

PROTAGONISTS IN CHEMISTRY



Professor João J.R. Fraústo da Silva

‘A man who makes things happen’ could be chosen as a motto to symbolize the pivotal role played by Professor J.J.R. Fraústo da Silva in the development of science, education, public administration and culture.

After getting his D. Phil degree in Oxford, in the field of Coordination Chemistry and under the supervision of Prof. Harry Irving in a record two-year period (1960–62), he returned to the Instituto Superior Técnico (IST), then the school of Engineering of Lisbon, where he had graduated earlier (1952–58) in Chemical Engineering and where he developed his academic career succeeding

to Professor Herculano de Carvalho, himself the successor of Professor Charles Lepierre, two distinguished analytical chemists. Later (1968), and in parallel with his academic commitments, he was invited by the Government to assume the important position of Head (1968–73) of the Research and Planning Department of the Ministry of Education (‘Gabinete de Estudos e Planeamento da Acção Educativa’, GEPAE) and, one year later, simultaneously appointed as Dean of the IST (1969–72), where he promoted a deep reorganization of the courses, expanded the research centres and sent his collaborators to prestigious foreign Universities, mainly to Oxford University with which he had already established scientific links during his D. Phil. work.

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The fruitful collaborative linkage he settled with that University is described separately by Prof. Robert J.P. Williams and Prof. Malcolm Green and resulted, *inter aliae*, in the establishment of research groups on Thermodynamics, Organometallic Chemistry and Molecular Biology at the multidisciplinary Structural Chemistry Centre ('Centro de Química Estrutural', CQE), which was created by Prof. Fraústo da Silva at the Interdisciplinary Complex ('Complexo Interdisciplinar'), a new research building (that started to operate ca. 1975) also the result of a joint effort with Prof. Abreu Faro, at the time President of the High Culture Institute ('Instituto de Alta Cultura', IAC), then the main granting body for research in Portugal.

The CQE, which in time became the top research centre in Chemistry in Portugal, gave subsequently rise to other research units (nowadays of comparable excellence), at the New University of Lisbon and at the Faculty of Sciences of Lisbon University. Prof. Fraústo da Silva is still a respected member of the CQE where he leads the research line on Bioinorganic Chemistry. In effect, he had since long a strong interest on the inorganic aspects of biological chemistry and e.g. the author of this biographical sketch started to do research in 1971 under his guidance on the chemistry of Nitrogen Fixation before joining Prof. Joseph Chatt's group at the University of Sussex at the request of Prof. Fraústo da Silva, whereafter (in 1976, upon getting his D. Phil.) he returned to the CQE.

However, the effective shift of Prof. Fraústo da Silva from a pure Coordination Chemist to a Bioinorganic Chemist occurred when (1975) he left again to Oxford (Royal Society/Academy of Sciences of Lisbon fellowship) after resigning (at his request) from a subsequent assignment as first Rector of the New University of Lisbon, which he founded from scratch and is nowadays one of the most active Universities in Portugal, but of a different model from the 'campus' interdisciplinary University he had projected for it.

This refreshing sabbatical leave in Oxford allowed the establishment of a highly fertile collaboration with Prof. Robert Williams (also a former student of Prof. Harry Irving), which has resulted in a number of joint seminal papers on the role of the chemical elements in Biology and in the publication (Oxford University Press) of four remarkable books: 'The Biological Chemistry of the Elements—The Inorganic Chemistry of Life', published in 1991, reprinted several times and with a second revised and expanded edition published in the end of 2001, 'The Natural Selection of the Chemical Elements—The Environment and Life's Chemistry' published 1996 and reprinted in 1997, and 'Bringing Chemistry to Life—from Matter to Man', published in 1999. All these highly inspiratory books have been very favourably reviewed and praised by the scientific community, the first one (a best-seller) having been con-

