



PONTIFICIA ACADEMIA SCIENTIARVM

MEMBERS' DIRECTORY 2013



THE PONTIFICAL ACADEMY OF SCIENCES

Members' Directory 2013

Vatican City





CASINA PIO IV – VATICAN GARDENS
Headquarters of the Pontifical Academy of Sciences

PONTIFICIA ACADEMIA SCIENTIARVM

MEMBERS' DIRECTORY 2013



VATICAN CITY 2013

The Pontifical Academy of Sciences
Casina Pio IV, V-00120 Vatican City
Tel: +39 0669883195 • 0669883451 • 0669885416
Fax: +39 0669885218
Email: pas@pas.va • Website: www.pas.va

ISBN 978-88-7761-105-5

© Copyright 2013

THE PONTIFICAL ACADEMY OF SCIENCES

VATICAN CITY

CONTENTS

Foreword	9
PAS Objectives	10
Historical Profile	11
The President, Chancellor and Council of the Academy	12
Presidents, Chancellors and Members of the Council 1936-2013	13
Index of Academicians	15
Deceased Academicians	251
Statistical Tables	
1. List of Disciplines	272
2. Alphabetical Order	273
3. Nation of Birth and Residence	276
4. Scientific Disciplines	280
5. Nation of Residence and Discipline	283
6. Continent of Residence and Discipline	286
7. Year of Birth and Discipline	289
8. Year of Appointment and Discipline	292
9. Year of Appointment and Continent of Residence	295
10. Academicians Appointed by each Supreme Pontiff	298
Winners of the Prizes of the Academy	299
The <i>Motu Proprio</i> of Pius XI	300
Statutes	303

Scientific Meetings 1949-2013	306
Publications 1936-2013	
Acta.....	310
Scripta Varia	311
Extra Series	319
Documenta	322
Commentarii (Volumen I, 1961-1966)	324
Commentarii (Volumen II, 1967-1972)	327
Commentarii (Volumen III, 1973-1996)	330
Commentarii (Volumen IV, 1996-)	331
Academicians' Addresses	332

FOREWORD

It is a great honour for me, as Chancellor of the Pontifical Academy of Sciences, to present this new Directory of our Academy to Pope Francis, the Catholic Church and other Churches, and the world of science and learning. This volume offers a photograph, a brief biography, a summary of scientific research, and a short list of publications of each Academician, as well as a variety of informative statistics. As can be seen from a perusal of the pages of this Directory, the Academy is loyal to the goals set out in its statutes, namely to achieve a representation within its ranks of the various branches of science and of the great regions of the world. The interdisciplinary and international dialogue that this network of knowledge and planning allows on the topical and pressing subjects of contemporary science is a very valuable and perhaps unique source of progress for man at both a scientific and ethical level. We have to recognise that during the last century humanity has achieved greater progress, if not in relation to knowledge about man certainly in relation to knowledge about the macrocosm and the microcosm, than was the case throughout the whole of the rest of the history of mankind. The happy insight of Pope Clement VII, who in founding the Academy of the Lynxes in 1603 – continued by Pope Pius XI with his refoundation of the Academy in the form of the Pontifical Academy of Sciences in 1936 – sought to establish a scientific ‘Senate’ within the Holy See, seems today more relevant than ever in this age of ours which has been defined by many as the age of science.

Of course, all the activities of the Academy would not be possible without the vital help of the Holy Father who has always followed its initiatives and deliberations with great care and interest, providing both keen moral support, as well as important funding and the magnificent headquarters in the Casina Pio IV. A profound debt of gratitude must therefore be expressed to His Holiness Francis for his benevolence and guidance. I would also like to extend my thanks to the President, Professor Werner Arber, the members of the Council, and all the Academicians, who, through their participation, make possible the life of the Academy.

Marcelo Sánchez Sorondo,
Bishop-Chancellor of the Pontifical Academy of Sciences

PAS OBJECTIVES

- Promoting the progress of the mathematical, physical and natural sciences, and the study of related epistemological questions and issues
- Recognising excellence in science
- Stimulating an interdisciplinary approach to scientific knowledge
- Encouraging international interaction
- Furthering participation in the benefits of science and technology by the greatest number of people and peoples
- Promoting education and the public's understanding of science
- Ensuring that science works to advance of the human and moral dimension of man
- Achieving a role for science which involves the promotion of justice, development, solidarity, peace, and the resolution of conflict
- Fostering interaction between faith and reason and encouraging dialogue between science and spiritual, cultural, philosophical and religious values
- Providing authoritative advice on scientific and technological matters
- Cooperating with the members of other Academies in a friendly spirit to promote such objectives.

HISTORICAL PROFILE

The Academy was founded in Rome on 17 August 1603 by Federico Cesi, Giovanni Heck, Francesco Stelluti and Anastasio de Filiis with the name 'Linceorum Academia'. After various vicissitudes it was refounded in 1847 by Pius IX with the name 'Pontificia Accademia dei Nuovi Lincei'. It was then enlarged in 1887 by Leo XIII; provided with its new headquarters of Casina Pio IV in the Vatican Gardens in 1922; and refounded again with new statutes by the Motu Proprio *In Multis Solaciis* of 28 October 1936 of Pius XI, who gave it the new name of 'Pontificia Academia Scientiarum'.

The Pontifical Academy of Sciences directly depends on the Supreme Pontiff and is made up of eighty 'Pontifical Academicians' who are such by sovereign appointment. They are proposed by the Academic Body and chosen without any form of discrimination from the most eminent scientists and scholars of the mathematical and experimental sciences of every country of the world.

The Pontifical Academy of Sciences is at the present time unique in its kind because it is the only Academy of Sciences which is supranational in character and belongs to a category that is unique in the world.

Its purpose is to honour pure science wherever it may be found, ensure its freedom, and favour its research, which are the indispensable bases for the progress of science.

The eighty 'Pontifical Academicians' are joined by the Academicians 'Perdurante Munere' who are such because of their office, and by the 'Honorary Academicians' who are such because of the services they have rendered to the Academy.

By his Apostolic 'Breve' of 25 November 1940 Pius XII granted to the 'Pontifical Academicians' the title of 'Excellency'.

By his Apostolic 'Breve' of 3 March 1961 John XXIII extended the title of 'Excellency' to the Honorary Academicians, and in addition in 1961 established the 'Pius XI Medal' to be awarded to young scientists for their notable contributions to duly recognised scientific research (Art. 4 of the Statutes).

THE PRESIDENT, CHANCELLOR AND COUNCIL OF THE ACADEMY

President of the Academy

Prof. **Werner ARBER**, appointed 20 December 2010

Chancellor

H.E. Msgr. **Marcelo SÁNCHEZ SORONDO**, appointed 5 October 1998

Members of the Council

Prof. **Werner ARBER**

Prof. **Paul J. CRUTZEN**

Prof. **Theodor W. HÄNSCH**

Prof. **Nicole M. LE DOUARIN**

Prof. **Jürgen MITTELSTRASS**

Prof. **Veerabhadran RAMANATHAN**

Prof. **Martin John REES**

H.E. Msgr. **Marcelo SÁNCHEZ SORONDO**

Prof. **Rafael VICUÑA**

PRESIDENTS, CHANCELLORS AND MEMBERS OF THE COUNCIL 1936-2013

Presidents

- Rev. F. **Agostino GEMELLI**, O.F.M. (28 October 1936 – 15 July 1959)
 Msgr. **Georges LEMÂÎTRE** (19 March 1960 – 20 June 1966)
 Rev. F. **Daniel J.K. O'CONNELL**, S.J. (15 January 1968 – 15 January 1972)
 Prof. **Carlos CHAGAS** (9 November 1972 – 30 October 1988)
 Prof. **Giovanni Battista MARINI-BETTÒLO** (31 October 1988 – 29 March 1993)
 Prof. **Nicola CABIBBO** (30 March 1993 – 16 August 2010)
 Prof. **Werner ARBER** (20 December 2010–)

Chancellors and Directors

- Prof. Dr. **Pietro SALVIUCCI** Chancellor (28 October 1936 – 31 December 1973)
 Rev. F. **Carlo Enrico di ROVASENDA**, O.P., Vice-Director (16 November 1972); Director (3 April 1974 – 31 December 1986)
 Msgr. Eng. **Renato DARDOZZI**, Vice-Director (5 July 1985); Director of the Chancellery (1 January 1987); Chancellor (30 January 1995 – 30 June 1997)
 H.E. Msgr. **Giuseppe PITTAU**, S.J., Chancellor (1 July 1997 – 4 October 1998)
 H.E. Msgr. **Marcelo SÁNCHEZ SORONDO** Chancellor (5 October 1998–)

Members of the Council of the Academy

ARMELLINI G.	1936-1940; 1944-1948
LEPRI G.	1936-1941; 1944-1948
ALBAREDA A.M.	1936-1962
BIANCHI E.	1936-1940
BOTTAZZI F.	1936-1941
AMALDI U.	1941-1944
GIORDANI F.	1941-1961
LOMBARDI L.	1941-1954
SEVERI F.	1944-1961
QUAGLIARIELLO G.	1944-1957
BOLDRINI M.	1958-1969

BONINO G.B.	1958-1980
CROCCO G.A.	1958-1965
PISTOLESI E.	1958-1968
O'CONNELL D.J.	1962-1982
BRÜCK H.A.	1964-1986
LEPRINCE-RINGUET L.	1964-1968; 1980-1988
DE BROGLIE L.	1969-1980
MARINI-BETTÒLO G.B.	1969-1996
TUPPY H.	1974-1988
PUPPI G.	1980-1988; 1993-1999
COYNE G.V.	1986-2006
CHAGAS C.	1988-1992
BLANC-LAPIERRE A.	1989-1992
ŁOJASIEWICZ S.	1989-1992
DALLAPORTA N.	1991-1998
DE GIORGI E.	1991-1996
LEJEUNE J.	1993-1994
PULLMAN B.	1994-1996
DARDOZZI R.	1995-1997
KEILIS-BOROK V.I.	1995-2004
RUNCORN S.K.	1995
ARBER W.	1996-
ESCHENMOSE A.	1996-2000
PITTAU G.	1997-1998
SÁNCHEZ SORONDO M.	1998-
CAFFARELLI L.A.	1999-2002
GERMAIN P.	1999-2006
CRUTZEN P.J.	2001-2012
LE DOUARIN N.M.	2001-
BLOBEL G.	2003-2007
MENON M.G.K.	2005-2009
MITTELSTRASS J.	2006-
VICUÑA	2009-
RAMANATHAN V.	2011-
REES M.J.	2011-
HÄNSCH T.	2012-

INDEX OF ACADEMICIANS

Werner Arber



Date of Birth 3 June 1929

Place Gränichen (Switzerland)

Nomination 12 May 1981 (President of the PAS from 20 Dec. 2010)

Field Microbiology

Title Professor, Nobel laureate in Physiology or Medicine, 1978

Most important awards, prizes and academies Nobel Prize in Physiology or Medicine (1978). *Academies*: European Molecular Biology Organization (1964); European Academy of Arts, Sciences and Humanities (1981); Foreign Associate of the National Academy of Sciences, USA (1984); Foreign Honorary Member of the American Academy of Arts and Sciences (1984); Academia Europaea (1989); Fellow of the American Academy of Microbiology (1996); Associate Fellow of the Third World Academy of Sciences (TWAS) (1997); President of the International Council of Scientific Unions (ICSU) (1996-1999).

Summary of scientific research W. Arber's main scientific interests are the mechanisms which promote and which limit the spontaneous variation of genetic information in micro-organisms. In his doctoral dissertation he explained that rare, spontaneous derivatives of the bacterial virus λ have a part of the viral DNA substituted by a segment from the chromosome of the host bacteria. The concept of these hybrid transducing viruses later served others as a model for the design of cloning vectors in recombinant DNA technology. Beginning in 1960, W. Arber explored the molecular basis of host-controlled modification of bacterial viruses. This led to the discovery that this phenomenon acts at the DNA level. Specific enzymes, now known as restriction endonucleases, serve in many bacterial strains to recognise foreign DNA upon its entry and they subsequently inactivate this DNA by cleavage. An associated DNA methylase protects the cellular DNA from restriction cleavage. Restriction and modification systems thus represent barriers limiting the exchange of genetic material between different micro-organisms, thereby improving genetic stability. Soon after their isolation, restriction enzymes proved to be extremely useful tools for molecular genetic studies, since they provide specific

fragmentation of the long DNA filaments, a prerequisite for detailed structural and functional analysis. W. Arber has also intensively studied enzyme-directed processes in the structural rearrangement of genetic material, in particular transposition and site-specific recombination. These processes lead to the recombination of nonhomologous DNA and thus can bring about new gene functions by fusion of previously independent DNA segments. They represent part of the mechanisms responsible for spontaneous mutagenesis and they are important agents in both vertical and horizontal evolution. On the basis of his long-term experience and taking into account knowledge accumulated over the past fifty years on molecular mechanisms of mutagenesis and of different kinds of recombination of genetic information, particularly in micro-organisms, W. Arber has postulated a theory of molecular evolution, according to which the products of evolution genes carried in the genome are involved either in the generation or in the limitation of genetic variation, without, however, implying a specific direction to biological evolution. Rather, the course of biological evolution results from the casual action of the products of evolution genes on DNA, from the conformational flexibility of the structures of biologically active molecules, from the largely stochastic nature of any interaction affecting genetic stability, and from chance environmental influences, whereby the steadily exerted natural selection limits diversity according to the temporal fitness of the organisms involved. In brief, a multitude of specific molecular mechanisms contribute to overall spontaneous genetic variation. These specific mechanisms can be classified into three major natural strategies of genetic variation, namely, small local changes in the nucleotide sequences, intragenomic rearrangement of DNA segments, and acquisition of a segment of foreign DNA by horizontal gene transfer. These strategies differ in the quality of their contributions to genetic variation and thus to biological evolution. The postulate that the products of specific evolution genes together with intrinsic properties of matter are at the origin of genetic variation which drives biological evolution has interesting philosophical implications. Nature cares actively for biological evolution. The juxtaposition of evolution genes and of the more classical genes acting to the benefit of individual lives implies an intrinsic duality of the genome. These aspects have been discussed by W. Arber in some of his recent publications, as well as the relevance of the acquired knowledge on spontaneous genetic variation for the evaluation of conjectural risks of genetic engineering.

Main publications Arber, W., Kellenberger, G. and Weigle, J.J., The defectiveness of lambda transducing phage, *Papers on bacterial genetics*

selected by E.A. Adelberg, Little, Brown and Co., Boston-Toronto, pp. 224-229 (1960); Arber, W. and Dussoix, D., Host specificity of DNA produced by *Escherichia coli*. 1. Host controlled modification of bacteriophage lambda, *J. Mol. Biol.*, 5, pp. 18-36 (1962); Dussoix, D. and Arber, W., Host specificity of DNA produced by *Escherichia coli*. 2. Control over acceptance of DNA from infecting phage lambda, *J. Mol. Biol.*, 5, pp. 37-49 (1962); Arber, W. and Linn, S., DNA modification and restriction, *Ann. Rev. Biochem.*, 38, pp. 467-500 (1969); Smith, J.D., Arber, W. and Kuehnlein, U., Host specificity of DNA produced by *Escherichia coli*. 14. The role of nucleotide methylation in in vivo B-specific modification, *J. Mol. Biol.*, 63, pp. 1-8 (1972); Arber, W., Iida, S., Juetter, H., Caspers, P., Meyer, J. and Haenni, C., Rearrangements of genetic material in *Escherichia coli* as observed on the bacteriophage P1 plasmid, *Cold Spring Harbor Symp. Quant. Biol.*, 43, pp. 1197-1208 (1978); Arber, W., Promotion and limitation of genetic exchange, *Science*, 205, pp. 361-365 (1979); Iida, S., Meyer, J. and Arber, W., Genesis and natural history of IS-mediated transposons, *Cold Spring Harbor Symp. Quant. Biol.*, 45, pp. 27-37 (1981); Iida, S., Meyer, J. and Arber, W., Prokaryotic IS elements, *Mobile genetic elements* (J.A. Shapiro, ed.), Academic Press, Inc., New York, pp. 159-221 (1983); Arber, W., Elements in microbial evolution, *J. Mol. Evol.*, 33, pp. 4-12 (1991); Arber, W., Evolution of prokaryotic genomes, *Gene*, 135, pp. 49-56 (1993); Arber, W., Naas, T. and Blot, M., Generation of genetic diversity by DNA rearrangements in resting bacteria, *FEMS Microbiol. Evol.*, 15, pp. 5-14 (1994); Arber, W., The generation of variation in bacterial genomes, *J. Mol. Evol.*, 40, pp. 7-12 (1995); Arber, W., Involvement of gene products in bacterial evolution, *Molecular strategies in biological evolution* (L.H. Caporale, ed.), Annals New York Academy of Sciences, vol. 870, pp. 36-44 (1999); Arber, W., Genetic variation: molecular mechanisms and impact on microbial evolution, *FEMS Microbiol. Rev.*, 24, pp. 1-7 (2000); Arber, W., Evolution of prokaryotic genomes, Pathogenicity islands and the evolution of pathogenic microbes (J. Hacker and J.B. Kaper, eds), *Curr. Top. Microbiol. Immunol.*, Vol. 264/1, pp. 1-14 (2002); Arber, W., Molecular evolution: comparison of natural and engineered variations, *Pontif. Acad. Sci. Scr. Varia*, 103, pp. 90-101 (2002); Arber, W., Cultural aspects of the theory of molecular evolution, *Pontif. Acad. Sci. Scr. Varia*, 105, pp. 45-58 (2003); Arber, W., Elements for a theory of molecular evolution, *Gene*, 317, pp. 3-11 (2003); Arber, W., The impact of science and technology on the civilization, *Biotech. Adv.* 27, pp. 940-944 (2009).

Vanderlei Salvador Bagnato



Date of Birth 28 September 1958

Place Sao Carlos (Brazil)

Nomination 27 September 2012

Field Physics and Material Science Engineering

Title Professor

Bagnato

Most important awards, prizes and academies SRE Scientific Prize 2011, IV Simpósio de Reabilitação Esportiva USP-RP; Personalidade da Tecnologia Prize 2011, Sindicato dos Engenheiros no Estado de São Paulo – SEESP; Physics Prize 2010 of the CBPF, Centro Brasileiro de Pesquisas Físicas; Galeno Prize 2010 for Work with Humans, Faculdade de Medicina de Ribeirão Preto – USP; Paulo Freire Prize 2009, elected best professor of 2008 by the students of the Degree in Exact Sciences 2005, Instituto de Física de São Carlos; Official Guest of the Town Council of Ilha Solteira 2009; Horácio Carlos Panepucci Prize 2008, best professor of 2007, IFSC/USP, São Carlos, Instituto de Física de São Carlos; Marco da Paz Trophy 2008, CONSEG – Conselho de Segurança do Estado de São Paulo / ACISC; Abilux Empresarial de Design Prize 2007; Commander of the National Order of Scientific Merit 2007, Presidency of the Republic of Brazil; Troféu Executivo / Personalidade Trophy 2005 – Imprensa Dr. Mário de Cico Trophy, 2005 edition, Associação de Bocha Feminino de São Carlos; Diploma of Public Recognition 2005, for work in science, Poder Legislativo São-carlense; 24th José Reis Prize 2004 for Scientific Diffusion, CNPq; Imprensa Trophy 2003, with the tribute of the Government of the State of São Paulo, Associação de Bocha Feminino de São Carlos; José Favoretto ZI Trophy 2003 e Comenda do Governo do Estado de São Paulo, Associação de Bocha Feminino de São Carlos; Tribute of the Federal Senate in the person of Senator Pedro Simon, 2003, Associação de Bocha Feminino de São Carlos; Imprensa Trophy 2000 – Oscar São-carlense – Scientist of the Year, Cidade de São Carlos, Associação de Bocha Feminino de São Carlos; 2001 Distinguished Citizen of Cidade de São Carlos, Câmara Municipal de São Carlos; Excellence Award in Meteorology 2001, Sociedade Brasileira de Metrologia; First Prize in

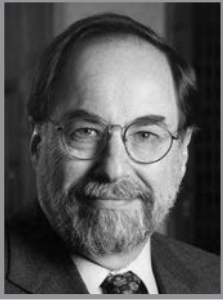
Science and Technology of São Carlos, 2000, Prefeitura Municipal de São Carlos / Secret. Munic. de Ciência, Tecnol. e Desenvol. Econômico; CPFL PLUS Prize 1994 in recognition of scientific work carried out in Physics, CPFL; Gleb Wataghin Prize 1988 for Young Researchers – Fundação de Amparo à Pesquisa do Estado de São Paulo/FAPESP; Tribute for the awarding of the Gleb Wataghin Prize 1988, Instituto de Física e Química de São Carlos / USP; First place in the 1980 competition for scientific work IV CBECIMAT; Young Paulista Scientists Prize 1976, Rotary Club São Carlos; Comendador Trophy 1975, Instituto de Educação Dr. Álvaro Guião. *Academies*: Member, Brazilian Academy of Sciences, 2005; Adjunct Faculty Member at PIEAS, Pakistan Institute of Engineering and Applied Sciences, 2008; Member, Third World Academy of Sciences (TWAS), 2009; Corresponding Member, Academia Paraense de Ciências, Belém, Pará, 2009; Member, Technical Scientific Council CTC, National Observatory, Rio de Janeiro, 2010.

Summary of scientific research Professor Bagnato's activities are based on laser cooling and trapping of neutral atoms and applications of optics and laser to health science. He has pursued pioneering work in the field of atomic and molecular physics with worldwide recognition. He has studied Quantum Turbulence involving atomic superfluid, and time and frequency metrology with the construction and evaluation of the first atomic clock developed in Latin America and the first pilot plant for the production of high precision microscopes. Recently the research group under his guidance implemented for the first time in Brazil the clinical use of Photo-Dynamic-Therapy for the treatment of cancer and microbiological control. A strong relation between basic research and industry is one of the characteristics of the work carried out by Bagnato, resulting in the implementation of high technology industries in the field of optics. During his academic life, he has supervised over 60 graduate students and he is presently supervising 21 graduate students involved in several research programs as well as many undergraduates. He maintains close international relations with many institutions around the world. Diffusion of science organizing a special TV channel and public exhibitions are part of his activity.

Main publications Professor Bagnato has published over 350 papers in international journals with more than 3000 citations. *Books*: Bagnato, V.S., Perussi Filho, S., Milori, D.M.B.P., Martin Neto, L., Ferreira, E.C., Pereira, F.M.V., Castro Neto, Jarbas Caiado de, Yasuoka, F.M.M., Ribeiro, F.M., *Óptica e Fotônica: Da Ciência à evolução e as perspectivas no pólo tecnológico de São Carlos*. 1. ed. São Carlos: Compacta Gráfica e Editora, 2009. v. 1.

221p.; Bagnato, V.S., *Laser: e suas aplicações em ciência e tecnologia*. 1. ed. São Paulo: Livraria da Física, 2008. v. 1. 87p.; Bagnato, V.S., *Novas técnicas ópticas para as áreas da saúde*. 1. ed. São Paulo: Livraria da Física, 2008. v. 1. 239p.; Marcassa, L.G. (Org.); Bagnato, V.S. (Org.), Helmersson, K. (Org.), *Atomic Physics 19: XIX International Conference on Atomic Physics, ICAP 2004*. 1. ed. Melville, NY: American Institute of Physics, 2005. v. 1. 414p.; Marcassa, L.G. (Org.), Telles, G.D. (Org.), Muniz, S.R. (Org.), Bagnato, V.S. (Org.). *International Conference on Atomic Physics, 19: abstracts of contributed papers*. São Paulo: 2004. v. 1. 281p.; Telles, G.D. (Org.), Bagnato, V.S. (Org.), Marcassa, L.G. (Org.). *Workshop on Mixtures of Ultracold Atoms: abstracts*. São Carlos: 2004. v. 1. 46p.; Bagnato, V.S., Nunes, F.D., *Comunicação óptica – uma visão para o futuro*. Editora Renovarum Ltda, 2002. v. 1. 100p.; Bagnato, V.S., Marcassa, L.G., Marcassa, J.C., Cestari, G., Ferreira, J., Kurachi, C., *Guia prático de terapia fotodinâmica pra o tratamento de tumores*. 1. ed. São Carlos: IFSC/USP, 2002. v. 1.

David Baltimore



Date of Birth 7 March 1938

Place New York, NY (USA)

Nomination 17 April 1978

Field Biology

Title Professor, Nobel laureate in Physiology or Medicine, 1975

Most important awards, prizes and academies *Awards:* First recipient of the Gustave Stern Award in Virology (1970); Warren Triennial Prize from the Massachusetts General Hospital (1971); Eli Lilly and Co. Award in Microbiology and Immunology (1971); National Academy of Sciences' United States Steel Award in Molecular Biology (1974); Gairdner Foundation Annual Award (1974); Nobel Prize in Physiology or Medicine (1975); National Medal of Science (1999); Warren Alpert Foundation Prize (2000). *Academies:* US National Academy of Sciences (1974); American Academy of Arts and Sciences (1974); Pontifical Academy of Sciences (1978); Chairman of the Board of Directors, American Association for the Advancement of Science (1980); Honorary Fellowship, American Medical Writers Association (1985); Foreign Member, The Royal Society, UK (1987); Honorary Membership, Alpha Omega Alpha Honor Medical Society (1987); Institute of Medicine (1988); Honorary Member, Japanese Biochemical Society (1991); Fellow, American Academy of Microbiology (1992).

Summary of scientific research Research in Dr. Baltimore's laboratory revolves around understanding aspects of the development and function of the immune system. His laboratory examines these issues at many levels – molecular, cellular and organismal – with the ultimate aim of integrating the various types of information. Present foci of activity include: 1) investigation of the NF- κ B family of transcription factors and their controlling proteins with emphasis on the effects of ablating the mouse genes for these proteins; 2) extension of the studies on NF- κ B to determine its role in neuronal function; 3) study of the role of the development and *c-abl* gene in cellular metabolism; 4) investigation of how memory T cells are set aside during an immune response.

Main publications Zarnegar B., He J.Q., Oganesyanyan G., Hoffmann A., Baltimore D., Cheng G. (2004) Unique CD40-mediated biological program in B cell activation requires both type 1 and type 2 NF-kappaB activation pathways, *Proc. Natl. Acad. Sci. USA* 101, 8108-13; Schatz D.G., Baltimore D. (2004) Uncovering the V(D)J recombinase, *Cell* 116, S103-6, 2 p following S106; Lu W., Yamamoto V., Ortega B., Baltimore D. (2004) Mammalian ryk is a wnt coreceptor required for stimulation of neurite outgrowth, *Cell* 119, 97-108; Leung T.H., Hoffmann A., Baltimore D. (2004) One nucleotide in a kappaB site can determine cofactor specificity for NF-kappaB dimers, *Cell* 118, 453-64; Baltimore D. (2004) Science and the Bush Administration. *Science* 305, 1873; Qin XF, An DS, Chen IS, Baltimore D (2003) Inhibiting HIV-1 infection in human T cells by lentiviral-mediated delivery of small interfering RNA against CCR5, *Proc. Natl. Acad. Sci. USA* 100, 183-8; Porteus M.H., Baltimore D. (2003) Chimeric nucleases stimulate gene targeting in human cells, *Science* 300, 763; Porteus M.H., Cathomen T., Weitzman M.D., Baltimore D. (2003) Efficient gene targeting mediated by adeno-associated virus and DNA double-strand breaks, *Mol. Cell. Biol.* 23, 3558-65; Meffert M.K., Chang J.M., Wiltgen B.J., Fanselow M.S., Baltimore D. (2003) NF-kappa B functions in synaptic signaling and behavior, *Nat. Neurosci.* 6, 1072-8; Klausner R.D., Fauci A.S., et al. (2003) Medicine. The need for a global HIV vaccine enterprise, *Science* 300, 2036-9; Hoffmann A., Leung T.H., Baltimore D. (2003) Genetic analysis of NF-kappaB/Rel transcription factors defines functional specificities, *Embo J.* 22, 5530-9; Brown E.J., Baltimore D. (2003) Essential and dispensable roles of ATR in cell cycle arrest and genome maintenance, *Genes Dev.* 17, 615-28; Antov A., Yang L., Vig M., Baltimore D., Van Parijs L. (2003) Essential role for STAT5 signaling in CD25+CD4+ regulatory T cell homeostasis and the maintenance of self-tolerance, *J. Immunol.* 171, 3435-41.

Antonio M. Battro



Date of Birth 6 February 1936

Place Mar del Plata (Argentina)

Nomination 3 August 2002

Field Neuro-developmental Study of Cognition

Title Professor

Most important awards, prizes and academies *Awards:* Premio Nacional de Ciencias, Psicología y Educación, Argentina (1970); Premio Mira y López, Fund. Getulio Vargas, Rio de Janeiro (1979); Premio Konex, Psicología, Buenos Aires (1986). *Fellowships:* Centre International d'Épistémologie Génétique, Geneva (1967-68); Guggenheim Fellow, Brain Research Laboratories, New York Medical College (1968); Fulbright Fellow, Project Man and Biosphere, UNESCO, Massachusetts Institute of Technology (1972); Directeur Associé, École Pratique des Hautes Études, Laboratoire de Psychologie Expérimentale et Comparée, Paris (1979); Centre Mondial Informatique, Paris (1983); Eisenhower Fellow (1986); Robert Kennedy Visiting Professor, Graduate School of Education, Harvard University (2002-03). *Academies:* Academia Nacional de Educación, Argentina (2000); Pontifical Academy of Sciences (2002); Chief Education Officer, OLPC, One Laptop Per Child; Former President IMBES, Mind, Brain and Education Society.

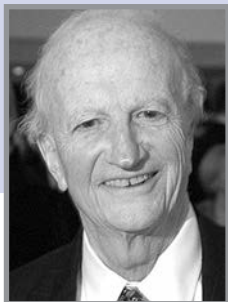
Summary of scientific education My scientific work has covered three areas. The development of basic cognitive and perceptual processes in children: we applied mathematical models (catastrophe theory, fractals, non-Euclidean geometries) to understand some visual illusions in large open fields, eye movements and memory. We also studied moral development in children. The deployment of computers and communication devices in education in developing countries: in particular, with the OLPC One Laptop per Child program we are actively promoting the use of computers by students and teachers of elementary schools around the world. The new field of neuroeducation: the interaction between mind, brain and education. We are working on the unfolding of new digital skills in the developing brain.

Main publications *Books:* *Dictionnaire d'épistémologie génétique* (avec

une préface de Jean Piaget), Reidel, Dordrecht, Presses Universitaires de France (Paris, 1996); Battro, A.M., *El pensamiento de Jean Piaget*, Emecé (Buenos Aires, 1969); Battro, A.M., Cruz Fagundes, L., *El niño y el semáforo*, Emecé (Buenos Aires, 1979); Battro, A.M., *Computación y aprendizaje especial*, Emecé (Buenos Aires, 1986); Battro, A.M., Denham, P.J., *Discomunicaciones. Computación para niños sordos*, Fundación Navarro Viola, El Ateneo (Buenos Aires, 1989); Battro, A.M., Denham, P.J., *La educación digital*, Emecé (Buenos Aires, 1997); Battro, A.M., *Half a brain is enough: The story of Nico*, Cambridge University Press (Cambridge, 2001); Battro, A.M. (with Denham, P.J., col.), *Aprender hoy: Una colección de ideas*, Papers Editores (Buenos Aires, 2002). *Articles*: Battro, A.M., Acerca de una estructura poco conocida del sistema nervioso central: el órgano subforniano, *Acta Neurologica Latinoamericana*, 8, pp. 15-20 (1962); Battro, A.M., Morphogenèse des limnées, adaptation vitale et théorie des catastrophes, *Bulletin de Psychologie*, 30, pp. 141-149, (1976); Battro, A.M., Réflexions sur une psychologie écologique expérimentale, *Psychologie expérimentale et comparée. Hommage à Paul Fraise* (G. Oléron, ed.), Presses Universitaires de France (Paris, 1976); Battro, A.M., Visual Riemannian space versus cognitive Euclidean space, *Synthese*, 1, pp. 45-74 (1977); Battro, A.M., Ellis, E.J., et al., Growing up in cities. *Studies in the spatial environment of adolescence in Cracow, Melbourne, Mexico City, Salta, Toluca and Warszawa* (K. Lynch, ed.), MIT Press (Cambridge, 1977); Battro, A.M., Ruggini, H.C., Kart, S.C., Perspectives in open spaces. A geometric application of the Thouless index, *Perception*, 7, pp. 583-8 (1977); Battro, A.M., Hemispheric lateralization in the development of spatial and logical reasoning in left and right-handed children, *Archives de Psychologie*, 49, pp. 83-90 (1981); Battro, A.M., Logo, talents and handicaps, *Logo et apprentissage* (J.L. Gurtner, J. Retschitzki, eds), Delachaux et Niestlé, Neuchâtel, pp. 167-173 (1991); Battro, A.M., La temperatura de la mirada: esbozo de un modelo fractal de los movimientos sacádicos, *Procesos sensoriales y cognitivos. Laboratorio de Investigaciones Sensoriales* (M. Guirao, ed.), Conicet, Dunken (Buenos Aires, 1997); Battro, A.M., The computer in the school: A tool for the brain, *The challenges for science: Education for the twenty-first century*, Pontifical Academy of Sciences (Vatican City, 2002); Battro, A.M., Digital skills. Globalization and education, *Globalization: Culture and education in the new millennium* (M. Suárez-Orozco, D. Baolian Qin-Hilliard, eds), California University Press (San Francisco, 2004); (With Denham, P.J.) *Hacia una inteligencia digital*, Academia Nacional de Educación, Buenos Aires, 2007; (With Fischer, K.W. &

Léna, P.J., eds); *The educated brain. Essays in neuroeducation*, Cambridge University Press (2008); Battro, A.M., *Homo Educabilis*, A neurocognitive approach, *What Is Our Real Knowledge about the Human Being?*, Pontifical Academy of Sciences (Vatican City, 2007); Battro, A.M., Reflections and actions concerning a globalized education, *Charity and Justice in the Relations among Peoples and Nations*, Pontifical Academy of Social Sciences (Vatican City, 2007); Battro, A.M., Digital Intelligence: the evolution of a new human capacity, *Scientific Insights into the Evolution of the Universe and of Life*, Pontifical Academy of Sciences (Vatican City, 2009); Battro, A.M. (2009), Multiple intelligences and constructionism in the digital era; *Multiple Intelligences around the World* (H. Gardner, ed.), Jossey-Bass/Wiley, San Francisco; Battro, A.M. (2010), The teaching brain, *Mind, Brain and Education*, Vol. 4, 1, 28-33; Battro, A.M, Fischer, K.W. and Léna, J.P. (eds): *The educated brain: Essays in neuroeducation*. Cambridge University Press and Pontifical Academy of Sciences (Cambridge, 2008); Battro, A.M., Dehaene, S. and Singer, W., *Human neuroplasticity and education*. Pontifical Academy of Sciences (Vatican City, 2011); Battro, A.M., Dehaene, S. and Singer, W., *Neurosciences and the Human Person*, Pontifical Academy of Sciences (Vatican City, 2013).

Gary Stanley Becker



Date of Birth 2 December 1930

Place Pottsville, PA (USA)

Nomination 3 March 1997

Field Economics

Title Professor, Nobel laureate in Economic Sciences, 1992

Most important awards, prizes and academies *Honors and awards:* John Bates Clark Medal, American Economic Association (1964); Nobel Prize in Economics (1992); Lord Foundation Award (1995); Honorary Member, Gente Nueva, Mexico City (1996); Irene B. Taeuber Award for Excellence in Demographic Research, Population Association of America (1997); National Medal of Science (2000); Phoenix Prize, University of Chicago (2000); American Academy of Achievement (2001); Heartland Prize (2002); NICHD Hall of Honor (2003); Hayek Award (2003); Medal of the Italian Presidency (2004); John von Neumann Lecture Award, Rajk College, Corvinus Univ., Budapest (2004); Arrow Award for Best Article in Health Economics (2005); Provost's Teaching Award, University of Chicago (2006); Presidential Medal of Freedom (2007). *Honorary degrees:* Doctor Philosophiae Honoris Causa, Hebrew University, Jerusalem (1985); Doctor of Laws, Knox College, Galesburg, IL (1985); Doctor of Arts, University of Illinois at Chicago (1988); Doctor of Sciences, SUNY at Stony Brook, NY (1990); Doctor of Humane Letters, Princeton University (1991); Doctor Philosophiae Honoris Causa, University of Palermo, Italy; University of Buenos Aires, Argentina (1993); Doctor Honoris Causa Scientiarum Oeconomicarum, Warsaw School of Economics (1995); Doctor Honoris Causa, University of Economics, Prague (1995); Doctor of Business Administration, University of Miami (1995); Doctor of Science, University of Rochester (1995); Doctor of Humane Letters, Hofstra University, Hempstead, NY (1997); Doctor of Humane Letters, University d'Aix-Marseilles (1999); Doctor Honoris Causa, University of Athens (2002); Doctor of Laws, Harvard University (2003); Doctor Honoris Causa, Hitotsubashi University (2005). *Academies:* Founding Member, National Academy of Education (1965, Vice-President 1965-67);

Fellow, American Academy of Arts and Sciences (1972); Member, National Academy of Sciences (1975); Member, American Philosophical Society (1986); Pontifical Academy of Sciences (1997); Corresponding Member, National Academy of Sciences of Buenos Aires (2000).

Summary of scientific research Gary Stanley Becker's research interests have been wide-ranging and have covered a broad spectrum of interests ranging from human capital and the economics of discrimination to general economic theory and the economic approach to human behaviour. He has also concentrated on such subjects as the family, accounting for tastes and the economics of life. A detailed specialist, he has also sought a wide audience for his discipline and his thought. Prof. Becker is a prominent 'savant', recognised and appreciated with universally high respect by the members of the world's communities of economists and experts in public policy.

