



## Carlos Chagas Filho



Rio de Janeiro, Brazil, 12 September 1910 - 16 February 2000

**Title** Professor emeritus

**Nomination**

18 August 1961 - President of the PAS from 1972 to 1989

**Field** Biology, Biophysics

**Commemoration** – Prof. Carlos Chagas Filho, former President of the Pontifical Academy of Sciences, died on 16 February 2000, in Rio de Janeiro, Brazil, at the age of eighty-nine. As his name suggests, he was the son of the famous Brazilian medical doctor, Carlos Chagas, who at the beginning of the twentieth century discovered the causes of an important tropical illness which subsequently bore his name – ‘Chagas Disease’.

Chagas Filho graduated in medicine in 1935 with great success, and from the outset of his career he directed his activities to scientific research. Chagas Filho was a privileged person: from his parents he received an excellent genetic background, an extraordinary cultural inheritance, and, to complete his success in life, he had a very happy marriage. His wife, Anah, contributed a great deal to his social life and his cultural activities.

In spite of these advantages, Chagas Filho’s life was not easy. Having a famous father in the same professional area meant that he had to be very demanding with himself in a methodical and constant way. In this way he was able to achieve success in scientific production and advancement in several cultural areas at both a national and an international level.

He began his scientific career as a student of medicine at the Institute Oswaldo Cruz in Rio de Janeiro, Brazil. After graduating in medicine he also obtained degrees in physics and mathematics. He began his research with work on the electric fish, *Electrophorus electricus*. With great success, in collaboration with colleagues and mainly with disciples and students, a series of more than one hundred important articles were published by Chagas in specialist reviews with an international circulation.

In 1936 he was appointed Full Professor of Biophysics at the Faculty of Medicine of the University of Rio de Janeiro. In 1945 he inaugurated the Institute of Biophysics at that university, an institution which was able to produce scientific knowledge and researchers of a high level. A few years later this Institute received international recognition as a Centre of Excellency, a status that it has maintained until today.

He promoted academic and educational activities of high level in Brazil and abroad. He received a Doctorate in Science from the University of Paris (1946); was President of the United Nations Committee on the Study of the Effects of Atomic Radiation (1956-62); was General Secretary of the Conference of the United Nations for the Application of Science and of Technology in Special Development, Geneva (1962-66); and was the Brazilian Permanent Ambassador at UNESCO, Paris, France (1966-70). We could mention about fifty other similar activities to be found in his curriculum. For example, he was a member of fifty-three scientific societies or Academies of Sciences. The list of decorations, medals, prizes and honorary titles that were granted to him is long indeed.

Of great importance in Chagas Filho’s activities was the efficient way in which he carried out the command tasks with which he was entrusted. To give some examples mention may be made of: a) his magnificent performance as the Director of the Institute of Biophysics, an Institute recognised internationally as much for its scientific production as for the training of outstanding researchers; b) his presidency of the United Nations Committee on the Study of the Effects of Atomic Radiation, which under his leadership produced a series of publications of great importance and relevance at the time. These were fundamental in the drawing up of conventions and international agreements on the use of the nuclear energy; c) how Prof. Federico Mayor, General Secretary of UNESCO, who from 1966 to 1970 worked in that institution under the leadership of Chagas, affirmed that:

'Don Carlos had the extraordinary quality of convincing his collaborators that what they did at that moment was the most important thing in their lives'; d) the magnificent performance of Chagas as President of the Pontifical Academy of Sciences. This is summed up by what he said when receiving the position, in 1972, from Pope Paul VI: "What I want in this function is very clear. I will try to change the Academy from a body of great prestige into one of great action also". This intention was expressed in important action. There was the revision of the Galileo case, an act which received universal approval, and was, without doubt, one of the landmarks of the Chagas presidency. Another important initiative, which had the support of the Academicians, Victor Weisskopf and Louis Leprince-Ringuet, was the campaign in 1981 against atomic arsenals and the production of atomic weapons. This wielded great influence on the resolutions which were subsequently passed by the United Nations. Acting in harmony with that campaign, Pope John Paul II sent letters to the governments of Washington, Moscow, Paris and London – the countries that had the atomic bomb – in which he asked them to receive a delegation from the Pontifical Academy of Sciences which would explain to them the dangers of possible nuclear conflicts for the future of the human species. These initiatives played an important role in the peace resolutions that were later approved by the governments of those countries and by the UN; e) the excellent publications of the proceedings of the plenary sessions held during the Chagas presidency, especially those on 'the Origin of the Universe, 'the Origin of Life', and 'the Origin of Man'. These demonstrated the mutual understanding which existed between the Catholic Church and Science, something which was always propagated with enthusiasm by Carlos Chagas Filho.