sidered as the 'bible' of bioinorganic chemistry [1], '... rich and refreshing... an excellent text for an advanced course and should have much to teach both students and teachers... in which disparate view-points are so admirably synthesised' [2], having also relevance to other sciences (e.g. 'is required reading for all those interested in ecological stoichiometry' [3]). The second joint book, 'The Natural Selection of the Elements' (although the 'theme is different and the setting wider') was compared [4] with the seminal L. Pauling's book on 'The Nature of Chemical Bond', foreseen [5] to 'become every origin of life's bible'..., recognized as 'an awe inspiring encyclopaedia of chemistry, biochemistry, geochemistry and environmental science... invaluable to teachers at all levels who seek examples with which to convey the excitement and centrality of chemistry' [5] and as an 'encyclopaedic volume, which together with the preceding one..., represents the legacy of a lifetime of involvement, thought and work in chemistry by two scientists... which leads us from early Chinese and Greek philosophy through refresher courses in thermodynamics and phase rule, inorganic chemistry, biological chemistry, with excursions into geochemistry, cosmology and biology, to the final holistic view of the universe and life on earth...' [6].

The quality and multidisciplinary character of these books were maintained in the following volumes, 'Bringing Chemistry to Life' considered a 'a hugely impressive work... a beautifully produced gem of a book that weaves together geology, biology, chemistry, physics and philosophy into a story that will be appreciated by anyone remotely interested in the ultimate questions of life, the universe and everything' [7] and 'a lucidly written volume which presents... together with the authors' magisterial earlier books... the theory of everything from a biochemical perspective. Few (authors) can bring such a broad perspective to such issues, as they can' [8].

These books followed the joint editorship of 'New Trends in Bioinorganic Chemistry' (Academic Press, 1979) based on an international symposium held at the Academy of Sciences of Lisbon on the occasion of its bicentennial celebrations, and the publication (in Portuguese) by Prof. Fraústo da Silva of 'Introduction to the Chemistry of Life' (New University of Lisbon, 1985), a preliminary approach to the ideas developed with Prof. Williams that were further expanded in the above series of joint books.

To testify the relevance of his work with Prof. Williams, it is perhaps enough to mention the impact of a very recent paper (still in press, at the time of this writing, in February 2003) entitled 'Evolution was Chemically Constrained' (Journal of Theoretical Biology, 2003) that has already been commented in the Times Higher Education Supplement (January 3rd) and in the New Scientist (January 18th), of which Prof.

Harold Morowitz said 'It's part of a quiet paradigm revolution going on in biology, in which the radical randomness of Darwinism is being replaced by a much more scientific law-regulated emergence of life' and that arose many pages of comments in a web site.

As to his very recent research work in Portugal, a paper (entitled 'Single-pot conversion of methane into acetic acid in the absence of CO and with vanadium catalysts such as Amavadiné'), in collaboration with the author of these lines, has just appeared at *Angew. Chem.* (2003, 115, 845; *Int. Ed.*: 2003, 42, 821) and qualified as a 'hot paper' by the same journal.

Prof. Fraústo da Silva's intellectual qualities, leadership capacity and personality are so much appreciated that he was practically led almost involuntarily to his restless destiny in the permanent pursuit of new and stimulating challenges, either in Portugal or abroad, but maintaining always a professional link and an affective tie with his IST and CQE. In fact, after returning from his sabbatical leave in Oxford (1976) and in view of the absence of any sufficiently stimulating project in a confuse post-revolution period in Portugal, he accepted an invitation to help in the set up of the first antibiotics production unit in Brazil and to teach at the Federal University of Rio de Janeiro and later at the prestigious Pontifical Catholic University ('Pontificia Universidade Católica', PUC) of the same city where he was soon elected as Director of the Chemistry Department. He returned from Brazil (1982) to become the President of the new National Institute of Administration ('Instituto Nacional de Administração', INA) which he reorganized and launched effectively to become one of the most prestigious institutions in Europe for higher staff training in Public Administration and whose activities included extensive cooperation with African Portuguese-speaking countries and Macao, in which Prof. Fraústo da Silva was also personally involved.

Meanwhile (1982), he reluctantly accepted the invitation to become Minister of Education of Portugal, which he had declined in two previous occasions. During his assignment (fortunately short, according to him) several legislation changes have been prepared and implemented, which had a decisive effect in the consolidation of the academic career, fixation of qualified staff and development of scientific research at the Universities. The research budget duplicated, the relations with the Unions of the academic staff improved markedly and an OECD exam to the education policy in Portugal was undertaken with such brilliance that he was invited on the spot and in public by the Secretary General of the Organization to become the leading examiner of the next country to be evaluated (actually Spain).