Main publications Becker, G.S., Murphy, K.M., *Social Economics*, Harvard University Press (2000); Becker, G.S., *Familie, Gesellschaft und Politik* (Family, Society and State), J.C.B. Mohr (Paul Siebeck) (1996); Becker, G.S., *The Economics of Life*, McGraw-Hill, Inc. (1996), translations: Chinese (1997), German, Japanese (1998), Czech (1997), Spanish (2002), Polish (2006); Becker, G.S., *Accounting for Tastes*, Harvard University Press (1996), translations: Czech (1998), Chinese (1999), Italian (2000); Becker, G.S., *A Treatise on the Family*, Harvard University Press (1981), expanded edition (1991), translations: Spanish (1987), Chinese (1988, 2000); Becker, G.S., *The Economic Approach to Human Behavior*, University of Chicago Press (1976), translations: German (1982), Polish (1990), Chinese (1993), Romanian (1994), Italian (1998); Becker, G.S., *Essays in Labor Economics in Honor of H. Gregg Lewis*, (ed.), Special Supplement to the Journal of Political Economy 84, n. 2, part 2 (August 1976); Becker, G.S., *The Allocation of Time and Goods Over the Life Cycle*, with Gilbert Ghez, Columbia University Press for the National Bureau of Economic Research (1975); Becker, G.S., *Essays in the Economics of Crime and Punishment* (with W.M. Landes, eds), Columbia University Press for the National Bureau of Economic Research (1974); Becker, G.S., *Economic Theory*, A. Knopf (1971), Japanese translation (1976); Becker, G.S., *Human Capital and the Personal Distribution of Income: An Analytical Approach*, University of Michigan (1967); Becker, G.S., *Human Capital*, Columbia University Press (1964), 2nd edition (1975), 3rd edition (1993), University of Chicago Press, translations: Japanese (1975), Spanish (1984), Chinese (1987, 2008), Romanian (1997), Italian (2007); Becker, G.S., *The Economics of Discrimination*, Univ. of Chicago Press (1957); 2nd edition (1971).

Daniel Adzei Bekoe



Date of Birth 7 December 1928

Place Accra (Ghana)

Nomination 26 September 1983

Field Chemistry/X-ray Crystallography

Title Professor, Chairman of the Council of State

Most important awards, prizes and academies Lecturer, University of Ghana (1958); promoted from Senior Lecturer etc. to Professor of Chemistry (1974); Pro-Vice-Chancellor, University of Ghana (1972-75); Vice-Chancellor (1976-83). Various periods spent at University of California at Los Angeles, USA, and University of Ibadan, Nigeria. Director, UNESCO Regional Office of Science and Technology for Africa (1983-85); Regional Director, International Development Research Centre (IDRC), Regional Office Eastern and Southern Africa based in Nairobi (1986). Served on Councils and Committees of various UN bodies; President of the International Council of Scientific Unions (1980-83). Member of the Pontifical Academy of Sciences (1983).

Summary of scientific research He pursued his university career first at the University of California at Los Angeles, and from 1958 at the University of Ghana in Legon, where he has spent all his career and became Vice-Chancellor in 1976. His scientific research has principally been in crystallography. Using x-rays he has studied the structure of various natural organic substances and syntheses. In recent years he has devoted himself to the solution of problems of development in Africa and the education of young African students. He has worked in various international organizations, especially UNESCO and the International Council of Scientific Unions (ICSU), of which he was President 1980-1983.

Main publications Bekoe, D.A., The Crystal Structure of i-Erythritol and its relationships to some derived d and l and racemic substances (with Powell, H.M.), *Proceedings of the Royal Society*, 250 A, pp. 301-15 (1959); Bekoe, D.A., The Crystal Structure of Tetracyanoethylene (with Trueblood, K.N.), *Zeitschrift für Kristallographie*, 113, pp. 1-22 (1960); Bekoe, D.A., The Crystal Structure of the Hexahydrated Calcium Salt of Hexacyanoisobuty-

lene (with Gantzel, P.K. and Trueblood, K.N.), *Acta Crystallographica*, 22, pp. 657-665 (1967); Bekoe, D.A., A Re-investigation of the Crystal Structure of Tetracyanoethylene (with Trueblood, K.N.), *Abstracts of Bozeman Meeting of the American Crystallographic Association*, p. 87 (1964); Bekoe, D.A., Molecular Structure of Cedrela Odorata Substance B (with Adeoye, S.A.), *Chemical Communications*, 14, pp. 301-2 (1965); Bekoe, D.A., *The Crystallographic Evidence for the Molecular Structure of Mexicanolide*, Ph.D. Thesis of S.A. Adeoye (1967); Bekoe, D.A., *The Crystal Structure of N, N-Diethyldithiocarbamate-triphenylstanne*, M.Sc. Thesis of K.A. Woode (1975); Bekoe, D.A., Hexamethylbenzene-Tetracyanoethylene (1:1) Complex at 113K: Structure and Energy Calculations (with Maverick, E. and Trueblood, K.N.), *Acta Crystallographica*, B 34, pp. 2777-2781 (1978); Bekoe, D.A., The Dilemma of the Scientist (Contribution to a Symposium on 'Building an Intellectual Community in Ghana', *Proceedings of the Ghana Academy of Arts and Sciences*) (1970), pp. 61-4; Bekoe, D.A., The Energy Problem in Perspective, *Proceedings of the Ghana Academy of Arts and Sciences*, XIV, pp. 15-24 (1976); Bekoe, D.A., International Cooperation in Science and Technology for Development Statement on the Symposium, *International Symposium on Science and Technology for Development*, Singapore, 22-26 January, 1979, pp. 7-13; Bekoe, D.A., Mobilizing Science and Technology to Increase Endogenous Capabilities in Developing Countries, *Science, Technology and Society – Needs, Challenges and Limitations* (K.H. Standke and M. Anandakrishna, eds), Pergamon Press (1980), pp. 457-63.

Paul Berg



Date of Birth 30 June 1926

Place Brooklyn, NY (USA)

Nomination 25 June 1996

Field Biochemistry

Title Professor, Nobel laureate in Chemistry, 1980

Most important awards, prizes and academies *Awards:* Work on the genetic apparatus that directs the synthesis of proteins earned Dr. Berg the Eli Lilly Award in Biochemistry (1959) and the California Scientist of the Year Award (1963). He has twice been honored with the Henry J. Kaiser Award for Excellence in Teaching at Stanford University School of Medicine and has won the Roche Institute for Molecular Biology V.D. Mattia Prize, the Sarasota Medical Awards for Achievement and Excellence, the Annual Award of the Gairdner Foundation, the Albert Lasker Basic Medical Research Award, and the New York Academy of Sciences Award. He also has won the American Association for the Advancement of Science Scientific Freedom and Responsibility Award, the National Medal of Science, the National Library of Medicine Medal and the Nobel Prize in Chemistry. *Academies:* A member of the National Academy of Sciences and the American Academy of Arts and Sciences since 1966, he is also a past president of the American Society of Biological Chemists, a foreign fellow of the French Academy of Sciences and the Royal Society, London, and an elected member of the American Philosophical Society. Dr. Berg has served as a Chairman of the National Advisory Committee of the Human Genome Project.

Summary of scientific research Dr. Berg, one of the principal pioneers in 'gene splicing' and his colleagues Dr. Walter Gilbert and Dr. Frederick Sanger were honored with the 1980 Nobel Prize in Chemistry for developing methods that make it possible to map the structure and function of DNA. According to *The New York Times*, the work of these scientists 'had a revolutionary impact on the understanding of the genetics of all living things and on the ability to manipulate the genetic material of cells from any species'. In quoting the Royal Swedish Academy of Sciences, this paper added that Berg

was cited 'for his fundamental studies of the biochemistry of nucleic acids, with particular regard to recombinant DNA'.

Main publications Berg, P., Physical and Genetic Characterization of Deletion Mutants of Simian Virus 40 Constructed In Vitro, Charles Cole, Terry Landers, Stephen Goff, Simone Manteuil-Brutlag, and Paul Berg., *J. Virol.*, 24, pp. 277-294 (1977); Berg, P., A Biochemical Method for Inserting New Genetic Information into SV40 DNA: Circular SV40 DNA Molecules Containing Lambda Phage Genes and the Galactose Operon of E. coli, David A. Jackson, Robert H. Symons, and Paul Berg, *Proc. Nat. Sci. USA*, 69, p. 2904 (1972); Berg, P., Construction of Hybrid Viruses Containing SV40 and Lambda Phage DNA Segments and Their Propagation in Cultured Monkey Cells, Stephen P. Goff, and Paul Berg, *Cell*, 9, p. 695 (1976); Berg, P., Synthesis of Rabbit beta-Globin in Cultured Monkey Kidney Cells Following Infection with a SV40 beta-Globin Recombinant Genome, R.C. Mulligan, B.H. Howard, and Paul Berg, *Nature*, 277, pp. 108-114 (1979); Berg, P., Expression of a Bacterial Gene in Mammalian Cells, R.C. Mulligan and Paul Berg, *Science*, 209, pp. 1422-1427 (1980).

Enrico Berti



Date of Birth 3 November 1935

Place Valeggio sul Mincio (Italy)

Nomination 28 September 2001

Field Philosophy

Title Professor

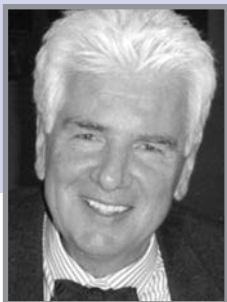
Most important awards, prizes and academies President of the Member of the Institut International de Philosophie, Paris; Corresponding Fellow of the Accademia Nazionale dei Lincei, Rome; Fellow of the Istituto Veneto di Scienze, Lettere e Arti and the Accademia Galileiana di Scienze, Lettere e Arti of Padua; Société Européenne de Culture; Fédération Internationale des Sociétés de Philosophie; Member of the Pontifical Academy of Saint Thomas Aquinas and of the Pontifical Academy of Sciences.

Summary of scientific research The first subject of my research was the philosophy of Aristotle, which has continued to be central to my interests. I then extended my studies to the Aristotelian tradition in ancient, medieval, modern and contemporary times, with particular attention to dialectics and the problem of contradiction. More recently I have discussed the possibilities of metaphysics within contemporary philosophy and devoted myself to problems of ethics and political philosophy.

Main publications Berti, E., *La filosofia del primo Aristotele*, Padova, Cedam (1962), pp. 590 (II ed., Milano, *Vita e pensiero*, 1997); Berti, E., *Il 'De re publica' di Cicerone e il pensiero politico classico*, Padova, Cedam (1963), pp. 103; Berti, E., *L'unità del sapere in Aristotele*, Padova, Cedam (1965), pp. 202; Berti, E., *Studi aristotelici*, L'Aquila, Japadre (1975), pp. 364; Berti, E., *Aristotele: dalla dialettica alla filosofia prima*, Padova, Cedam (1977), pp. 477; Berti, E., *Ragione filosofica e ragione scientifica nel pensiero moderno*, Roma, La Goliardica (1977), pp. 239; Berti, E., *La metafisica di Platone e di Aristotele nell'interpretazione di Antonio Rosmini*, Roma, Città Nuova (1977), pp. 182; Berti, E., *Profilo di Aristotele*, Roma, Studium (1979), pp. 332 (II ed. 1985, III ed. 1993); Berti, E., *Logica aristotelica e dialettica*, Bologna, Cappelli, pp. 63; Berti, E., *Il bene*, Brescia, La Scuola (1983)

(Il ed. 1984), pp. 245; Berti, E., *Il pensiero d'occidente* (with Moravia, S.), Pagine e testimonianze, Firenze, Le Monnier (1987) (ristampato nel 1987, 1988, 1989, 1991, 1994), pp. 706; Berti, E., *Contraddizione e dialettica negli antichi e nei moderni*, Palermo, L'Epos (1987), pp. 306; Berti, E., *Le vie della ragione*, Bologna, Il Mulino (1987), pp. 299; Berti, E., *Analitica e dialettica nel pensiero antico*, Napoli, Edizioni Scientifiche Italiane (1989), pp. 45; Berti, E., *Le ragioni di Aristotele*, Roma-Bari, Laterza (1989), pp. 186 (Portug. trans., *As razões de Aristóteles*, São Paulo, Brasil, Edições Loyola, 1998, pp. 191); Berti, E., *Storia della filosofia*, vol. I, *Antichità e medioevo*, Roma-Bari, Laterza (1991) (VIII ed. 2000), pp. xix, 295; Berti, E., *Storia della filosofia*, vol. II, *Dal Quattrocento al Settecento*, Roma-Bari, Laterza (1991) (VII ed. 1998), pp. XII, 293; Berti, E., *Storia della filosofia*, vol. III, *Ottocento e Novecento* (with Volpi, F.), Roma-Bari, Laterza (1991) (VIII ed. 2000), pp. xvi, 465; Berti, E., *Aristotele nel Novecento*, Roma-Bari, Laterza (1992), pp. 278 (Portug. trans., *Aristóteles no século XX*, trad. D. Davi Macedo, São Paulo, Brasil, Edições Loyola, 1997, pp. 334); Berti, E., *Introduzione alla metafisica*, Torino, Utet-Libreria, 1993, pp. 125 (Polish trans., *Wprowadzenie do metafizyki*, Warszawa, PAN, 2002); Berti, E., *Soggetti di responsabilità. Questioni di filosofia pratica*, Reggio Emilia, Edizioni Diabasis (1993), pp. 222; Berti, E., *Platone teoretico*, in *Enciclopedia multimediale delle scienze filosofiche. Le radici del pensiero filosofico, 1: La filosofia greca dai Pre-socratici ad Aristotele*, vol. VII, Roma, Istituto della Enciclopedia Italiana (1993), pp. 91; Berti, E., *Il pensiero politico di Aristotele*, Roma-Bari, Laterza (1997), pp. 208; Berti, E., *Filosofia* (with Girotti, A.), Brescia, La Scuola (2000), pp. 224; Berti, E., *Filosofia pratica*, Napoli, Guida (2004); Berti, E., *Aristotele: dalla dialettica alla filosofia prima, con saggi integrativi*, Milano, Bompiani (2004); Berti, E., *Nuovi studi aristotelici, I – Epistemologia, logica e dialettica*, Brescia, Morcelliana (2004); Berti, E., *Nuovi studi aristotelici, II – Fisica, antropologia e metafisica*, Brescia, Morcelliana (2005); Berti, E., *Incontri con la filosofia contemporanea*, Pistoia, Editrice Petite Plaisance (2006); Berti, E., *In principio era la meraviglia. Le grandi questioni della filosofia antica*, Roma-Bari, Laterza (2007); Berti, E., *Aristotele nel Novecento*, Laterza (2008); Berti, E., *Nuovi studi aristotelici, III – La filosofia pratica*, Brescia, Morcelliana (2008).

Günther Blobel



Date of Birth 21 May 1936

Place Waltersdorf/Silesia (Germany, now Poland)

Nomination 28 September 2001

Field Cell Biology

Title Professor, Nobel laureate in Physiology or Medicine, 1999

Most important awards, prizes and academies *Academies:* National Academy of Sciences (1983); Leopoldina (1983); Honorary Member of the Japanese Biochemical Society (1983); American Academy of Arts and Sciences (1984); Associate Member of the European Molecular Biology Organization (1986); Honorary Member of the German Society of Cell Biology (1988); American Philosophical Society (1989); Institute of Medicine (2000); Orden Pour le Mérite (2001); Pontifical Academy of Sciences (2001). *Awards:* US Steel Award in Molecular Biology (1978); The Gairdner Foundation Award (1982); The Warburg Medal of the German Biochemical Society (1983); The Richard Lounsbery Award (1983); The V.D. Mattia Award (1986); The Wilson Medal of the American Society for Cell Biology (with D.D. Sabatini) (1986); The Louisa Gross Horwitz Prize (1987); The Waterford Bio-Medical Science Award (1989); The Max-Planck Forschungsspreis (1992); Albert Lasker Basic Medical Research Award (1993); Ciba Drew Award in Biomedical Research (with J. Schlessinger and A. Levine) (1995); King Faisal International Prize for Science (with J. Rothman and H. Pelham) (1996); Mayor's Award for Excellence in Science and Technology (with R. Axel) (1997); Nobel Prize in Physiology or Medicine (1999); Ellis Island Medal of Hon. (2000). *Honours:* President of the American Society for Cell Biology (1990); Grosse Bundesverdienstkreuz mit Stern (2000); Honorary Senator, Technical Institute of Dresden (2000). *Honorary degrees:* Doctor of Medicine, the Mt. Sinai Medical Center, New York City, USA (1994); Doctor of Medicine, Yeshiva University, New York City, USA (2000); Doctor of Philosophy, Technische Universität Bergakademie, Freiberg, Germany (2001); Doctor of Science, Gustavus Adolphus College, Saint Peter, MN, USA (2001); Doctor of Philosophy, Johann Wolfgang Goethe University, Frankfurt,

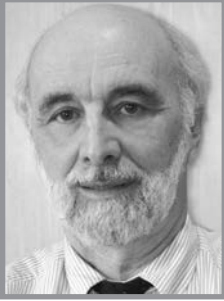
Germany (2002); Doctor of Medical Sciences, Charles University, Prague, Czech Republic (2003); Doctor of Philosophy, The Babes-Bolyai University, Cluj-Napoca, Romania (2003).

Summary of scientific research Prof. Blobel obtained his medical degree from the University of Tübingen in 1960. He moved to the United States in 1963, gained a Ph.D. degree at the University of Wisconsin in 1967 and subsequently spent two years at the laboratory of George Palade (Pontifical Academician, Nobel Prize in Medicine 1974) at the Rockefeller University in New York. Professor Blobel has since remained at the Rockefeller University, rising to Assistant Professor in 1969, Associate Professor in 1973, Professor in 1976, and John D. Rockefeller Jr Professor in 1992. Since 1986 he has been an Investigator of the Howard Hughes Institute. Professor Blobel is a distinguished cell biologist, known worldwide for having elucidated the mechanisms whereby newly formed proteins are transferred from their site of synthesis in the cytosol to their final location inside or outside the cell. His contributions have been recognised by a large number of awards, the latest one being the Nobel Prize in Physiology or Medicine 1999. In recent years, Professor Blobel has created a foundation, the Friends of Dresden, Inc. which has already raised several million dollars for the reconstruction of the monuments of the city destroyed by Allied bombing during the Second World War, in particular the Frauenkirche and the Synagogue. Professor Blobel donated most of his Nobel Prize money to this foundation.

Main publications Blobel, G. and Dobberstein, B., Transfer of proteins across membranes. I. Presence of proteolytically processed and unprocessed nascent immunoglobulin light chains on membrane-bound ribosomes of murine myeloma, *J. Cell Biol.*, 67, pp. 835-51 (1975); Blobel, G. and Dobberstein, B., Transfer of proteins across membranes. II. Reconstitution of functional rough microsomes from heterologous components, *J. Cell Biol.*, 67, pp. 852-62 (1975); Lingappa, V.R., Katz, F.N., Lodish, H.F. and Blobel, G., A Signal Sequence for the insertion of a transmembrane glycoprotein: Similarities to the signals of secretory proteins in primary structure and function, *J. Biol. Chem.*, 253, pp. 8667-70 (1978); Blobel, G., Intracellular protein topogenesis, *Proc. Natl. Acad. Sci. USA*, 77, pp. 1496-1500 (1980); Walter, P. and Blobel, G., Signal recognition particle contains a 7S RNA essential for protein translocation across the endoplasmic reticulum, *Nature*, 299, pp. 691-8 (1982); Gilmore, R., Blobel, G. and Walter, P., Protein translocation across the endoplasmic reticulum. I. Detection in the microsomal membrane of a receptor for the signal recognition particle, *J. Cell Biol.*, 95, pp. 463-9

(1982); Gilmore, R., Walter, P. and Blobel, G., Protein translocation across the endoplasmic reticulum. II. Isolation and characterization of the signal recognition particle receptor, *J. Cell Biol.*, 95, pp. 470-7 (1982); Simon, S.M. and Blobel, G., A protein-conducting channel in the endoplasmic reticulum, *Cell*, 65, pp. 371-80 (1991); Moore, M.S. and Blobel, G., The GTP-binding protein Ran/TC4 is required for protein import into the nucleus, *Nature*, 365, pp. 661-3 (1993); Chook, Y.M. and Blobel, G., Structure of the karyopherin β 2-ran GppNHp nuclear transport complex, *Nature*, 399, pp. 230-7 (1999); Beckmann, R., Spahn, C.M.T., Eswar, N., Helmers, J., Penczek, P.A., Sali, A., Frank, J. and Blobel, G., Architecture of the protein-conducting channel associated with the translating 80S ribosome, *Cell*, 107, pp. 361-72 (2001).

Thierry Boon-Falleur



Date of Birth 3 December 1944

Place Kessel-Lo (Belgium)

Nomination 6 February 2002

Field Biology

Title Professor

Most important awards, prizes and academies *Awards:* Prix Rik et Nel Wouters pour la recherche sur le cancer (1986); Prix De Vooght d'Immunologie (1986); Cancer Research Institute, Award for Research in Immunology (1987); Dr Joseph Steiner Cancer prize (1990); Prix Francqui (1990); Prix Louis Jeantet (1994); Rabbi Shai Shacknai Memorial Prize in Immunology and Cancer Research (1994); Prix Sandoz d'Immunologie (1995); Prix Léopold Griffuel (1999). *Academies:* Belgian Immunological Society; Société Belge de Biologie Cellulaire; Membre Titulaire, Académie Royale de Médecine de Belgique (1994); Associate Member, Académie Royale des Sciences, des Lettres et des Beaux-Arts de Belgique (1996). *Scientific Committees:* Fonds National de la Recherche Scientifique; Caisse Générale d'Épargne et de Retraite; Committee of Cancer Experts of the European Community (1985-1993); Scientific Council of the Institut Curie, Paris; Fédération belge contre le Cancer. *Editorial Boards:* *The European Journal of Immunology*; *Immunity*; *Cancer Cell*; *International Journal of Cancer*.

Summary of scientific research Cancer immunotherapy is based on the notion that it is possible to artificially improve the immune response to tumor antigens to make it reach its full potential. Unlike responses directed against viral antigens, anti-tumoral responses may not have been perfected throughout evolution, because escaping cancer probably conferred little or no selective advantage. Our interest in tumor immunology started with a fortuitous observation made with a mouse tumor which was strictly non-immunogenic. Mice from which this tumor was removed by surgery did not show any protection against a challenge with the same tumor cells. We observed that by treating the tumor cells *in vitro* with a mutagen we obtained tumor cell mutants that were rejected in the mice by a T lymphocyte mediated process.

Remarkably the mice that had rejected these "tum-" mutants showed a degree of protection against a challenge with the original non-immunogenic tumor cells. This led to two conclusions. First, all mouse tumors bear tumor-specific antigens recognized by T cells even though many of them are non-immunogenic. Second, it is possible to create conditions that favor the T lymphocyte responses against the tumor antigens. On the basis of these findings we launched an effort to identify the antigens recognized on mouse tumors by T cells. A first step was to obtain in vitro cytolytic T lymphocytes (CTL) that specifically lysed the tumor cells. Antigenic transfectants could be detected on the basis of their ability to stimulate the proliferation of the relevant CTL clone and the genes coding for the antigens could be retrieved from these transfectants by using appropriate cosmid technology. Later the genes coding for these antigens were identified. Our results demonstrated that there are two major genetic processes that produce tumor-specific antigens. The first is the acquisition of mutations by the cancer cell, which generate peptides because of an amino-acid change. Mutated peptides either become capable of binding to major histocompatibility complex molecules or contain a new epitope. The second is the expression by the tumor of a gene which is not expressed in the normal cells of the adult. Around 1985 we began to examine whether the results obtained in mice could be extended to man. We focused our efforts on melanoma. Stimulation of T lymphocytes with autologous melanoma cells produced cytolytic T cells that appeared to lyse the tumor cells specifically. This led to the identification of the first gene coding for a human tumor-specific antigen recognized by T cells. This previously unknown gene was named MAGE and it was soon found to be expressed in many tumors and not in normal cells with the exception of male germline cells. Antigens encoded by cancer-germline genes ought to be very suitable as therapeutic vaccines for cancer-patients as they are strictly tumor-specific and present on a large proportion of tumors. Gene mutation was also found to be a major source of human tumor-specific antigens. Finally, we observed that CTL of melanoma patients can respond to antigens encoded by melanocytic differentiation genes, such as tyrosinase and Melan-A. Our first clinical trial involved the vaccination of metastatic melanoma patients with an antigenic peptide which is encoded by MAGE-3 and presented by HLA-A1. Seven patients out of 26 showed evidence of tumor regression. No toxicity was observed. Similar results were observed after vaccination with the MAGE-3 protein or with an ALVAC recombinant virus coding for MAGE sequences. We have therefore developed highly sensitive approaches for the detection of CTL responses combined with an

analysis of the T cell receptor diversity of the responding CTL. These approaches are beginning to show a correlation between CTL responses and tumor regressions. We will use these approaches to try to understand why only a minority of cancer patients respond to therapeutic vaccination.

Main publications Van Pel, A., Boon, T., Protection against a non-immunogenic mouse leukemia by an immunogenic variant obtained by mutagenesis, *Proc. Natl. Acad. Sci. USA*, 79, pp. 4718-4722 (1982); De Plaen, E., Lurquin, C., Van Pel, A., Mariamé, B., Szikora, J-P., Wölfel, T., Sibille, C., Chomez, P. and Boon, T., Immunogenic (tum-) variants of mouse tumor P815: Cloning of the gene of tum- antigen P91A and identification of the tum- mutation, *Proc. Natl. Acad. Sci. USA*, 85, pp. 2274-2278 (1988); Lurquin, C., Van Pel, A., Mariamé, B., De Plaen, E., Szikora, J-P., Janssens, C., Reddehase, M.J., Lejeune, J. and Boon, T., Structure of the gene coding for tum- transplantation antigen P91A. A peptide encoded by the mutated exon is recognized with Ld by cytolytic T cells, *Cell*, 58, pp. 293-303 (1989); van der Bruggen, P., Traversari, C., Chomez, P., Lurquin, C., De Plaen, E., Van den Eynde, B., Knuth, A. and Boon, T., A gene encoding an antigen recognized by cytolytic T lymphocytes on a human melanoma, *Science*, 254, pp. 1643-1647 (1991); Traversari, C., van der Bruggen, P., Luescher, I., Lurquin, C., Chomez, P., Van Pel, A., De Plaen, E., Amar-Costesec, A. and Boon, T., A nonapeptide encoded by human gene MAGE-1 is recognized on HLA-A1 by cytolytic T lymphocytes directed against tumor antigen MZ2-E, *Journal of Experimental Medicine*, 176, pp. 1453-1457 (1992); Gaugler, B., Van den Eynde, B., van der Bruggen, P., Romero, P., Gaforio, J.J., De Plaen, E., Lethé, B., Bresseur, F. and Boon, T., Human gene MAGE-3 codes for an antigen recognized on a melanoma by autologous cytolytic T lymphocytes, *Journal of Experimental Medicine*, 179, pp. 921-930 (1994); Coulie, P., Lehmann, F., Lethé, B., Herman, J., Lurquin, C., Andrawiss, M. and Boon, T., A mutated intron sequence codes for an antigenic peptide recognized by cytolytic T lymphocytes on a human melanoma, *Proceedings of the National Academy of Sciences USA*, 92, pp. 7976-7980 (1995); Mandruzzato, S., Bresseur, F., Andry, G., Boon, T. and van der Bruggen, P., A CASP-8 mutation recognized by cytolytic T lymphocytes on a human head and neck carcinoma, *Journal of Experimental Medicine*, 186, pp. 785-793 (1997); Ikeda, H., Lethé, B., Lehmann, F., Van Baren, N., Baurain, J.-F., De Smet, C., Chambost, H., Vitale, M., Moretta, A., Boon, T. and Coulie, P.G., Characterization of an antigen that is recognized on a melanoma showing partial HLA loss by CTL expressing an NK inhibitory receptor, *Immunity*, 6, pp. 199-208 (1997); Mar-

chand, M., Van Baren, N., Weynants, P., Brichard, V., Dréno, B., Tessier, M-H., Rankin, E., Parmiani, G., Arienti, F., Humblet, Y., Bourland, A., Vanwijck, R., Liénard, D., Beauduin, M., Dietrich, P-Y., Russo, V., Kerger, J., Masucci, G., Jäger, E., De Greve, J., Atzpodien, J., Brasseur, F., Coulie, P.G., van der Bruggen, P., and Boon, T., Tumor regressions observed in patients with metastatic melanoma treated with an antigenic peptide encoded by gene MAGE-3 and presented by HLA-A1, *International Journal of Cancer*, 80, pp. 219-230 (1999); Morel, S., Lévy, F., Burlet-Schiltz, O., Brasseur, F., Probst-Kepper, M., Peitrequin, A-L., Monsarrat, B., Van Velthoven, R., Cerottini, J-C., Boon, T., Gairin, J.E. and Van den Eynde, B., Processing of some antigens by the standard proteasome but not by the immunoproteasome results in poor presentation by dendritic cells, *Immunity*, 12, pp. 107-117 (2000); Coulie, P.G., Karanikas, V., Colau, D., Lurquin, C., Landry, C., Marchand, M., Dorval, T., Brichard, V., and Boon, T., A monoclonal cytolytic T-lymphocyte response observed in a melanoma patient vaccinated with a tumor-specific antigenic peptide encoded by gene MAGE-3, *Proceedings of the National Academy of Sciences USA*, 98, pp. 10290-10295 (2001).

Joachim von Braun



Date of birth 10 July 1950

Place Brakel, Germany

Nomination 27 September 2012

Field Development and Agricultural Economics

Title Director, Center for Development Research (ZEF)

Most important awards, prizes and academies Justus von Liebig Prize for World Nutrition, Fiat Panis Foundation, University of Hohenheim, 2011; The Bertebos Prize, Royal Swedish Academy of Agriculture and Forestry, Stockholm, 2009; Lifetime Fellow, International Association of Agricultural Economists (IAAE), 2009; Lifetime Fellow, African Association of Agricultural Economists (AAAE), 2010; Fellow of the American Association for the Advancement of Science (AAAS), 2006; Research Fellow, Institute for the Study of Labor (IZA), Bonn, 2010; Honorary Doctoral Degree (Dr. hc) in Agricultural Economics, University of Stuttgart-Hohenheim, Germany, 2005; Honorary Professorial Appointment to the International Research Center for Food and Agriculture Economics of Nanjing Agricultural University, China, 2004; Elected Fellow of the German Economics Association's (Verein für Socialpolitik) Development Economics Branch, 1996; Josef G. Knoll Science Prize, Eiselen Foundation, Germany, 1988; Professor Title (Habilitation, Dr. Habil) in Agricultural Economics at University of Göttingen, Germany, 1983; Award from the Federal German Labor Office for doctoral dissertation, 1978. Memberships: Academy of Science of the State of North Rhine-Westphalia, 1999; German Academy of Science and Engineering (acatech), 2011; International Food and Agricultural Trade Policy Council (IPC), 2007; Chair of the 'Bio-Economy Council' at acatech for the Federal German Government (member since 2009, Chair since 2012); Innovation Council (Innovationsbeirat) of the Federal German Ministry for Economic Cooperation and Development, 2011; World Economic Forum's Global Agenda Council on Food Security (2008-11) and participant in the Davos World Economic Forum (2001-08); Chicago Council on Global Affairs, Advisory Group for Global Agricultural Development Initiative, 2010; Global Alliance for Improved Nutrition (GAIN),

2012; Academic Advisory Board of the European Union for the Joint Programming Initiative on Agriculture, Food Security and Climate Change Research, 2010; Academic Board for Program Evaluation of the Alexander von Humboldt Foundation, 2011; Robert Bosch Foundation program on natural resources and development research (1998-2002 and since 2007); Strategic Advisory Group on Water Supply and Sanitation of United Nations, WHO/UNICEF, 2009; Nestlé Advisory Board on "Creating Shared Value", 2009; Chair, Scientific Advisory Board of the Courant Research Centre of the University of Göttingen for *Poverty, Equity, and Growth in Developing Countries*, 2010; Indo-German Council, 2011; Board of Academic Advisors of the Center for Chinese Agricultural Policy, Chinese Academy of Science (CAS), 2005. Academic associations, including: IAAE; AAAS; AAAE; EAAE; GeWiSoLa; Verein fuer Socialpolitik; EUDN. Boards of journals, including: *World Development*, 1996-2004; *Quarterly Journal of International Agriculture*, since 1995; *economics. The Open-Access, Open-Assessment E-journal*, since 2005; *Food Security* journal, since 2009; *Journal of Social Exclusion Studies*, Indian Institute of Dalit Studies, since 2011. Academic Reviews and Advisory Services for various organizations, including: Bill and Melinda Gates Foundation; Volkswagen Foundation; German Science Foundation; Federal German Parliament; EU-Commission; The World Bank; FAO; WFP; UN ECOSOC; US Senate Committees (Foreign Relations, Energy).

Summary of scientific research von Braun is considered an internationally leading expert on the problems of hunger and malnutrition and solutions of these problems. His scientific publications address poverty; international development economics, economics of natural resources, agriculture, and science and technology policy. von Braun was Director General of the International Food Policy Research Institute (IFPRI) based in Washington, DC, USA from 2002 to 2009. Since 2009 von Braun is Director of the Center for Development Research (ZEF) and Professor for Economic and Technological Change at University of Bonn, Germany. ZEF is Germany's leading multi-disciplinary research institute on aspects of development. von Braun serves as chair of the Bio-Economy Council of the German Government, and on various international and European advisory councils. He has had work experience in the following countries: Egypt, Gambia, Guatemala, Rwanda, Sudan, Ethiopia, India, China, Bangladesh, Russia

Main publications *Books and Monographs*: Lal, Rattan, Klaus Lorenz, Reinhard F. Hüttl, Bernd Uwe Schneider, Joachim von Braun ed. 2012. *Recarbonization of the Biosphere. Ecosystems and the Global Carbon Cycle*.

Dordrecht Heidelberg New York London: Springer; E. Nkonya, N. Gerber, T. Walter, J. von Braun, P. Baumgartner 2011. *The Economics of Land Degradation: Toward an Integrated Global Assessment* (Development Economics and Policy); von Braun, J., R. Vargas-Hill, R. Pandya-Lorch, eds 2009. *The Poorest and Hungry: Assessments, Analyses, and Actions*. IFPRI Book. Washington DC., USA; von Braun, J., and E. Diaz-Bonilla, ed. 2008. *Globalization of Food and Agriculture and the Poor*. New Delhi: Oxford University Press; Torero, M., and J. von Braun, ed. 2006. *Information and communication technology for development and poverty reduction: The potential of telecommunications*. Baltimore, Maryland, USA: The Johns Hopkins University Press; Virchow, D., and J. von Braun ed. 2001. *Villages in the Future: Crops, Jobs, and Livelihood*. Berlin, Heidelberg, New York: Springer-Verlag; Wehrheim, P., K. Froberg, E. Serova, and J. von Braun ed. 2000. *Russia's Agro-food Sector: Towards Truly Functioning Markets*. Boston, Dordrecht, and London: Kluwer Academic Publishers; Peters, G.H., and J. von Braun ed. 1999. *Food Security, Diversification, and Resource Management: Refocusing the Role of Agriculture?* England: Ashgate Publishing Ltd.; von Braun, J., T. Teklu, and P. Webb. 1998. *Famine in Africa: Causes, Responses, and Prevention*. Baltimore and London: The Johns Hopkins University Press; Ling, Z., J. Zhongyi, and J. von Braun. 1997. *Credit Systems for the Rural Poor in China*. Commack, NY: Nova Science Publishers, Inc.; Zeller, M., G. Schrieder, J. von Braun, and F. Heidhues. 1997. *Rural Finance for Food Security for the Poor: Implications for Research and Policy*. Washington, DC: International Food Policy Research Institute; von Braun, J. ed. 1995. *Employment for Poverty Reduction and Food Security*. Washington, DC: International Food Policy Research Institute; von Braun, J., and E. Kennedy ed. 1994. *Agricultural Commercialization, Economic Development, and Nutrition*. Baltimore and London: The Johns Hopkins University Press; Webb, P., and J. von Braun. 1994. *Famine and Food Security in Ethiopia: Lessons for Africa*. Chichester, NY, Brisbane, Toronto, and Singapore: John Wiley and Sons Publ. *Recent Book Chapters*: von Braun, J., M.T. Ruel, and S. Gillespie. 2012: Bridging the Gap between the Agriculture and Health Sectors. In: *Reshaping Agriculture for Nutrition and Health. An IFPRI 2020 Book*. von Braun, J. 2011. „Auf die Kleinen kommt es an“ – Welternährung zwischen Mangel und Markt. In *Herausforderung Mensch – Energie, Ernährung, Gesundheit*. Verhandlung der Gesellschaft Deutscher Naturforscher und Ärzte e.V., 126. Versammlung, 17. bis 21. September 2010 in Dresden. Georg Thime Verlag KG. 125-136; von Braun, J. 2011: Increasing and More Volatile Food Prices and the Consumer. In: *The Oxford Handbook of*

the Economics of Food Consumption and Policy. 612-628, Oxford University Press; von Braun, J. 2010. ICT for the Poor at Large Scale: Innovation Connection to Markets and Services. In *ICT for the Next Five Billion People*. Josef Springer, Berlin Heidelberg. 3-14; Birner, R., J. von Braun. 2009. *Decentralization and Public Service Provision – A Framework for Pro-poor Institutional Design*. In: Ehtisham Ahmad, and Giorgio Brosio, Does Decentralization Enhance Service Delivery and Poverty Reduction? E. Elgar Publ.; von Braun, J. 2008. Rural-urban linkages for growth, employment, and poverty reduction. In *Proceedings of the Fifth International Conference on the Ethiopian Economy, Vol. 1*. Addis Ababa: Ethiopian Economic Association (EEA); von Braun, J. 2008. *Recent Journal Articles*: von Braun, J. 2011. Food price crisis and health. Policies on trade, grain reserves, and biofuel subsidies all need to change. *British Medical Journal* 2011; 342; von Braun, J. 2010. Strategic body needed to beat food crises – The system that oversees global agriculture and food security needs an overhaul, *Nature*, June 2010. 548-549 www.nature.com/nature/journal/v465/n7298/full/465548a.html; von Braun, J. 2010. "Land Grabbing". Ursachen und Konsequenzen internationaler Landakquirierung in Entwicklungsländern. *Zeitschrift für Außen- und Sicherheitspolitik* 3.10.299-307. www.springerlink.com/content/q86j765nrw8l0335/fulltext.pdf?MUD=MP; von Braun, J. 2010. Food Insecurity, Hunger, and Malnutrition: Necessary Policy and Technology Changes. *NewBiotechnology* (2010), <http://dx.doi.org/10.1016/j.nbt.2010.08.006>; von Braun, J. 2009. Addressing the Food Crisis: Governance, Market Functioning, and Investment in Public Goods. In: *Food Security* 1: 9-15. www.springerlink.com/content/u7t112n7501642v3/fulltext.pdf

Luis Ángel Caffarelli



Date of Birth 8 December 1948

Place Buenos Aires (Argentina)

Nomination 2 August 1994

Field Mathematics

Title Professor

Most important awards, prizes and academies *Professional societies:* American Mathematical Society; American Academy of Arts and Sciences (1986); National Academy of Sciences (1991); Pontifical Academy of Sciences; Unión Matemática Argentina; Foreign Member, Academia Nacional de Ciencias, Buenos Aires and Córdoba; Foreign Member, Accademia Nazionale delle Scienze; Foreign Member, Accademia Nazionale dei Lincei. *Honours and awards:* Plenary Lecturer at ICM Beijing (2002); Fermi Lectures, Scuola Normale di Pisa (1998); Colloquium Lecturer – A.M.S. (1993); Pius XI Gold Medal (1988); Invited Lecturer, Math into the XXI Century Series, A.M.S. Centennial Celebration Guggenheim Fellowship (1985); Bocher Prize (1984); Co-awarded Stampacchi Prize (1982); Premio Konex Platino-Brillante (2003); Rolf Schock Prize, Swedish Academy of Science (2005); Doctor Honoris Causa Universidad Autónoma de Madrid, École Normale Supérieur, and Universidad de la Plata; Honorary Professor Universidad de Buenos Aires and Universidad de Mar del Plata.

