya (Chagas Filho, 1993a).

The medical teaching followed the French anatomical model and the clinical examination of patients was based on Laennec's semiology and on a detailed anamnesis.

In the late XIX century, the works by Louis Pasteur and Robert Koch induced a change in the medical paradigm with emphasis in experimental demonstrations of the causal link between microbes and disease. During the same years in Germany appeared the pathological concept of disease, linking organic lesions with symptoms, and the discoveries of Paul Ehrlich in the chemical synthesis of therapeutic compounds. All these innovations were adopted by the reforms of the medical schools in Brazil and influenced the scientific formation of Chagas.

Malaria and Yellow Fever were prevalent in Brazil in those years, especially during the summer, in Rio de Janeiro, the capital of the empire. Hematozoan parasites were known to be the causative agents of Malaria but the cause of Yellow Fever and its mode of transmission were not. Chagas was interested in the analysis of the vomits and stools of the patients in search of an experimental demonstration of a causative microbe. Naturally the viral agent could not be evidenced with the methods available at the time.

Chagas met Miguel Cuoto at the Hospital "Santa Casa" where the medical students had their clinical practice. Cuoto introduced Chagas to the detailed study of the experimental works published by Claude Bernard and Louis Pasteur. He also met Francisco Fajardo who appointed him as his laboratory assistant in his studies on the hematozoan parasites, the causative agents of human malaria. This laboratory experience with Fajardo would prove very useful in the doctoral work that Chagas was to start in 1902 at the Institute of Manguinhos under the guidance of Oswaldo Cruz.

Chagas completed his medical studies between 1897 and 1903 and his examinations during these years were always ranked with high grades. His clinical learning at the bedside of the patients was enhanced by his laboratory experience which oriented his reasoning towards the searching for the causes of disease and the linking of the clinical symptoms with the causal agents and their mode of transmission.

Oswaldo Cruz accepted Chagas as a doctoral candidate and directed his thesis on "Hematological studies of Malaria" which was completed in 1903 and was received with honors by the examiners. This research was carried out in 45 patients and is an example of detailed knowledge of the morphology, the life cycle of the hematozoan in man and the relationship with the clinical symptoms. For example, the description of the relationship between the increase of parasitaemia and the febrile crises in the patient is an example of precise observation and clarity of language.

In 1903 the director appointed Chagas as research assistant at the Institute. However, since the daily clinical practice was so important for Chagas, he succeeded in being appointed as a house doctor at the Hospital of Juruba, an institution of the public health city network that was in charge of the management and treatment of patients with infectious diseases.

In those years, the Institute of Manguinhos, under the direction of Oswaldo Cruz, initiated a process of institutional growth and gathered a distinguished group of Brazilian scientists, namely, Henrique Figueiredo de Vasconcellos, Henrique Rocha Lima, Antonio Cardoso Fontes, Alcides Godoy, Arthur Neiva, Carlos Chagas, Henrique Aragao and Ezequiel Dias and of foreign collaborators, among them: Stanislaus von Prowazek (parasitologist), Gustav Giemsa (chemist, inventor of the staining of microscopic preparations), Max Hartman (parasitologist) and Hermann Dürk (pathologist) (Chagas Filho, 1993b).

For a young doctor such as Carlos Chagas, this was an exceptional scientific environment to advance his laboratory and field research work in experimental medicine.

In March 1905, Chagas was commissioned to control malaria outbreaks in Itatinga, close to the port of Santos and afterwards in the Xerem valley. In both opportunities he put into practice, with success, the intradomicile spraying with insecticides to prevent the contact of the mosquito with man. In 1907, he was requested again to investigate and control another malaria outbreak, this time in Lassance, Minas Gerais.

In this moment Chagas could not have imagined that this field research was the beginning of one of the most notable medical discoveries. When reading his reports, written in a clear and elegant style, the reader realizes that the observations and precise conclusions are the fruit of lucid reasoning (Brener, 1989).

Chagas was, at the age of 28, a Research Assistant at the Institute of Manguinhos and was studying in a *Callitrix penicillata* primate a new flagellate parasite isolated from triatomine insects captured in the State of Minas Gerais. He described and named this parasite *Trypanosoma minasense*.

During the field work in Lassance, Cantarino Motta, the chief engineer of the construction works of the central railroad of Brazil, showed Chagas an insect that hid in the cracks of the mud walls of the rural dwellings whose inhabitants complained that at night they were bitten in the face by these insects, known locally as "barbeiros" ("barbers"). He also observed that a clinical condition in that region was frequent in children. The clinical picture was characteristic with episodic fever, severe anemia, spleen enlargement, edema and swollen lymph nodes. Most cases had a benign progression after a few weeks but a proportion of them developed severe cardiac lesions.

The complete description of the clinical picture was made in a two-year-old girl, Berenice, from whose blood Chagas isolated the same parasites that he inoculated in laboratory animals in which he described the different phases of the life cycle of the parasite. The scientific question for him to ask was whether the clinical picture observed in men was caused by the parasite isolated in the insects. The only way to prove it was through experimentation: the first step was to show that the parasite could also infect other mammals. Chagas sent some insects to Oswaldo Cruz requesting him to inject their intestinal contents in laboratory bred monkeys that were free of natural infections. A few weeks later he received a communication from Cruz reporting that one of the experimentally infected monkeys was sick.

Chagas returned to the Institute and observed in the monkey blood the same parasites that he had observed in the bloodstream of the patients in Lassance. This time he named the parasite *Trypanosoma cruzi* in honor of Doctor Cruz.

The cardiac alterations, the most serious chronic lesions of the disease, had also been observed by Chagas who describe them as follows: "*The symptoms that most deeply impressed me in the patients of that region, particularly in those that lived in houses infected by the triatomine insects, were the cardiac rhythm alterations in the form of extra systoles*".

The link between the causal agent, the vector and the clinical picture was complete!

Chagas made his discoveries in this order: first the causal agent, then the vector and finally the human cases. The little girl Berenice was the first patient in whom was described and experimentally confirmed the medical entity that later on was to be named "Chagas disease".

These notable discoveries were carried out by Chagas in twenty months, living in a car of the central Brazilian railroad where he had installed his house and his field laboratory in Lassance. If we compare the time elapsed to confirm the aetiology, the transmission and the symptoms of other tropical diseases, the work of Carlos Chagas is outstanding. For example, the correct description of the life cycle

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