As an internationally recognized expert on education, he had other unusual missions in various countries and at the OECD (e.g. as consultant and as Editor of the

International Journal of Institutional Management of Higher Education) and was elected (1987) Vice-President of the International Conference of High-Level Education Experts held in Kyoto (Japan), the President being Prime-Minister Nakasone himself. He was also the 'Rapporteur' of the Education area in the first Conference Euro-92, which took place in Paris, at the invitation of Minister Valéry Giscard d'Estain. Later he was also charged of the global reorganization of the curricula and programs of the basis and the secondary education levels in Portugal. [PM1]

Although being always politically independent (too independent to affiliate to any political party), that did not prevent governments of different tendencies to invite him for the abovementioned functions and even President Mário Soares in his two successful election campaigns to appoint him as his National Representative and later Counsellor of State (1988–96).

The interest of Prof. Fraústo da Silva for the Arts (his main hobby is music, especially opera) led him to leave the INA and accept (in 1996) a new challenge as President (a position he still holds) of the Cultural Centre of Belém ('Centro Cultural de Belém', CCB), an emblematic institution of the modern Portugal which was the seat of the first Portuguese Presidency of the European Union and now plays a pivotal role in the promotion of cultural activities. The CCB is now a success of public of all ages and became 'a must' for all arts' lovers.

In view of all those commitments, always in parallel with his scientific interests, it is not surprising that one does not see him often in conferences and meetings, despite being a first-class lecturer and regularly present in the pages of scientific journals. He is a man who prefers 'doing' rather than 'being' but, as he says, 'to be' is often a necessary condition to be able 'to do', so something has to be sacrificed.

He has a most pleasant, open and friendly character and talking to him, listening to his opinions and experienced advices, is always a very enriching experience from which some of us have benefited mainly on Saturdays or Sundays afternoons when he regularly comes to the CQE to keep his research group on the move... To those who ask how he can manage such diversity of responsibilities and interests, he earnestly replies that he 'takes care of one at a time (...) and his best succeeded achievements were mostly due to the outstanding stature of the personalities he has worked with and to the exceptional quality of the collaborators he had the intuition to choose'.

The above and many other functions, honours (amongst which the 'Legion d'Honneur', awarded by the President of the Republic of France) and prizes he has been awarded along his life, as summarized in his curriculum vitae (see below for a brief version), attest to the many merits of Professor Fraústo da Silva, a man of

'two cultures' with eminent human and civic dimensions (with unexceeding senses of justice and truth and an impeccable ethical behaviour) to whom his Country, Science (particularly Chemistry) and many of us (namely myself) so much owe.

Curriculum vitae (brief)

Professor João José Rodiles Fraústo da Silva was born in 1933 at Tomar, Portugal, is married and has one daughter and one son.

Academic degrees: B.A. Chemical Engineering (Universidade Técnica de Lisboa), 1958; D. Phil. (Oxon)—Chemistry (Oxford University), 1962; Ph.D. Chemical Engineering (Universidade Técnica de Lisboa), 1965; Doctor in Public Administration, Honoris Causa (University of Macao), 1994; Doctor in Chemistry, Honoris Causa (Universidade Nova de Lisboa), 2001.

Academic career: Professor of Inorganic and Analytical Chemistry (Universidade Técnica de Lisboa), 1967 to the present; Professor of Chemistry (Instituto de Hidrologia de Lisboa), 1968–2002; Associate Professor of the Pontifícia Universidade Católica do Rio de Janeiro (PUC), Brazil, October 1979–1982; Visiting Professor of the Universidade Federal do Rio de Janeiro, Brazil, 1977–1979; Invited 'Fellow' of St. Edmund Hall (University of Oxford—England), 1975–1976.