Chagas Filho believed in what he was doing. That is demonstrated in an article written by Darcy Fontoura de Almeida, one of his former-students. He related how Chagas was an 'academic professor par excellence who performed his duties even in a wheel chair until December of 1999, attending the Institute of Biophysics, tracking a post-graduate course which was highly appreciated by the students'. From another former-student, Antônio Paes de Carvalho, we have the statement: 'The owner of a special intelligence, Chagas prevailed by reason in all the forums in which he had the opportunity to act, inside and outside of the country. In science, so demanding in its methodology, Chagas's contribution was marked by the creativity of his ideas, his heady hypotheses, and the rigidity and the patience with which he knew how to lead his more immediate collaborators. We could not find a better paradigm of dignity, of intelligence, and of love for one's neighbour and of the wisdom of life'. Chagas Filho possessed an extraordinary series of human qualities. One of the most evident was his firm and constant propensity to do what was good. Of Chagas Filho, whom I knew for sixty years and with whom I shared numerous contacts and collaborations, I have the most valuable and honorable memories, besides an enormous admiration. He was really a great human being.

C. Pavan

During four four-term years as President of the Pontifical Academy of Sciences, which is composed of scientists of the highest level from all over the world, among whom several Nobel Prize winners, Chagas, within the vast horizon of his mind open to truth, considered the world, in the words of Henri Bergson, a "machine à faire des dieux", a house open to transcendence, a light and shaded home of divine and human knowledge. When Man's house ran the risk of being universally ruined because of the use of nuclear energy for warfare, the Pontifical Academy of Sciences, through Chagas's initiative, drew up four documents on the universal catastrophe of nuclear conflict. Pope John Paul II supported with his authority the documents of the Academy, which were presented by delegations of the Academy, accompanied by the Pontifical Nuncios, to the major world powers, from the USSR to the USA. The Galileo case, which during previous centuries had caused a contrast between scientific and religious authorities, was the object of resolute attention by Chagas in his specific function as President of the Pontifical Academy of Sciences. Chagas invited the Nobel Prize winner, Paul Dirac, to review the most up-to-date scientific theory of relativity, and asked John Paul II to proclaim the authentic relationship that existed between science and faith, an initiative which was in the highest tradition of the Church's teaching. Chagas's initiative had the widest cultural and religious echo, and re-established in the scientific world a deeper confidence in the Church's teaching. Carlos Chagas, an authoritative guide of illuminated command, and an expert on the human soul, secured, wisely and mildly, the adhesion of his co-workers of all functions and levels. Light of science and transcendence, wisdom of command and goodness of direction, are sculpted in the perpetual memory of Carlos Chagas.

Enrico di Rovasenda

Mi associo con tutto il cuore alla celebrazione dell'indimenticabile e non-dimenticato Presidente Carlos Chagas, nel dolore. Serie ragioni di salute mi impediscono di essere presente. Mi rivolgo particolarmente a Donna Anna Sua consorte confidente e amata, alle magnifiche e amate Figliole: Mara da Gloria – Silvia Amelia – Margarita – e Cristina –, che Egli tanto amava e che sono anche nel mio cuore.

Don Carlos, uno dei Primi Padri Fondatori, con Gemelli, con Gianfranceschi, con Lemaître, con O'Connell, con Enrico di Rovasenda, ha avuto l'intuizione, la capacità e la forza, di interpretare e attuare il particolare ruolo che il Fondatore Pio XI, assegnò e assegnava specificamente all'Accademia. E cioè approfondire, in un secolo dinamico esigente e difficile, e promuovere autonomamente le basi della scienza, la scienza stessa con le sue applicazioni. E ciò a fianco e a supporto del pensiero sulla trascendenza metafisica; nella distinzione non nella separazione in una integrazione globale. Egli (Don Carlos), saggio prudente ed acuto, propose sempre l'obiettivo del Fondatore (Pio XI) alla riflessione delle alte menti pensanti del mondo per raggiungere l'Unità del Sapere, perfetta e superiore nella Carità. A questo grande Spirito, che vive in Dio ancora fra noi, innalzo sentimenti profondi di immensa riconoscenza, chiedendoGli di continuare a illuminarci con quella particolare attenzione e amore che abitualmente riservava a tutti noi. La Consorte e le Sue Figliole anche da noi amate ci portino nella mente e nel cuore.