Summary of scientific research Luis Caffarelli works in non linear analysis, mainly on non linear partial differential equations arising from geometry and mechanics. He has conducted extensive research into free boundary and singular perturbation problems. He has worked on free boundary problems that arise naturally when a constitutive relation or a conserved quantity (a temperature, a pressure, a density) changes discontinuously its behavior across some value of the variables under consideration. Typical examples are solid-liquid interphases, burnt-unburnt mixtures in flame propagation, and flow in porous media. Understanding of the geometry and stability of the solution and its interphase is important in selecting and evaluating simulation methods, as well as understanding the models themselves.

Another area of research is fully non linear equations and optimal transportation. Fully non linear equations arise in optimization and optimal control. They have also been recently studied in relation to optimal transportation and optimal antenna design. Other areas of interest are incompressible flows, harmonic maps, and minimal surface theory and more recently, on non linear random homogenization.

Main publications Caffarelli, L.A., Non linear elliptic theory and the Monge-Ampere equation, *Proceedings of the International Congress of Mathematicians*, Vol. I, pp. 179-87, Higher Ed. Press (Beijing, 2002); Caffarelli, L.A., Jerison, D., Kenig, C.E., Some new monotonicity theorems with applications to free boundary problems, *Ann. of Math.*, (2) 155(2002), no. 2, pp. 369-404 (Reviewer: Ján Lovivsek); Caffarelli, L.A., Roquejoffre, J.-M., A nonlinear oblique derivative boundary value problem for the heat equation: analogy with the porous medium equation, *Ann. Inst. H. Poincaré Anal. Non Linéaire*, 19(2002), no. 1, pp. 41-80 (Reviewer: Jesús Hernández); Caffarelli, L.A., Feldman, M., McCann, R.J., Constructing optimal maps for Monge's transport problem as a limit of strictly convex costs, *J. Amer. Math. Soc.*, 15(2002), no. 1, pp. 1-26 (electronic), (Reviewer: J.E. Brothers); Caffarelli, L.A., Viaclovsky, J.A., On the regularity of solutions to Monge-Ampère equations on Hessian manifolds, *Comm. Partial Differential Equations*, 26(2001), no. 11-12, pp. 2339-51 (Reviewer: John Urbas); Athanasopoulos, I., Caffarelli, L.A., Salsa, S., The free boundary in an inverse conductivity problem, *J. Reine Angew. Math.*, 534(2001), pp. 1-31 (Reviewer: Hong Ming Yin); Caffarelli, L.A., The obstacle problem. *Lezioni Fermiane* [Fermi Lectures], Accademia Nazionale dei Lincei, Rome, Scuola Normale Superiore, Pisa, 1998, pp. ii+54, pp. 49-52; Athanasopoulos, I., Caffarelli, L.A., Salsa, S., Caloric functions in Lipschitz domains and the regularity of solutions to phase transition problems, *Ann. of Math.*, (2), 143(1996), no. 3, pp. 413-34 (Reviewer: Elena Comparini); Caffarelli, Luis A., A priori estimates and the geometry of the Monge Ampère equation, *Nonlinear partial differential equations in differential geometry* (Park City, UT, 1992), 5-63, IAS/Park City Math. Ser., 2, Amer. Math. Soc., Providence, RI (1996), (Reviewer: John Urbas); Caffarelli, L.A., Cabré, X., Fully nonlinear elliptic equations, *American Mathematical Society Colloquium Publications*, 43, American Mathematical Society, Providence, RI (1995), pp. vi+104 (Reviewer: P. Lindqvist); Caffarelli, L.A., Gidas, B., Spruck, J., Asymptotic symmetry and local behavior of semilinear elliptic equations with critical Sobolev growth, *Comm. Pure Appl. Math.*, 42(1989), no. 3, pp. 271-97 (Reviewer: Robert McOwen).

Luigi Luca Cavalli Sforza



Date of Birth 25 January 1922

Place Genoa (Italy)

Nomination 2 August 1994

Field Genetics

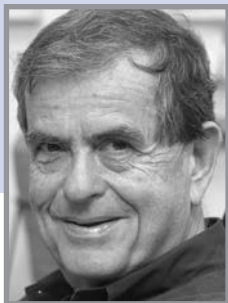
Title Professor

Most important awards, prizes and academies *Awards:* Catalonia Prize; Fyssen Prize, Paris; Balzan Prize; Accademia dei Lincei Prize. *Academies:* Member and former President of the American Society of Human Genetics; former President of the Biometric Society; Hon. Foreign Member of the American Academy of Arts and Sciences and the US National Academy of Sciences; Foreign Member of the Royal Society and of Académie de Science, Institut de France; Accademia Nazionale dei Lincei. *Honorary degrees:* Columbia University, NY; Cambridge University, UK; University of Calabria; University of Bologna; University of Cagliari; University of Rome; University of Sassari.

Summary of scientific research His research concentrated on bacterial genetics during the period 1942-1954 and has focused on human population genetics and evolution since 1951.

Main publications Cavalli-Sforza, L., *The Genetics of Human Populations*, Freeman (New York, 1971) and Dover Publications (New York, 1999); Cavalli-Sforza, L., *Cultural Transmission and Evolution*, Princeton Univ. Press (1981); Cavalli-Sforza, L., *The Neolithic Transition and Population Genetics of Europe*, Princeton UP (1984); Cavalli-Sforza, L., *African Pygmies*, Acad. Press (1986); Cavalli-Sforza, L., *History and Geography of Human Genes*, Princeton UP (June-July 1994); Italian edition published by Adelphi; Cavalli-Sforza, L., *Chi Siamo*, Mondadori (1993), English edition, *The Great Human Diasporas*; Cavalli-Sforza, L., *Genes, Peoples and Languages*, Ferrar Strauss and Giroux (1999), Penguin Press (2000), Italian edition published by Adelphi; Cavalli-Sforza, L., *The Meaning of Nature*, *Scripta Varia* 95, Vatican City (2000), pp. 195-209; Cavalli-Sforza, L.L., *Il caso e la necessità - Ragoni e limiti della diversità genetica*, 2007, Di Renzo Editore, Roma.

Aaron J. Ciechanover



Date of Birth 1 October 1947

Place Haifa (Israel)

Nomination 12 February 2007

Field Biochemistry

Title Professor, Nobel laureate in Chemistry, 2004

Most important awards, prizes and academies *Awards:* The Austria Ilse and Helmut Wachter Prize, University of Innsbruck (1999); The Jewish National Fund Alkales Award for Distinguished Scientific Achievements (2000); The Albert and Mary Lasker Award for Basic Medical Research (2000); The Michael Landau Israeli Lottery (Mifa'al Ha'Peis) Award for a significant breakthrough in Medical Sciences (2001); EMET (Truth) Prize (Israeli Prime Minister Prize), for Arts, Science and Culture (in Life Sciences and Medicine) (2002); The Israel Prize for Biology (2003); Japan Society for Promotion of Science (JSPS) (2003 & 2006); Distinguished Scientist Award (2003); Nobel Prize in Chemistry (shared with Drs. Avram Hershko and Irwin A. Rose) (2004). *Fellowships:* Fulbright Fellow, M.I.T., (Dr. Harvey Lodish's Laboratory) (1981-4); Leukemia Society of America Fellow, M.I.T. (1981-3); Israel Cancer Research Fund (ICRF), USA Fellow, M.I.T. (1981-4); Medical Foundation and Charles A. King Trust Fellow, M.I.T. (1983-4); American Cancer Society Eleanor Roosevelt Memorial Fellow (1988-9). *Academies and professional societies:* American Association for Advancement of Science (AAAS); Member, Council of the European Molecular Biology Organization (EMBO) (1996-present); Member, Asia-Pacific IMBN (International Molecular Biology Network) (1999-present); Member, European Academy of Arts and Sciences (2004); Member, Israeli National Academy of Sciences and Humanities (2004); Fellow (Hon.), Royal Society of Chemistry RCS (UK), HonFRSC (2005); Foreign Member, American Philosophical Society (2005); Honorary Member, Society for Experimental Biology and Medicine (2006); Fellow, Federation of Asian Chemical Societies (FACS) (2006); Member, Pontifical Academy of Sciences (2007). *Honours:* Janet and David Polak Professor of Life Sciences, Technion-Israel Institute of Technology, Haifa, Israel (1996-pre-

sent); University Distinguished Professor, Technion-Israel Institute of Technology, Haifa, Israel (2002-present); Professor, Israel Cancer Research Fund (ICRF), USA (2003-present); Cell Stress Society International – CSSI – Medal (2005); Sir Hans Krebs Medal, Federation of the European Biochemical Societies (FEBS) (2006). *Honorary degrees*: Honorary Doctorate (Doctor Philosophiae Honoris Causa; Ph.D. Hon.), Tel Aviv University, Tel Aviv, Israel (2001); Honorary Doctorate (Doctor Philosophiae Honoris Causa; Ph.D. Hon.), Ben-Gurion University, Beer Sheba, Israel (2004); Honorary Doctorate, City University of Osaka, Japan (2005); Honorary Doctorate, University of Athens, Greece (2005); Honorary Doctorate, National University of Uruguay, Montevideo, Uruguay (2005); Honorary Doctorate, Washington University, St. Louis, Missouri, USA (2006); Honorary Doctorate (Doctor Philosophiae Honoris Causa; Ph.D. Hon.), Cayetano Heredia University, Lima, Peru (2006); Honorary Professor, Capital University of Medical Sciences (CPUMS), Beijing, China (2006); Honorary Professor, Peking Union Medical College (PUMC), Beijing, China; Honorary Professor, Chinese Academy of Medical Sciences (CAMS), China (2006); Honorary Doctorate (Doctor Philosophiae Honoris Causa; Ph.D. Hon.), Hebrew University, Jerusalem, Israel (2007); Honorary Doctor and Foreign Fellow, Polish Academy of Medicine (2007); Honorary Doctorate (Doctor Philosophiae Honoris Causa; Ph.D. Hon.), Bar-Ilian University, Ramat Gan, Israel (2007); Honorary Doctorate (Doctor Honoris Causa), Universidad San Francisco, Quito, Ecuador (2008).

Summary of scientific research Dr Ciechanover's current research focuses on the regulation of transcriptional factors, tumour suppressors, and onco-proteins, and the development of novel modalities for the treatment of diseases such as malignancies and neurodegenerative disorders based on a known mechanism of action and aberrations in the activity of the ubiquitin system which he co-discovered.

Main publications Hershko, A., Heller, H., Ganoth, D., and Ciechanover, A. (1978), Mode of degradation of abnormal globin chains in rabbit reticulocytes, *Protein Turnover and Lysosome Function* (H.L. Segal & D.J. Doyle, eds) Academic Press, New York, pp. 149-69; Ciechanover A., Hod, Y., and Hershko, A. (1978), A heat-stable polypeptide component of an ATP-dependent proteolytic system from reticulocytes, *Biochem. Biophys. Res. Commun.* 81, 1100-5; Ciechanover, A., Heller, H., Elias, S., Haas, A.L., and Hershko, A. (1980), ATP-dependent conjugation of reticulocyte proteins with the polypeptide required for protein degradation, *Proc. Natl. Acad. Sci. USA.* 77, 1365-8; Hershko, A., Ciechanover, A., Heller, H., Haas, A.L., and Rose, I.A.

(1980), Proposed role of ATP in protein breakdown: Conjugation of proteins with multiple chains of the polypeptide of ATP-dependent proteolysis, *Proc. Natl. Acad. Sci. USA* 77, 1783-6; Ciechanover, A., Elias, S., Heller, H., Ferber, S. and Hershko, A. (1980), Characterization of the heat-stable polypeptide of the ATP-dependent proteolytic system from reticulocytes, *J. Biol. Chem.* 255, 7525-8; Hershko, A., Ciechanover, A., and Rose, I.A. (1981), Identification of the active amino acid residue of the polypeptide of ATP-dependent protein breakdown, *J. Biol. Chem.* 256, 1525-8; Ciechanover A., Heller H., Katz-Etzion R., Hershko A. (1981) Activation of the heat-stable polypeptide of the ATP-dependent proteolytic system, *Proc. Natl. Acad. Sci. USA*, Feb 78(2):761-5; Ciechanover, A., and Ben-Saadon R. (2004), N-terminal ubiquitination: More protein substrates join in, *Trends Cell Biol.* 14, 103-6; Ciechanover, A., Elias, S., Heller, H. & Hershko, A. (1982), 'Covalent affinity' purification of ubiquitin-activating enzyme, *J. Biol. Chem.* 257, 2537-42; Hershko, A., Heller, H., Elias, S., and Ciechanover, A. (1983), Components of ubiquitin-protein ligase system: Resolution, affinity purification and role in protein breakdown, *J. Biol. Chem.* 258, 8206-14; Hershko, A., Eytan, E., Ciechanover, A. and Haas, A.L. (1982), Immunochemical Analysis of the turnover of ubiquitin-protein conjugates in intact cells: Relationship to the breakdown of abnormal proteins, *J. Biol. Chem.* 257, 13964-70; Finley, D., Ciechanover, A., and Varshavsky, A. (1984), Thermolability of ubiquitin-activating enzyme from the mammalian cell cycle mutant ts85, *Cell* 37, 43-55; Ciechanover, A., Finley D., and Varshavsky, A. (1984), Ubiquitin dependence of selective protein degradation demonstrated in the mammalian cell cycle mutant ts85, *Cell* 37, 57-66; Ciechanover A., Finley D., Varshavsky A. (1984) Ubiquitin dependence of selective protein degradation demonstrated in the mammalian cell cycle mutant ts85, *Cell*, May 37(1):57-66; Ciechanover A., Wolin S.L., Steitz J.A., Lodish H.F. (1985), Transfer RNA is an essential component of the ubiquitin- and ATP-dependent proteolytic system, *Proc. Natl. Acad. Sci. USA*, Mar 82(5):1341-5; Ferber S., Ciechanover A. (1986) Transfer RNA is required for conjugation of ubiquitin to selective substrates of the ubiquitin- and ATP-dependent proteolytic system, *J. Biol. Chem.*, Mar 5;261(7):3128-34; Ferber S., Ciechanover A. (1987) Role of arginine-tRNA in protein degradation by the ubiquitin pathway, *Nature*, Apr 23-29; 326(6115):808-11; Ciechanover A., Ferber S., Ganoth D., Elias S., Hershko A., Arfin S. (1988) Purification and characterization of arginyl-tRNA-protein transferase from rabbit reticulocytes. Its involvement in post-translational modification and degradation of acidic NH₂ termini substrates of the ubiqui-

tin pathway, *J. Biol. Chem.*, Aug 15;263(23):11155-67; Mayer A., Siegel N.R., Schwartz A.L., Ciechanover A. (1989) Degradation of proteins with acetylated amino termini by the ubiquitin system, *Science*, Jun 23;244(4911):1480-3; Elias S., Ciechanover A. (1990) Post-translational addition of an arginine moiety to acidic NH₂ termini of proteins is required for their recognition by ubiquitin-protein ligase, *J. Biol. Chem.*, Sep 15;265(26):15511-7; Ciechanover, A., DiGiuseppe, J.A., Bercovich, B., Orian, A., Richter, J.D., Schwartz, A.L., and Brodeur, G.M. (1991), Degradation of nuclear oncoproteins by the ubiquitin system in vitro, *Proc. Natl. Acad. Sci. USA* 88, 139-43; Breitschopf K., Bengal E., Ziv T., Admon A., Ciechanover A. (1998) A novel site for ubiquitination: the N-terminal residue, and not internal lysines of MyoD, is essential for conjugation and degradation of the protein, *EMBO J.* Oct 15;17(20):5964-73; Glickman, M.H., and Ciechanover, A. (2002), The ubiquitin-proteasome pathway: Destruction for the sake of construction, *Physiological Reviews* 82, 373-428; Ciechanover, A. (2005), From the lysosome to ubiquitin and the proteasome, *Nature Rev. Mol. Cell Biol.* 6, 79-86; Ciechanover A. (2005). Intracellular protein degradation: from a vague idea, through the lysosome and the ubiquitin-proteasome system, and onto human diseases and drug targeting (Nobel lecture), *Angew. Chem. Int. Ed. Engl.*, Sep 19;44(37):5944-67.

Claude Cohen-Tannoudji



Date of Birth 1 April 1933

Place Constantine (Algeria)

Nomination 17 May 1999

Field Atomic and Molecular Physics

Title Professor, Nobel laureate in Physics, 1997

Cohen-Tannoudji

Most important awards, prizes and academies Nobel Prize in Physics (1997); Commandeur de la Légion d'honneur; Commandeur de l'Ordre national du mérite; Big Cross of the National Order of the Brazilian Scientific Merit. *Academies:* Académie des sciences, Paris; National Academy of Sciences, USA; American Academy of Arts and Sciences; Accademia Nazionale dei Lincei, Italy; Académie Royale des Sciences, des Lettres et des Beaux-Arts, Belgium; Russian Academy of Sciences; American Physical Society (1986); American Academy of Arts and Sciences (1992); European Academy of Arts and Sciences; Academia Europaea (1993); National Academy of Sciences, USA (1994); Académie Royale des Sciences, des Lettres et des Beaux-Arts de Belgique (1996); Accademia dei Lincei, Italy; National Academy of Sciences, Allahabad, India (1998); Indian Academy of Sciences, Bangalore (1999); Pontificia Academia Scientiarum (1999); Académie des Sciences, Belles-Lettres et Arts de Lyon; Indian Science Academy of New Delhi (2000); Optical Society of America (2002); Indonesia Physics Society; Brazilian Academy of Sciences (2003).

Summary of scientific research The scientific problems investigated by Claude Cohen-Tannoudji deal with radiation-matter interactions. With his collaborators he has written five books on quantum mechanics, quantum electrodynamics and quantum optics, and about 200 theoretical and experimental papers on various problems of atomic physics and quantum optics. During his Ph.D. done under the supervision of Alfred Kastler and Jean Brosse, he predicted that atomic energy levels should be displaced by light and he observed the corresponding light shifts. A few years later, he showed that very narrow level crossing resonances can be observed in atomic ground states and he detected in this way very weak magnetic fields (in the nanogauss

range). With his students, S. Haroche, J. Dupont-Roc, S. Reynaud and J. Dalibard, he developed the dressed atom approach for describing atom-photon interactions. This approach has been very useful, not only in understanding in a synthetic way various physical effects in the RF and optical domains (Autler-Townes effect, fluorescence triplet, photon antibunching, intermittent fluorescence, dipole forces ...), but also in discovering new physical effects (cancellation of an atomic g-factor by a RF field, time correlations between frequency filtered photons, Sisyphus effect ...). He developed simple physical pictures for radiative corrections such as the Lamb shift and the spin anomaly g-2. During the last fifteen years, he has made with his collaborators, A. Aspect, J. Dalibard and Ch. Salomon, several contributions to the field of manipulation of atoms by light, such as the Sisyphus cooling mechanism where a moving atom is running up potential hills more frequently than down, or the use of velocity selective dark states for cooling atoms at one, two and three dimensions, below the limit corresponding to the recoil kinetic energy of an atom emitting or absorbing a single photon. Other recent contributions have investigated gravitational cavities for neutral atoms where cold atoms bounce (up to 10 times) off a mirror formed by an evanescent wave, and the quantization of atomic motion and the localization of atoms in periodic optical potential wells. Very recently, his group has observed Bose-Einstein condensation of helium atoms in a metastable state. He was co-laureate of the 1997 Nobel Prize in Physics for the development of methods to cool and trap atoms with laser light.

Main publications Books: Cohen-Tannoudji, C., Diu, B., Laloë, F., *Quantum Mechanics*, Tomes I and II, Wiley (New York, 1997); Cohen-Tannoudji, C., Dupont-Roc, J., Grynberg, G., *Photons and Atoms, Introduction to Quantum Electrodynamics*, Wiley (New York, 1989); Cohen-Tannoudji, C., Dupont-Roc, J., Grynberg, G., *Atom-Photon Interactions: Basic Processes and Applications*, Wiley (New York, 1992); Cohen-Tannoudji, *Atoms in Electromagnetic Fields*, World Scientific (Singapore, 1994, 2nd ed. 2004); Bardou F., Bouchaud, J.-P., Aspect, A., Cohen-Tannoudji, C., *Lévy Statistics and Laser Cooling, How Rare Events Bring Atoms to Rest* (Cambridge, 2001). Articles: Cohen-Tannoudji, C., Dupont-Roc, J., Experimental study of Zeeman light shifts in weak magnetic fields, *Phys. Rev.*, A5, p. 968 (1972); Dupont-Roc, J., Haroche, S., Cohen-Tannoudji, C., Detection of very weak magnetic fields (10⁻⁹ Gauss) by Rb-87 zero-field level crossing resonances, *Phys. Letters*, A28, p. 638 (1969); Dalibard, J., Cohen-Tannoudji, C., Dressed-atom approach to atomic motion in laser light: the dipole force revisited, *J.O.S.A.*,

B2, p. 1707 (1985); Aspect, A., Dalibard, J., Heidmann, A., Salomon, C., Cohen-Tannoudji, C., Cooling atoms with stimulated emission, *Phys. Rev. Lett.*, 57, p. 1688 (1986); Dalibard, J., Cohen-Tannoudji, C., Laser cooling below the Doppler limit by polarization gradients: simple theoretical models, *J.O.S.A.*, B6, p. 2023 (1989); Aspect, A., Arimondo, E., Kaiser, R., Vansteenkiste, N., Cohen-Tannoudji, C., Laser cooling below the one-photon recoil energy by velocity-selective coherent population trapping, *Phys. Rev. Lett.*, 61, p. 826 (1988); Verkerk, P., Lounis, B., Salomon, C., Cohen-Tannoudji, C., Courtois, J.-Y., Grynberg, G., Dynamics and spatial order of cold cesium atoms in a periodic optical potential, *Phys. Rev. Lett.*, 68, p. 3861 (1992); Aminoff, C.G., Steane, A.M., Bouyer, P., Desbiolles, P., Dalibard, J., Cohen-Tannoudji, C., Cesium atoms bouncing in a stable gravitational cavity, *Phys. Rev. Lett.*, 71, p. 3083 (1993); Bardou, F., Bouchaud, J.-P., Emile, O., Aspect, A., Cohen-Tannoudji, C., Sub-recoil laser cooling and Lévy flights, *Phys. Rev. Lett.*, 72, p. 203 (1994); Kulin, S., Saubamea, B., Peik, E., Lawall, J., Hijmans, T.W., Leduc, M., Cohen-Tannoudji, C., Coherent Manipulation of Atomic Wave Packets by Adiabatic Transfer, *Phys. Rev. Lett.*, 78, p. 4185 (1997); Saubama, B., Hijmans, T.W., Kulin, S., Rasel, E., Peik, E., Leduc, M., Cohen-Tannoudji, C., Direct Measurement of the Spatial Correlation Function of Ultracold Atoms, *Phys. Rev. Lett.*, 79, p. 3146 (1997); Pereira, F., Leonard, J., Wang, J., Barrelet, C., Perales, F., Rasel E., Unnikrishnan, C., Leduc, M., Cohen-Tannoudji, C., Bose-Einstein Condensation of Metastable Helium, *Phys. Rev. Lett.*, 86, p. 3459 (2001); J. Léonard, M. Walhout, A.P. Mosk, F. Perales, T. Muller, M. Leduc, C. Cohen-Tannoudji, *Phys. Rev. Lett.* 91 (2003): Giant helium dimmers produced by photoassociation of ultracold metastable atoms; J. Léonard, A.P. Mosk, M. Walhout, P. van der Straten, M. Leduc, and C. Cohen-Tannoudji, *Phys. Rev. A* 69, (2004): Analysis of photoassociation spectra for giant helium dimmers; J. Kim, S. Moal, M. Portier, J. Dugué, M. Leduc et C. Cohen-Tannoudji, *Europhys. Lett.* 72 (4) (2005): Frequency shifts of photoassociative spectra of ultracold metastable helium atoms: A new measurement of the s-wave scattering length; C. Cohen-Tannoudji, *et al.*, La condensation de Bose-Einstein dans les gaz, *Einstein aujourd'hui*, *EDP Sciences* (2005); C. Cohen-Tannoudji et J. Dalibard: Manipulating atoms with photons, *The New Physics for the Twenty-First Century*, ed. G. Fraser, Cambridge University Press (2005); C. Cohen-Tannoudji: Qu'est-ce que la lumière pour le physicien d'aujourd'hui?, *La Lumière au siècle des Lumières & aujourd'hui*, *Art et Science*, Odile Jacob (2005); S. Moal, M. Portier, J. Kim, J. Dugué, U.D. Rapol, M. Leduc and C. Cohen-Tannoudji, *Phys. Rev. Lett.* 96

(2006): Accurate determination of the scattering length of metastable Helium atoms using dark resonances between atoms and exotic molecules; M. Portier, S. Moal, J. Kim, M. Leduc, C. Cohen-Tannoudji and O. Dulieu: Analysis of light-induced frequency shifts in the photoassociation of ultracold metastable helium atoms, *J. Phys. B*, 39 (2006).

Francis S. Collins



Date of Birth 14 April 1950

Place Staunton, VA (USA)

Nomination 10 February 2009

Field Genetics

Title Professor, Director of the National Institutes of Health

Most important awards, prizes and academies Professor Collins' accomplishments have been recognized by numerous awards and honors, including election to the Institute of Medicine and the National Academy of Sciences. On November 5, 2007, he received the Presidential Medal of Freedom from U.S. President George W. Bush, the nation's highest civil award, for his revolutionary contributions to genetic research. He was also present at the bill signing for the Genetic Information Nondiscrimination Act in the Oval Office, in recognition of his work in genetics, and his early papers and commentary on the need for such protections.

Summary of scientific research Professor Collins' research has led to the identification of genetic variants associated with type 2 diabetes and the genes responsible for cystic fibrosis, neurofibromatosis, Huntington's disease and Hutchinson-Gilford progeria syndrome. As director of the National Center for Human Genome Research, which became NHGRI in 1997, he oversaw the International Human Genome Sequencing Consortium and many other aspects of what he has called "an adventure that beats going to the moon or splitting the atom". In 1994, Collins founded NHGRI's Division of Intramural Research (DIR), a collection of investigator-directed laboratories that conduct genome research on the NIH campus and that has developed into one of the nation's premier research centers in human genetics. With new tools arising from the human genome project and technology development studies supported by the genome institute, Collins is optimistic about the chances of uncovering hereditary contributors to common diseases, such as heart disease, cancer and mental illness. In the overall research agenda of NHGRI, this interest is reflected in the highly ambitious effort to construct a haplotype map of the human genome. The now-completed "hap map"

project produced a catalog of genetic variations – called single nucleotide polymorphisms (SNPs) – which is now being widely used to discover genetic variations correlate with disease risk. There was a dramatic increase of published scientific papers linking genetic variations to common illnesses in 2007. Collins's work in his highly active lab demonstrates that research emphasis, which is devoted to finding the genes that contribute to adult-onset, Type 2 diabetes. In addition to his long list of contributions to basic genetic research and scientific leadership, Collins is known for his close attention to ethical and legal issues in genetics. He has been a strong advocate for protecting the privacy of genetic information and has served as a national leader in efforts to prohibit gene-based insurance discrimination. Building on his own experiences as a physician volunteer in a rural missionary hospital in Nigeria, Collins is also very interested in opening avenues for genome research to benefit the health of people living in developing nations.

Main publications Crabtree J.S., Scacheri P.C., Ward J.M., McNally S.R., Swain G.P., Hage J.H., Hanahan D., Edlund H., Magnuson M.A., Garrett-Beal L., Burns A.L., Chandrasekharappa S.C., Marx S.J., Spiegel A.M., Collins F.S., Of mice and MEN1: insulinomas in a conditional mouse knockout, *Molec Cell Biol*, 23:6075-6085, 2003; Eriksson M., Brown W.T., Gordon L.B., Glynn M.W., Singer J., Scott L., Erd M.R., Robbins C.M., Moses T.Y., Berglund P., Dutra A., Pak E., Durkin S., Csoka A.B., Boehnke M., Glover T.W., Collins F.S., Recurrent de novo point mutations in lamin A cause Hutchinson-Gilford progeria syndrome, *Nature*, 423(6937):293-8, 2003; Crawford G.E., Holt I.E., Mullikin J.C., Tai D., National Institutes of Health Intramural Sequencing Center, Green E.D., Wolfsberg T.G., Collins F.S., Identifying gene regulatory elements by genome-wide recovery of DNase hypersensitive sites, *Proc Natl Acad Sci USA* 101:992-997, 2004; Goldman R.D., Shumaker D.K., Erdos M.R., Eriksson M., Goldman A.E., Gordon L.B., Gruenbaum Y., Khuon S., Mendez M., Varga R., Collins F.S., Accumulation of mutant lamin A causes progressive changes in nuclear architecture in Hutchinson-Gilford progeria syndrome, *Proc Natl Acad Sci USA*, 101:8963-8968, 2004; Silander, K., Mohlke K.L., Scott L.J., Peck E.C., Hollstein P., Skol A.D., Jackson A.U., Deloukas P., Hunt S., Stavrides G., Chines P.S., Erdos, M.R., Narisu N., Conneely K.N., Li C., Fingerlin T.E., Dhanjal S.K., Valle T.T., Bergman R.N., Tuomilehto, J., Watanabe R.M., Boehnke M., Collins F.S. Genetic variation near the hepatocyte nuclear factor-4a gene predicts susceptibility to type 2 diabetes, *Diabetes*, 53:1141-1149, 2004; Capell BC, Erdos MR, Madigan JP, Fiordalisi JJ, Varga R, Conneely KN, Gordon LB, Der

CJ, Cox AD, Collins FS, Inhibiting farnesylation of progerin prevents the characteristic nuclear blebbing of Hutchinson-Gilford progeria syndrome, *PNAS*, 102: 12879-12884, 2005; Guttmacher A.E., Collins, F.S., Realizing the promise of genomics for biomedical research, *JAMA*, 294(11):1399-402, 2005; Crawford GE, Holt IE, Whittle J, Webb BD, Tai D, Davis S, Margulies EH, Chen Y, Bernat JA, Ginsburg D, Zhou D, Luo S, Vasicek TJ, Daly MJ, Wolfsberg TG, Collins FS, Genome-wide mapping of DNase Hypersensitive sites using Massively Parallel Signature Sequencing (MPSS), *Genome Research*, 16(1) 123-131, 2006; Varga R, Eriksson M, Erdos MR, Olive M, Harten I, Kolodgie F, Capell BC, Cheng J, Faddah D, Perkins S, Avallone H, San H, Qu X, Ganesh S, Gordon LB, Virmani R, Wight TN, Nabel EG, Collins FS, Progressive vascular smooth muscle cell defects in a mouse model of Hutchinson-Gilford progeria syndrome, *Proc Natl Acad Sci USA*, 103(9) 3250-3255, 2006; Scacheri PC, Davis S, Odom DT, Crawford GE, Perkins S, et al., Genome-Wide Analysis of Menin Binding Provides Insights to MEN1 Tumorigenesis, *PLoS Genet*, 2(4)e51, 2006; Crawford GE, Davis S, Scacheri PC, Renaud G, Halawi MJ, Erdos MR, Green R, Meltzer PS, Wolfsberg TG, Collins FS, DNase-chip: a high-resolution method to identify DNase I hypersensitive sites using tiled microarrays, *Nature Methods*, 3(7) 503-509, 2006; Bonnycastle LL, Willer CJ, Conneely KN, Jackson AU, Burrill CP, Wantanabe RM, Chines PS, Narisu N, Scott LJ, Enloe ST, Swift AJ, Duren WL, Stringham HM, Erdos MR, Reibow NL, Buchanan TA, Valle TT, Tuomilehto J, Bergman RN, Mohlke KL, Boehnke M, and Collins FS, Common Variants in MODY Contribute to Risk of Type 2 Diabetes in Finns, *Diabetes*, (9):2534-40, 2006; Feero, WG, Guttmacher, AE, Collins, The Genome Gets Personal – Almost, *JAMA*, 299(11):1351-1352, 2008. Books: Collins, Francis S., *The Language of Science and Faith: Straight Answers to Genuine Questions with Karl Giberson*, IVP Books, 2011; Collins, Francis S., *The Language of Life: DNA and the Revolution in Personalized Medicine*, HarperCollins, 2010; Collins, Francis S., *Belief: Readings on the Reason for Faith*, HarperOne, 2010; Collins, Francis S., *The Language of God: A Scientist Presents Evidence for Belief*, Free Press, 2006; Guttmacher, Alan E., Collins, Francis S., Drazen, Jeffrey M. eds, Foreword by Elias Zerhouni, M.D., *Genomic Medicine: Articles from the New England Journal of Medicine*, Baltimore: Johns Hopkins University Press, 2004; Gelehrter, Thomas D., Collins, Francis S., Ginsberg, David, *Principles of Medical Genetics*, 2nd ed. Baltimore: Lippincott, Williams & Wilkins, 1998.

Suzanne Cory



Date of Birth 11 March 1942

Place Melbourne (Australia)

Nomination 27 January 2004

Field Molecular Biology

Title Professor

Most important awards, prizes and academies *Awards:* David Syme Prize, University of Melbourne (1982); Avon Australia 'Spirit of Achievement' Award (1992); Lemberg Medal, Australian Society for Biochemistry & Molecular Biology (1995); Burnet Medal, Australian Academy of Science (1997); Australia Prize (shared) (1998); Charles S. Mott Prize (shared), General Motors Cancer Research Foundation (1998); L'Oreal – UNESCO Women in Science Award (2001); Royal Medal, Royal Society (2002); Centenary of Federation Medal, Australia (2003). *Academies:* Australian Academy of Sciences (1986); Royal Society (1992); American Association for Immunology (1993); Royal Society of Victoria (1996); US National Academy of Science (1997); Asia-Pacific International Molecular Biology Network (1998); American Academy of Arts and Sciences (2001); French Academy of Sciences (2002); Australian Society for Biochemistry and Molecular Biology; American Association for Cancer Research.

Summary of scientific research Suzanne Cory's research has had a major impact on the understanding of immunology and the development of cancer. After pioneering Ph.D. studies determining the sequence of methionine transfer RNA, using the sequencing methods that had just been developed by Fred Sanger, her post-doctoral studies at the University of Geneva focused on sequence analysis of R17 phage RNA a model messenger RNA. Cory and Adams returned to Melbourne in 1971 to The Walter and Eliza Hall Institute. During the first few years, they discovered 5' caps on mammalian messenger RNAs, helped to introduce gene cloning technology in Australia, and addressed a central puzzle regarding the immune response: how does the body make the myriad antibodies needed to fight diverse infectious agents? Their laboratory helped uncover the astonishing solution: antibody genes are enco-

ded as bits and pieces which can combine in a myriad ways, thereby creating much greater diversity with which to fight infection. In 1981, their attention turned to the nature of the genetic accidents that cause cancer. Their laboratory showed that damage to chromosomes can activate cancer-promoting genes. They tracked down the mutation which activates the oncogene *myc* and leads to Burkitt's lymphoma, a malignancy of antibody-producing cells. In collaboration with Alan Harris, they then engineered novel lines of lymphoma-prone mice, to study the early stages of disease and test for synergistic mutations. The current focus of their research is how cells decide whether to live or die. This program was launched in 1988 by the seminal finding of David Vaux in their laboratory that *bcl-2*, the gene responsible for follicular lymphoma, promotes cell survival. This discovery opened an entirely new way of thinking about cancer development, since all other oncogenes (cancer-causing genes) had been found to promote cell proliferation. The *bcl-2* gene proved to have numerous relatives, and some actually promote cell death (apoptosis) rather than cell survival. Today, a major program at the Hall Institute, led by Adams, Cory, Harris, Strasser, Huang, Vaux, Gerondakis and Colman is directed to understanding how apoptosis is controlled, influences normal development and contributes to cancer and other diseases. This knowledge will lead to the development of more effective therapeutics for cancer and degenerative diseases.

