Fondation Francqui-Stichting
Fondation d'Utilité Publique - Stichting van Openbaar Nut

Ceremony of the Francqui Prize by His Majesty The King Albert II at the "Fondation Universitaire" on June 19, 1997

Scientific Career - Research activities - Report of the Jury

Jean-Luc Brédas

Scientific Career

Jean-Luc Brédas was born in Fraire (Walcourt), on 23 May 1954. In 1976, he graduates in Chemistry a the Facultés Universitaires Note-Dame de la Paix in Namur. He then starts a Ph.D. in Theoretical Chemistry at the same University under the supervision of Professor Jean-Marie André. In 1977, he becomes Aspirant of the Belgian National Fund for Scientific Research (FNRS) and spends the first of his numerous extended research stays in foreign institutes at the Donegani Research Center of Montedison in Novara, Italy. He is awarded a Ph.D. in Science in 1979.

In Fevruary 1980, he departs for the United States where he had obtained a post-doctoral grant from the US National Science Fondation to work on a project led by Professor Robert Silbey at the Massachusetts Institute of Technology and Dr. R.R. Chance at the Corporate Research Center of Allied Chemical in Morristown, New Jersey. He spends a total of 13 months in both places and acquires a strong taste for the applied aspects of this theoretical studies.

Back with Jean-Marie André in Namur from 1981 till 1988, he is appointend Chargé de Recherche FNRS in 1981 and starts interacting and collaborating with numerous research groups inside and outside Belgium, in both academia and industry. Nearly every year, he is invited for extended research stays, as

Visiting Scientist or Visiting Professor, in Europe, United States, or Japan - in 1982 and 1994, at the Massachusetts Institute of Technology; in 1983, in 1984-85 (for seven months), 1987 and 1991, at the IBM Research Centen in San Jose, California; in 1985 and 1992, at the Department of Physics of Linköping University, Sweden; in 1986, at the Exxon Corporate Research Center in Annandale, New Jersey; in 1987, at the Institute for Research on Polymers and Textiles in Tsukiba, Japan; in 1988, at the RIKEN Institute in Wako, Japan; in 1988, 1990, 1993, 1995 and 1996, at the Institute for Polymers and Organic Solids of the University of California at Santa Barbara; in 1994 - as well as the Summer of 1997, at the California Institute of Technology in Pasadena. In 1983, he obtains a permanent position at the Belgian FNRS as Chercheur Qualifié. In 1986, he is awarded the degree of Agrégé de l'Enseignement Supérieur by the Catholic University of Louvain and is promoted to Maître de Recherches FNRS in 1987.

In July 1988, he is appointed Chargé de Cours at the University of Mons-Hainaut where he haeds and develops a new Laboratory for Chemistry of Novel Materials; he becomes Professeur ordinaire in 1990. In 1992, together with Professor André Persoons form the Catholic University of Leuven, he established the UMH-KUL Interuniversity Center for Research in Molecular Electronics and Photonics. Since 1994, he is Professeur Invité at the Catholic University of Louvain and, since 1995, Professeur Visiteur at FUNDP Namur.

A major characteristic in the career of Jean-Luc Brédas has been, in parallel to his theoretical background, his constant interaction with exprimentalists. This translates namely into teh development of an experimental section in his Mons Laboratory, devoted to the characterizaation of polymer materials by scanning probe microscopies. The relevance to technology of his theoretical work is witnessed by his participation in several ESPRIT and BRITE-EURAM projects of the European Commission with industries such as Philips, Hoechst, or Thomson-DSF. He has held consulting positions with Exxon and Uniax in the US and has currently one with Hoechst in Germany;

Jean-Luc Brédas has been appointed three times to the "Chaire Francqui au titre Belge" at the University of Liège (1994), Namur (1994) and Antwerp (1996); his laboratory is recognized as a Belgian Center of Excellence by the Federal Government through the award of Interuniversity Attraction Pole programmes (for the periods 1190-1996 and 1997-2001), as well as a "Pôle d'Excellence - Materia Nova" by the Government of the Region of Wallonia. He is recipient of a number of awards (Prix Jean Stas de l'Académie Royale de Belgique, 1980; Prix Scientifique Louis Empain, 1984; Pris Louis d'Or de la Société Royale des Sciences de Liège, 1985; Prix du Cercle des Alumni de la Fondation Universitaire, 1986; Pris de la Fondation Désiré Jaumain "Sciences, Art et Culture en Wallonie", 1988; Prix Triennal de la Société Royale de Chimie, 1991; Prix Alphonse Wetrems de l'Académie Royale de Belgique, 1995; Prix Francqui, 1997). Since 1991, he is Foreign Member of the Frontier Research Program launched by the Japanese government at the RIKEN Institute in Wako. He was elected in 1993 Fellow of the American Physical Society. He is currently Vice President of the Société Royale de Chimie and will serve as President for a two-year term starting in October 1997.