Managerial functions: President of the Fundação Centro Cultural de Belém, since 1996; President of the National Institute of Administration (INA), January 1982 to October 1996; Director of the Department of Chemistry (Pontifícia Universidade Católica do Rio de Janeiro, PUC), Brazil, March 1980 to December 1981; Scientific Director of the Brazilian Company of Antibiotics (CIBRAN), 1977–1979; Vice-Chancellor of the Universidade Nova de Lisboa, 1973–1975; Dean of the Instituto Superior Técnico Lisboa (IST), 1970–1972; Head of the Research and Planning Department of the Ministry of Education (GEPAE), 1968–1973.

Political functions: Minister of Education of Portugal (VIIIth Constitutional Government), 1982/1983; National Representative of the candidate Dr Mário Soares to the 1986 and 1991 elections for the Presidency of the Republic of Portugal; Privy Counsellor of the State (Conselho de Estado), 1988–1996.

Functions in international organizations: Representative of the Portuguese Universities and of the Portuguese Government in the Programme of Institutional Management of Higher Education (CERI, OECD), 1973–1977; Portuguese Delegate to the Education Committee of OECD, 1970–1973; Portuguese Delegate to the Science Committee of OECD, 1965–1967.

Other functions: Consultant to the OECD (Education Policy)—Missions in Turkey (1976) and Spain (1984,

1985, 1986); Consultant to the Calouste Gulbenkian Foundation—Mission in S. Tomé e Príncipe (1984). Editor of 'Coloquium—Education and Society', published by the Gulbenkian Foundation; Editor of the International Journal of Institutional Management of Higher Education, OECD, 1976–1982; Chairman of the Board of Trustees of the Orient Foundation, from 1987.

Publications: Eight text-books on Analytical Chemistry, Inorganic Chemistry and Bio-Inorganic Chemistry (Students' Editions); three thesis, ca. 200 papers in the field of Chemistry, over thirty studies and reports on Education Policy, Science Policy and Planning, over one hundred and eighty communications to national and international conferences, many entries for encyclopaedias, newspaper articles and literary works. Edited 'New Trends in Bioinorganic Chemistry' (Academic Press, 1979) and published 'Introduction to the Chemistry of Life' (New University of Lisbon, 1985), 'The Biological Chemistry of the Elements—The Inorganic Chemistry of Life' (Oxford University Press, 1991, 1993, 1994, and 1997, re-edited in 2001), 'The Natural Selection of the Chemical Elements—The Environment and Life's Chemistry' (Clarendon Press/Oxford University Press, Oxford, 1996, 1997) and 'Bringing Chemistry to Life—from Matter to Man' (Oxford University Press, 1999), the last three in collaboration with R.J.P. Williams.

Technical and consulting work in other countries: Spain (education policy), Turkey (public administration), Cape Vert (public administration and education), S. Tomé e Príncipe (education policy), Angola (public administration), Macau (public administration) and Brazil (chemical industry).

Honours: Member of the Portuguese Academy of Sciences, 1981 (Corresponding Member from 1971 to 1981); 'Grande Oficial' of the Order of Public Instruction (Portugal, 1973); 'Grande Oficial' of the Order of Infante D. Henrique (Portugal, 1988); 'Pedro Ernesto' medal from the Câmara Municipal do Rio de Janeiro (Brazil, 1986); Officier de la Légion d'Honneur (France, 1986); Gold Medal of Câmara Municipal de Oeiras (Oeiras, 1989); Doctor Honoris Causa in Public Administration, University of Macau, 1994; Ferreira da Silva medal, Sociedade Portuguesa de Química, 2000; Doctor Honoris Causa in Chemistry, Universidade Nova de Lisboa, 2001.

Academic awards: Prize 'Boa Esperança', Secretariat of State of Science and Technology, 1992; Prize Artur Malheiros, Portuguese Academy of Sciences, 1965; Prizes Bandeira de Melo, Mário Bastos Wagner and Companhia União Fabril, 1958 (best graduate—Chemical Engineering).

Scientific societies: Royal Society of Chemistry (London): Fellow (F.R.S.C.); New York Academy of Sciences: Member; Portuguese Society of Chemistry (National President from 1982 to 1985).

Professional societies: Royal Society of Chemistry (London)—Chartered Chemist; Ordem dos Engenheiros (Portugal).

Scientific interests: Coordination Chemistry, Bioinorganic Chemistry, Education Policy and Planning, Public Administration Policy.

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