Main publications Adams, J.M. and Cory, S., Modified nucleosides and bizarre 5'-termini in mouse myeloma mRNA, *Nature*, 255, pp. 28-33 (1975); Cory, S. and Adams, J.M., Deletions are associated with somatic rearrangement of immunoglobulin heavy chain genes, *Cell*, 19, pp. 37-51 (1980); Adams, J.M., Gerondakis, S., Webb, E., Corcoran, L.M. and Cory, S., Cellular *myc* oncogene is altered by chromosome translocation to an immunoglobulin locus in murine plasmacytomas and rearranged similarly in Burkitt lymphomas of man, *Proc. Natl. Acad. Sci. USA*, 80, pp. 1982-6 (1983); Corcoran, L.M., Adams, J.M., Dunn, A.R. and Cory, S., Murine T lymphomas in which the cellular *myc* oncogene has been activated by retroviral insertion, *Cell*, 37, pp. 113-22 (1984); Adams, J.M., Harris, A.W., Pinkert, C.A., Corcoran, L.M., Alexander, W.S., Cory, S., *et al.*, The *c-myc* oncogene driven by immunoglobulin enhancers induces lymphoid malignancy in transgenic mice, *Nature*, 318, pp. 533-8 (1985); Vaux, D., Cory, S. and Adams, J.M., *Bcl-2* gene promotes haematopoietic cell survival and cooperates with *c-myc* to immortalize pre-B cells, *Nature*, 335, pp. 440-2 (1988); Johnson, G.R., Gonda, T.J., Metcalf, D., Hariharan, J.K. and Cory, S., A lethal myeloproliferative syndrome in mice transplanted with bone marrow cells infected with a retrovirus expressing

granulocyte-macrophage colony stimulating factor, *EMBO J.*, 8, pp. 441-8 (1989); Strasser, A., Harris, A.W., Bath, M.L. and Cory, S., Novel primitive lymphoid tumours induced in transgenic mice by cooperation between *myc* and *bcl-2*, *Nature*, 348, pp. 331-3 (1990); Rosenbaum, H., Harris, A.W., Bath, M.L., McNeall, J., Webb, E., Adams, J.M. and Cory, S., An $\text{E}\mu\text{-v-abl}$ transgene elicits plasmacytomas in concert with an activated *myc* gene, *EMBO J.*, 9, pp. 897-905 (1990); Elefanty, A.G., Hariharan, I.K. and Cory, S., *bcr-abl*, the hallmark of chronic myeloid leukaemia in man, induces multiple haemopoietic neoplasms in mice, *EMBO J.*, 9, pp. 1069-78 (1990); Perkins, A., Kongsuwan, K., Visvader, J., Adams, J.M. and Cory, S., Homeobox gene expression plus autocrine growth factor production elicits myeloid leukemia, *Proc. Natl. Acad. Sci. USA*, 87, pp. 8398-8402 (1990); Strasser, A., Harris, A.W. and Cory, S., *bcl-2* transgene inhibits T cell death and perturbs thymic self-censorship, *Cell*, 67, pp. 889-99 (1991); Adams, J.M. and Cory, S., The *Bcl-2* protein family: arbiters of cell survival, *Science*, 281, pp. 1322-26 (1998); Print, C.G., Loveland, K.L., Gibson, L., Meehan, T., Stylianou, A., Wreford, N., de Kreter D., Metcalf, D., Kontgen, F., Adams, J.M. and Cory, S., Apoptosis regulator *Bcl-w* is essential for spermatogenesis but appears otherwise redundant, *Proc. Natl. Acad. Sci. USA*, 95, pp. 12424-31 (1998); Bouillet, P., Purton, J.F., Godfrey, D.I., Zhang, L.C., Coultas, L., Puthalakath, H., Pellegrini, M., Cory, et al., *BH3*-only *Bcl-2* family member Bim is required for apoptosis of autoreactive thymocytes, *Nature*, 415, pp. 922-6 (2002); Cory, S., Adams, J.M., The *Bcl2* family: regulators of the cellular life-or-death switch, *Nat. Rev. Cancer*, 2(9), pp. 647-56 (2002); Adams, J.M., Cory, S., Apoptosomes: engines for caspase activation, *Curr. Opin. Cell. Biol.* 14(6), pp. 715-20 (2002); Cory, S., et al., The *Bcl-2* family: roles in cell survival and oncogenesis, *Oncogene*, 22(53), pp. 8590-607 (2003); Egle, A., Harris, A.W., Bath, M.L., O'Reilly, L., Cory, S., *VavP-Bcl2* transgenic mice develop follicular lymphoma preceded by germinal center hyperplasia, *Blood*, 103(6), pp. 2276-83 (2004); Egle, A., Harris, A.W., Bouillet, P., Cory, S., Bim is a suppressor of *Myc*-induced mouse B cell leukaemia, *Proc. Natl. Acad. Sci. USA*, 101(16), pp. 6164-9 (2004); Smith, D.P., Bath, M.L., Metcalf, D., Harris, A.W., Cory, S., *MYC* levels govern hematopoietic tumor type and latency in transgenic mice, *Blood*, 108(2), pp. 653-61 (2006); van Delft, M.F., Wei, A.H., Mason, K.D., Vandenberg, C.J., Chen, L., Czabotar, P.E., Willis, S.N., Scott, C.L., Day, C.L., Cory, S., et al., The *BH3* mimetic ABT-737 targets selective *Bcl-2* proteins and efficiently induces apoptosis via Bak/Bax if *Mcl-1* is neutralized, *Cancer Cell*, 10(5), pp. 389-99 (2006).

Georges M.M. Card. Cottier, O.P.



Date of Birth 25 April 1922
Place Geneva (Switzerland)
Nomination 28 October 1992
Field Theology
Title Professor

Cottier

Most important awards, prizes and academies Lect. et lic. en théol.; Doct. en phil.; Théologien de la Maison Pontificale; Secrétaire général de la Commission Théologique Internationale; Président de la Commission Théologique du Comité préparatoire du Grand Jubilé de l'An 2000; Consultant à la Congrégation pour la Doctrine de la Foi; Consultant du Conseil Pontifical pour les non-croyants; Consultant du Conseil Pontifical 'Cor Unum'; Directeur de la revue *Nova et Vetera*. Academies: Pont. Acad. Théol. Rom.; Acad. Pontificale de Saint Thomas d'Aquin; Comité Scientifique de l'Istituto Paolo VI, Brescia; Institut International de Synthèse de la Société Görres; Fondation Cardinal Journet; Cercle Jacques et Raïssa Maritain; Membre Correspondant Etranger de la Real Academia de Doctores, Madrid.

Summary of scientific research Problèmes frontières entre philosophie et théologie. Philosophie de la religion. Histoire de la philosophie.

Main publications Cottier, G.M., *L'athéisme du jeune Marx et ses origines hégéliennes*, éd. Vrin, (Paris, 1959), 2ème éd. 1969; Cottier, G.M., *L'ateismo del giovane Marx. Le origini hegeliane*, ed. Vita e Pensiero (Milano, 1981); Cottier, G.M., *Du romantisme au marxisme*, éd. Alsatia (Paris, 1961); Cottier, G.M., *Horizons de l'athéisme*, éd. Le Cerf (Paris, 1969); Cottier, G.M., *Panoramica actual del ateismo*, ed. Studium (Madrid, 1971); Cottier, G.M., *La mort des idéologies et l'espérance*, éd. Le Cerf (Paris, 1970); Cottier, G.M., *Le conflit des espérances*, éd. Desclée de Brouwer (Paris, 1977); Cottier, G.M., *Speranza cristiana e speranza marxista*, Città Nuova Editrice, (Roma, 1979); Cottier, G.M., *Humaine raison*, Éditions Universitaires (Fribourg, 1980); Cottier, G.M., *Etica dell'intelligenza*, ed. Vita e Pensiero (Milano, 1988); Cottier, G.M., *Questions de la modernité*, FAC-éditions (Paris, 1985); Cottier, G.M., *Consacrés dans la vérité*, Mame (Paris, 1992); Cottier,

G.M., *Histoire et connaissance de Dieu*, Éditions Universitaires, (Fribourg, Suisse, 1993), pp. 255; Cottier, G.M., *Scritti di Etica*, ed. Piemme (Casale Monferrato, 1994); Cottier, G.M., *Défis Ethiques*, éd. Saint-Augustin (Saint-Maurice, Suisse, 1995); Cottier, G.M., *Valori e transizione. Il rischio dell'indifferenza*, ed. Studium (Roma, 1994), pp. 244; Cottier, G.M., *Chemins de la Raison*, éd. Parole et Silence (Paris, 1997); Cottier, G.M., *Mémoire et Repentance. Pourquoi l'Église demande pardon*, éd. Parole et Silence (Paris, 1998); Cottier, G.M., *Le désir de Dieu*, éd. Parole et Silence (Paris, 2002). Cottier, G.M., *Deviens ce que tu es*, éd. Parole et Silence (Paris, 2003).

Paul J. Crutzen



Date of Birth 3 December 1933

Place Amsterdam (The Netherlands)

Nomination 25 June 1996

Field Chemistry

Title Professor, Nobel laureate in Chemistry, 1995

Most important awards, prizes and academies *Awards:* Leo Szilard Award for "Physics in the Public's Interest" of the American Physical Society (1985); Tyler Prize for Environmental Achievement (1989); Volvo Environment Prize (1991); Deutscher Umweltpreis of the Federal "Umweltstiftung" (1994); Max-Planck-Forschungspreis (with Dr. M. Molina)(1994); Nobel Prize in Chemistry (with Dr. M. Molina and F.S. Rowland)(1995). *Academies:* Fellow, American Geophysical Union (1986); Foreign Honorary Member, American Academy of Arts and Sciences (1986); Founding Member, Academia Europaea (1988); Corresponding Member, Royal Netherlands Academy of Art and Sciences (1990); Foreign Member, Royal Swedish Academy of Sciences (1992); Foreign Associate, US National Academy of Sciences (1994). *Honorary Degrees:* York University, Canada (1986); Université Catholique de Louvain-la-Neuve, Belgium (1992); University of East Anglia, Norwich, UK (1994); Aristotle University of Thessaloniki, Greece (1996); Oregon State University, USA (1997); Tel Aviv University, Israel (1997); Université de Liège, Belgium (1997); University of San José, Costa Rica (1997); University of Chile, Chile (1997); Université de Bourgogne, Dijon, France (1997); University of Athens, Greece (1998); University of Xanthi, Greece (2001); Nova Gorica Polytechnic, Slovenia (2002); University of Hull, UK (2002).

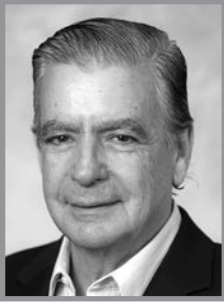
Summary of scientific research The research of Paul J. Crutzen has been mainly concerned with the photochemistry of the atmosphere, in particular the role of ozone both in the stratosphere and troposphere. In 1970 Crutzen hypothesized that ozone production by the action of solar ultraviolet radiation on molecular oxygen (O_2) could be mainly balanced by ozone destruction processes, involving NO and NO_2 as catalysts. These catalysts in turn result from the oxidation of N_2O , a product of the microbiological nitro-

gen conversion in soils and waters. In 1971, together with Prof. Harold Johnston of the University of California, Berkeley, he pointed out that NO emissions from large fleets of supersonic aircraft could cause substantial ozone losses in the stratosphere. In the years 1972-74 Crutzen proposed that NO and NO₂ could catalyze ozone production in the background troposphere by reactions occurring in the CO and CH₄ oxidation chains. Additional photochemical reactions leading to ozone loss were likewise identified. These gross ozone production and destruction terms are each substantially larger than the downward flux of ozone from the stratosphere, which until then had been considered the main source of tropospheric ozone. In 1979-1980 Crutzen and co-workers drew attention to the great importance of the tropics in atmospheric chemistry. In particular, some measurement campaigns in Brazil clearly showed that biomass burning in the tropics was a major source of air pollutants, on a par with or in some cases larger than industrial pollution in the developed world. In 1982 Crutzen, together with Prof. John Birks of the University of Colorado, drew attention to the risk of strong cooling occurring at the earth surface as a consequence of huge loadings of the atmosphere with black aerosol particles resulting from the many fires which would break out as a consequence of a nuclear war ('nuclear winter'). This study and additional studies by R. Turco, B. Toon, T. Ackerman, J. Pollack and C. Sagan and by the Scientific Committee on Problems of the Environment (SCOPE) showed that more people could die from the indirect consequences of a nuclear war than from the direct impacts of the nuclear explosions. In 1986, together with Dr. F. Arnold of the Max-Planck-Institute of Nuclear Physics in Heidelberg, Crutzen showed that nitric acid and water vapour could co-condense in the stratosphere, an important contributing process in a chain of events leading to rapid ozone depletion at high latitudes during late winter and spring (the so-called Antarctic 'ozone hole'). His most recent research is concerned with the role of clouds in atmospheric chemistry as well as photochemical reactions taking place in the marine boundary layer, involving catalysis by halogen radicals, derived from seasalt and photolysis of reactive organohalogen gases produced by marine organisms. In addition, his current research mainly deals with the chemical and climatic effects of the heavy air pollution which is found over Asia and other regions in the developing world: the so-called ABC (Atmospheric Brown Clouds) phenomenon.

Main publications Crutzen, P.J., The influence of nitrogen oxides on the atmospheric ozone content, *Quart. J. Roy. Meteor. Soc.*, 96, pp. 320-5 (1970); Crutzen, P.J., Ozone production rates in an oxygen-hydrogen-nitro-

gen oxide atmosphere, *J. Geophys. Res.*, 76, pp. 1490-7 (1971); Crutzen, P.J., A discussion of the chemistry of some minor constituents in the stratosphere and troposphere, *Pure App. Geophys.*, 106-8, pp. 1385-99 (1973); Fishman, J. and Crutzen, P.J., The origin of ozone in the troposphere, *Nature*, 274, pp. 855-8 (1978); Crutzen, P.J., Heidt, L.E., Krasnec, J.P., Pollock, W.H. and Seiler, W., Biomass burning as a source of atmospheric gases CO, H₂, N₂O, NO CH₃Cl and COS, *Nature*, 282, pp. 253-6 (1979); Crutzen, P.J. and Birks, J.W., The atmosphere after a nuclear war: Twilight at noon, *Ambio*, 2&3, pp. 114-25 (1982); Crutzen, P.J., Delany, A.C., Greenberg, J., Haagenson, P., Heidt, L., Lueb, R., Pollock, W., Seiler, W., Wartburg, A. and Zimmermann, P., Tropospheric chemical composition measurements in Brazil during the dry season, *J. Atmos. Chem.*, 2, pp. 233-56 (1985); Crutzen, P.J. and Arnold, F., Nitric acid cloud formation in the cold Antarctic stratosphere: A major cause for the springtime "ozone hole", *Nature*, 324, pp. 651-5 (1986); Crutzen, P.J. and Andreae, M.O., Biomass burning in the tropics: Impact on atmospheric chemistry and biogeochemical cycles, *Science*, 250, pp. 1669-78 (1990); Lelieveld, J. and Crutzen, P.J., Influence of cloud and photochemical processes on tropospheric ozone, *Nature*, 343, pp. 227-33 (1990); Vogt, R. and Crutzen, P.J., Sander, R., A mechanism for halogen release from sea salt aerosol in the remote marine boundary layer, *Nature*, 382, pp. 327-30 (1996); Crutzen, P.J. *et al.*, High spatial and temporal resolution measurements of primary organics and their oxidation products over the tropical forests of Surinam, *Atmos. Environ.*, 37, pp. 1161-5 (2000); Lelieveld, J. and Crutzen, P.J. *et al.*, The Indian Ocean Experiment: Widespread Pollution from South and Southeast Asia, *Science*, 291, pp. 1031-6 (2001); Ramanathan, V., Crutzen, P.J., Kiehl, J.T. and Rosenfeld, D., Aerosols, Climate and the Global Environment: A Hazy Future for the Blue Planet?, *Science*, 294 pp. 2041-236 (2001); Crutzen, P.J. and Ramanathan, V., The Parasol Effect on Climate, *Science*, 302, pp. 1679-80 (2003); von Glasow, R., Lawrence, M.G., Sander, R. and Crutzen, P.J., Modeling the chemical effects of ship exhaust in the cloud-free marine boundary layer, *Atmos. Chem. Phys.*, 3, pp. 233-50 (2003); Ramanathan, V. and Crutzen, P.J., New Directions: Atmospheric Brown "Clouds", *Atmos. Environ.*, 37, pp. 4033-5 (2003).

Edward M. De Robertis



Date of Birth 6 June 1947

Place Boston, MA (USA)

Nomination 8 September 2009

Field Biology

Title Professor

Most important awards, prizes and academies Edward De Robertis is a member of the National Academy of Sciences, the American Academy of Arts and Sciences, the European Molecular Biology Organization, an honorary member of the Société de Biologie, Paris, France, and corresponding member of the Latin American Academy of Sciences. He is active in Latin American affairs and has served on the scientific board of the Pew Charitable Trusts Latin program for 20 years. He received the Ross G. Harrison prize in developmental biology. From 2002 to 2006 he was President of the International Society of Developmental Biologists.

Summary of scientific research The research of Edward De Robertis centers on the molecular mechanisms of embryonic induction in vertebrate embryos. He has cloned several genes that code for secreted antagonists of growth factors that are used by embryonic cells to communicate with each other. These proteins are used to control cell differentiation and have been conserved in all bilateral animals. His work has led to the realization that the molecular machinery for embryonic patterning is common to all animal embryos. In 1984 Edward De Robertis, together with his close colleague Walter Gehring, isolated the first vertebrate development-controlling gene, now called Hox-C6. The conservation of Hox genes between vertebrates and fruit flies, which regulate the antero-posterior body axis, marked the beginning of the young scientific discipline of Evolution and Development, Evo-Devo. In the 1990s De Robertis carried out the systematic dissection of the molecular mechanisms that mediate embryonic induction. In 1924 Hans Spemann and Hilde Mangold identified a region of the amphibian embryo that was able to induce the formation of Siamese twins after transplantation. De Robertis isolated genes expressed in this region. He discovered Chordin, a

protein secreted by dorsal cells that binds Bone Morphogenetic Protein (BMP) growth factors, facilitating their transport to the ventral side of the embryo, where Chordin is digested by a protease so that BMPs can signal. This flow of growth factors determines dorsal (back) to ventral (belly) cell and tissue differentiations in many bilateral animals, such as fruit flies, spiders, early chordates and mammals. Recently, his laboratory is studying the close relationship between the Wnt signaling pathway, multivesicular endosomes and protein degradation. In sum, De Robertis has been a pioneer in the remarkable current realization that the molecular mechanisms of antero-posterior and dorsal-ventral patterning are common to all animal embryos. This use of conserved gene networks during development has channeled the outcomes of evolution by Natural Selection arising from *Urbilateria*, the last common ancestor of vertebrates and invertebrates.

Main publications De Robertis, E.M. and Gurdon, J.B. (1977). Gene Activation in somatic nuclei after injection into amphibian oocytes. *Proc. Natl. Acad. Sci. USA* 74, 2470-2474. Carrasco, A.E., McGinnis, W., Gehring, W.J. and De Robertis, E.M. (1984). Cloning of a *Xenopus laevis* gene expressed during early embryogenesis that codes for a peptide region homologous to Drosophila homeotic genes: implications for vertebrate development, *Cell* 37, 409-14; Sasai, Y., Lu, B., Steinbeisser, H., Geissert, D., Gont, L.K. and De Robertis, E.M. (1994), *Xenopus* chordin: a novel dorsalizing factor activated by organizer-specific homeobox genes, *Cell* 79, 779-90; Piccolo, S., Sasai, Y., Lu, B. and De Robertis, E.M. (1996), Dorsoventral patterning in *Xenopus*: Inhibition of ventral signals by direct binding of Chordin to BMP-4, *Cell* 86, 589-98; Bouwmeester, T., Kim, S.H., Sasai, Y., Lu, B. and De Robertis, E.M. (1996), Cerberus, a head-inducing secreted factor expressed in the anterior endoderm of Spemann's Organizer, *Nature* 382, 595-601; Piccolo, S., Agius, E., Lu, B., Goodman, S., Dale, L. and De Robertis, E.M. (1997), Cleavage of Chordin by the Xolloid metalloprotease suggests a role for proteolytic processing in the regulation of Spemann organizer activity, *Cell* 91, 407-16; Reversade, B. and De Robertis, E.M. (2005), Regulation of ADMP and BMP2/4/7 at opposite embryonic poles generates a self-regulating morphogen field, *Cell* 123, 1147-60; Lee, H.X., Ambrosio, A.L., Reversade, B. and De Robertis, E.M. (2006), Embryonic dorsal-ventral signaling: secreted Frizzled-related proteins as inhibitors of Tolloid proteinases, *Cell* 124, 147-59; Fuentealba, L.C., Eivers, E., Ikeda, A., Hurtado, C., Kuroda, H., Pera, E.M., and De Robertis, E.M. (2007), Integrating patterning signals: Wnt/GSK3 regulates the duration of the BMP/Smad1 signal, *Cell* 131, 980-

93; De Robertis, E.M. (2008), Evo-Devo: Variations on Ancestral themes, *Cell* 132, 185-95; Taelman, V.F., Dobrowolski, R., Plouhinec, J.L., Fuentealba, L.C., Vorwald, P.P., Gumper, I., Sabatini, D.D. and De Robertis, E.M. (2010). Wnt signaling requires the sequestration of Glycogen Synthase kinase 3 inside multivesicular endosomes. *Cell* 143, 1136-1148. Dobrowolski, R., Vick, P., Ploper, D., Gumper, I., Snitkin, H., Sabatini, D.D. and De Robertis, E.M. (2012). Presenilin deficiency or lysosomal inhibition enhance Wnt signaling through relocalization of GSK3 to the late endosomal compartment. *Cell Reports* 2, 1316-1328.

Stanislas Dehaene



Date of Birth 12 May 1965

Place Roubaix (France)

Nomination 9 June 2008

Field Experimental Cognitive Psychology

Title Professor

Most important awards, prizes and academies Fanny Emden Prize, French Academy of Sciences (1996); Jean Rostand Award for the book *La Bosse des Maths* (1997); James S. McDonnell Centennial Fellowship (1999); Villemot Prize, French Academy of Sciences (1999); Jean-Louis Signoret Prize, IPSEN Foundation (2001); Boehringer-Ingelheim Prize, Federation of European Neuroscience Societies (2002); Pius XI Medal of The Pontifical Academy of Sciences (2002); Grand Prix de la Fondation Louis D. de l'Institut de France (with D. Le Bihan) (2003); Member of the Académie des sciences (2005); Grande médaille d'or, Association Arts-Sciences-Lettres (2007).

Summary of scientific research Stanislas Dehaene received his training in mathematics at the Ecole Normale Supérieure in Paris, then completed a PhD in cognitive psychology with Jacques Mehler, post-doctoral studies with Michael Posner, as well as neuronal modelling studies with Jean-Pierre Changeux. He has been working since 1997 at the Orsay brain imaging center near Paris (Service Hospitalier Frédéric Joliot of the Commissariat à l'Energie Atomique), where he has directed the Cognitive Neuroimaging Unit since 2001. In September 2005 he was elected full professor of the newly created chair of Experimental Cognitive Psychology at the Collège de France in Paris. Stanislas Dehaene's interests concern the cerebral bases of specifically human cognitive functions such as language, calculation, and reasoning. The team uses a variety of experimental methods, including mental chronometry in normal subjects, cognitive analyses of brain-lesioned patients, and brain-imaging studies with positron emission tomography, functional magnetic resonance imaging, and high-density recordings of event-related potentials. Formal models of minimal neuronal networks are also devised and simulated in an attempt to throw some links between molecular, physiological, imaging, and behavioural data. Stanislas Dehaene's main

scientific contributions include the study of the organization of the cerebral system for number processing. Using converging evidence from PET, ERPs, fMRI, and brain lesions, Stanislas Dehaene demonstrated the central role played by a region of the intraparietal sulcus in understanding quantities and arithmetic (the number sense). He was also the first to demonstrate that subliminal presentations of words can yield detectable cortical activations in fMRI, and has used these data to support an original theory of conscious and nonconscious processing in the human brain. With neurologist Laurent Cohen, he also studied the neural networks of reading and demonstrated the crucial role of the left occipito-temporal region in word recognition (the visual word form area).

Main publications *Articles:* Dehaene-Lambertz, G., & Dehaene, S. Speed and cerebral correlates of syllable discrimination in infants, *Nature*, 370, 292-5, 1994; Dehaene, S., Naccache, L., Le Clec'h, G., Koechlin, E., Mueller, M., Dehaene-Lambertz, G., Van de Moortele, P.F., & Le Bihan, D., Imaging unconscious semantic priming, *Nature*, 395, 597-600, 1998; Dehaene, S., Le Clec'h, G., Cohen, L., Van de Moortele, E., & Le Bihan, D., Inferring behaviour from functional brain images, *Nature Neuroscience*, 1, 549-50, 1998; Dehaene, S., Kerszberg, M., & Changeux, J.P., A neuronal model of a global workspace in effortful cognitive tasks, *Proceedings of the National Academy of Sciences, USA*, 95, 14529-34, 1998; Dehaene, S., Spelke, L., Pinel, P., Stanescu, R., Tsivkin, S., Sources of mathematical thinking: behavioral and brain-imaging evidence, *Science*, 284, 970-4, 1999; Dehaene, S., Naccache, L., Cohen, L., Le Bihan, D., Mangin, J.F., Poline, J.B., & Riviere, D., Cerebral mechanisms of word masking and unconscious repetition priming, *Nature Neuroscience*, 4, 752-8, 2001; Simon, O., Mangin, J.F., Cohen, L., Bruandet, M., Pinel, P., Hennel, F., Poline, J.B., Bihan, D.L., & Dehaene, S., Topographical arrangement of hand, eye, calculation, and language related areas in the human intraparietal sulcus, *Neuron*, 33, 475-87, 2001; Dehaene-Lambertz, G., Dehaene, S., Hertz-Pannier, L., Functional neuroimaging of speech perception in infants, *Science*, 2002, 298, 2013-5; Pica, P., Lemer, C., Izard, V., Dehaene, S., Exact and approximate arithmetic in an Amazonian indigene group, *Science*, 2004, 306, 499-503; Sergent, C., Baillet, S., Dehaene, S., Timing of the brain events underlying access to consciousness during the attentional blink, *Nature Neuroscience*, 2005, 8, 1391-1400. *Books:* Dehaene, S. (Ed.) *Numerical Cognition*, Oxford, Blackwell, 1992; Dehaene, S. (Ed.) *Le cerveau en action: l'imagerie cérébrale en psychologie cognitive*, Paris, Presses Universitaires de France, 1997; Dehaene, S. *La Bosse des Maths*, Paris, Editions Odile Jacob, 1997; Dehaene, S. *The number sense*, New York, Oxford University Press, 1997; Cambridge (UK), Penguin Press, 1997; Dehaene, S. (Ed.) *The cognitive neuroscience of consciousness*, Cambridge, MIT Press, 2002.

Manfred Eigen



Date of Birth 9 May 1927

Place Bochum (Germany)

Nomination 12 May 1981

Field Physical Chemistry

Title Professor, Nobel laureate in Chemistry, 1967

Eigen

Most important awards, prizes and academies *Awards:* Nobel Prize in Chemistry (1967); Otto-Hahn-Prize; Linus Pauling Medal; Carus Medal; Palmes Académiques; Ordre pour le mérite; Paul Ehrlich/Ludwig Darmstädter Prize; Paracelsus Medal; Keilin Medal; Faraday Medal; Helmholtz Medal; Diesel Medal, Küpfmüller Ring. *Honorary Degrees:* Washington (St. Louis), Harvard, Chicago, Nottingham, Jerusalem, Hull, Bristol, Cambridge, Debrecen, München, Bielefeld, Utah, Alicante. *Academies:* Deutsche Akademie der Naturforscher, Halle; Akademie der Wissenschaften, Göttingen; Bayerische Akademie der Wissenschaften, München; Berlin-Brandenburgische Akademie der Wissenschaften; Honorary member, Österreichische Akademie der Wissenschaften; Royal Society, London; Honorary member, Weizmann Institute of Sciences; Royal Danish Academy of Sciences; Institut de France, Paris; Académie Royale de Belgique; Honorary member, Hungarian Academy of Sciences; Pontifical Academy of Sciences; Russian Academy of Sciences; American Philosophical Society, Philadelphia; National Academy of Sciences, USA; American Academy of Arts and Sciences; Honorary member, New York Academy of Sciences; Honorary member, European Academy of Arts and Sciences.

Summary of scientific research The mechanisms of biochemical reactions (enzyme kinetics, code reading, biopolymerization); the origins and evolution of life (theory and experiments); evolutionary biotechnology.

Main publications Eigen, M., Über die Kinetik sehr schnell verlaufender Ionenreaktionen in wässriger Lösung, *Z. phys. Chem. N.F.*, 1, p. 176 (1954); Eigen, M., Methods for Investigation of Ionic Reactions in Aqueous Solutions with Half Times as Short as 10^{-9} sec., *Disc. Farad. Soc.*, 17, p. 194 (1954); Eigen, M., Proton Transfer, Acid-Base Catalysis, and Enzymatic Hydrolysis,

Angew. Chem. Intern. Ed., 3, pp. 1-19 (1964); Eigen, M., Kinetics of reaction control and information transfer in enzymes and nucleic acids. Nobel Symp. 5 on Fast Reactions and Primary Processes, *Chem. Kinetics* (Stig Claesson, ed.), Almquist & Wiksell, Stockholm, *Intersci. Publ.*, p. 333 (1968); Eigen, M., Die "unmeßbar" schnellen Reaktionen Nobelvortrag, *Les Prix Nobel en 1967*, p. 151 (1968); Eigen, M., Selforganization of Matter and the Evolution of Biological Macromolecules, *Naturwissenschaften*, 58, p. 465 (1971); Eigen, M., Das Spiel – Naturgesetze steuern den Zufall, Piper-Verlag, München 1975 (with Winkler-Oswatitsch, R.), *Laws of the Game – How the Principles of Nature Govern Chance*, Alfred A. Knopf (New York, 1981) (with Winkler-Oswatitsch, R.); Eigen, M., The Hypercycle, "A Principle of Natural Self-Organization", *Naturwissenschaften*, 64, pp. 541-65 (1977), 65, pp. 7-41 and 65, pp. 341-69 (1978) (with Schuster, P.); Eigen, M., Die Kunst zu Titrieren. Vom klassischen Endpunktverfahren zur modernen differentiellen und dynamischen Analyse, *Angew. Chem.*, 91, pp. 20-51 (1979) (with Winkler-Oswatitsch, R.); Eigen, M., Evolutionary Molecular Engineering Based on RNA Replication, *Pure & Appl. Chem.*, 56, pp. 967-978 (1984) (with Gardiner, W.); Eigen, M., *Stufen zum Leben. Die frühe Evolution im Visier der Molekularbiologie*, R. Piper-Verlag, München (1987), *Steps towards Life, A Perspective on Evolution*, Oxford University Press (Oxford, 1992), pp. 173 (with Winkler-Oswatitsch, R.); Eigen, M., The Molecular Quasispecies, *Adv. Chem. Phys.*, 75, Ch. 4, pp. 149-263 (1987) (with McCaskill, J.S. and Schuster, P.); Eigen, M., Sequence Space and Quasispecies Distribution, *RNA Genetic* (Domingo, E., Holland, J.J. und Ahlquist, P., Hrsg.), vol. III, *Variability of RNA Genomes*, pp. 211-45, CRC Press, Boca Raton, FL (1988) (with Biebricher, C.K.); Eigen, M., Statistical Geometry in Sequence Space: A Method of Quantitative. Comparative Sequence Analysis, *Proc. Natl. Acad. Sci. USA*, 85, pp. 5913-7 (1988) (with Winkler-Oswatitsch, R. and Dress, A.); Eigen, M., *Perspektiven der Wissenschaften*, Deutsche Verlagsanstalt, Stuttgart, p. 288, S. (1988); Eigen, M., How Old Is the Genetic Code? Statistical Geometry of tRNA Provides an Answer, *Science*, 244, pp. 673-9 (1989) (with Lindemann, B.F., Tietze, M., Winkler-Oswatitsch, R., Dress, A. and von Haeseler, A.); Eigen, M., The Hypercycle, Coupling of RNA and Protein Biosynthesis in the Infection Cycle of an RNA Bacteriophage, *Biochem.*, 10, pp. 11005-18 (1991) (with Biebricher, C.K., Gebinoga, M. and Gardiner, W.C.); Eigen, M., The Fifth Paul Ehrlich Lecture, Virus Strains as Models of Molecular Evolution, *Medicin. Res. Rev.*, 13, pp. 385-9 (1993); Eigen, M., Sorting single molecules: Application to diagnostic

and evolutionary biotechnology, *Proc. Natl. Acad. Sci. USA*, 91, pp. 5740-7 (1994) (with Rigler, R.); Eigen, M., Quasispecies: The concept and the word, *Molecular Basis of Viral Evolution* (A. Gibbs, C.H. Calisher, eds), pp. 181-91, Cambridge University Press, Cambridge (1995) (with Domingo, E., Holland, J., Biebricher, C.); Eigen, M., *Die 'unmeßbar' schnellen Reaktionen. Frühe Arbeiten (1954-1967)*. Mit einem Vorw. und Einf. von R. Winkler-Oswatitsch. Ostwalds Klassiker der exakten Wissenschaften Band 281, Verlag Harri Deutsch, Frankfurt am Main (1996); Eigen, M., Detection of HIV-1 RNA by nucleic acid sequence-based amplification combined with fluorescence correlation spectroscopy, *Proc. Natl. Acad. Sci. USA*, 93, pp. 12811-6 (1995) (with Oehlschläger, F. and Schwille, P.); Eigen, M., Prionics or the kinetic basis of prion diseases, *Biophysical Chemistry*, 63, (1996) A1-A18 – M. Eigen; Eigen, M., Rapid assay processing by integration of dual-color fluorescence cross-correlation spectroscopy: High throughput screening for enzyme activity, *Proc. Natl. Acad. Sci. USA*, 95, pp. 1421-6 (1998) (Koltermann, A., Kettling, U., Bieschke, J., Winkler, T., Eigen, M.); Eigen, M., BSE und das Prionen-Problem, *Spektrum der Wissenschaft*, 4, pp. 40-9 (2001).