Jean-Luc Brédas is leading a group of over 25 scientists (graduate and undergraduate students, postodocs, and visiting scientists) in his laboratory and Center for Molecular Electronics and Photonics at the University of Mons-Hainaut. Over the years, these postdocs and visiting scientists have come from all over the world (Brazil, China, Denmark, France, Germany, India, Italy, Japan, Marocco, The Netherlands, Russia, Spain, Sweden, Switzerland, United States). Upon returning to their countries, many of these postdocs have engaged in an academic career.

He is author or co-author of over 450 scientific papers, amont which a vast majority in international refereed journals such as : Science, Nature, Journal of the American Chemical Society, Physical Review Letters, Physical Review, Journal of Chemical Physics, Macromolecules, Chemical Reviews, Chemical Physics Letters, Sunthetic Metals. Several of these papers have been among the 50 most cited papers in the whole field of chemistry within three years of their publication. He is co-author of two books, co-editor of five books, and co-editor of special issues of "Nonlinear Optics" and "Synthetic Metals". He has given over 230 lectures and seminars at international conferences and scientific institutions.

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Research activities

The research activities of Jean-Luc Brédas and his group mainly deal with the modeling, characterization, and development of novel organic materials that display promising electrical and optical properties, exploitable in electronics, photonics, and information technology.

Most studies focus on polymer and oligomer materials, i.e. plastics, with a so-called conjugated backbone which provides for highly delocalizable and polarizable electrons. The conjugated polymers are dramatically different from the conventional plastics, such as polethylene, polypropylene, or nylon, which are mainly exploited for their remarkable mechanical properties. In conjugated polymers, mechanical properties can be combined to electrical and optical properties that were previously known only to conventional metals or inoragnic semiconductors. Research worldwide is now thriving towards the development of plastics that could ideally be simultaneously (nearly) as conducting as copper and as strong as steel, or could emit light as brightly as in inorganic solid-state diodes or lasers.

The research efforts mostly rely on theoretical investigations based on powerful computational techniques derived from quantum chemistry and solid-state physics; with this approach, the organic materials can be modeled reliably in order to understand and/or predict their electronic and optical properties. The investigations also involve experimental methods; in this regard, the newest aspect consists in the use of Scanning Tunneling Microscopy, STM, and Atomic Force Microscopy, AFM. The works are carried out in close collaboration with a number of experimental groups, in Belgium, Europe, USA and Japan.

The major goals of the investigations on these electrically and optically active

polymers, are to provide a rationalization for, and to help in the enhancemnet of :

- metal-like electrical conductivities - that can be induced by chemical or electrochemical reactions and have led to the development of intrinsically conducting plastics and fibers;

- semiconducting properties - exploitable in the fabrication of flexible field-effect transistors, light-emitting diodes, or solid-state lasers, paving the way ultimately to thin flexible displays;

- outstanding nonlinear optical properties in compounds with donor/acceptor substituents - these could be incorporated for instance in future generations of all-optical communications and computer systems;

- specific surface interactions that can develop with other materials, such as metals - such interactions can help for instance in preventing metal corrosion.

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Report of the Jury (April 5, 1997)

Professor Jean-Luc Brédas is a leader in the interdisciplinary field of semiconducting and metallic polymers.

He has emerged as a major international scientific figure with a prolific and remarkable record of influential publications. His theoretical studies of the electronic structure of this novel class of electronic polymers have served to guide experimentalists and have a truly major impact on the development of high performance materials.

He has demonstrated success in training students who have emerged as world-class young scientists. Through his scientific accomplishments and his leadership, Professor Jean-Luc Brédas has had major impact on science in Belgium and on the role of Belgium in the international scientific community.

To recognize his significant accomplishments, the Jury concluded that Professor Brédas is deserving of the stature and recognition of the Francqui Prize.

Jury members :

Professor Lennart CARLESON
Professor at the Royal Institute of Technology
Department of Mathematics
Stockholm - Sweden

Chairman

and

Professor Marie-Christine ARTRU
Professor at the Ecole Normale Supérieure de Lyon
France

Professor Margaret BEATTIE

Professor at the Mount Allison University
Department Mathematics
Sackville - Canada

Professor Hans-Joachim BUNGE
Professor at the Institut für Metallkunde und Metallphysik der TU
Claustahl-Zellerfeld - Germany

Professor Israel GOHBERG
Professor at the University of Tel Aviv School of Mathematical Sciences
Ramat Aviv - Israel

Professor J. HEEGER
Professor at the University of California
Institute for Polymers and Organic Solids
Santa Barbara, CA - USA

Professor Brian E. LAUNDER
Professor at the University of Manchester
Institute of Science & Technology (UMIST)
Department of Mechanical Engineering
Manchester - UK

Professor John TYSON
Professor at the Virginia Polytechnic Institute and State University
Department of Biology
Blacksburg, Virginia - USA

Professor Edward P.J. van den HEUVEL
Professor at the University of Amsterdam
Sterrenkundig Instituut Anton Pannekoek
The Netherlands

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