Sempre memore il dev.mo e aff.mo Renato Dardozi

### **Most important awards, prizes and academies**

*Awards:* Officer of the Polar Star, Sweden; Commander of the Merit Order, Italy; of the Order of Christ, Portugal; of the Légion d'honneur, France; Grand Cross of the Order of Alfonso el Sabio, Spain; and of Andrés Bello, Venezuela; Cavaliere di Gran Croce dell'Ordine di S. Gregorio Magno, Città del Vaticano. *Prizes:* D. Antonia Chaves Berchons d'Essarts, Moinho Santista, Alfred Jurzykowski, Anisio Teixeira, all from Brazil. *Medals:* D. João VI, Pirajá da Silva, Patriarca, Gaspar Vianna, Oswaldo Cruz, all from Brazil; Marie Curie Medal; Enrique Tejero Gold Medal, Venezuela; U.F.R.J. Gold Medal, Brazil. *Academies* Academia Brasileira de Ciências; Academia Nacional de Medicina do Brasil; de Ciências de Lisboa; American Philosophical Society; American Academy of Arts and Sciences; Académie de sciences, France; French Academy of Medicine; Royal Academy of Medicine of Belgium; Academy of Medicine, Rome; National Academy of Sciences, Italy; Leopoldine Akademie, Naturwissenschaften; Indian National Science Academy. *Honorary degrees:* University of Paris, France; University of Coimbra, Portugal; University of Toronto, Canada; University of Liege, Belgium; University of Clermont-Ferrand, France; University of Bordeaux, France; University of Salamanca, Spain; Tufts University, USA; Bahia; Pernambuco; Belo Horizonte; Gojaz, Brazil.

### **Summary of scientific research**

Carlos Chagas, dès ses premières recherches jusqu'à aujourd'hui, a travaillé principalement sur un matériel biologique de choix que lui offre son pays: les organes électriques du gymnote. Il a étudié presque tous les aspects de leur fonctionnement. Alors que les recherches sur le métabolisme lié à l'électrogenèse étaient encore à leur début (1945), Carlos Chagas a réalisé des expériences pour tester l'hypothèse qui proposait la phosphocréatine comme source d'énergie. Il montra que la quantité d'énergie que l'on peut obtenir d'un groupe de décharges est de l'ordre de grandeur que l'on peut calculer à partir de la quantité de phosphocréatine hydrolysée. D'autre part, utilisant le radiophosphore, il a déterminé les activités spécifiques de la phosphocréatine et de l'acide adénosine triphosphorique dans diverses conditions et mis en évidence l'intervention de celui-ci dans la resynthèse de la phosphocréatine.

Dans un étude des caractères électriques de la décharge, il a mesuré la vitesse de propagation le long des piles de cellules où se développe le voltage et a obtenu une valeur très grande par rapport aux vitesses d'influx nerveux, suggérant ainsi l'existence d'une excitation de proche en proche, de nature électrique. En ce qui concerne le processus fondamental de l'électrogenèse, il faut citer l'application de la méthode de microincinération à l'histochemie de l'organe électrique.

Carlos Chagas a considérablement éclairci le problème soulevé par l'existence de deux types de réponse à l'excitation: des décharges isolées de 1 à 2 V et des groupes de décharges atteignant quelques centaines de volts. L'analyse oscillographique des réponses du premier type lui a permis de localiser dans ce cas la région limitée de l'organe d'où provient la décharge, tandis que la totalité de l'organe contribue aux réponses du second type.

La mise en évidence (1956) d'un complexe non dialysable formé entre un curare radioactif et un composante protéique de l'organe électrique a marqué le départ d'une nouvelle ligne de recherches sur le récepteur cellulaire actif dans la transmission cholinergique.

Après 1976, Chagas a pris comme sujet d'étude la dénervation et l'action trophique des nerfs. Il propose que cette action se passe par un mécanisme normatif, qui nous est inconnu sur la synthèse des protéines. Cette régulation disparaît après la section des nerfs et en conséquence un nouveau cadre va s'établir.

### **Main publications**

*Comparative Study of Cholinergic Membranes from Main Sachs and Hunter Electric Organs of Electrophorus electricus*, 1982; *Histoenzymological evidence for the modification in the activity of some enzymes in the*

*denervated electrogenic tissue of E. electricus*, 1980; E. Gomes-Quintana, R.D. Machado, C. Chagas Filho, Cholinergic membranes from normal and denervated electric organ of *Electrophorus electricus* (L.), *IRCS Med. Sci Biochem*, 1980; *Synthetic neuromuscular blocking agents: absorption, distribution, metabolism, excretion*, 1972; *Etude du comportement de l'électroplaque isolée en fonction de l'abaissement de la température*, 1974; *Effet de la dénervation sur le métabolisme macromoléculaire chez le tissu électrique de l'E. electricus* (L.), 1975; H. Meyer, G. Oliveira Castro, C. Chagas Filho, Quelques aspects de l'histogenèse et de l'ontogenèse des organes électriques chez l' *Electrophorus electricus*..., *CR Acad Sci Paris*, 1971; C. Chagas Filho, E. Penna-Franca, A. Hassón-Voloch, Studies of the mechanism of curarization, *An Acad Bras Cien*, 1957; *Quelques aspects de l'électrogenèse chez l'Electrophorus electricus*, 1947.