Gerhard L. Ertl



Date of Birth 10 October 1936

Place Stuttgart (Germany)

Nomination 19 January 2010

Field Physical Chemistry

Title Professor, Nobel laureate in Chemistry, 2007

Most important awards, prizes and academies *Honorary Memberships:* 2009, Deutscher Hochschulverband; 2008, Dechema (German Society of Chemical Technology); 2008, GDCh (German Chemical Society); 2008, Berliner Wissenschaftliche Gesellschaft; 2008, European Academy of Sciences and Art; 2008, Physikalischer Verein, Frankfurt a.M.; 2007, Royal Society of Chemistry; 2006, Deutsche Bunsengesellschaft für Physikalische Chemie; 1985, Honorary Fellow, Royal Society of Edinburgh. *Memberships:* 1993, Member, Berlin-Brandenburg Academy of Sciences; 1993, Foreign Honorary Member, American Academy of Arts and Sciences; 1992, Member, Academia Europaea; 1986, Member, German Academy of Sciences, "Leopoldina". *Corresponding memberships:* 2001, Austrian Academy of Sciences; 1998, Bavarian Academy of Sciences; 1993, Nordrhein.-Westfal. Academy of Sciences; 1986, Scientific Society of Braunschweig; 2002, Foreign Associate, National Academy of Sciences. *Dr. honoris causa:* 2009, Marie Curie-Sklodowska University, Lublin; 2009, Comenius University, Bratislava; 2009, Humboldt-Universität zu Berlin; 2008, Technische Universität München; 2008, Queen's University Belfast; 2003, University of Aarhus; 2003, Chalmers University of Technology, Goeteborg; 2003, University of Leuven; 2000, University of Münster; 1992, Ruhr-University of Bochum. *Awards:* 2008, Diesel Gold Medal, Deutsches Institut für Erfindungswesen; 2008, Nicolaus Copernicus Medal, Polish Academy of Sciences; 2008, Großes Bundesverdienstkreuz mit Stern, President of the Federal Republic of Germany; 2008, Verdienstmedaille, Land Baden-Württemberg; 2007, Nobel Prize in Chemistry, The Nobel Prize Foundation; 2007, Otto-Hahn-Preis, Gesellschaft Deutscher Chemiker, Deutsche Physikalische Gesellschaft, & the City of Frankfurt/M; 2007, Gold Medal, Slovak Chemical Society;

2007, Baker Lectureship, Cornell University, Ithaca (NY); 2007, Faraday Lectureship, Royal Society of Chemistry; 2006, Guptill Lecture, Dalhousie University, Halifax; 2005, Angström Lecture, University of Uppsala; 2005, Linus Pauling Lecture, California Institute of Technology; 2002, FMC Lectureship Princeton University; 2002, Karl Ziegler Visiting Professor, Max Planck Institute Mulheim; 2002, Spiers Memorial Medal and Lectureship, Royal Society of Chemistry; 2001, G.F. Smith Lecture, University of Illinois, Urbana; 2001, Kelly Lecture, Purdue University; 2001, Schuit Lecture, Technical University of Eindhoven; 2001, Pitzer Lecture, University of California, Berkeley; 1999, Roessler Lectureship, Cornell University; 1999, Le Bel Lecture, Université de Strasbourg; 1999, Debye Lecture, Universiteit Utrecht; 1998, Wolf Prize in Chemistry, Wolf Foundation; 1998, Karl Ziegler Prize, German Chemical Society; 1998, Francois Gault Lectureship, European Catalysis Society; 1998, M. Curie Lectureship, Polish Chemistry Society; 1997, Laird Lecture, University of British Columbia; 1997, A.D. Little Lectureship, Massachusetts Institute of Technology; 1996, Honorary Professor, Humboldt University, Berlin; 1996, Carl Engler Medal, German Scientific Society for Coal and Petroleum Research (DGMK); 1996, Merck Lecture, Rutgers University; 1996, Brdicka Lecture, Czech Academy of Sciences; 1995, Medard W. Welch Award, American Vacuum Society; 1995, Stauffer Lecture, University of Southern California; 1994, Rolf Sammet Visiting Professor, University of Frankfurt; 1992, Hewlett-Packard Europhysics Prize, European Physical Society; 1992, Japan Prize, Science and Technology Foundation of Japan; 1992, Bunsen Medal, German Bunsen Society for Physical Chemistry; 1992, Großes Bundesverdienstkreuz, President of the Federal Republic of Germany; 1992, Koltthoff Lectureship, University of Minnesota; 1992, Kaufman Memorial Lecture, University of Pittsburgh; 1991, Leibniz Prize, German Science Foundation; 1991, Bourke Medal and Lectureship, Royal Society of Chemistry; 1990, Alwin Mittasch Medal, German Federation of Chemical Engineers (DECHEMA); 1990, Dow Lectureship, University of Western Ontario; 1990, Coover Lecture, Iowa State University; 1989, Frontiers in Chemical Research Lectureship, Texas A&M University; 1988, William Draper Harkins Lecture, University of Chicago; 1988, Barre Lecture, University of Montreal; 1987, Liebig Medal, German Chemical Society; 1986, Honorary Professor, Free University of Berlin; 1986, Honorary Professor, Technical University of Berlin; 1986, Langmuir Lecture, American Chemical Society; 1985, C.F. Gauss Medal, Scientific Society of Braunschweig; 1985, Centenary Medal and Lectureship, Royal Society of Chemistry; 1985, C.G.A. Schuit Lecture,

University of Delaware; 1984, FECS Lecture, Federation of European Chemical Societies; 1984, Industry Lecture, Norwegian Chemical Society; 1979, Paul H. Emmett Award in Fundamental Catalysis, American Catalysis Society; 1979, E.W. Müller Award, University of Wisconsin-Milwaukee; 1977, Frank Ciapetta National Lectureship, American Catalysis Society; 1976, Sherman Fairchild Distinguished Scholar, California Institute of Technology. Other distinctions: 2009, Gerhardt Ertl Young Investigator Award (German Physical Society); 2008, Gerhard Ertl Building (Faculty of Chemistry & Pharmacy, Ludwig-Maximilians-Universität, Munich); 2008, Gerhard Ertl Lecture Award (jointly instituted by FHI, FUB, HUB, TUB); 2008, Integrierte Gesamtschule Gerhard Ertl, Sprendlingen/Rheinhausen; 2008, Ehrenmitglied, Berliner Oratorien-Chor; 2008, Ertl Center for Electrochemistry and Catalysis (Gwangju Institute of Science and Technology, S. Korea).

Summary of scientific research Gerhard Ertl is known for determining the detailed molecular mechanisms of the catalytic synthesis of ammonia over iron (Haber Bosch process) and the catalytic oxidation of carbon monoxide over platinum (catalytic converter). During his research he discovered the important phenomenon of oscillatory reactions on platinum surfaces and, using photoelectron microscopy, was able to image for the first time, the oscillating changes in surface structure and coverage that occur during reaction. He always used new observation techniques like low-energy electron diffraction (LEED) at the beginning of his career, later ultraviolet photoelectron spectroscopy (UPS) and scanning tunneling microscope (STM) yielding ground breaking results. He won the Wolf Prize in Chemistry in 1998 along with Gabor A. Somorjai of the University of California, Berkeley for "their outstanding contributions to the field of the surface science in general and for their elucidation of fundamental mechanisms of heterogeneous catalytic reactions at single crystal surface in particular". Gerhard Ertl was awarded the 2007 Nobel Prize in Chemistry for his studies of chemical processes on solid surfaces.

Main publications Ertl, G., Reaktionen an Oberflächen: vom Atomaren zum Komplexen (Nobel-Vortrag), *Angew. Chem.* 120, 3578-90 (2008); Reactions at Surfaces: From Atoms to Complexity (Nobel Lecture), *Angew. Chem. Int. Ed.* 47, 3524-35 (2008), Ertl, G., Activation of diatomic molecules at solid surfaces, *Phil. Trans. R. Soc. A* 363, 955-8 (2005); Ertl, G., Ammonia Synthesis – Heterogeneous, in Istvan T. Horváth (Ed.), *Encyclopedia of Catalysis*, 6 vol., John Wiley & Sons, Hoboken, NJ, 2003, Vol. 1, pp. 329-52, online in: I.T. Horváth, E. Iglesia, M.T. Klein, J.A. Lercher, A.J. Russell, E.I. Stiefel (eds), *Encyclopedia of Catalysis* www.mrw.interscience.wiley.com/encat/, John

Wiley & Sons, New York, 2002; Ertl, G., Heterogeneous catalysis on atomic scale, *J. Mol. Catal. A* 182-182, 5-16 (2002); Ertl, G., Spiers Memorial Lecture – Dynamics of surface reactions. Spiers Memorial Lecture. *Faraday Discuss.* 121, 1-15 (2002); Ertl, G., Heterogeneous catalysis on the atomic scale, *Chem. Rec.* 1, 33-45 (2001); Ertl, G., Heterogeneous catalysis on the atomic scale, *Chem. Rec.* 1, 33-45 (2001); Ertl, G., Heterogeneous catalysis: from “black art” to atomic understanding, in *Chemistry for the 21st Century* (eds), E. Keinan, I. Schechter, Wiley-VCH, Weinheim-New York 2001, 54-69; Ertl, G., Dynamics of reactions at surfaces, *Adv. Catal.* 45, 1-69 (2000); Ertl, G., and T. Gloyna, Katalyse: Vom Stein der Weisen zu Wilhelm Ostwald, *Z. Phys. Chem.* 217, 1207-19 (2003); Ertl, G., H. Knözinger, F. Schüth, and J. Weitkamp (eds), *Handbook of Heterogeneous Catalysis*, 2nd Edition, 8 Volumes, Wiley-VCH, Weinheim 2008 (includes: Ertl, G., Dynamics of surface reactions, pp. 1462-79; Ertl, G., Non-linear dynamics: Oscillatory kinetics and spatio-temporal pattern formation, pp. 1492-1516).

Albert Eschenmoser



Date of Birth 5 August 1925

Place Erstfeld (Switzerland)

Nomination 9 June 1986

Field Organic Chemistry

Title Emeritus Professor

Most important awards, prizes and academies *Awards:* Benoist Prize, Swiss Gov. (1973); Welch Award, R.A. Welch Foundation, Houston, TX (1974); Cope Award, Amer. Chem. Soc. (1984); Wolf Prize in Chemistry, Israel Gov. (1986); Paracelsus Prize, Swiss Chem. Soc. *Academies:* Akademie der Naturforscher Leopoldina, Halle, Germany; Pontifical Academy of Sciences; Academia Europaea; American Academy of Arts and Sciences, Boston, MA; National Academy of Sciences, Washington, DC; Royal Society, London; Akademie der Wissenschaften, Göttingen, Germany; Croatian Academy of Arts and Sciences. Ordre 'Pour le mérite', Berlin, Germany; Österreichisches Ehrenzeichen für Wissenschaft und Kunst, Wien, Austria.

Summary of scientific research *A. Reaction mechanism and reaction stereochemistry:* Early experimental and theoretical studies relevant to terpene biosynthesis on the course and stereochemistry of acid-catalyzed cyclizations of terpenoid polyenes (biogenetic isoprene rule, together with L. Ruzicka, 1953); the stereochemical interpretation of the biogenetic isoprene rule, together with D. Arigoni and L. Ruzicka (1955); the experimental demonstration of strain release control of the oxidation of alcohols with chromic acid (1955) and of stereoelectronic control of SN_2 - reactions (1970); experimental and theoretical studies on nitrogen inversion (1969). *B. Chemical synthesis:* development of new reactions and reagents: Introduction of heterocyclic fragmentation reactions into organic synthesis (1952); epoxy-ketone \rightarrow alkinone-fragmentation (1967); amide acetal version of Claisen rearrangement (1969); methods for making C, C-bonds: enamino-iminoester condensations (1964), sulfide-contractions (1968), dimethyl-methylideneiminium iodide (1971) and α -Chloro-nitrone reactions (1972). *C. Chemical synthesis:* synthesis of complex natural products and related structures:

Synthesis of the alkaloid of the autumn crocus, Colchicin (1959); synthetic routes to corrins (1964, 1969); synthesis of vitamin B₁₂ (collaboratively with R.B. Woodward) (1972); synthetic studies related to the problem of vitamin B₁₂ biosynthesis (1980). *D. Contemporary studies*: Chemical etiology of nucleic acid structure; experimental and theoretical studies relevant to the problem of designing chemical models of biogenesis.

Main publications Eschenmoser, A., *Zur säurekatalysierten Zyklisierung bei Mono- und Sesquiterpenverbindungen*, Promotionsarbeit Nr 2018, ETH Zürich 1951; Eschenmoser, A., Ruzicka, L., Jeger, O. and Arigoni, D., Zur Kenntnis der Triterpene. Eine stereochemische Interpretation der biogenetischen Isoprenregel bei den Triterpenen, *Helv. Chim. Acta*, 38, p. 1890 (1955); Stadler, P.A., Nechtatal, A., Frey, A.J. and Eschenmoser, A., Untersuchungen über den sterischen Verlauf säurekatalysierter Cyclisationen bei terpenoiden Polyenverbindungen, *Helv. Chim. Acta*, 40, p. 1373 (1957); Schreiber, J., Leimgruber, W., Pesaro, M., Schudel, P., Threlfall, T. and Eschenmoser, A., Synthese des Colchicins, *Helv. Chim. Acta*, 44, p. 540 (1961); Bertele, E., Boos, H., Dunitz, J.D., Elsinger, F., Eschenmoser, A., Felner, I., Gribi, H.P., Gschwend, H., Meyer, E.F., Pesaro, M. and Scheffold, R., Ein synthetischer Zugang zum Corrinssystem, *Angew. Chem.*, 76, p. 393 (1964); Felix, D. and Eschenmoser, A., Language Inversion am pyramidal gebundenen Stickstoff: Isolierung von diastereomeren 7-Chlor-7-azabicyclo (4.1.0) heptanen bei Raumtemperatur, *Angew. Chem.*, 80, p. 197 (1968); Yamada, Y., Miljkovic, D., Wehrli, P., Golding, B., Löliger, P., Keese, R., Müller, K. and Eschenmoser, A., Ein neuer synthetischer Zugang zum Corrinssystem, *Angew. Chem.*, 81, p. 301 (1969); Tenud, L., Farooq, S., Seibl, J. and Eschenmoser, A., Endocyclische S_N-Reaktionen am gesättigten Kohlenstoff, *Helv. Chim. Acta*, 53, p. 2059 (1970); Eschenmoser, A., Roads to Corrins (Centenary Lecture), *Quart. Revs.*, 24, p. 366 (1970); Eschenmoser, A., Post-B₁₂ Problems in Corrin Synthesis, *Chem. Soc. Revs.*, 5, p. 377 (1976); Eschenmoser, A., Organische Naturstoffsynthese heute. Vitamin B₁₂ als Beispiel, *Naturwiss*, 61, p. 513 (1974), erweiterte Version in Englisch: Eschenmoser, A. and Wintner, C.E., Natural Product Synthesis and Vitamin B₁₂, *Science*, 196, p. 1410 (1977); Pfaltz, A., Juan, B., Fässler, A., Eschenmoser, A., Jaenchen, R., Gilles, H.H., Diekert, G. and Thauer, R.K., Zur Kenntnis des Faktors F430 aus methanogenen Bakterien: Struktur des porphinoïden Ligandsystems, *Helv. Chim. Acta*, 65, p. 828 (1982); Eschenmoser, A., Chemistry of Corphinoïds, *Ann. N.Y. Acad. Sci.*, 471, p. 108 (1986); Eschenmoser, A., Vitamin B₁₂: Experimente zur Frage nach dem Ursprung seiner molekularen Struktur, *Angew. Chem.*, 100, p. 5 (1988); Eschenmoser, A., Chemical Etiology of Nucleic Acid Structure, *Science*, 284, p. 2118 (1999).

José G. Funes, S.J.



Date of Birth 31 January 1963

Place Córdoba (Argentina)

Nomination 5 August 2006

Field Sciences of the Universe

Title Professor

Most important awards, prizes and academies Argentine Astronomical Society; American Astronomical Society; International Astronomical Union; Pontifical Academy of Sciences.

Summary of scientific research José Funes specialises in extragalactic astronomy. His field of research includes the kinematics and dynamics of disk galaxies and star formation in nearby galaxies. For his doctoral thesis he studied kinematic properties of the ionized-gas component in their inner regions of disk galaxies. The analysis of the emission lines for each galaxy allowed the identification of galaxies which are good candidates to host a supermassive black hole, which in the standard paradigm are believed to be nearly ubiquitous in galaxy centres. He has studied the correlations between supermassive black-hole masses and global properties of disk galaxies. He is currently studying one of the major problems in Astrophysics, the understanding of galaxy formation. In this process, the history of the star formation rate in the universe plays a very important role. Funes is a member of a team that is conducting a deep imaging survey using the Vatican Telescope in Arizona. These data in combination with GALEX observations (Galaxy Evolution Explorer, one of NASA's space telescope) will provide in-depth information on the distributions of local star formation in terms of galaxy types, luminosities, and interstellar environments, and provide critical tests of the methodology used in constructing the history of the star formation rate in the local universe. In addition, he studies star formation in satellite galaxies and elliptical galaxies with dust lanes. The formation and evolution of early-type galaxies is not completely understood yet. The study of ionized-gas distribution and star formation properties in elliptical galaxies with dust lanes can shed light on the formation process of early-type galaxies.

Main publications Lapasset E., Funes J.G., The peculiar behaviour of the photometric variability of V508 Ophiuchi, 1985, *Ap&SS*, 113, 83; Vega Beltrán J.C., Zeilinger W.W., Amico P., Schultheis M., Corsini E.M., Funes J.G., Beckman J., Bertola F., Mixed early and late-type properties in the bar of NGC 6221: Evidence for evolution along the Hubble sequence?, 1998, *A&AS*, 131, 105; Corsini E.M., Pizzella A., Funes J.G., Vega Beltrán J.C., Bertola F., The circumnuclear ring of ionized gas in NGC 3593, 1998, *A&A*, 337, 80; Bertola F., Cappellari M., Funes J.G., Corsini E.M., Pizzella A., Vega Beltrán J.C., Circumnuclear Keplerian Disks in Galaxies, 1998, *ApJ*, 509, L93; Corsini E.M., Pizzella A., Sarzi M., Cinzano P., Vega Beltrán J.C., Funes J.G., Bertola F., Persic M., Salucci P., Dark matter in early-type spiral galaxies: the case of NGC 2179 and of NGC 2775, 1999, *A&A*, 342, 671; Bertola F., Corsini E.M., Vega Beltrán J.C., Pizzella A., Sarzi M., Cappellari M., Funes J.G., The Bulge-Disk Orthogonal Decoupling in Galaxies: NGC 4698, 1999, *ApJ*, 519, L127, Sarzi M., Corsini E.M., Pizzella A., Vega Beltrán J.C., Cappellari M., Funes J.G., Bertola F., NGC 4672: A new case of an early-type disk galaxy with an orthogonally decoupled core, 2000, *A&A*, 360, 439; Funes J.G., Corsini E.M., Galaxy Disks and Disk Galaxies, 2000, *PASP*, 112, 1510, Funes J.G., Corsini E.M., Galaxy Disks and Disk Galaxies, 2001, *ASP Conf. Ser.* 230; Sarzi M., Bertola F., Cappellari M., Corsini E.M., Funes J.G., Pizzella A., Vega Beltrán J.C., The Orthogonal Bulge-Disk Decoupling in NGC 4698, 2001, *Ap&SS*, 276, 467, Vega Beltrán J.C., Zeilinger W.W., Pizzella A., Corsini E.M., Bertola F., Funes J.G., Beckman J.E., Kinematics of Gas and Stars in 20 Disc Galaxies, 2001, *Ap&SS*, 276, 1201; Pignatelli E., Vega Beltrán J.C., Beckman J.E., Corsini E.M., Pizzella A., Scarlata C., Bertola F., Funes J.G., Zeilinger, W.W., Modeling gas and stellar kinematics in disc galaxies, 2001, *Ap&SS*, 277, 493; Funes, J.G., Kinematics of the Ionized Gas in the Inner Regions of Disk Galaxies, 2001, *PASP*, 113, 257; Pignatelli E., Vega Beltrán J.C., Beckman J.E. Corsini E.M., Pizzella A., Scarlata C., Bertola F., Funes, J.G., Zeilinger, W.W., Modelling gaseous and stellar kinematics in the disc galaxies NGC 772, 3898 and 7782, 2001, *MNRAS*, 323, 188; Vega Beltrán J.C., Pizzella A., Corsini E.M., Funes J.G., Zeilinger W.W., Beckman J.E., Bertola F., Kinematic properties of gas and stars in 20 disc galaxies, 2001, *A&A*, 374, 394, Funes J.G., Corsini E.M., Cappellari M., Pizzella A., Vega Beltrán J.C., Scarlata C., Bertola F., Position-velocity diagrams of ionized gas in the inner regions of disk galaxies, 2002, *A&A*, 388, 50; Minniti D., Rejkuba M., Funes J.G., Akiyama S., Optical Counterparts of X-Ray Point Sources Observed by

Chandra in NGC 5128: 20 New Globular Cluster X-Ray Sources, 2004, *ApJ*, 600, 716; Coccato L., Corsini E.M., Pizzella A., Morelli L., Funes J.G., Bertola F., Minor-axis velocity gradients in disk galaxies, 2004, *A&A*, 416, 507; Minniti D., Rejkuba M., Geisler D., Funes J.G., Centaurus A: VLT Views of the Nearest Giant Elliptical Galaxy, 2004, *Ap&SS*, 290, 363, Minniti D., Rejkuba M., Funes J.G., Kennicutt R.C., Jr., The Most Exciting Massive Binary Cluster in NGC 5128: Clues to the Formation of Globular Clusters, 2004, *ApJ*, 612, 215; Villegas D., Minniti D., Funes J.G., HST photometry of the binary globular cluster Sersic 13N-S in NGC 5128, 2005, *A&A*, 442, 437; Gutiérrez C.M., Alonso M.S., Funes, J.G., Ribeiro M.B., Star Formation in Satellite Galaxies, 2006, *AJ*, 132, 596.

Antonio García-Bellido



Date of Birth 30 April 1936

Place Madrid (Spain)

Nomination 24 June 2003

Field Molecular Biology

Title Professor

García-Bellido

Most important awards, prizes and academies *Awards:* Principe de Asturias de Investigación Científica, Spain (1984); Leopold Mayer de l'Academie des Sciences de Paris, France (1986); Santiago Ramón y Cajal National Prize for Scientific Research, Spain (1995); Severo Ochoa Chair in Biology, Section: Research abroad, Spain (1996); Comunidad Autónoma de Madrid Research Prize, Spain (1998); Rey Jaime I Research Medal, Valencia, Spain (1998); Encomienda con Placa de la Orden Civil de Alfonso X el Sabio (2005); Premio México de Ciencia y Tecnología (2006). *Academies:* Real Academia de Ciencias Exactas Físicas y Naturales, Spain (1984); Foreign Member, American Academy of Arts and Sciences, USA (1985); Foreign Member, Royal Society, London (1986); Foreign Member, Nat. Acad. of Sciences USA, Washington, DC (1987); Founder Member, Academia Europaea (1988); Foreign Member, Nat. Acad. of Sciences of France (1995); European Academy of Sciences (2004). *Honorary Degrees:* Academy of Sciences USSR, Moscow (1990); University of La Coruña, Spain (1996); University of Barcelona, Spain (1996); University of Oviedo, Spain (1997); University of Salamanca, Spain (1998); University of Elche, Alicante, Spain (2001).

Summary of scientific research The work of Antonio García-Bellido has been pioneer and prevalent in exploring an 'apogenetic' notion of Development: the genome, active in the individual cells, determines specific cell behaviour and this, in turn, the organization of cells in supracellular systems. The wealth of new ideas contributed by Antonio García-Bellido in the field of Developmental Biology is related with his outstanding experimental results in the studies of the genetic bases of cell recognition (1966-69); genetic mosaics and blastoderm maps (1968); clonal analysis of developing systems (1968-73) that lead him to the discovery of developmental compartments and the

theory of selector genes; somatic cell genetics (1970-76); genetic trans-regulation and syntagmas (1972-82); cell-cell interactions in Morphogenesis (1984-). Venation and cell proliferation control (1989-). His ideas and new approaches to the problem of Development have been followed and continued by numerous researchers all over the world mainly in Europe and the United States of America, prompting similar research studies in other animal groups, such as mammals, and plants. The present flourishing of the Molecular Genetics of Development in *Drosophila* is due, in a large extent, to the important work of Antonio García-Bellido that is already quoted and explained in text books (e.g. Genetics, Strickberger, Molecular Biology of the Cell, B. Alberts et al.). Some of his papers have been qualified as 'citation classics' by Current Contents and commented and praised by many colleagues in research papers, review articles and dedications of books.

Main publications García-Bellido, A., Larvalentwicklung transplantierter Organe von *Drosophila melanogaster* im Adultmilieu, *J. Ins. Physiol.*, 11, pp. 1071-8 (1965); García-Bellido, A., Pattern reconstruction by dissociated Imaginal Disk Cell of *Drosophila Melanogaster*, *Develop. Biol.*, 14, pp. 278-306 (1966); García-Bellido, A. and Merriam, J.R., Cell Lineage of the Imaginal Discs in *Drosophila Gynandromorphs*, *J. Exp. Zool.*, 170, pp. 61-76 (1969); García-Bellido, A. and Merriam, J.R., Parameters of the Wing Imaginal Disc Development of *Drosophila Melanogaster*, *Develop. Biol.*, 24, pp. 61-87 (1971); García-Bellido, A. and Merriam, J.R., Genetic Analysis of Cell Heredity in Imaginal Discs of *Drosophila Melanogaster*, *Proc. Natl. Acad. Sc. USA*, 68, pp. 2222-6 (1971); García-Bellido, A., Some Parameters of Mitotic Recombination in *Drosophila Melanogaster*, *Molec. Gen. Genetics*, 115, pp. 54-72 (1972); García-Bellido, A., *Pattern Formation in Imaginal Disks, Results and Problems in Cell Differentiation*, vol. 5, pp. 59-91 (H. Ursprung, R. Nothiger, eds), Springer-Verlag (Berlin, 1972); García-Bellido, A. and Santamaria, P., Developmental Analysis of the Wing Disc in the Mutant Engrailed of *Drosophila Melanogaster*, *Genetics*, 72, pp. 87-104 (1972); García-Bellido, A., Ripoll, P. and Morata, G., Developmental Compartmentalization of the Wing Disk of *Drosophila*, *Nature New Biology*, 245, pp. 251-3 (1973); Capdevila, M.P. and García-Bellido, A., Development and Genetic Analysis of Bithorax Phenocopies in *Drosophila*, *Nature*, 250, pp. 500-2 (1974); García-Bellido, A., Genetic Control of Wing Disc Development in *Drosophila*, *Cell Patterning*, Ciba Foundation Symposium 29, pp. 161-82, Elsevier (Amsterdam, 1975); García-Bellido, A. and Ripoll, P., The Number of Genes in *Drosophila Melanogaster*, *Nature*, 273, pp. 399-499

(1978); García-Bellido, A. and Moscoso del Prado, J., Genetic Analysis of Maternal Information in *Drosophila*, *Nature*, 278, pp. 346-8 (1979); García-Bellido, A., Genetic Analysis of the Achaete-Scute System of *Drosophila Melanogaster*, *Genetics*, 91, pp. 491-520 (1979); Capdevila, M.P. and García-Bellido, A., Genes Involved in the Activation of the Bithorax Complex of *Drosophila*, *Wilhelm Roux's Archiv.*, 190, pp. 339-50 (1981); García-Bellido, A. and Robbins, L.G., Viability of Female Germ-Line Cells Homozygous for Zygotic Lethals in *Drosophila Melanogaster*, *Genetics*, 103, pp. 235-47 (1983); Moscoso del Prado, J. and García-Bellido, A., Genetic Regulation of the Achaete-Scute Complex of *Drosophila Melanogaster*, *Roux's Arch. Dev. Biol.*, 193, pp. 242-5 (1984); Diaz-Benjumea, F.J. and García-Bellido, A., Genetics Analysis of the Wing Vein Pattern of *Drosophila*, *Roux's Arch. Dev. Biol.*, 198, pp. 336-54 (1990); Diaz-Benjumea, F.J. and García-Bellido, A., Behaviour of Cells Mutant for an EGF Receptor Homologue of *Drosophila* in Genetic Mosaics, *Proc. R. Soc. Lond. B*, 242, pp. 36-44 (1990); García-Bellido, A., Cortés, F. and Milán, M., Cell Interactions in the Control of Size in *Drosophila* Wings, *Proc. Natl. Acad. Sci. USA*, 91, pp. 10222-6 (1994); Milán, M., Campuzano, S. and García-Bellido, A., Cell Cycling and Patterned Cell Proliferation in the *Drosophila* Wing during Metamorphosis, *Proc. Natl. Acad. Sci. USA*, 93, pp. 11687-92 (1996); Cifuentes, F.J. and García-Bellido, A., Proximo-Distal Specification in the Wing Disc of *Drosophila* by the Nubbin Gene, *Proc. Natl. Acad. Sci. USA*, 94, pp. 11405-10 (1997); García-Bellido, A.C. and García-Bellido, A., Cell Proliferation in the Attainment of Constant Sizes and Shapes: the Entelechia Model, *Int. J. Dev. Biol.*, 42, pp. 353-62 (1998); Martin-Blanco, E., Pastor-Pareja J.C. and García-Bellido, A., JNK and Decapentaplegic Signaling Control Adhesiveness and Cytoskeleton Dynamics during Thorax Closure in *Drosophila*, *PNAS*, 97, n. 14, pp. 7667-8192 (2000); Baonza, A. and García-Bellido, A., Notch signaling directly controls cell proliferation in the *Drosophila* wing disc, *Proceedings of the National Academy of Sciences*, 97: 2609-14 (2000); Baena-López, L.A., Baonza, A. and García-Bellido, A., The Orientation of Cell Divisions Determines the Shape of *Drosophila* Organs, *Current Biology*, 15: 1640-4 (2005); Baena-López, L.A. and García-Bellido, A., Control of growth and positional information by the graded vestigial expression pattern in the wing of *Drosophila melanogaster*, *Proceedings of the National Academy of Sciences*, 103: 13734-9 (2006).

Takashi Gojobori



Date of Birth 24 October 1951

Place Fukuoka (Japan)

Nomination 5 September 2007

Field Evolutionary Genomics

Title Professor

Most important awards, prizes and academies Society Prize (Kihara Medal), The Genetic Society of Japan (2005); Society Prize (Motoo Kimura Medal), The Society of Evolutionary Studies, Japan (2004); The Gaetano Salvatore Gold Medal, Stazione Zoologica, Anton Dohrn, Italy (2004); Science Award from Japan Science and Technology Corporation (JST) (1997); Science Award from Hitoshi Kihara Memorial Foundation, Japan (1995); Promotion Award from Japanese Society of Genetics (1987). *Fellowships*: Visiting Research Fellow at Imperial Cancer Research Fund (ICRF) in London (1989); Fellow of American Association for the Advancement of Science (AAAS) (2006). *Academies and Professional organisations*: Foreign Honorary Member of the American Academy of Arts and Sciences (2006); Member of the Pontifical Academy of Sciences (2007); Vice-Chairman, The International Society of Molecular Evolution; Member, The American Society of Genetics; Member, The Society of Molecular Biology and Evolution; Member, The Japanese Society of Genetics; Member, The Japanese Society of Evolutionary Studies.

Summary of scientific research He has worked extensively on the rates of synonymous and nonsynonymous substitutions, positive selection, horizontal gene transfer, viral evolution, genomic evolution, and comparative gene expression. In recent years he has focused on the evolution of the brain and of the Central Nervous System. He has contributed to the DDBJ/GenBank/EMBL international nucleotide sequence database construction as well as the H-Invitational human gene database.

Main publications Jung Shan, H., Ohyanagi, H., Hayakawa, S., Osato, N., Nishimiya-Fujisawa, C., Ikeo, K., David, C., Fujisawa, T. and Gojobori, T. (2007), The evolutionary emergence of cell type specific genes inferred

from the gene expression analysis of hydra, *Proc. Natl. Acad. Sci. USA*. 104(37), 14735-40; The Rice Annotation Project: Ito, T. and Gojobori, T., *et al.* (2007), Curated Genome Annotation of *Oryza sativa ssp. Japonica* and Comparative Genome Analysis with *Arabidopsis thaliana*, *Genome Res.* 17(2), 175-83; Iwama, H., Gojobori, T., Itoh, T., Niimura, Y., Fujii, Y., Habara, T., Sakai, H., Sato, Y., Wilson, G., Kumar, K., McCouch, S., Juretic, N., Hoen, D., Wright, S., Bruskiwich, R., Bureau, T., Miyao, A., Hirochika, H., Nishikawa, T., Kadowaki, K. and Sugiura, M. (2005), The map-based sequence of the rice genome, *Nature* 436: 793-800; Nakamura, Y., Itoh, T., Matsuda, H. and Gojobori, T. (2004), Biased biological functions of horizontally transferred genes on 324,653 open reading frames of 116 prokaryotic complete genomes, *Nature Genetics* 36(7): 760-6; Iwama, H. and Gojobori, T. (2004), Highly conserved upstream sequences for transcription factor genes and implications for the regulatory network, *Proc. Natl. Acad. Sci. USA*. 101, 17156-61; Imanishi, T., other 152 authors, Gojobori, T., and Sugano S. (2004), Integrative annotation of 21,037 human genes validated by full-length cDNA clones, *PLoS Biol.* 2, 1-21; Andrews, T.D. and Gojobori, T. (2004), Strong positive selection and recombination drive the antigenic variation of the Pile protein of the human pathogen neisseria meningitidis, *Genetics* 166, 25-32; Anzai, T., Shiina, T., Kimura, N., Yanagiya, K., Kohara, S., Shigenari, A., Yamagata, T., Kulski, J.K., Naruse, T.K., Fujimori, Y., Fukuzumi, Y., Yamazaki, M., Tashiro, H., Iwamoto, C., Umehara, Y., Imanishi, T., Meyer, A., Ikeo, K., Gojobori, T., Bahram, S. and Inoko, H. (2003), Comparative sequencing of human and chimpanzee MHC class I regions unveils insertions/deletions as the major path to genomic divergence, *Proc. Natl. Acad. Sci. USA*. 100(13):7708-13; Nakazawa, M., Cebria, F., Mineta, K., Ikeo, K., Agata, K. and Gojobori, T. (2003), Search for the evolutionary origin of a brain. Planarian brain characterized by microarray, *Mol. Biol. Evol.* 20(5): 784-91; Mineta, K., Nakazawa, M., Cebria, F., Ikeo, K., Agata, K. and Gojobori, T. (2003), Origin and evolutionary process of CNS elucidated by comparative genomics analysis of planarian ESTs, *Proc. Natl. Acad. Sci. USA*. 100(13): 7666-71; Niimura, Y. and Gojobori, T. (2002), In silico chromosome staining: Reconstruction of Giemsa bands from the whole human genome sequence, *Proc. Natl. Acad. Sci. USA*. 99(2): 797-802; Tanaka, Y., Hanada, K., Mizokami, M., Yeo, A.E.T., Shih, J.W.-K., Gojobori, T. and Alter, H.J. (2002), A Comparison of the molecular clock of hepatitis c virus in the United States and Japan predicts that hepatocellular carcinoma incidence in the United States will increase over the next two decades,

Proc. Natl. Acad. Sci. USA. 99, 15584-9; Sasaki, T., Yamamoto, K., Sakata, K., Baba, T., Katayose, Y., Wu, J., Niimura Y., Cheng Z., Nagamura Y., Kanamori, H., Hosokawa, S., Masukawa, M., Arikawa, Antonio, B.A. and Gojobori, T. (2002), The genome sequence and structure of rice chromosome 1., *Nature* 420: 312-6; Fantom Consortium (Okazaki, Y., Gojobori, T., *et al.*), Riken Genome Exploration Research Group Phase I & II Team, Mouse Genome Sequencing Consortium, Scientific management: Y. Hayashizaki (2002). Analysis of the Mouse Transcriptome based on Functional Annotation of 60,770 full-length cDNAs, *Nature* 420: 563-73; RIKEN Genome Exploration Research Group Phase II Team and FANTOM Consortium (Okazaki, Y., Gojobori, T., *et al.*), General organizer: Y. Hayashizaki (2001). Functional annotation of a full-length mouse cDNA collection, *Nature* 409(6821): 685-90; International Human Genome sequencing Consortium (DNA sequence databases: DNA Data Bank of Japan *et al.*) (2001). Initial sequencing and analysis of the human genome, *Nature*, 409(6822): 860-921; Gaudieri, S., Dawkins, R.L., Habara, K., Kulski, J.K., and Gojobori, T. (2000), SNP profile within the human major histocompatibility complex reveals an extreme and interrupted level of nucleotide diversity, *Genome Res.* 10(10): 1579-86; Yamaguchi-Kabata, Y. and Gojobori, T. (2000), Reevaluation of amino acid variability of the human immunodeficiency virus type 1 gp120 envelope glycoprotein and prediction of new discontinuous epitopes, *J. Virology* 74(9):4335-50; Gaudieri, S., Kulski, J., Dawkins, R., and Gojobori, T. (1999), Different evolutionary histories in two subgenomic regions of the major histocompatibility complex, *Genome Res.* 9(6): 541-9; Bellgard, M. and Gojobori, T. (1999), Inferring the direction of evolutionary changes of genomic base composition, *Trends in Genetics* 15(7): 254-6; Itoh, T., Takemoto, K., Mori, H., and Gojobori, T. (1999), Evolutionary instability of operon structures disclosed by sequence comparisons of complete microbial genomes, *Mol. Biol. Evol.* 16(3): 332-46; Yamaguchi, Y. and Gojobori, T. (1997), Evolutionary mechanisms and population dynamics of the third variable envelope region of HIV within single hosts, *Proc. Natl. Acad. Sci. USA.* 94(4): 1264-9; Gojobori, T., Tateno, Y., and Ohta, T., ed. (1997), Special Issue: Networks and Evolution of Molecular Information, *J. Mol. Evol.*, Vol. 44. S1-S180; Endo, T., Ikeo, K., and Gojobori, T. (1996), Large-scale search for genes on which positive selection may operate, *Mol. Biol. Evol.* 13(5): 685-90; Miura, T., Fukunaga, T., Igarashi, T., Yamashita, M., Ido, E., Funahashi, S.-I., Ishida, T., Washio, K., Ueda, S., Hashimoto, K.-I., Yoshida, M., Osame, M., Singhal, B.S., Zaninovic, V., Cartier, L., Sonoda, S., Tajima,

K., Ina, Y., Gojobori, T., and Hayami, M. (1994), Phylogenetic subtypes of human T-lymphotropic virus type I and their relations to the anthropological background, *Proc. Natl. Acad. Sci. USA.* 91: 1124-7; Gojobori, T. and Ikeo, K. (1994), Molecular evolution of serine protease and its inhibitor with special reference to domain evolution, *Philos. Trans. R. Soc. Lond. B Biol. Sci.* 344(1310): 411-5; Gojobori, T., Moriyama, E.N., Ina, Y., Ikeo, K., Miura, T., Tsujimoto, H., Hayami, M., and Yokoyama, S. (1990), Evolutionary origin of human and simian immunodeficiency viruses, *Proc. Natl. Acad. Sci. USA.* 87(11): 4108-11; Orito, E., Mizokami, M., Ina, Y., Moriyama, E.N., Kame-shima, N., Yamamoto, M., and Gojobori, T. (1989), Host-independent evolution and a genetic classification of the hepadnavirus family based on nucleotide sequences, *Proc. Natl. Acad. Sci. USA.* 86(18): 7059-62; Tsujimoto, H., Hasegawa, A., Maki, N., Fukasawa, M., Miura, T., Speidel, S., Cooper, R.W., Moriyama, E.N., Gojobori, T., and Hayami, M. (1989), Sequence of a novel simian immunodeficiency virus from a wild-caught African mandrill, *Nature* 341(6242): 539-41; Gojobori, T. and Yokoyama, S. (1985), Rates of evolution of the retroviral oncogene of Moloney murine sarcoma virus and of its cellular homologues, *Proc. Natl. Acad. Sci. USA.* 82(12): 4198-201; Shimotohno, K., Takahashi, Y., Shimizu, N., Gojobori, T., Golde, D.W., Chen, I.S.Y., Miwa, M., and Sugimura, T. (1985), Complete nucleotide sequence of an infectious clone of human T-cell leukemia virus type II: An open reading frame for the protease gene, *Proc. Natl. Acad. Sci. USA.* 82(10): 3101-5; Gojobori, T. (1983), Codon substitution in evolution and the 'saturation' of synonymous changes, *Genetics* 105(4): 1011-27; Li, W.-H., Gojobori, T., and Nei, M. (1982), Reply on Goodman's comment 'Positive selection causes purifying selection', *Nature* 295: 630; Gojobori, T., Li, W.-H., and Graur, D. (1982). Patterns of nucleotide substitution in pseudo-genes and functional genes, *J. Mol. Evol.* 18(5): 360-9; Gojobori, T., Ishii, K., and Nei, M. (1982), Estimation of average number of nucleotide substitutions when the rate of substitution varies with nucleotide, *J. Mol. Evol.* 18(6): 414-23; Li, W.-H., Gojobori, T., and Nei, M. (1981), Pseudogenes as a paradigm of neutral evolution, *Nature* 292(5820): 237-9.

Theodor W. Hänsch



Date of Birth 30 October 1941

Place Heidelberg (Germany)

Nomination 15 May 2006

Field Physics

Title Professor, Nobel laureate in Physics, 2005

Most important awards, prizes and academies California Scientist of the Year, Calif. Museum of Science and Industry; Alexander von Humboldt Senior U.S. Scientist Award (1977); Cyrus B. Comstock Prize, U.S. National Academy of Science (1983); Herbert P. Broida Prize, American Physical Society (1983); William F. Meggers Award, Optical Society of America (1985); Michelson Medal, The Franklin Institute, Philadelphia (1986); Italgas Prize for Research and Innovation, Italgas, Torino (1987); Gottfried Wilhelm Leibniz Preis, Deutsche Forschungsgemeinschaft (1988); King Faisal International Prize for Science, Saudi Arabia (1989); Einstein Medal for Laser Science (1995); Arthur L. Schawlow Prize for Laser Science, American Physical Society (1996); Philip Morris Research Prize (atomic clock) (1988); Stern-Gerlach Medal, Deutsche Physikalische Gesellschaft (2000); Arthur L. Schawlow Award, Laser Institute of America (2000); Philip Morris Research Prize (atom laser) (2000); Quantum Electronics and Optics Prize, European Physical Society (2001); SUNAMCO Medal, International Union of Pure and Applied Physics (2001); Matteucci Medal, Italian National Academy of Sciences (2002); Bundesverdienstkreuz 1. Klasse (Order of Merit, Germany) (2003); Bayerischer Maximiliansorden (Order of Merit, Bavaria) (2003); I.I. Rabi Award, IEEE (2005); Frederic Ives Medal, Optical Society of America (2005); Otto-Hahn-Prize for Chemistry and Physics, GDCh, and City of Frankfurt/M (2005); Nobel Prize in Physics, jointly with Prof. J.L. Hall and Prof. R. Glauber (2005); Grand Officer Cross (Order of Merit, Republic of Italy) (2006). *Professional Societies and Academies:* American Physical Society (1973); Optical Society of America (1973); American Academy of Arts and Sciences (1983); The Franklin Institute, Philadelphia (1986); Bavarian Academy of Arts and Sciences (1991); U.S. National Academy of Scien-

ce (2002); Accademia Nazionale dei Lincei, Italy (2002); Berlin-Brandenburg Academy of Sciences (2005); Académie des Sciences, Institut de France (2005); The Society of Sigma Xi (2005); German Academy of Natural Scientists Leopoldina (2006).

Summary of scientific research Prof. Hänsch is widely known for his seminal contributions in the field of laser spectroscopy. His early work includes the first narrowband tunable dye laser, the invention of commonly used techniques of Doppler-free laser spectroscopy, and the first proposal for laser cooling of atomic gases. Since the early 1970s, Hänsch has pursued precision spectroscopy of the simple hydrogen atom, which permits unique confrontations between experiment and fundamental theory. This work has yielded accurate values of the Rydberg constant, the Lamb shift of the hydrogen ground state, and the charge radii of proton and deuteron. More recently, he has pioneered the revolutionary frequency comb technique for measuring the frequency of light with ultrashort pulses. Exploring the quantum physics of cold neutral atoms, Hänsch and his coworkers have realized the first two- and three-dimensional atomic lattices bound by light, they have demonstrated the first atom laser that emits a continuous beam of coherent matter waves, and they have shown how to integrate a quantum laboratory for ultracold atoms on a micro-fabricated 'atom chip'. With a Bose-Einstein condensate in an optical lattice potential, they have been the first to observe a quantum phase transition between a wave-like superfluid state and a particle-like Mott insulator crystal.

Main publications Measurement of Atomic Parameters by Laser Differential Spectrometry (T.W. Hänsch, P. Toschek), *Phys. Letters*, 20, 273 (1966); Laser Differential Spectrometry Measurements on Neon Depolarization (T.W. Hänsch, P. Toschek), *Phys. Letters*, 22, 150 (1966); Observation of Saturation Peaks in a He-Ne Laser by Tuned Laser Differential Spectrometry (T.W. Hänsch, P. Toschek), *IEEE J. Quant. Electr.*, QE-4, 467 (1968); Image Amplification by Dye Lasers (T.W. Hänsch, *et al.*), *Appl. Phys. Letters*, 18, 108 (1971); Complete Hyperfine Structure of a Molecular Iodine Line (T.W. Hänsch, *et al.*), *Phys. Rev. Letters*, 26, 949 (1971); High Resolution Saturation Spectroscopy of the Sodium D Line with a Pulsed Tunable Dye Laser (T.W. Hänsch, *et al.*), *Phys. Rev. Letters*, 27, 707 (1971); Optical Resolution of the Lamb Shift in Atomic Hydrogen by Laser Saturation Spectroscopy (T.W. Hänsch, *et al.*), *Nature*, 235, 63 (1972); Two-Photon Spectroscopy of Na 3s-4d without Doppler Broadening, Using a CW Dye Laser (T.W. Hänsch, *et al.*), *Opt. Comm.*, 11, 50 (1974); Rydberg Constant (T.W. Hänsch), in *McGraw-Hill Yearbook*

of Science and Technology, 1975; Cooling of Gases by Laser Radiation (T.W. Hänsch, A.L. Schawlow) *Opt. Comm.*, 13, 68 (1975); Doppler Effect (T.W. Hänsch), in *Encyclopedia of Physics*, Am. Inst. Phys., 1976; Rydberg Constant (T.W. Hänsch), in *McGraw-Hill Encyclopedia of Science and Technology*, 1977 ed., Vol. II, p. 713, 1980 ed., pp. 785-8, 1995 ed., 1999 ed.; High-Resolution Spectroscopy of Atoms and Molecules (T.W. Hänsch), *Physics Today*, 30, 34 (1977); A Self-Calibrating Grating (T.W. Hänsch), in *Laser Spectroscopy III*, Springer Series in Optical Sciences, Vol. 7, Springer Verlag, New York, Heidelberg, 1977, p. 423; Multiple Coherent Interactions (T.W. Hänsch), in *Laser Spectroscopy III*, Springer Series in Optical Sciences, Vol. 7, Springer Verlag, New York, Heidelberg, 1977, p. 149; Laser Spectroscopy (T.W. Hänsch), in *McGraw-Hill Yearbook of Science and Technology*, New York, 1979; The Spectrum of Atomic Hydrogen (T.W. Hänsch, et al.), *Scientific American*, 240, 94 (1979); Laser Spectroscopy (T.W. Hänsch), in *McGraw-Hill Encyclopedia of Science and Technology*, New York, 1980, pp. 556-60; Precision Laser Spectroscopy of Hydrogen (T.W. Hänsch), in *Quantum Electronics of Strong Fields* (NATO Advanced Study Institute, Lahnstein, Germany, 1981), Plenum Press, New York, 1983, pp. 669; Sub-Doppler Spectroscopy (T.W. Hänsch), in *Atomic Physics 8*, Plenum Publishing Corporation, New York, 1983, pp. 55-70; High Resolution Laser Spectroscopy (T.W. Hänsch), in *Advances in Laser Spectroscopy*, Plenum Press, New York, 1983, pp. 127; Precision Laser Spectroscopy (T.W. Hänsch), in *Precision Measurements and Fundamental Constants II*, NBS Special Publication 617 (1984), pp. 111; High Resolution Spectroscopy of Hydrogen (T.W. Hänsch), in *The Hydrogen Atom*, Springer Verlag, Berlin, Heidelberg, New York, 1989, p. 93; A Proposed Sub-Femtosecond Pulse Synthesizer Using Separate Phase-Locked Laser Oscillators (T.W. Hänsch), *Opt. Comm.*, 80, 71 (1990); Two-Dimensional Atomic Crystal Bound by Light (A. Hemmerich, T.W. Hänsch), *Phys. Rev. Letters*, 70, 410 (1993); Laser Spectroscopy of Hydrogen and Antihydrogen (T.W. Hänsch, C. Zimmermann), *Hyperfine Interactions*, 76, 47 (1993); Line Strengths in Vibrational Spectra of a 2D Optical Crystal (A. Hemmerich, T.W. Hänsch), *Phys. Rev. A*, Rapid Communications, 48, 1753 (1993); Measurement of the Temporal Coherence of Ultrashort Harmonic Pulses: Towards Coherent Spectroscopy in the Extreme Ultraviolet (M. Bellini, T.W. Hänsch), *Applied Physics B*, R 65, 677 (1997); Frequency Independent Laser Cooling Based on Interferometry (M. Weitz, T.W. Hänsch), *Europhys. Lett.* 49, 302 (2000); Measurement of the Spatial Coherence of a Trapped Bose Gas at the Phase Transition (I. Bloch, T.W. Hänsch,

and T. Esslinger) *Nature* 403, 166 (2000); Bose-Einstein Condensation on a Microelectronic Chip (W. Hänsel, P. Hommelhoff, T.W. Hänsch, and J. Reichel), *Nature* 413, 498 (2001); A New Type of Frequency Chain and Its Application to Optical Frequency Metrology (R. Holzwarth, J. Reichert, Th. Udem, and T.W. Hänsch), *Laser Physics* 11, 1100 (2001); Generation and Applications of Phase-Locked White-Light Continuum Pulses (M. Bellini, T.W. Hänsch), *Laser and Particle Beams* 19, 157 (2001); Optical Frequency Metrology (Th. Udem, R. Holzwarth, and T.W. Hänsch), *Nature*, 416, 233 (2002); Collapse and Revival of the matter wave field of a Bose-Einstein Condensate (M. Greiner, O. Mandel, T.W. Hänsch, and I. Bloch), *Nature* 419, 51 (2002); Tonks-Girardeau Gas of Ultracold Atoms in an Optical Lattice (B. Paredes, A. Widera, V. Murg, O. Mandel, S. Fölling, I. Cirac, G.V. Shlyapnikov, T.W. Hänsch and I. Bloch) *Nature* 429, 277-81 (2004); Atoms, Quanta and Relativity (T.W. Hänsch, *et al.*) A Century after Einstein's Miraculous Year, *Journal of Physics B-Atomic, Molecular & Optical Physics* 38, Preface of Special Issue; A Frequency Comb in the Extreme Ultraviolet (Ch. Gohle, Th. Udem, J. Rauschenberger, R. Holzwarth, M. Herrmann, H.A. Schüssler, F. Krausz, and T.W. Hänsch) *Nature*, 436, 234-7 (2005); Vibrationally Resolved Strong-Field Dissociation of D_2^+ in Ion Beams (D. Pavicic, T.W. Hänsch, and H. Figger) *Phys. Rev. A* 72, 053413/1-9 (2005); Precision Spectroscopy of Hydrogen and Femtosecond Frequency Combs (T.W. Hänsch, *et al.*) *Phil. Trans. R. Soc. A* 363 2155-63 (2005); Theodor W. Hänsch, Autobiographical Note, *Le Prix Nobel 2005*, Almquist & Wiksell Intl., Stockholm 2006, submitted for publication; A Passion for Precision, Nobel Lecture, *Le Prix Nobel 2005*, Almquist & Wiksell 2005, Stockholm 2006, submitted for publication; Carrier-Envelope Phase-Stabilized Amplifier Systems (J. Rauschenberger, T. Fuji, M. Hentschel, A.-J. Verhoeff, T. Udem, C. Gohle, T.W. Hänsch, and F. Krausz) *Laser Physics Lett.* 3 37-42 (2006).

Stephen W. Hawking



Date of Birth 8 January 1942

Place: Oxford (UK)

Nomination: 9 January 1986

Field: Physics

Title: Lucasian Professor

Most important awards, prizes and academies *Awards:* Adams Prize; Eddington Medal, Royal Astronomical Society; Pius XI Medal, The Pontifical Academy of Sciences; Dannie Heinemann Prize; William Hopkins Prize; Maxwell Medal and Prize; The Hughes Medal; The Einstein Award of the Strauss Foundation; The Albert Einstein Medal; Commander of the British Empire; Gold Medal, Royal Astronomical Society; Wolf Prize in Physics; Prince of Asturias Awards; Companion of Honour; Julius Edgar Lilienfeld Prize, American Physical Society; Aventis Book Prize; Michelson Morley Award, Case Western Reserve University; Smithson Bicentennial Medal; Copley Medal, Royal Society. *Academies:* Royal Society; Pontifical Academy of Sciences; US National Academy of Sciences.

Summary of scientific research I started research in gravitation and cosmology in 1962 at Cambridge under the supervision of Dr. D.W. Sciama. My first major work was on the question of whether there was a singularity, a point of infinite density and space-time curvature, at the beginning of the present expansion phase of the universe. Together with Roger Penrose I was able to show that there would be such a singularity in any reasonable cosmological model if the general theory of relativity was correct. The singularity would be a beginning of the universe, a place where the laws of physics break down. In 1970 I started to work on black holes. These are regions of space-time in which the gravitational field is so strong that nothing can escape. They are formed when burnt out stars or larger objects collapse. I was one of the people whose combined work proved the 'no hair' theorem which showed that a black hole would settle down to a state that depended only on the mass and angular momentum of the hole. I also showed that the event horizon, the boundary of the black hole, always increased in area as matter

fell into the hole. This suggested a connection between the area and the thermodynamic concept of entropy, which became more definite in 1974 when I showed that quantum mechanics would cause small black holes to create and emit particles as if they were hot bodies. Since 1974 I have worked mainly on the problem of unifying gravity and quantum mechanics. With others at Cambridge I developed a Euclidean approach which is now generally accepted. I have been interested in the extra degree of predictability that gravity introduces because the topology of space-time can change. I have also done quite a lot of work on the very early universe. I worked on the inflationary model and more recently on the initial boundary conditions of the universe. I have suggested that the boundary conditions of the universe are that it has no boundary. This would mean that there was no singularity and no single event that could be identified as the creation. Instead one could say that the universe was created quantum mechanically from nothing.

Main publications Books: Hawking, S.W., *The Large Scale Structure of Space-Time*, Cambridge University Press (1973); Hawking, S.W., *Is the End in Sight for Theoretical Physics?*, Camb. Univ. Press (1980); Hawking, S.W., *A Brief History of Time*, Bantam Press (1988); Hawking, S.W., *Black Holes and Baby Universes and Other Essays*, Bantam Books (1993); Hawking, S.W., *The Nature of Space and Time*, Princeton University Press (1996); Hawking, S.W., *The Large, the Small, and the Human Mind*, Cambridge University Press (1997); Hawking, S.W., *The Universe in a Nutshell*, Bantam Press (2001); Hawking, S.W., *On The Shoulders of Giants. The Great Works of Physics and Astronomy*, Running Press (2002); Hawking, S.W., *Information Loss in Black Holes*, Cambridge University Press (2005); Hawking, S.W., *God Created the Integers: The Mathematical Breakthroughs That Changed History*, Running Press (2005); Hawking, S.W., *A Briefer History of Time*, Bantam Books (2005); L. Hawking, S.W. Hawking, *George's Secret Key to the Universe*, Doubleday (2007); L. Hawking, S.W. Hawking, *George's Cosmic Treasure Hunt*, Doubleday (2009); S.W. Hawking, *The Grand Design*, Bantam Books (2010); L. Hawking, S.W. Hawking, *George and the Big Bang*, Doubleday (2011). Articles: Hawking, S.W., Occurrence of Singularities in Open Universes, *Phys. Rev. Lett.*, 15, p. 689 (1965); Hawking, S.W., Perturbations of an Expanding Universe, *Astrophys. J.*, 145, p. 544 (1966); Hawking, S.W., The Singularities of Gravitational Collapse and Cosmology, *Proc. Roy. Soc.*, A314, p. 529 (1970); Hawking, S.W., Black Holes in General Relativity, *Commun. Math. Phys.*, 25, p. 152 (1972); Hawking, S.W., The Four Laws of Black Hole Mechanics, *Commun. Math. Phys.*, 31, p. 161

(1973); Hawking, S.W., Particle Creation by Black Holes, *Commun. Math. Phys.*, 43, p. 199 (1975); Hawking, S.W., Zeta Function Regularization of Path Integrals in Curved Space-Time, *Commun. Math. Phys.*, 56, p. 133 (1977); Hawking, S.W., Spacetime Foam, *Nucl. Phys. B.*, 144, p. 349 (1977); Hawking, S.W., The Quantum State of the Universe, *Nucl. Phys. B.*, 239, p. 257 (1984); Hawking, S.W., The Origin of Structure in the Universe, *Phys. Rev. D.*, 31, p. 8 (1985); Hawking, S.W., Information loss in black holes, *Phys. Rev. D.*, 72(8).

Michael Heller



Date of Birth 12 March 1936

Place Tarnów (Poland)

Nomination 4 October 1990

Field Theoretical Physics

Title Professor

Most important awards, prizes and academies *Awards:* Zonn Medal, Polish Astronomical Society for the popularization of science (1986); Templeton Prize (2008). *Academies:* Ordinary member, Saint Petersburg Academy of the History of Science and Technology (1998); Pontifical Academy of Sciences (1990). *Honorary Degrees:* Technological University A.G.H., Cracow (1996).

Summary of scientific research In the early seventies Prof. Michael Heller studied, as one of the first cosmologists, relativistic world models with bulk viscosity dissipation. Now such models are considered to be standard, and bulk viscosity is interpreted as due to various quantum and semiquantum effects (e.g. the creation of particles in a strong gravitational field). Heller also investigated the influence of bulk viscosity in the appearance of singularities in cosmology. He has always been interested in the problem of classical singularities in relativistic physics. It turned out that to cope with this problem one has to generalize the standard concept of smooth manifold. To this end, Heller and his co-workers developed the theory of differential spaces and later on (with W. Sasin) the theory of structured spaces. Both these theories, by using algebraic methods, generalize the standard differential geometry to various 'pathological' situations. It turns out that different kinds of singularities met in general relativity can be investigated with the help of the theory of structured spaces. Although in the case of the most malicious singularities this methods fails to be adequate, it at least explains the source of the problem. Happily enough, even the most malicious singularities surrender to the methods based on so-called non-commutative geometry. These methods have been adapted and successfully applied to the singularity problem in general relativity by Heller and Sasin. The generalization of Einstein's gene-

ral relativity in terms of structured spaces (the so-called Einstein algebras) has also been worked out. By changing from commutative Einstein algebras to non-commutative Einstein algebras, one obtains the version of general relativity expressed in terms of mathematical structures which are very close to those used in quantum physics. Following this similarity, Heller and Sasin have proposed a model, based on non-commutative geometry, unifying general relativity and quantum mechanics. This model explains surprisingly well several non-local phenomena met in cosmology and quantum physics. M. Heller has written several books and about 700 papers on the history and philosophy of modern physics, and the relationship between science and theology.

Main publications Heller, M., *Questions to the Universe - Ten Lectures on the Foundations of Physics and Cosmology*, Pechart Publishing House (Tucson, 1986); Heller, M., *Theoretical Foundations of Cosmology - Introduction to the Global Structure of Space-Time*, World Scientific (Singapore-London, 1992); Heller, M., Klimek, Z. and Suszycki, L., Imperfect Fluid Friedmannian Cosmology, *Astrophysics and Space Science*, 20, pp. 205-12 (1973); Heller, M. and Klimek, Z., Viscous Universes without Initial Singularity, *Astrophysics and Space Science*, 33, L37-L39 (1975); Gruszczak J., Heller, M. and Multarzyński, P., A Generalization of Manifolds as Space-Time Models, *Journal of Mathematical Physics*, 29, pp. 2576-80 (1988); Heller, M., Algebraic Foundations of the Theory of Differential Spaces, *Demonstratio Mathematica*, 24, n. 3-4, pp. 349-64 (1991); Heller, M., Einstein Algebras and General Relativity, *International Journal of Theoretical Physics*, 31, pp. 277-8 (1992); Heller, M. and Sasin, W., The Structure of the b-Completion of Space-Time, *General Relativity and Gravitation*, 26, pp. 797-811 (1994); Heller, M. and Sasin, W., Sheaves of Einstein Algebras, *International Journal of Theoretical Physics*, 34, pp. 387-98 (1995); Heller, M. and Sasin, W., Structured Spaces and Their Application to Relativistic Physics, *Journal of Mathematical Physics*, 36, pp. 3644-62 (1995); Heller, M. and Sasin, W., Non-Commutative Structure of Singularities in General Relativity, *Journal of Mathematical Physics*, 37, pp. 5665-71 (1996); Heller, M. and Sasin, W., Groupoid Approach to Non-commutative Quantization of Gravity, *Journal of Mathematical Physics*, 38, pp. 5840-53 (1997); Heller, M. and Sasin, W., Origin of Classical Singularities, *General Relativity and Gravitation*, 31, pp. 555-70 (1999); Heller, M., *The World and the Word*, Pachart Publishing House (Tucson, 1986); Heller, M., *The Morality of Thinking*, Biblos (Tarnów, 1993) (in Polish); Heller, M., *The New Physics and a New Theology*, Vatican Observatory Publications

(Vatican City State, 1996); Heller, M., *To Grasp the Transient Moment*, Znak (Cracow, 1997) (in Polish); Heller, M., *Happiness in the Banach Space*, Znak (Cracow, 1997) (in Polish); Heller, M., *Is Physics an Art?*, Biblos (Tarnów, 1998) (in Polish); Heller, M., *Time of the Universe, The Far-Future Universe - Eschatology from a Cosmic Perspective*, (G.F.R. Ellis, ed.), Templeton Foundation Press, Philadelphia-London, 2002, pp. 53-64; Heller, M., Odrzygózdz, Z., Pysiak, L., and Sasin, W., *Structure of Malicious Singularities*, *International Journal of Theoretical Physics*, 42, pp. 427-41 (2003); Heller, M., *Creative Tension – Essays on Science and Religion*, Templeton Foundation Press (Philadelphia-London, 2003); Heller, M., *Some Mathematical Physics for Philosophers*, Pontifical Council for Culture, Gregorian University (2005); Heller, M., *A Comprehensible Universe: The Interplay of Science and Theology* (Springer Verlag, 2008) with George Coyne; Heller, M., *Ultimate Explanations of the Universe* (Springer-Verlag, 2009).

Raymond Hide



Date of Birth 17 May 1929

Place Doncaster (UK)

Nomination 25 June 1996

Field Geophysics

Title Professor

Hide

Most important awards, prizes and academies *Awards:* Chree Medal, British Institute of Physics (1974); Holweck Medal, French Physical Society (1982); Gold Medal, Royal Astronomical Society (1989); Commander of the British Empire (1990); Bowie Medal, American Geophysical Union (1997); Hughes Medal, Royal Society (1998); Richardson Medal, European Geophysical Society (1999); Symons Gold Medal, Royal Meteorological Society (2003). *Academies:* American Academy of Arts and Sciences (1964), Royal Society (1971); Academia Europaea (1988); Pontifical Academy of Sciences (1996). *President:* Royal Meteorological Society (1974-76); Royal Astronomical Society (1983-85); European Geophysical Society (1982-84). *Honorary Degrees:* Leicester (1985); Manchester, Institute of Science and Technology (1994); Paris (1995).

Summary of scientific research Main contributions in geophysics (geomagnetism, meteorology, geodesy, oceanography, etc.), planetary physics, fluid mechanics and nonlinear dynamics. His work on the hydrodynamics and magnetohydrodynamics (MHD) of spinning fluids has elucidated flow phenomena in planetary atmospheres, oceans and interiors. In laboratory studies of 'sloping thermal convection' he discovered various régimes of 'vacillation' and other multiply-periodic flows and aperiodic flows ('geostrophic turbulence'), which findings (a) influenced seminal mathematical studies of deterministic chaos and (b) provided a paradigm for interpreting large-scale flows in planetary atmospheres. Other contributions include the concept of 'dynamic superhelicity' as well as general theoretical results tested by crucial laboratory experiments on boundary layers and detached shear layers. His research on fluctuations in the Earth's rotation led to new developments in meteorology, oceanography and studies of the Earth's deep interior.

He introduced new types of self-exciting dynamo which show promise as low-dimensional theoretical models for investigating temporal fluctuations of stellar and planetary magnetic fields, including the irregular timeseries of geomagnetic polarity reversals. His discovery of 'nonlinear quenching' made during the course of this work has wide implications in the study of nonlinear systems. His contributions to electrodynamics and MHD include the concepts of 'potential magnetic field' and 'electrodynamic superhelicity' and discoveries of (a) basic theorems and other general results, (b) new types of MHD wave motion expected to occur in spinning planets and stars, (c) methods for locating interfaces and investigating their properties. He initiated research on the electromagnetic effects of hypervelocity impacts in connection with the magnetism of small bodies (Moon, meteorites, asteroids) in the Solar System.

Main publications More than 230 papers in learned journals, including: Hide, R., Experiments on thermal convection in a rotating liquid, *Quart. J. Roy. Meteorol. Soc.*, 79, p. 161 (1953), *Phil. Trans. Roy. Soc.*, A250, pp. 441-78 (1958); Hide, R., Hydrodynamics of the Earth's core, *Phys. Chem. Earth.*, 1, pp. 94-137 (1956); Hide, R., Hydrodynamics of Jupiter's atmosphere, *Mem. Soc. Roy. Liège*, 7, pp. 481-505 (1962); Hide, R., Free hydro-magnetic oscillations of the Earth's core and the theory of the geomagnetic secular variation, *Phil. Trans. Roy. Soc.*, A259, pp. 615-47 (1966); Hide, R., Planetary magnetic fields, *Planet. Space Sci.*, 14, pp. 579-86 (1966); Hide, R., Motions of the Earth's core and mantle and variations of the main geomagnetic field, *Science*, 157, pp. 55-6 (1967), see also Interaction between the Earth's liquid core and solid mantle, *Nature*, 222, pp. 1055-6 (1969); Hide, R., Dynamics of the atmospheres of the major planets, *J. Atmos. Sci.*, 26, pp. 841-7 (1969); Hide, R., Magnetohydrodynamic oscillations of neutron stars, *Nature*, 229, pp. 114-5 (1971); Hide, R., Comments on the Moon's magnetism, *The Moon*, 4, p. 39 (1972); Hide, R., How to locate the electrically-conducting fluid core of a planet from external magnetic observations, *Nature*, 271, pp. 640-1 (1978); Hide, R., The magnetic flux linkage of a moving medium: a theorem and geophysical applications, *J. Geophys. Res.*, 86, pp. 11681-7 (1981); Hide, R., The magnetic analogue of Ertel's potential vorticity theorem, *Ann. Geophys.*, 1, pp. 59-60 (1983); Hide, R., Superhelicity, helicity and potential vorticity, *Geophys. Astrophys. Fluid Dyn.*, 48, pp. 69-79 (1989); Hide, R., Fluctuations in the Earth's rotation and the topography of the core-mantle interface, *Phil. Trans. Roy. Soc.*, A328, pp. 351-63 (1989); Hide, R., Sloping convection: a paradigm for large-scale waves and eddies in planetary atmospheres (with Lewis, S.R. and Read, P.L.), *Chaos*, 4,

pp. 135-62 (1994); Hide, R., On the effects of rotation on fluid motions in containers of various shapes and topological characteristics, *Dyn. Atmos. Oceans*, 27, pp. 243-56 (1997); Hide, R., Nonlinear quenching of current fluctuations in a self-exciting homopolar dynamo, *Nonlinear Processes in Geophysics*, 4, pp. 201-5 (1997); Hide, R., Generic nonlinear processes in self-exciting dynamos and the long-term behaviour of the main geomagnetic field, including polarity superchrons, *Phil. Trans. Roy. Soc.*, A358, pp. 943-55 (2000); Hide, R., Helicity, superhelicity and weighted relative potential vorticity: Useful diagnostic pseudoscalars?, *Quart. J. Royal Meteorol. Soc.*, 128, pp. 1759-62 (2002); Hide, R., Quenching Lorenzian chaos (with McSharry, P.E., Finlay, C.C., and Peskett, G.D.), *Int. J. of Bifurcation and Chaos*, 14, pp. 2875-84 (2004); Hide, R., Reflections on the analogy between the equations of electrodynamics and hydrodynamics, pp. 25-33, and, Potential magnetic field and potential vorticity in magnetohydrodynamics, pp. 34-6, in *Meteorological and geophysical fluid dynamics* (a book to commemorate the centenary of the birth of Hans Ertel) (ed. W. Schroeder), Bremen, Deutsches Arbeitskreis Geschichte Geophysik und Kosmische Physik (2004); Hide, R. & Moroz I.M., Physically-realistic self-exciting Faraday-disk dynamos, *Mathematical Aspects of Natural Dynamos* (eds E. Dormy & A.M. Soward) (2005); Hide, R., Geomagnetism, "vacillation", atmospheric predictability and "deterministic chaos", The Pontifical Academy of Sciences, *Acta* 18, pp. 257-4 (2006); Hide, R., 'Proudman-Taylor theorem' and 'Potential vorticity and potential magnetic field theorems', *Encyclopaedia of Geomagnetism and Palaeomagnetism* (eds D Gubbins and E. Herrero-Bervera), Springer (2007).

Fotis C. Kafatos



Date of Birth 16 April 1940
Place Heraklion, Crete (Greece)
Nomination 23 January 2003
Field Biology
Title Professor

Most important awards, prizes and academies *Awards:* G.J. Mendel Honorary Gold Medal for Merit in the Biological Sciences, Academy of Sciences of the Czech Republic (1995); Honorary Professor, University of Heidelberg, Germany (2000); Honorary Medal for Distinction in Biology, Academy of Athens (2000); Taxiarchis of Phoenix Medal, awarded by the President of the Hellenic Republic (2003); Medal of Honour, City of Heraklion, Crete (2004); Bundesverdienstkreuz 1. Klasse, awarded by the President of the Federal Republic of Germany (2004). *Academies:* European Molecular Biology Organisation (1977); American Academy of Arts and Sciences (1980); National Academy of Sciences, USA (1982); Academia Europaea (1991); Churchill College, University of Cambridge (1993); Académie des sciences, France (2002); Pontifical Academy of Sciences (2003); Royal Society, London (2003).

Summary of scientific research My group is studying the interactions between Plasmodium parasites and the mosquito, *Anopheles gambiae*. Molecular genetic studies on this socially important organism, a vector responsible for more than two million deaths from malaria each year in Africa, capitalise on recent developments in genome analysis, transgenesis and the comparative study of innate immunity. We aim to trace the immune responses of the mosquito to the parasite, through highly collaborative research, involving close interactions with laboratories in Europe, the USA and Africa (see references). Genomic characterisation of *Anopheles* is an important aspect of our studies. Our pilot EST project identified for the first time a wealth of new *A. gambiae* genes. We have constructed detailed genetic and physical maps of *A. gambiae*, localizing genes that are involved in refractoriness to the parasite. The genetic markers are also facilitating the analysis of mosquito popu-

lation biology and refractoriness in Africa. Sequencing of a 528 kb chromosomes DNA region encompassing one of these genes has permitted a first genomic comparison between *A. gambiae* and *D. melanogaster*. Furthermore, we actively promoted, participated in and helped lead an international collaboration for the whole genome sequencing of *A. gambiae*, which was achieved in 2002 and was recognised as a landmark in malaria research. Previously, we generated hemocyte-like cell lines which help in analysing mosquito immunity by DNA microarrays and other techniques. Insects and vertebrates share ancient, potent defence mechanisms of innate immunity (distinct from the antibody and T-cell receptor-based adaptive immunity of vertebrates). Our major aim is to dissect these mechanisms in the mosquito, and focus on those pertaining to parasite intrusion. To this effect, we have constructed *A. gambiae* cDNA microarrays and used them to analyse global expression profiles of cells and whole mosquitoes in response to microbial challenge, sterile or septic injury and malaria infection. These studies identified novel immune elicitor-specific gene clusters potentially implicated in biochemical and physiological responses to infections. Responses to the parasite extensively overlap with responses to bacterial challenge but not to injury. Furthermore, parasites co-cultured with mosquito cell lines elicit robust responses suggesting specific recognition of the parasite by the mosquito immune surveillance system. Comparison of response profiles of malaria susceptible and refractory mosquitoes has indicated significant differences in immune competence and redox state. Some of the differentially expressed genes are likely to be implicated in the mechanism of parasite killing in the refractory mosquitoes. Among the molecules transcriptionally up-regulated by bacterial and parasite infections, we have identified a new family of thioester-containing proteins (aTEPs), resembling the complement factors that until recently were considered a hallmark of vertebrates. Using dsRNA knockdown in cell lines, we demonstrated that TEPI is required for promotion of early phagocytosis, indicating conservation of an ancient complement-like function. We are now extending our analysis to other members of the family. Cell biological studies use advanced light microscopy techniques in conjunction with specific antibodies. The aTEP system is of particular interest, as Plasmodium needs to evade two complement systems – in the mammalian host and in the insect vector. We have recently shown that TEPI is responsible for killing Plasmodium in a refractory strain of *A. gambiae*. Transformation techniques provide a crucial tool for genetic and genomic studies. We have participated in developing two genetic transformation methods based on the

Minos transposable element in the *A. gambiae* cell lines and in the germ line of *A. stephensi* (an important urban vector of malaria in the Indian subcontinent). Refinements underway include development of inducible systems for conditional gene expression and vectors for in vivo RNAi knock-down of genes. With these techniques we can analyse in vivo functions of candidate genes (selected by genetics, cell biology, biochemistry, microarray profiling and bioinformatics) that may be involved in vital physiological pathways of the mosquito, or in mosquito/parasite interactions. Ultimate benefits may be the identification of targets for new environmentally friendly insecticides or targets to block parasite transmission. Future research will continue to address the genetic, genomic, molecular, and cellular mechanisms that permit the malaria parasite to develop within the mosquito.

Main publications *Articles:* Zheng, L., Collins, F.H., Kumar, V. and Kafatos, F.C., A detailed genetic map for the X chromosome of the malaria vector, *Anopheles gambiae*, *Science*, 261, pp. 605-608 (1993); Zwiebel, L.J., Saccone, A.Z., Besansky, N.J., Favia, G., Collins, F.H., Louis, C. and Kafatos, F.C., The White Gene of *Ceratitis Capitata*: A Phenotypic Marker for Germline Transformation, *Science*, 270, pp. 2005-2008 (1995); Hoffmann, J.A., Kafatos, F.C., *et al.*, Phylogenetic Perspectives in Innate Immunity, *Science*, 284, pp. 1313-1318 (1999); Catteruccia, F., Nolan, T., Loukeris, T.G., Blass, C., Savakis, C., Kafatos, F.C. and Crisanti, A., Stable germline transformation of the malaria mosquito *Anopheles stephensi*, *Nature*, 405, pp. 959-962 (2000); Han, Y.S., Thompson, J., Kafatos, F.C. and Barillas-Mury, C., Molecular interactions between *Anopheles stephensi* midgut cells and *Plasmodium berghei*: The Time Bomb Theory of ookinete invasion of mosquitoes, *EMBO J.*, 19 (22), pp. 6030-6040 (2000); Levashina, E., Moita, L., Blandin, S., Vriend, G., Lagueux, M. and Kafatos, F.C., Conserved Role of a Complement-like Protein in Phagocytosis Revealed by dsRNA Knockout in Cultured Cells of the Mosquito, *Anopheles gambiae*, *Cell*, 104, pp. 709-718 (2001); Osta, M.A., Christophides, G.K. and Kafatos, F.C., Effects of Mosquito Genes on Plasmodium Development, *Science*, 303, pp. 2030-2032 (2004); Blandin, S., Shiao, S.-H., Moita, L.F., Waters, A.P., Kafatos, F.C. and Levashina, E.A., Complement-like protein TEPI is a determinant of vectorial capacity in the malaria vector *Anopheles gambiae*, *Cell*, 116, pp. 661-670 (2004); Kafatos, F.C., Eisner, T., Unification in the century of biology, *Science* 2004 Feb 27; 303(5662) 1257; Abraham, E.G., Pinto, S.B., Ghosh, A., Vanlandingham, D.L., Budd, A., Higgs, S., Kafatos, F.C., *et al.*, An immune-responsive serpin, SRPN6, mediates mosquito defense against malaria parasites,

Proc. Natl. Acad. Sci. USA 2005 Nov 8; 102(45) 16327-32; Volz, J., Osta, M.A., Kafatos, F.C., and Muller, H.M., The roles of two clip domain serine proteases in innate immune responses of the malaria vector *Anopheles gambiae*, *J. Biol. Chem.* 2005 Dec 2; 280(48) 40161-8; Michel, K., Budd, A., Pinto, S., Gibson, T.J., and Kafatos, F.C., *Anopheles gambiae* SRPN2 facilitates midgut invasion by the malaria parasite *Plasmodium berghei*, *EMBO Rep.* 2005 Sep; 6(9) 891-7; Meister, S., Kanzok, S.M., Zheng, X.L., Luna, C., Li, T.R., Hoa, N.T., Clayton, J.R., White, K.P., Kafatos, F.C., *et al.*, Immune signaling pathways regulating bacterial and malaria parasite infection of the mosquito *Anopheles gambiae*, *Proc. Natl. Acad. Sci. USA* 2005 Aug 9; 102(32) 11420-5; Vlachou, D. and Kafatos, F.C., The complex interplay between mosquito positive and negative regulators of *Plasmodium* development, *Curr. Opin. Microbiol.* 2005 Aug; 8(4) 415-21; Belyakin, S.N., Christophides, G.K., Alekseyenko, A.A., Kriventseva, E.V., Belyaeva, E.S., Nanayev, R.A., Makunin, I.V., Kafatos, F.C., and Zhimulev, I.F., Genomic analysis of *Drosophila* chromosome underreplication reveals a link between replication control and transcriptional territories, *Proc. Natl. Acad. Sci. USA* 2005 Jun 7; 102(23) 8269-74; Kriventseva, E.V., Koutsos, A.C., Blass, C., Kafatos, F.C., *et al.*, AnoEST: toward *A. gambiae* functional genomics, *Genome Res.* 2005 Jun; 15(6) 893-9; Michel, K. and Kafatos, F.C., Mosquito immunity against *Plasmodium*, *Insect Biochem. Mol. Biol.* 2005 Jul; 35(7) 677-89; Danielli, A., Barillas-Mury, C., Kumar, S., Kafatos, F.C., and Loukeris T.G., Overexpression and altered nucleocytoplasmic distribution of *Anopheles* ovalbumin-like SRPN10 serpins in *Plasmodium*-infected midgut cells, *Cell Microbiol.* 2005 Feb; 7(2) 181-90; Hall, N., Karras, M., Raine, J.D., Carlton, J.M., Kooij, T.W., Berriman, M., Florens, L., Janssen, C.S., Pain, A., Christophides, G.K., James, K., Rutherford, K., Harris, B., Harris, D., Churcher, C., Quail, M.A., Ormond, D., Doggett, J., Trueman, H.E., Mendoza, J., Bidwell, S.L., Rajandream, M.A., Carucci, D.J., Yates, J.R. 3rd, Kafatos, F.C., *et al.*, A comprehensive survey of the *Plasmodium* life cycle by genomic, transcriptomic, and proteomic analyses, *Science* 2005 Jan 7; 307(5706) 82-6; Volz, J., Muller, H.M., Zdanowicz, A., Kafatos, F.C., and Osta, M.A., A genetic module regulates the melanization response of *Anopheles* to *Plasmodium*, *Cell Microbiol.* 2006 Sep; 8(9) 1392-405; Vlachou, D., Schlegelmilch, T., Runn, E., Mendes, A., and Kafatos, F.C., The developmental migration of *Plasmodium* in mosquitoes, *Curr. Opin. Genet. Dev.* 2006 Aug; 16(4) 384-91; Lycett, G.J., McLaughlin, L.A., Ranson, H., Hemingway, J., Kafatos, F.C., *et al.*, *Anopheles gambiae* P450 reductase is

highly expressed in oenocytes and in vivo knockdown increases permethrin susceptibility, *Insect Mol. Biol.* 2006 Jun; 15(3) 321-7; Moita, L.F., Vriend, G., Mahairaki, V., Louis, C., and Kafatos, F.C., Integrins of *Anopheles gambiae* and a putative role of a new beta integrin, BINT2, in phagocytosis of *E. coli*, *Insect Biochem. Mol. Biol.* 2006 Apr; 36(4) 282-90.

Krishnaswamy Kasturirangan



Date of Birth 24 October 1940

Place Ernakulum (India)

Nomination 21 October 2006

Field Astronomy

Title Professor

Most important awards, prizes and academies *Awards:* Three civilian awards from the Government of India: the Padma Shri (1982), Padma Bhushan (1992) and Padma Vibhushan (2000); Intercosmos Council Award, Soviet Academy of Sciences (1981); Dr. K.R. Ramanathan Memorial Gold Medal, Indian Geo-Physical Union (1995); M.P. Birla Memorial Award in Astronomy (1997); Goyal Award, Goyal Foundation (1997); Biren Roy Memorial Lecture Medal, Indian Physical Society (1998); Shri Murli M. Chugani Memorial Award for Excellence in Applied Physics, Indian Physics Association (1999); H.K. Firodia Award for Excellence in Science & Technology (1999); IGU Millennium Award, Indian Geo-Physical Union (1999); M.N. Saha Birth Centenary Award, 87th Indian Science Congress (2000); Aryabhata Medal Award 2000, Indian National Science Academy (2001); 4th Sri Chandrasekarendra Saraswati National Eminence Award, South Indian Education Society (2001), International Collaboration Accomplishment Award, International Society for Air Breathing Engines (2001); Officer of the Légion d'honneur, France (2002); Rathindra Puraskar by Visva Bharati, Shantiniketan (2002); V. Krishnamurthy Award for Excellence, Centre for Organisation Development (2002); G.M. Modi Award for outstanding contribution in innovative Science, Gujarmal Modi Science Foundation (2002); Bhoovigyan Ratna Award, Bhoovigyan Vikas Foundation (2002); 8th National Science & Technology Award for Excellence, Jeppiaar Educational Trust (2003); 6th Ram Mohan Puraskar, Ram Mohan Mission (2003); Ashustosh Mukerjee Gold Medal, Indian Science Congress Association (2004); Lifetime Contribution Award in Engineering, Indian National Academy of Engineering (2004); Prof. M.N. Saha Memorial Lecture Medal, National Academy of Sciences of India (2004); Brock Medal of the International Society for Photo-

grammetry and Remote Sensing and American Society for Photogrammetry and Remote Sensing (2004); Alan D. Emil Memorial Award, International Astronautical Federation (IAF) (2004). *Academies and Professional organisations*: President, Indian National Academy of Engineering (2005-06); Vice-President, Indian Academy of Sciences (1998-2000); President, Indian Academy of Sciences (2001-3); Chairman, Board of Governors, Indian Institute of Technology, Madras (2000-6); Chairman, Council of Raman Research Institute, (since 2000); Chairperson, Research Council of National Aerospace Laboratories, Bangalore (2001-3); Member, Board of Governors of IIT, Roorkee, (2001-3); General President, Indian Science Congress (2002-3); Chairman, Governing Council, Indian Institute of Science (since 2004); Chairman, Governing Council, Aryabhata Institute of Observational Sciences (since 2003); Vice-President, International Academy of Astronautics (2003-5); Member, International Academy of Astronautics Sub-Committee on Mars Exploration (1992-93); Member, COSPAR Bureau (1994-2002), Member, Scientific Advisory Committee to the Cabinet, Member, Board of Trustees of the International Academy of Astronautics, Paris; Member, Advisory Board of International Space University, Strasbourg, France; Indian Representative, IEEE Space Panel (1992); Chairman, COSPAR Panel on Space Research in Developing Countries (1994-2000), Chairman, International Committee on Earth Observation Satellites (1997-98), Chairman, Governing Body of the United Nations Centre for Space Science and Technology Education in Asia and the Pacific (1995-2004); Chairman, Senior Officials Committee of UN-ESCAP Meet (1999-2000) leading to Delhi Declaration; Co-Chairman, International Academy of Astronautics Study Committee on 'Space for Peace', (2002-03). *Fellowships/Memberships*: Indian Academy of Sciences; Indian National Science Academy; National Academy of Sciences of India; Indian National Academy of Engineering; Astronautical Society of India; National Telematics Forum; Indian Meteorological Society; Astronomical Society of India; Institution of Electronics and Telecommunication Engineers; Aeronautical Society of India; Kerala Academy of Sciences; Indian Institute of Chemical Engineers; Indian Physics Association; Indian Society of Remote Sensing; Indian Science Congress Association; International Astronomical Union; International Academy of Astronautics; Third World Academy of Sciences.

Summary of scientific research Dr. Kasturirangan was responsible for directing the Indian Space programme for over 9 years, as Chairman of ISRO and the Space Commission and as Secretary to the Government of India in the Department of Space, before laying down office on 27 August

2003. He was earlier the Director of ISRO Satellite Centre, overseeing the development of new generation spacecraft, the Indian National Satellite (INSAT-2) and the Indian Remote Sensing Satellites (IRS-1A and 1B) as well as scientific satellites. He was also the Project Director for India's first two experimental earth observation satellites, Bhaskara-I and II. Dr. Kasturirangan has made wide-ranging contributions to the design and development of sensor and telescope systems for astronomy research in optical, uV, x-ray and gamma ray radiation domains that have been successfully flown in balloons, rockets and satellites over the last three decades. He was one of the earliest to determine the spectrum of diffused cosmic x-rays in the 20-200 Kev range, investigate the time variabilities of ScoX-1, CygX-1 and HerX-1 sources, detect the change in the spectral characteristics during the state transition of CygX-1 and hard x-ray spectral behaviour of HerX-1. He studied super luminal source GRS 1915-105 relating to quasi-regular bursts and detection of x-ray dips as well as relating these with accretion models. He also worked on the conceptualization, planning, implementation and interpretation of an experiment to search for a possible unique ring structure around the Sun during a total solar eclipse and placed useful upper limits to the related mass. He has also carried out fundamental investigations on the ionization effects of cosmic x-rays in D-region of the earth's ionosphere in the context of the first quantitative estimation of the perturbation effects of ionization in the night time low-latitude D-region during the transit of ScoX-1. He has led the pioneering efforts to develop world-class Remote Sensing satellites, which today is a key element of India's space capability. More recently, he played an active role in the definition of India's first dedicated multi-wavelength high-energy astronomy observatory and the first mission to the Moon known as Chandrayaan-1. Finally, during the period 1994-2003, as Head of India's space programme, he oversaw a multi-dimensional space endeavour, encompassing development and operationalisation of new satellites and rockets, space applications as well as space sciences. The confidence to undertake the Mission to the Moon and the development of the sophisticated astronomical satellite ASTROSAT, is the outcome of the major achievements witnessed in this period. Also, the efforts during this period placed India as one of the leading space-faring nations among a handful of countries around the world.

Main publications Contributed around 220 papers which were published in national and international journals; co-authored/edited books/journals: *The Aryabhata Project* by U.R. Rao and K. Kasturirangan (1979); *Perspectives in Communications* by U.R. Rao, K. Kasturirangan, K.R. Sridhara Murthi

and Surendra Pai (1987); *Space – In Pursuit of New Horizons* (A Festschrift for Prof. U.R. Rao) by R.K. Varma, K. Kasturirangan, U.S. Srivastava and B.H. Subbaraya (1992); *Role of Developing Countries in Ground Based Experiments in Support of Space Observations for Global and Regional Studies* edited by K. Kasturirangan and R.R. Daniel (COSPAR Journal Advances in Space Research, 1996); *The Geocentric Planets* by K. Kasturirangan and R.K. Kochhar; *Human Connectivity Through Space* (Science and Technology for Achieving Food Economic and Health); *Problems of Space Science Research: Education and the Role of Teachers* edited by K. Kasturirangan, J.L. Fellous, S.C. Chakravarthy, R.S. Young and M.J. Rycroft (COSPAR Journal Advances in Space Research, 1997).

Vladimir I. Keilis-Borok



Date of Birth 31 July 1921

Place Moscow (Russia)

Nomination 16 October 1994

Field Earth Sciences

Title Professor

Most important awards, prizes and academies *Awards:* First Richardson medal for non-linear dynamics (1998). *Academies:* American Academy of Arts and Sciences (1969); US National Ac. Sci. (1971); Russian Ac. Sci. (1988); Royal Astronomical Society (1989); Austrian Ac. Sci. (1992); Academia Europaea (1999); President, Int. Union of Geodesy and Geophysics (1987-91); Pontifical Academy of Sciences (1994); Russian Ac. Sci. Committee for International Security and Disarmament (1997-). Expert, technical meetings on the nuclear test ban treaty (1960-62, 1987-90); Chairman of several international projects for basic research; member of the editorial boards of several international journals.

Summary of scientific research He studied the dynamics and structure of solid Earth, with applications to earthquake prediction, the identification of nuclear explosions, and mineral exploration. Later on, his research was extended to the dynamics of chaotic and complex systems, with applications to the prediction of critical phenomena, socio-economic crises included. A distinctive tradition of these studies has been the involvement of world-class 'pure' mathematicians, and direct transition from fundamental research to major applications. In this tradition he founded the International Institute of the Russian Academy of Sciences; the biannual International Symposia for Mathematical Geophysics; annual workshops at the Abdus Salam International Centre for Theoretical Physics, Trieste; and an international series of publications.

Main publications Keilis-Borok, V.I. (ed.), *Computational Seismology and Geodynamics*, Series currently published in Russia and USA (1966-present); Keilis-Borok, V.I. and Sánchez Sorondo, M. (eds), *Science for survival and sustainable development*, Pontifical Academy of Sciences (Vatican City, 2000), pp. 427; Keilis-Borok, V.I., *Seismology and logic*, *Research in Geophysics*, 2,

The MIT, Press, pp. 61-79 (1964); Keilis-Borok, V.I. and Yanovskaya, T.B., Inverse problems of seismology (structural review), *Geophys. J.R. Astr. Soc.*, 13, pp. 223-34 (1967); Keilis-Borok, V.I., Press, F., On seismological applications of pattern recognition, *Source Mechanism and Earthquake Prediction Applications* (Paris, 1980); Gabrielov, A.M. and Keilis-Borok, V.I., Patterns of stress corrosion: geometry of the principal stresses, *PAGEOPH*, 121, n. 3, pp. 477-94 (1983); Lichtman, A.J. and Keilis-Borok, V.I., Aggregate-level analysis and prediction of midterm senatorial elections in the United States, 1974-86, *Proc. Natl. Acad. Sci. USA*, 86, pp. 10176-80 (1989); Keilis-Borok, V.I. (ed.), Intermediate-term earthquake prediction: models, phenomenology, worldwide tests, *Physics of the Earth and Planetary Interiors*, 61, pp. 1-144 (1990); Kantorovich, L.V. and Keilis-Borok, V.I., Earthquake prediction and decision making: social, economic, legislative and civil defence domains, *Proc. of International Conference 'Earthquake Prediction: State-of-the-Art'*, Strasbourg, France, 15-18 October, pp. 586-93 (1991); Gabrielov, A., Keilis-Borok, V. and Jackson, D., Geometric incompatibility in a fault system, *Proc. Natl. Acad. Sci. USA*, 93, pp. 3838-42 (1996); Keilis-Borok, V.I. and Shebalin, P.N. (eds), Dynamics of the lithosphere and earthquake prediction, *Physics of the Earth and Planetary Interiors*, 111, pp. 179-327 (1999); Gabrielov, A., Keilis-Borok, V., *et al.*, Critical transitions in colliding cascades, *Physical Review E*, 62, pp. 237-49 (2000); Keilis-Borok, V., *et al.*, Pre-recession pattern of six economic indicators in the USA, *Journal of Forecasting*, 19, pp. 65-80 (2000); Keilis-Borok, V., Earthquake prediction: state-of-the-art and emerging possibilities, *Annu. Rev. Earth Planet. Sci.*, 30, p. 38 (2002); Keilis-Borok, V.I., and Soloviev, A.A. (eds), *Nonlinear Dynamics of the Lithosphere and Earthquake Prediction*, Springer-Verlag, (Heidelberg, 2003), p. 337; Keilis-Borok, V.I., *et al.*, On predictability of homicide surges in megacities, in Beer, T. and Ismail-Zadeh, A. (eds), *Risk Science and Sustainability*, Kluwer Academic Publishers, Dordrecht, pp. 91-110 (2003); Keilis-Borok, V.I., *et al.*, Dynamics of macroeconomic indicators before the rise of unemployment in Western Europe and the USA, submitted to *European Economic Review* (2003); Zaliapin, I., Keilis-Borok, V. and Ghil, M., A Boolean delay equation model of colliding cascades. Part II: Prediction of critical transitions, *Journal of Statistical Physics*, 111, pp. 839-61 (2003); Keilis-Borok, V., *et al.*, Reverse tracing of short-term earthquake precursors, *Physics of the Earth and Planetary Interiors*, 145, pp. 75-85 (2004); Shebalin, P., Keilis-Borok, V., *et al.*, Advance short-term prediction of the large Tokachi-oki earthquake, September 25, 2003, M=8.1 A case history, *Earth Planets Space*, 56, pp. 715-24 (2004).

Klaus von Klitzing



Date of Birth 28 June 1943

Place Schroda (Germany)

Nomination 22 May 2007

Field Physics

Title Professor, Nobel laureate in Physics, 1985

Most important awards, prizes and academies Awards: Schottky Prize (1981); Hewlett Packard Prize (1982); Nobel Prize in Physics (1985); Dirac Medal (1988); Philip Morris Prize (1990); Eötvös Medal (1994); Award for a Lifetime Achievement in Science, Birla Science Center (1999); Bayerischer Maximiliansorden für Wissenschaft und Kunst; Carl Friedrich Gauß-Medaille (2005). *Honorary doctorates* from Universities in 12 countries. *Memberships*: US National Academy of Sciences; Russian Academy of Sciences; Royal Society of London; Chinese Academy of Science; Ehrenmitglied Deutsche Physikalische Gesellschaft; Russian Metrological Academy; Bayerische Akademie der Wissenschaften; Heidelberg Akademie der Wissenschaften; Deutsche Akademie der Naturforscher Leopoldina; Academia Europea; Austrian Academy of Science; American Physical Society; Korean Academy of Science and Technology; UK Institute of Physics; Singapore Institute of Physics; NTT Basic Research Laboratory Advisory Board; Scientific Committee International Solvay Institutes; Kuratorium Physikalisch-Technische Bundesanstalt Braunschweig; Kuratorium Deutsches Museum München; Board of Directors IBZ University of Stuttgart; Prize Committee 'Innovationsspreis der deutschen Wirtschaft'; Jury Member START-Wittgenstein Program Austria; Board of Trustees 'Institute of Advanced Studies' of TUM; Nano Initiative Munich Advisory Board.

Summary of scientific research Prof. Klitzing was awarded the Nobel Prize for Physics in 1985 for his discovery that under appropriate conditions the resistance offered by an electrical conductor is quantized; that is, it varies by discrete steps rather than smoothly and continuously. Prof. Klitzing demonstrated that electrical resistance occurs in very precise units by using the Hall effect. The Hall effect denotes the voltage that develops between the edges of

a thin current-carrying ribbon placed between the poles of a strong magnet. The ratio of this voltage to the current is called the Hall resistance. When the magnetic field is very strong and the temperature very low, the Hall resistance varies only in the discrete jumps first observed by Klitzing. The size of those jumps is directly related to the so-called fine-structure constant, which defines the mathematical ratio between the motion of an electron in the innermost orbit around an atomic nucleus to the speed of light. The significance of Klitzing's discovery, made in 1980, was immediately recognized. His experiments enabled other scientists to study the conducting properties of electronic components with extraordinary precision. His work also aided in determining the precise value of the fine-structure constant and in establishing convenient standards for the measurement of electrical resistance.

Main publications Series Editor of *Nanoscience and Technology* (Springer); Series Editor of *Springer Series in Solid-State Sciences*; Editor of *Physics and Applications of Quantum Wells and Superlattices* (Plenum Press); Editorial Board, *Superlattices and Microstructures* (Academic Press); Executive Board, *Encyclopedia of Physical Science & Technology* (Academic Press); over 500 publications in scientific journals and conference proceedings, of which the main ones are: von Klitzing, K., Dorda, G., Pepper, M., New Method for High-Accuracy Determination of the Fine Structure Constant Based on Quantized Hall Resistance, *Physical Review Letters* 1980, 45, (6), 494-7; Stein, D., von Klitzing, K., Weimann, G., Electron-Spin Resonance on GaAs-AlxGa1-x Heterostructures, *Physical Review Letters* 1983, 51, (2), 130-3; von Klitzing, K., The Quantized Hall-Effect, *Reviews of Modern Physics* 1986, 58, (3), 519-31; Doherty, M., von Klitzing, K., Weimann, G., Electron-Spin Resonance in the Two-Dimensional Electron Gas of GaAs-AlxGa1-x Heterostructures, *Physical Review B* 1988, 38, (8), 5453-6; Weiss, D., von Klitzing, K., Ploog, K., Weimann, G., Magnetoresistance Oscillations in a Two-Dimensional Electron-Gas Induced by a Submicrometer Periodic Potential, *Europhysics Letters* 1989, 8, (2), 179-84; Blick, R.H., Pfannkuche, D., Haug, R.J., von Klitzing, K., Eberl, K., Formation of a coherent mode in a double quantum dot, *Physical Review Letters* 1998, 80, (18), 4032-5; Mani, R.G., Smet, J.H., von Klitzing, K., Narayanamurti, V., Johnson, W.B., Umansky, V., Zeroresistance states induced by electromagnetic-wave excitation in GaAs/AlGaAs heterostructures, *Nature* 2002, 420, (6916), 646-50; Kukushkin, I.V., Smet, J.H., von Klitzing, K., Wegscheider, W., Cyclotron resonance of composite fermions. *Nature* 2002, 415, (6870), 409-12; Kuku-

shkin, I.V., Akimov, M.Y., Smet, J.H., Mikhailov, S.A., von Klitzing, K., Aleiner, I.L., Falko, V.I., New type of B-periodic magneto-oscillations in a two-dimensional electron system induced by microwave irradiation. *Physical Review Letters* 2004, 92, (23); von Klitzing, K. (2005), '25 years of quantum hall effect (QHE) a personal view on the discovery, physics and applications of this quantum effect', *Quantum Hall Effect: Poincare Seminar* 2004 45, 1-21; Kukushkin, I.V., Smet, J.H., Abergel, D.S.L., Fal'ko, V.I., Wegscheider, W., von Klitzing, K., Detection of the electron spin resonance of two-dimensional electrons at large wave vectors. *Physical Review Letters* 2006, 96, (12); Hubel, A., Held, K., Weis, J., Von Klitzing, K. (2008), Correlated Electron Tunneling through Two Separate Quantum Dot Systems with Strong Capacitive Interdot Coupling, *Physical Review Letters* 101(18), 186804; Martin, J., Akerman, N., Ulbricht, G., Lohmann, T., Smet, J.H., Von Klitzing, K., Yacoby, A. (2008), Observation of electron-hole puddles in graphene using a scanning single-electron transistor, *Nature Physics* 4(2), 144-8; Kukushkin, I.V., Smet, J.H., Scarola, V.W., Umansky, V., von Klitzing, K. (2009), Dispersion of the Excitations of Fractional Quantum Hall States, *Science* 324(5930), 1044-7; Lohmann, T., von Klitzing, K., Smet, J.H. (2009), Four-Terminal Magneto-Transport in Graphene p-n Junctions Created by Spatially Selective Doping, *Nano Letters* 9(5), 1973-9; Yoon, Y., Tiemann, L., Schmult, S., Dietzsche, W., von Klitzing, K., Wegscheider, W. (2010), Interlayer Tunneling in Counterflow Experiments on the Excitonic Condensate in Quantum Hall Bilayers, *Physical Review Letters* 104(11), 116802; Weis, J., von Klitzing, K. (2011), Metrology and microscopic picture of the integer quantum Hall effect, *Philosophical Transactions of the Royal Society A-mathematical Physical and Engineering Sciences* 369(1953), 3954-74.

Nicole Marthe C. Le Douarin



Date of Birth 20 August 1930

Place Lorient (France)

Nomination 3 September 1999

Field Developmental Biology

Title Professor

Le Douarin

Most important awards, prizes and academies *Awards:* Academy of Sciences, France; Royal Academy of Belgium; Kyoto Prize in Advanced Technology, Japan; Jeantet Prize in Medicine; Grand Prix de la Fondation pour la Recherche Médicale; Ross Harrison Prize of Columbia University, New York; The Pearl Meister Greengard Prize, The Rockefeller University, New York; The Conklin Award of the American Society for Developmental Biology, San Francisco; Grand Officier dans l'Ordre National du Mérite; Grand Croix dans l'Ordre de la Légion d'honneur; Grand Croix dans l'Ordre National du Mérite; Commandeur dans l'Ordre des Palmes académiques. *Academies:* Académie des sciences, France; American Academy of Arts and Sciences; Academia Europaea; Pontifical Academy of Sciences; National Academy of Sciences, USA; Royal Society, UK; Royal Academy of Medicine of Spain; Royal Academy of Belgium; Academy of Athens.

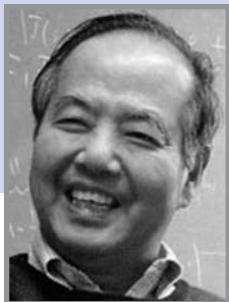
Summary of scientific research My work deals with the development of the nervous and the hemopoietic and angiogenic systems in the vertebrate embryo. I devised a cell marking technique which enables the migration and fate of cells to be followed within the embryo during the entire developmental period. With my colleagues, we have particularly studied the fate of the neural crest, an embryonic structure composed of multipotent stem cells. Neural crest cells undergo extensive migrations within the embryo and differentiate into a large variety of cell types. The neural crest plays a crucial role in the construction of the vertebrate head and of the peripheral nervous system. It also yields pigment and endocrine cells. We established the embryonic origin of the hemopoietic stem cells and how the development of the immune system proceeds in the embryo and early post-natal life. We demonstrated that immune tolerance to self involves, in addition to the elimi-

nation of self reactive T cells in the thymus, an active mechanism which consists in the production in the thymic environment of regulatory cells that suppress the activity of the effector T cells that have escaped thymic elimination.

Main publications Books: Le Douarin, N.M., *Dans le secret des êtres vivants: Itinéraire d'une biologiste* (Robert Laffont, 2012); Le Douarin, N.M., *Les cellules souches, porteuses d'immortalité* (Odile Jacob, 2007); Le Douarin, N.M., *The Neural Crest* (Cambridge University Press, 1982; 2000); Le Douarin, N.M., *Des Chimères, des Clones et des Gènes* (Odile Jacob, 2000). Articles: A Biological Cell Labeling Technique and its Use in Experimental Embryology, *Dev. Biol.*, 30, 217-22 (1973); Le Douarin, N.M. and Jotereau, F.V., Tracing of Cells of the Avian Thymus through Embryonic Life in the Interspecific Chimeras, *J. Exp. Med.*, 142, 17-40 (1975); The Ontology of the Neural Crest in Avian Embryo Chimeras, *Trends in Neurosciences*, 3, 39-42 (1980); Cell Line Segregation during Peripheral Nervous System Ontogeny, *Science*, 231, 1515-22 (1986); Baroffio, A., Dupin, E. and Le Douarin, N.M., Common Precursors for Neural and Mesectodermal Derivatives in the Cephalic Neural Crest, *Development*, 112, 301-5 (1990); Embryonic Neural Chimeras in the Study of Brain Development, *Trends in Neurosciences*, 16, 2m, 64-72 (1993); Dupin, E., Glavieux, C., Vaigot, P. and Le Douarin, N.M., Endothelin 3 induces the reversion of melanocytes to glia through a neural crest-derived glial-melanocytic progenitor, *Proc. Natl. Acad. Sci. USA*, 97, 7882-7 (2000); Creuzet, S., Couly, G., Bennaceur, S., Vincent, C., and Le Douarin, N.M., Negative effect of Hox gene expression on the development of the neural crest-derived facial skeleton, *Development*, 129, 4301-13 (2002); Dupin, E., Real, C., Glavieux-Pardanaud, C., Vaigot, P. and Le Douarin, N.M., Reversal of developmental restrictions in neural crest lineages: transition from Schwann cells to glial-melanocytic precursors in vitro, *Proc. Natl. Acad. Sci. USA*, 100, 5229-33 (2003); Real, C., Dupin, E., Glavieux-Pardanaud, C. and Le Douarin, N.M., Melanocytes can reverse into self-renewing multipotent cells in vitro, *Pigment Cell Res.*, 16, 573 (2003); Thibert, C., Teillet, M.-A., Lapointe, F., Mazelin, L., Le Douarin, N.M. and Mehlen, P., Sonic hedgehog controls survival of the neuroepithelial cells of the developing neural tube by regulating Patched-induced apoptosis, *Science*, 203, 843-6 (2003); Le Douarin, N.M., *et al.*, Neural crest cell plasticity and its limits, *Development*, 131, 4637-50 (2004); Trentin, A., Glavieux-Pardanaud, C., Le Douarin, N.M. and Dupin, E., Self-renewal capacity is a widespread property of various types of neural crest precursor cells, *Proc. Natl. Acad. Sci. USA* 101, 4495-4500 (2004); Creuzet, S.E., Martinez, S. and Le Douarin, N.M., The cephalic neural crest exerts a critical effect on forebrain and midbrain develop-

ment, *Proc. Natl. Acad. Sci. USA*, 103:1433-8 (2006); Real, C., Glavieux-Pardanaud, C., Le Douarin N.M. and Dupin E., Clonally cultured differentiated pigment cells can dedifferentiate and generate multipotent progenitors with self-renewing potential, *Developmental Biology*, vol. 300(2), 656-69 (2006); Le Douarin, N.M., Brito, J.M., and Creuzet, S., The role of the neural crest in face and brain development, *Brain Res. Reviews*, 55(2), 237-47 (2007); Calloni, G. W., Glavieux-Pardanaud, C., Le Douarin, N.M. and Dupin, E. (2007); Sonic Hedgehog promotes the development of multipotent neural crest progenitors endowed with both mesenchymal and neural potentials. *Proc. Natl. Acad. Sci. USA*, 104, 19879-19884; Le Douarin, N., Dieterlen-Lievre, F., Creuzet, S., Teillet, M.A. (2008); Quail-chick transplantations. *Methods Cell Biol.*, 87, 19-58. Le Douarin, N. (2008); Developmental patterning deciphered in avian chimeras, *Dev. Growth Differ.* 50, 11-28. Le Douarin, N., Calloni, G., Dupin, E. (2008); The stem cells of the neural crest, *Cell Cycle*, 7, 1013-1019; Calloni G.W, Le Douarin N.M and Dupin E., (2009); High frequency of cephalic neural crest cells shows coexistence of neurogenic, melanogenic and osteogenic differentiation capacities. *Proc. Natl. Acad. Sci. USA*, 106, 8947-8952; Le Douarin, N.M. and Creuzet, S.E. (2009). Craniofacial patterning. Book Chapter. In *The Skeletal System*, Cold Spring Harbor Laboratory Press, 53, 117-147; Dupin E., Calloni G.W., Le Douarin N.M. (2010) The cephalic neural crest of amniote vertebrates is composed of a large majority of precursors endowed with neural, melanocytic, chondrogenic and osteogenic potentialities. *Cell Cycle*, 9, 238-249; Le Douarin, N.M. (2012) In *The History in Neuroscience in Autobiography*, L.R. Squire ed.; Vol. 7, pp. 334-381; Neves, H., Dupin, E. Parreira, L. and Le Douarin N.M. (2012) Modulation of Bmp4 signalling in the epithelial-mesenchymal interactions that take place in early thymus and parathyroid development in avian embryos. *Dev. Biol.* 36, 208-219; Bronner, M.E., Le Douarin, N.M. (2012) Development and evolution of the neural crest: An overview. *Dev. Biol.* 366, 2-9; Le Douarin, N.M., Couly, G. and Creuzet, S.E. (2012) The neural crest is a powerful regulator of pre-otic brain development. *Dev. Biol.* 366, 74-82; Le Douarin, N.M. and Dupin, E. (2012) The neural crest and vertebrate evolution. *Curr. Op. Gen. Dev.* 22, 305-400; Le Douarin, N.M. (2012) Piecing together the vertebrate skull (Commentary about the article: The triple origin of the skull in higher vertebrates: a study in quail-chick chimeras. Couly, G., Coltey, P. and Le Douarin, N.M., 1993). *Development* 139, 4296-4296; Le Douarin, N.M. and Dieterlen, F. (2013) How studies on the avian embryo have opened new avenues in the understanding of development: a view about the neural and hematopoietic systems. *Dev. Growth Differ.* 55, 1-14.

Tsung-Dao Lee



Date of Birth 26 November 1926

Place Shanghai (PRC)

Nomination 14 April 2003

Field Physics

Title Professor, Nobel laureate in Physics, 1957

Most important awards, prizes and academies *Awards:* Nobel Prize in Physics (1957); Albert Einstein Award in Science; Galileo Galilei Medal; Order of Merit, Grande Ufficiale, Republic of Italy; Science for Peace Prize, China National-International Cooperation Award; Naming of Small Planet 3443 as the T.-D. Lee Planet; New York City Science Award; New York Academy of Sciences Award; The Order of the Rising Sun, Gold and Silver Star, Japan. *Academies:* American Physical Society; Academia Sinica; American Academy of Arts and Sciences; National Academy of Sciences; American Philosophical Society, Accademia Nazionale dei Lincei; Chinese Academy of Sciences; Third World Academy of Sciences; Pontifical Academy of Sciences.

Summary of scientific research Lee began his research under Enrico Fermi at the University of Chicago, with his first paper on the universality of the Fermi Interaction and his thesis on white dwarfs stars. He then worked with collaborators on phase transitions in statistical mechanics and polarons in condensed matter physics. After joining Columbia University in 1953, Lee worked mainly in particle physics and field theory. He created the Lee Model and the fields of high energy neutrino physics and the relativistic heavy ion physics. More recently, his interests have turned into high T_c superconductivity, lattice physics, difference equations and new ways to solve the Schrödinger Equation.

Main publications *Books:* T.D. Lee, *Particle Physics and Introduction to Field Theory*, Harwood Academic Publishers, 1981; T.D. Lee, *Selected Papers*, Vols 1-3, Ed. G. Feinberg, Birkhauser Boston Inc., 1986; *Thirty Years Since Parity Nonconservation, A Symposium for T.D. Lee*, Birkhauser Boston Inc., 1988; T.D. Lee, *Symmetries, Asymmetries, and the World of Particles*, University of Washington Press, 1988; T.D. Lee, *Selected Papers*, 1985-96, eds H.C. Ren and Y. Pang, Gordon and Breach, 1998; *Science and Art*, eds

T.D. Lee and Liu Huaizu, Shanghai Science and Technology Publisher, 2000; T.D. Lee, *The Challenge from Physics*, China Economics Publisher, 2002; T.D. Lee, *Response to the Dispute of Discovery of Parity Violation*, eds Ji Cheng, Liu Huaizu and Teng Li (in Chinese), Gansu Science and Technology Publisher, 2004, Cosmos Books Ltd. Hong Kong, 2004. *Articles*: Lee, T.D., *et al.*, Interaction of Mesons with Nucleons and Light Particles, *Physical Review*, 75, p. 905 (1949); Lee, T.D., Hydrogen Content and Energy Productive Mechanism of White Dwarfs, *Astrophysical Journal*, 111, p. 625 (1951); Lee, T.D. and Yang, C.N., Statistical Theory of Equations of State and Phase Transitions. II. Lattice Gas and Ising Model, *Physical Review*, 87, p. 404 (1952); Lee, T.D. and Pines, D., Motion of Slow Electrons in Polar Crystals, *Physical Review*, 88, p. 960 (1952); Lee, T.D., Some Special Examples in Renormalizable Field Theory, *Physical Review*, 95, p. 1329 (1954); Lee, T.D. and Yang, C.N., Question of Parity Conservation in Weak Interaction, *Physical Review*, 104, p. 254 (1956); Lee, T.D., Abnormal Nuclear States and Vacuum Excitations, *Review of Modern Physics*, 47, p. 267 (1975); Friedberg, R., Lee, T.D. and Sirlin, A., Class of Scalar-field Soliton Solutions in Three Space Dimensions, *Physical Review*, D1 3, p. 2739 (1976); Christ, N.H., Friedberg, R. and Lee, T.D., Random Lattice Field Theory: General Formulation, *Nuclear Physics*, B 202, p. 89 (1982); Lee, T.D., Can Time Be a Discrete Dynamical Variable?, *Physics Letters*, 12213, p. 217 (1983); Lee, T.D., Soliton Stars and the Critical Masses of Black Holes, *Physical Review*, D, p. 3637 (1987); Lee, T.D., Bosonization of Lattice Fermions and High Tc Superconductivity, *Physica*, 186 (1994); Friedberg, R., Lee, T.D., Zhao, W.Q., and Cimenser, A., A Convergent Iterative Solution of the Quantum Double-well Potential, *Annal Physics*, 294, p. 67 (2001); Lee, T.D., A New Approach to Solve the Lying States of the Schroedinger Equation, *Journal of Statistical Physics* 121, 1015 (2005); Lee, T.D., *et al.*, Convergent Iterative Solutions for a Sombro-Shaped Potential in Any Space Dimension and Arbitrary Angular Momentum, *Ann. Phys.* 321, 1981 (2006); Lee, T.D., Comments on the Superconductivity Solution of an Ideal Charged Boson System, *Journal of Superconductivity and Novel Magnetism* 19, 277 (2006); Lee, T.D., A Possible Relation between the Neutrino Mass Matrix and the Neutrino Mapping Matrix (with R. Friedberg), *HEP & NP* 30 591, (2006); Lee, T.D., Hidden Symmetry of the CKM and Neutrino Mapping Matrices (with R. Friedberg), *Ann. Phys.* (2007); Lee, T.D., Jarlskog Invariant of the Neutrino Mapping Matrix (with R. Friedberg), *Ann. Phys.* (2007); Lee, T.D., A Bright Future for Particle Physics, *CERN Courier*, 31867, Nov (2007).

Yuan-Tseh Lee



Date of Birth 19 November 1936

Place Hsinchu, Taiwan (ROC)

Nomination 23 July 2007

Field Physical Chemistry

Title Professor, Nobel laureate in Chemistry, 1986

Most important awards, prizes and academies *Fellowships:* Alfred P. Sloan Fellow, 1969-71; Camille and Henry Dreyfus Foundation Teacher Scholar Grant, Recipient 1971-4; Fellow, American Academy of Arts and Science, 1975; Fellow, American Physical Society, 1976; John Simon Guggenheim Fellow, 1976-7. *Academies:* Member, U.S. National Academy of Sciences, 1979; Member, Academia Sinica, Taiwan, China, 1980; Corresponding Member, Göttingen Academy of Sciences, Germany, 1988; Honorary Foreign Member, Indian National Science Academy, 1997; Honorary Member, The Japan Academy, 2007; Honorary Member, The Hungarian Academy of Sciences, 2007; Member of the Pontifical Academy of Sciences, 2007. *Honours:* Honorary Professor, Institute of Chemistry, Chinese Academy of Science, Beijing, China, 1980; Honorary Professor, Fudan University, Shanghai, China, 1980; Miller Professorship, University of California, Berkeley, California, 1981; Honorary Professor, Chinese University of Science and Technology, Hefei, Anhui, China, 1986; Honorary Doctor of Science Degree, University of Waterloo, 1986. *Awards:* Ernest O. Lawrence Award, U.S. Department of Energy, 1981; Sherman Fairchild Distinguished Scholar, California Institute of Technology, 1983; Harrison Howe Award, Rochester Section, American Chemical Society, 1983; Peter Debye Award of Physical Chemistry, American Chemical Society, 1986; National Medal of Science, White House, USA, 1986; Nobel Prize in Chemistry, 1986; Faraday Medal, Royal Society of Chemistry, UK, 1992; Jawaharlal Nehru Biorth Centenary Medal, Indian National Science Academy, 2004.

Summary of scientific research Prof. Lee determined the structure and chemical behaviour of highly reactive polyatomic radicals and unusual transient species. He provided microscopic details of mechanisms and dynamics

for elementary chemical reactions and primary photodissociation processes. He probed the nature of infra- and intermolecular energy relaxation. He searched for bond-selective, region-selective or mode-selective means to modify and manipulate chemical reactivity. He developed methods for detecting and studying directly the transient intermediates that are critical in combustion and atmospheric processes.

Main publications The following are Prof. Lee's ten most representative publications: P.A. Schultz, Aa.S. Sudbo, E.R. Grant, Y.R. Shen, and Y.T. Lee, Multiphoton Dissociation of SF₆ by a Molecular Beam Method, *J. Chem. Phys.*, 72, 4985-95 (1980). LBL-9202; Carl C. Hayden, Daniel M. Neumark, Kosuke Shobatake, Randal K. Sparks, and Yuan T. Lee, Methylene Singlet-Triplet Energy Splitting by Molecular Beam Photodissociation of Ketene, *J. Chem. Phys.*, 76, 3607-13 (1982); D. Krajnovich, F. Huisken, Z. Zhang, Y.R. Shen, and Y.T. Lee, Competition Between Atomic and Molecular Chlorine Elimination in the Infrared Multiphoton Dissociation of CF₂Cl₂, *J. Chem. Phys.*, 77, 5977-89 (1982). LBL-14478; L.J. Butler, E.J. Hintsa, and Y.T. Lee, Bond Selective Photochemistry in CH₂Br Through Electronic Excitation at 210 nm, *J. Chem. Phys.*, 84, 4104-6 (1986). LBL-20770; Xinsheng Zhao, Eric J. Hintsa, and Yuan T. Lee, Infrared Multiphoton Dissociation of RDX in a Molecular Beam, *J. Chem. Phys.*, 88, 801-10 (1988); R.H. Page, Y.R. Shen, and Y.T. Lee, Infrared-Ultraviolet Double Resonance Studies of Benzene Molecules in a Supersonic Beam, *J. Chem. Phys.*, 88, 5362-76 (1988). LBL-23769; Xinsheng Zhao, Robert E. Continetti, Atsushi Yokoyama, Eric J. Hintsa, and Yuan T. Lee, Dissociation of Cyclohexene and 1,4-Cyclohexadiene in a Molecular Beam, *J. Chem. Phys.*, 91, 4118-27 (1989). LBL-26333; Floyd Davis and Yuan T. Lee, Dynamics and Mode Specificity in OCIO Photodissociation, *J. Phys. Chem.*, 96, 5681-4 (1992). LBL-32189; J.J. Lin, D.W. Huang, Y.T. Lee, and X. Yang, Specific site and isotope effects on the concerted molecular hydrogen elimination from ethylene, *J. Chem. Phys.*, 109 (8), 2979-82 (JCP communication) (1998); S. Harich, J.J. Lin, Y.T. Lee, and X. Yang, Site Specific Dissociation Dynamics of Propyne at 157 nm, *J. Chem. Phys.*, 112, 15, 6656-65 (2000).

Jean-Marie Lehn



Date of Birth 30 September 1939

Place Rosheim (France)

Nomination 30 May 1996

Field Chemistry

Title Professor, Nobel Laureate in Chemistry, 1987

Most important awards, prizes and academies *Awards:* Gold Medal of the Pontifical Academy of Sciences (1981); Gold Medal of the CNRS (1981); Paracelsus Prize of the Swiss Chemical Society (1982); Alexander von Humboldt Forschungspreis (1983); Prize of the Commissariat à l'Energie Atomique, Académie des Sciences (1984); Rolf-Sammet Prize, Frankfurt University (1985); Nobel Prize in Chemistry (1987); Karl-Ziegler Prize (1989); Bonner Chemiepreis (1993); 'Ettore Majorana Centre Erice Science for Peace' Prize (1994); Davy Medal (1997); Lavoisier Medal (1997); Messel Medal (1998); Giulio Natta Medal (2003). *Academies:* Member or Foreign Member or Honorary Member of 33 Academic bodies.

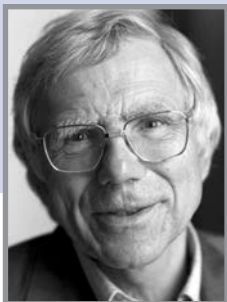
Summary of scientific research Jean-Marie Lehn received his Doctorat-ès-Sciences in 1963 from the University of Strasbourg working in the laboratory of Guy Ourisson. The following year he joined the group of Robert Burns Woodward at Harvard University, where he participated in the total synthesis of vitamin B12. On his return to Strasbourg he started to work in areas on the frontier between organic and physical chemistry, later taking an interest in biological processes as well. In 1970 Lehn became Professor of Chemistry at the Université Louis Pasteur in Strasbourg and since 1979 he has been Professor at the Collège de France in Paris. The research work of Jean-Marie Lehn led in 1968 to the synthesis of cage-like molecules that form inclusion complexes, the cryptates, with various metal ions. With this began his research on the chemical basis of 'molecular recognition' (i.e. the way in which a receptor molecule recognizes and selectively binds a substrate), which also plays a fundamental role in biological processes. For these studies Lehn received the Nobel Prize for Chemistry in 1987. In the 1975-85 period he also conducted research on the photochemical splitting of water and artificial photosynthesis for which he recei-

ved the Pius XI Gold Medal of the Pontifical Academy of Sciences in 1981. Over the years, Lehn's main line of research has expanded from the studies on molecular recognition to the definition and exploration of a new field of chemistry, which he proposed calling 'supramolecular chemistry' as it deals with the complex entities formed by the association of two or more chemical species held together by intermolecular forces, whereas molecular chemistry studies the features of the entities constructed from atoms linked by covalent bonds. His work has also covered supramolecular catalysis, artificial enzymes and transport processes. It has further extended to the design of functional molecular and supramolecular devices belonging to the areas of molecular electronics, ionics and photonics. More recently a main line of development has been the design of 'programmed' systems that undergo self-organization by the spontaneous assembly of suitable components into well-defined supramolecular architectures following an Aufbau plan. The long-range goal is the study and design of organized matter and the progressive build-up of complexity. The results of the work of Jean-Marie Lehn have been described in more than 700 scientific publications.

Main publications Dietrich, B., Lehn, J.-M., Sauvage, J.-P., *Les Cryptates*, *Tet. Letters*, p. 2889 (1969); Lehn, J.-M., Nitrogen inversion: experiment and theory, *Fortschritte der chemischen Forschung*, 15, p. 311 (1970), Springer-Verlag; Lehn, J.-M., Design of organic complexing agents. Strategies towards properties, *Structure and Bonding*, 16, p. 1 (1973); Lehn, J.-M., Cryptates: the chemistry of macropolycyclic inclusion complexes, *Acc. Chem. Res.*, 11, p. 49 (1978); Lehn, J.-M., Cryptates: inclusion complexes of macropolycyclic receptor molecules, *Pure & Appl. Chem.*, 50, p. 871, 1978; Lehn, J.-M., Macropolycyclic receptor molecules: Aspects of chemical reactivity. Investigations into molecular catalysis and transport processes, *Pure & Appl. Chem.*, 51, p. 979 (1979); Lehn, J.-M., Cryptate inclusion complexes. Effects on solute-solute and solute-solvent interactions and on ionic reactivity, *Pure & Appl. Chem.*, 52, p. 2303 (1980); Lehn, J.-M., Chemistry of transport processes – Design of synthetic carrier molecules, *Physical Chemistry of Transmembrane Ion Motions* (G. Spach, ed.), p. 181 (Elsevier, 1983); Lehn, J.-M., Supramolecular chemistry: Receptors, catalysts and carriers, *Science*, 227, p. 849 (1985); Lehn, J.-M., Supramolecular chemistry – Scope and perspectives. Molecules, supermolecules, and molecular devices, (*Nobel Lecture*, 8.12.1987), *Angew. Chem. Int. Ed. Engl.*, 27, pp. 89-112 (1988); Lehn, J.-M., Perspectives in supramolecular chemistry – From molecular recognition towards molecular information processing and self-organization, *Angew.*

Chem. Int. Ed. Engl., 29, p. 1304 (1990); Lehn, J.-M., *Supramolecular Chemistry – Concepts and Perspectives, VCH* (1995); Lehn, J.-M., *Supramolecular chemistry/Science. Some conjectures and perspectives* (R. Ungaro, E. Dalcanale, eds), *Supramolecular Science: Where It is and Where It is Going*, Kluwer Academic Publisher, pp. 287-304 (1999); Lehn, J.-M., *Dynamic combinatorial chemistry and virtual combinatorial libraries*, *Chem. Eur. J.*, 5, pp. 2455-63 (1999); Lehn, J.-M., *Programmed chemical systems: Multiple subprograms and multiple processing/expression of molecular information*, *Chem. Eur. J.*, 6, pp. 2097-2102 (2000); Lehn, J.-M., *Supramolecular Polymer Chemistry – Scope and Perspectives, Supramolecular Polymers* (Alberto Ciferri, ed.), pp. 615-41 (2000); Lehn, J.-M., *Toward complex matter: Supramolecular Chemistry and self-organization*, *Proc. Natl. Acad. Sci. USA*, 99, pp. 4763-8 (2002); O. Ramström, J.-M. Lehn, *Dynamic Ligand Assembly, Comprehensive Medicinal Chemistry II*, D. Triggle, J. Taylor (eds), Elsevier, Ltd, Oxford, 959-76 (2007); D. Sarazin, M. Schmutz, J.-M. Guenet, A. Petitjean, J.-M. Lehn, *Structure of Supramolecular Polymers Generated via Self-Assembly through Hydrogen Bonds*, *Mol. Cryst. Liq. Cryst.*, 468, 187-201 (2007); E. Buhler, S.-J. Candau, E. Kolomiets, J.-M. Lehn, *Dynamical Properties of Semidilute Solutions of Hydrogen-Bonded Supramolecular Polymers*, *Physical Review E*, 76, 061804-1-061804-8 (2007); N. Sreenivasachary, J.-M. Lehn, *Structural Selection in G-Quartet-Based Hydrogels and Controlled Release of Bioactive Molecules*, *Chem. Asian J.*, 3, 134-9 (2008); D.T. Hickman, N. Sreenivasachary J.-M. Lehn, *Synthesis of Components for the Generation of Constitutional Dynamic Analogues of Nucleic Acids*, *Helv. Chim. Acta*, 91, 1-20 (2008); S. Ulrich, J.-M. Lehn, *Reversible switching between macrocyclic and polymeric states by morphological control in a constitutional dynamic system*, *Angew. Chem. Int. Ed.*, 47, 2240-3 (2008); A. Petitjean, L.A. Cuccia, M. Schmutz, J.-M. Lehn, *Naphthyridine-based helical foldamers and macrocycles: Synthesis, cation binding, and supramolecular assemblies*, *J. Org. Chem.*, 73, 2481-95 (2008); G. Pace, A. Petitjean, M.-N. Lalloz-Vogel, J. Harrowfield, J.-M. Lehn, P. Samori, *Subnanometer-resolved patterning of bicomponent self-assembled monolayers on Au(111)*, *Angew. Chem. Int. Ed.* 47, 2484-8 (2008); Y. Ruff, J.-M. Lehn, *Glycodynamers: Dynamic analogs of arabinofuranoside oligosaccharides*, *Biopolymers*, 89, 486-96 (2008); Y. Ruff, J.-M. Lehn, *Glycodynamers: Fluorescent dynamic analogues of polysaccharides*, *Angew. Chem Int. Ed.*, 47, 3556-9 (2008); M. Barboiu, J.-M. Lehn, *Helical Diastereomerism in Self-Organization of Molecular Strands*, *Rev. Chim. (Bucuresti)*, 59, 255-9 (2008).

Pierre Jean Léna



Date of Birth 22 November 1937

Place Paris (France)

Nomination 18 January 2001

Field Astrophysics

Title Professor Emeritus, Université Paris Diderot

Most important awards, prizes and academies *Awards:* Officier de la Légion d'honneur; Commandeur de l'Ordre du Mérite; Prix Deslandres et Henri de Parville, Académie des sciences; Prix Maurice Pérouse, Fondation de France; Prix Holweck, Société française de physique/Institute of Physics; Médaille Janssen, Société astronomique de France; Médaille Erasmus de l'Academia Europaea. *Academies:* Académie des sciences, Paris (1991); Academia Europaea (1991); Pontifical Academy of Sciences (2001); Academia Nacional de Ciencias Exactas, Físicas y Naturales de Buenos Aires (2005); Academia Nacional de Educación, Argentina (2005); Academia Nacional de Ciencias del Peru (2010); Academia de Ciencias Físicas, Matemáticas y Naturales de Venezuela (2011).

Summary of scientific research The scientific work of Pierre Léna is centred on infrared astronomy, a major branch of astronomy born in about 1960. With novel observations, he helped to model the solar atmosphere and its temperature minimum, then switched to the far infrared emission of molecular clouds in our Galaxy and the diffuse emission of interstellar medium observed with an airborne telescope. Adapting to infrared the speckle interferometry discovered by the French scientist Antoine Labeyrie, he was the first, with his students, to apply it to star formation and to measure the size of dust cocoons around forming stars. This work led him to organize the European Very Large Telescope as an interferometer, again following Labeyrie's ideas. This is the world's most powerful instrument and is now operating. He then worked on a new interferometer, connecting with optical fibres large telescopes on Mauna Kea (Hawaii). Beginning in 1984, he led a team which was the first to implementing adaptive optics on a telescope, a technique now adopted worldwide on giant instruments. With his students, he

applied it to various astronomical objects. As an experimental physicist, he contributed to numerous techniques required by infrared astronomy, such as bolometers, Fourier spectrometers, bi-dimensional arrays, and air- and space-borne instruments. He represented France on the governing Council of the European Southern Observatory (1986-1993), and directed the Graduate School of Astrophysics at Université Paris 7 (1976-1984 and 1992-1996) before becoming Director of the École Doctorale Astronomie d'Île-de-France. His interest in educational matters led him to become President of the Institut National de Recherche Pédagogique (1991-1997) and to be an active member of *La Main à la Pâte* activity designed to renovate science education in schools. He was President of the Société Française de Physique in 1989 and from 2003 to 2007 President of the Comité d'éthique du CNRS. He built and was in charge of the Education office at the French Académie des sciences and became (2011) President of the new Foundation for science education, set by the Académie.

Main publications *Articles:* Eddy, J., Léna, P. and McQueen, R.M., Far infrared measurement of the solar minimum temperature, *Solar Physics*, 10, pp. 330-41 (1969); Léna, P., Le rayonnement continu de la photosphère solaire, *Astron. Astrophys.*, 4, pp. 202-19 (1970); Turon, P. and Léna, P., First observation of the granulation at 1.65 micrometers. Center to limb variation of the contrast, *Solar Physics*, 30, pp. 3-14 (1973); Léna, P. *et al.*, The thermal emission of the dust corona during the eclipse of June 30, 1973, 1, *Astron. Astrophys.*, 37, pp. 75-9 (1974); Rouan, D., Léna, P., Puget, J.L., de Boer, K. and Wijnbergen, J., Far infrared observations of the galactic plane and molecular cloud S 140, *Ap. J.*, 213, L35-39 (1977); Chelli, A., Léna, P. and Sibille, F., Angular dimensions of accreting young stars, *Nature*, 278, pp. 143-6 (1979); Sibille, F., Chelli, A. and Léna P., Infrared speckle interferometry, *Astron. Astrophys.*, pp. 315-28 (1979); Chelli, A., Perrier, C. and Léna, P., The sub-arcsecond structure of I Rc at 5 μm , *Astrophys. J.*, 280, p. 163 (1984); Jiang Dong-rong, Perrier, C. and Léna, P., NGC2024 IRS2, Infrared speckle interferometry and nature of the source, *Astron. Astrophys.*, 135, pp. 249-54 (1984); Roddier, F. and Léna, P., Long baseline Michelson interferometry with large ground based telescopes at optical wavelengths, I & II, *Journ. Optics*, 15, pp. 171-82 & pp. 363-74 (1984); Léna, P. and Merkle, F., The interferometric mode of the European Very Large Telescope, *Astroph. Sp. Sc.*, 160, pp. 363-8 (1989); Rousset, G., Fontanella, J.C., Kern, P., Gigan, P., Rigaut, F., Léna, P. *et al.*, First diffraction-limited astronomical images with adaptive optics, *Astron. Astrophys.*, 230, L29-32 (1990); Gen-

dron, E. and Léna, P., Astronomical adaptive optics. I. Modal control optimization, *Astron. Astrophys.*, 291, pp. 337-47 (1994); Mariotti, J.-M., Coudé du Foresto, V., Perrin, G., Zhao, P. and Léna, P., Interferometric connection of large ground based telescopes, *Astron. Astrophys. Suppl. Series*, 116, pp. 381-93 (1996); Clénet, Y., Rouan, D., Gendron, E., Montri, J., Rigaut, F., Léna, P. and Lacombe, F., Adaptive optic L-band observations of the Galactic Center region, *Astron. Astrophys.*, 376, p. 124 (2001); Glanc, M., Gendron, E., Lacombe, F., Lafaille, D., Le Gargasson, J.F. and Léna, P., Towards wide field retinal imaging with adaptive optics, *Opt. Comm.*, 230, pp. 225-38 (2004). *Books: Lumières. Une introduction aux phénomènes optiques*, avec A. Blanchard, InterEditions, 1990; *Astrophysique: méthodes physiques de l'observation*, 2^e éd. 1996, avec F. Lebrun & F. Mignard, EDP, Paris (English translation); *Astrophysical Observation*, Springer, 1998 (translated in Chinese, National Institute for Compilation and Translation, Taiwan, 2004). A revised edition was published in French in 2008 (*L'Observation en astrophysique*) and in English in 2012 as *Observational Astrophysics* (Springer); *Adaptive optics for Astronomy* (F. Roddier, ed.), Cambridge University Press, 1998; O. Charpak, P. Léna, Y. Quéré, *L'Enfant et la Science. L'aventure de La main à la pâte*, ed. Odile Jacob, 2005. *Other Publications: L'espace pour l'homme*, coll. Dominos, Flammarion (1993) (translated in Korean and Portuguese); *La main à la pâte. L'enseignement des sciences à l'école primaire*, ouvr. coll. présenté par G. Charpak, Flammarion (1996) (translated in Portuguese, Vietnamese, Arabic and Chinese); *Les Sciences du ciel*, sous la direction de P. Léna, Flammarion (1996); *Le Trésor*, dictionnaire des sciences, ouvr. coll. dirigé par Michel Serres et Nayla Farouki, Flammarion (1997); *Paysages des sciences*, ouvr. coll. dirigé par Michel Serres & Nayla Farouki, Le Pommier (1999); *La science*, Yang Huanming and Pierre Léna, Desclée de Brouwer (2003). Parution simultanée en chinois, Presses de Shanghai; *Eclipse 73* (CERIMES, Paris); *Tours du Monde, Tours du Ciel*, dix heures d'émission pour la télévision, en collaboration avec Michel Serres, auteur et réalisateur R. Pansard-Besson (1990 and 2009). EDP Sciences (2009).

Jean-Michel Maldamé, O.P.



Date of Birth 31 August 1939

Place Alger (Algeria)

Nomination 29 January 1997

Field Philosophy

Title Professor

Most important awards, prizes and academies 1er Prix des Libraires Catholiques, Siloë (1999). Pontifical Academy of Sciences (1997).

Summary of scientific research Dialogue Science/Foi; Recherche sur la théologie de la Création; Relation entre la théologie et la cosmologie; approche de Dieu à partir des questions posées par la sciences de la nature.

Main publications *Books: Le Christ et le cosmos, Incidence de la cosmologie moderne sur la théologie*, Desclée (Paris, 1993), traduction italienne: *Cristo e il cosmo: Cosmologia e teologia*, San Paolo (Milan, 1995), pp. 281; *Le Saint Suaire, 'Dossiers sur des questions actuelles', 'Que penser de ...? 33'*, Fidélité (Bruxelles, 1997), pp. 50, traduction en espagnol, Mensajero (Madrid, 2000); 'Le Christ pour l'Univers', *Jésus et Jésus-Christ*, n. 73, Desclée (Paris, 1998), 1 vol. de pp. 294; *Un livre inspiré, la Bible*, Cerf (Paris, 1998), pp. 132; *En travail d'enfantement, création et évolution*, Aubin (Saint-Étienne, 2000), 1 vol. de pp. 160; *Le scandale du mal. Une question posée à Dieu*, Cerf (Paris, 2001), pp. 146; *L'univers du Big-bang. Lecture biblique*, Vrin (Paris, 2001), pp. 256; *De l'ombre de la mort... à la vie, Sources de la Vie* (Toulouse, 2002), pp. 120; *Science et foi en quête d'unité. Discours scientifiques et discours théologiques*, Cerf (Paris, 2003), pp. 360; *Jésus, fils de Joseph: Comment comprendre aujourd'hui la conception virgine de Jésus?*, Jean-Marc Moschetta et Jean-Michel Maldamé, Broché (2002); *De l'Ombre de la Mort a la Vie*, Broché (2005); *Création et providence: Bible, science et philosophie*, Broché (2006); *Le péché originel: Foi chrétienne, mythe et métaphysique*, Broché (2008). *Articles in books: Réflexion philosophique et théologique sur le moment de la mort, The Determination of Brain Death and its Relationship to Human Death*, Pontificiae Academiae Scientiarum, *Scripta Varia* 83 (Vatican City, 1992), pp. 177-

186; Science, culture et théologie, Pontificiae Academiae Scientiarum, *Scripta Varia* 85 (Vatican City, 1994), pp. 397-431; L'origine de la vie en philosophie et en théologie, *Commentarii*, vol. V, n. 5, Académie pontificale des sciences (Vatican City, 1997), pp. 33-49; Fondements épistémologiques des sciences cognitives, *Le Défi des sciences cognitives*, Colloque Institut catholique, 1997, Chronique, pp. 21-41; Culture scientifique et déplacement du religieux, *Le temps des religions sans Dieu*, Esprit (juin 1997), pp. 70-3; Identité humaine et génétique, Pontificiae Academiae Scientiarum, *Scripta Varia* 92 (Vatican City, 1998), pp. 157-170; Actualité de la démarche de saint Thomas d'Aquin pour comprendre la vie, *La Vita, storia et teoresi*, Pont. Univ. Lateranense (Rome, 1999), pp. 77-91; The Concept of Nature in Morality and Theology, *Changing Concepts of Nature*, Pontificiae Academiae Scientiarum, *Scripta Varia* 95 (Vatican City, 2000), pp. 303-316; L'entrée du Christ dans la gloire, renouvellement du rapport de l'homme et de l'espace, *Dieu, l'Église et les extraterrestres*, Questions de n. 122 (Paris, 2000), pp. 47-68; Le face-à-face Église et science au XXe siècle, *Les grandes révolutions de la théologie moderne*, Bayard (Paris, 2003), pp. 9-60. Articles: La pensée de la fin, *Recherches de science religieuse*, LXXXIV, 2, pp. 193-218 (1996); Encore le saint Suaire de Turin. Note épistémologique, *Bulletin de littérature ecclésiastique*, XCVII, 3, pp. 280-7 (juillet-septembre 1996); Evolution et création. La théorie de l'évolution: ses rapports avec la philosophie de la nature et la théologie de la création, *Revue Thomiste*, 4, pp. 575-616 (1996); Darwin et Dieu. Etude de l'itinéraire spirituel de Darwin en lien avec l'élaboration de la théorie de l'évolution, *Bulletin de littérature ecclésiastique*, XCVIII, pp. 155-79 (1997); L'origine de la vie, *Etudes*, pp. 641-50 (mai 1997); Science et foi, conditions nouvelles du dialogue, *Revue Thomiste*, 3, pp. 525-62 (1997); Le Christ et l'univers. *Dialogue entre la théologie et la cosmologie scientifique*, Angelicum, LXXIV, pp. 335-358 (1997); A la recherche de l'un, la cosmologie, *Revue des Questions scientifiques*, 168, pp. 225-43 (Namur, Belgique, 1997); Sciences cognitives, neurosciences et âme humaine, *Revue Thomiste*, 2, pp. 282-322 (1998); Origines de l'homme. Confrontation entre les résultats scientifiques et la tradition chrétienne, *Esprit et vie*, 13, pp. 289-97 (1998); Quelques remarques théologiques sur l'Intelligence artificielle, *Esprit et vie*, 13, pp. 298-306 (1998); L'Église et la science en dialogue, *Bulletin de littérature ecclésiastique*, 3, pp. 303-21 (juillet-septembre 1998); Dessein de Dieu et Providence. Finalité et finalités en théologie, *Revue d'éthique et de théologie morale*, 208, pp. 139-60, Cerf (mars 1999); Présentation de l'encyclique de Jean-Paul II *Fides et ratio*, *Cahiers saint Dominique* (juin

1999); La science est-elle un chemin vers Dieu?, *Esprit et vie*, 15, pp. 337-54 (5 août 1999); Le monde a-t-il été créé imparfait?, *Esprit et vie*, 21, pp. 457-64 (4 novembre 1999); Dieu et le temps, *Cahiers saint Dominique*, pp. 5-20 (décembre 1999); Dessein de Dieu et Providence. Finalité et finalités en théologie, *Revue d'Éthique et de théologie morale*, Le Supplément, 208, pp. 139-60 (mars 1999); Entre maîtrise et chaos. Civilisation techno-scientifique, possibilité de maîtrise, *Revue d'Éthique et de théologie morale*, Le Supplément, 209, pp. 129-35 (juin 1999); Sciences cognitives: L'âme perdue et retrouvée?, *Théophilyon*, IV-2, pp. 327-53 (1999); La place de l'homme dans l'univers. Astrophysique et foi chrétienne, *L'Homme dans la création*, revue *Christus*, 185, pp. 55-60 (janvier 2000); Emergence d'un nouveau paradigme scientifique et déplacements dans la catégorie du divin, *Lumière et vie*, 245, pp. 25-44 (janvier-mars 2000); Mieux dire le péché originel, grâce au sciences de la nature, *Esprit et vie*, 7 et 8, pp. 8-15 et 4-12 (5 et 19 avril 2000); Église et science d'après les discours des papes à l'Académie pontificale des sciences, *Connaître*, Cahiers de l'Association Foi et Culture scientifique, 14, pp. 36-62 (décembre 2000); Le mystère du temps: temps des hommes et temps de Dieu. A l'occasion du commencement du nouveau millénaire, *Esprit et vie*, 3 livraisons (janvier et février 2001); Peut-on parler de la pluralité des mondes, *Rev. des Quest. Scient.*, 172, pp. 245-75 (2001); Situation actuelle du début science-foi. Impasses, renouveaux et ouvertures, *L'Église à la croisée des chemins*, Cerf (Paris, 2002).

Félix Wa Kalenga Malu



Date of Birth 22 September 1936

Place Boma (Zaire)

Nomination 26 September 1983

Field Physics

Title Professor

Malu

Most important awards, prizes and academies *Awards:* Médaille d'Argent du Mérite Civique, R.D.C.; Médaille d'Or du Mérite des Sciences et Lettres, Zaïre; Commandeur de l'Ordre National du Léopard, R.D.C.; Chevalier de l'Ordre de la Francophonie et du Dialogue des Cultures 'La Pléiade', France; Prix international du 'Mercure d'Or', Italie. *Academies:* Membre Correspondant, Académie des Sciences d'Outre-Mer, Belgique; Membre-fondateur, Académie du Tiers-Monde, Trieste, Italie; Membre-fondateur, Académie Africaine des Sciences, Nairobi; Académie Pontificale des Sciences.

Summary of scientific research Dans le domaine de l'étude des phénomènes non linéaires et stochastiques, le Dr. Malu wa Kalenga s'est principalement attaché à l'étude des circuits électroniques comme le paramétron, l'oscillateur de Van Der Pol et le circuit de Duffing. L'étude du paramétron a permis de préciser les conditions de son emploi comme élément de mémoire dans les ordinateurs, dans le cas de signaux corrompus par du bruit. Dans le domaine du génie atomique, le Dr. Malu wa Kalenga, qui a dirigé la construction du réacteur Triga Mark II du Centre Régional d'Etudes Nucléaires de Kinshasa (CREN-K) (puissance en continu: 1 MW; puissance en pulsation: 1600 MW), s'intéresse à l'étude des réacteurs pulsés et des effets de bruit associés. Il a en particulier montré comment les neutrons retardés et les effets d'inertie en température pouvaient être pris en compte dans la dérivation sous une forme analytique compacte de la réactivité en mode pulsé. Il a plus généralement travaillé à la promotion et à l'utilisation de l'énergie atomique en Afrique et au Zaïre qui a abouti à la création, sous les auspices de l'OUA, du Centre Régional d'Etudes Nucléaires de Kinshasa (CREN-K) dont il assure la direction. L'importance de l'énergie dans le processus de développement des pays du Tiers-Monde, l'a conduit très tôt à s'intéresser à l'étude comparative des

systèmes énergétiques et singulièrement des systèmes d'énergie renouvelable dans le contexte de l'Afrique. Ses travaux et publications dans le secteur de l'énergie solaire ont été déterminants dans l'éclosion de cette forme d'énergie au Zaïre. Les recherches du Professeur Malu wa Kalenga restent orientées actuellement sur les problèmes posés par les énergies nouvelles et renouvelables, sur les problèmes de l'appréciation de la demande d'énergie, et sur le comportement de réacteur Triga Mark II en mode pulsé. Les problèmes posés par les interactions 'science, technologie et société', rencontrés dans le domaine des économies des systèmes énergétiques, amènent le Professeur Malu à s'intéresser de plus près à la science de la complexité et aux conséquences épistémologiques du paradigme évolutif en science.

Main publications Malu, F.W.K., Evaluation of the envelope dispersion of oscillations in a Van der Pol's type oscillator acted upon by weak noise, *5th International Conference on non-linear oscillations*, 4, pp. 308-21 (Kiev, USSR, 1969); Malu, F.W.K., *Influence des perturbations aléatoires sur le comportement dynamique du paramétron à inductance non linéaire*, Presse Universitaire, pp. 155, Université de Louvain (Belgique, 1969); Malu, F.W.K., Influence des pertes linéaires et non linéaires sur le comportement dynamique du paramétron à inductance non linéaire, *Revue H.F.*, vol. VIII, 1, pp. 9-18 (Belgique, 1970); Malu, F.W.K., Étude et réalisation d'un générateur de bruit à basse fréquence utilisant une source radioactive au Cobalt, *Utilisation de l'Energie Atomique à des fins pacifiques en Afrique*, pp. 455-6, IAEA (Vienne, 1970); Malu, F.W.K., Extension de la théorie des processus markoviens à des cas non-markoviens, I, *Bulletin de la Société Mathématique de Belgique*, 23 (3), pp. 264-70 (1971); Malu, F.W.K., *Les solutions possibles du problème du déficit énergétique de la Province Minière du Katanga en RDC*, Presse de l'ONRD, pp. 145 (1971); Malu, F.W.K., Le phénomène de commutation de phase du paramétron à inductance non linéaire en présence de bruit (transitoire d'amorçage), *Annales de la Faculté Polytechnique*, II, vol. 1, pp. 107-141, Presse Universitaire du Zaïre (1976); Malu, F.W.K., Power stabilisation of the Triga Mark II reactor of CREN-K, *Conférence sur les Réacteurs Triga*, General Atomic Press, TOC-7, pp. 3-38 à 3-48 (Salt Lake City, USA, 1976); Malu, F.W.K., Modification de la conception originale de la cuve du réacteur Triga Mark II du CREN-K, *General Atomic Press*, TOC-8, pp. 2-24 à 2-48 (1976); Malu, F.W.K., *Rapport de sécurité du réacteur Triga Mark II du CREN-K; puissance en continu: 1000 KW, puissance de pulsation:*

1600 MW, (en collaboration), Édition du CGEA (Zaire, 1976), pp. 475; Malu, F.W.K., *Les utilisations de l'énergie nucléaire: cas de l'Afrique*, Presse Universitaire du Zaïre (1977), pp. 219; Malu, F.W.K., *Les perspectives de l'énergie nucléo-électrique en Afrique Centrale, L'énergie nucléaire et son cycle de combustible*, AIEA, 6, pp. 127-40 (1978); Malu, F.W.K., *Sur les énergies nouvelles: l'énergie solaire*, Presse SPE (1978), pp. 201; Malu, F.W.K., *Hydrogen as a feed-stock in chemical and petrochemical: the case of Zaïre*, in Veziroglu, T.N., Fueki, K., Ohta, T., *Hydrogen Energy Progress*, Pergamon Press, pp. 1265-72 (1980); Malu, F.W.K., *Inertial effect on the CREN-K Triga reactor on pulsed mode*, *Revue Zaïroise des Sciences Nucléaires*, vol. 1, 1, pp. 1-14 (1980); Malu, F.W.K., *Solenoid pick-up problem in the CREN-K Triga Mark II Reactor*, *Revue Zaïroise des Sciences Nucléaires*, vol. II, 1-2, pp. 111-5 (juin-déc. 1981); Malu, F.W.K., *Un modèle économétrique de l'appréciation de la demande d'énergie par tête au Zaïre*, *Revue Zaïroise des Sciences Nucléaires*, vol. III, 1, pp. 119-34 (1982); Malu, F.W.K., *Incidence énergétique du phénomène de l'exode rural et de l'explosion démographique en Afrique au Sud du Sahara*, Dossier Méthodologique, Presse Universitaire du Zaïre, pp. 185 (1983); Malu, F.W.K., *Nuclear power and the demand problem in LDC's*, *Revue Zaïroise des Sciences Nucléaires*, vol. IV, pp. 1-18 (1984); Malu, F.W.K., *Science et technologie en Afrique (histoire, leçon et perspective)*, Académie Royale des sciences d'Outre-Mer de Belgique mémoire, in-8, nouvelle série, Tome 18, pp. 266 (Bruxelles, 1992).

Yuri Ivanovich Manin



Date of Birth 16 February 1937

Place Simferopol (Russia)

Nomination 25 June 1996

Field Mathematics

Title Professor

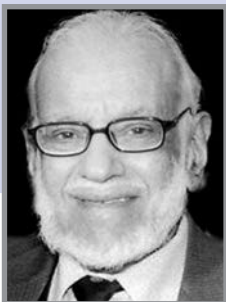
Most important awards, prizes and academies *Awards:* Moscow Mathematical Society (1963); Lenin Prize for work in Algebraic Geometry (1967); Brouwer Golden Medal for work in Number Theory, Royal Society and Mathematical Society of the Netherlands (1987); Frederic Esser Nemmers Prize in Mathematics, Northwestern University, Evanston, IL, USA (1994); Rolf Schock Prize in Mathematics, Swedish Royal Academy of Sciences (1999); Georg Cantor Medal, German Mathematical Society (2001); King Faisal Prize in Science, Saudi Arabia (2002); Order pour le Mérite, Germany (2007); Great Cross of Merit with Star, Germany (2008); Janos Bolyai International Mathematical Prize, Hungarian Academy of Sciences (2010). *Academies:* Academy of Sciences, Russia (1990); Royal Society of Sciences, Netherlands (1990); Academia Europaea (1993); Max-Planck-Gesellschaft (1993); Göttingen Academy of Sciences, Class of Physics and Mathematics (1996); Pontificia Academia Scientiarum (1996); Academia Leopoldina (2000); American Academy of Arts and Sciences (2004); Académie des sciences (2005). *Honorary Degrees:* Honorary Professor, Bonn University (1993); Université Pierre et Marie Curie, Paris (1999); University of Oslo (2002); Warwick University (2006); Honorary Member, London Mathematical Society (2011).

Summary of scientific research The main contributions of Prof. Yuri Manin are in the domains of algebraic geometry, number theory, differential equations, and mathematical physics. In algebraic geometry, he proved the Mordell conjecture for algebraic curves over functional fields: non-constant curves of genus more than 1 have only finitely many rational points. In the course of proof, he introduced an important tool which is now widely used under the name of Gauss-Manin connection in algebraic geometry, theory of

singularities, theory of differential equations and mathematical physics. Another significant contribution is his counterexample to the classical Lüroth conjecture (joint work with V.A. Iskovskih) which revived the birational techniques of Italian algebraic geometry. In number theory, he constructed the so-called Manin-Brauer obstruction to the solvability of Diophantine equations. In many cases vanishing of this obstruction is the necessary and sufficient condition of the existence of solutions. His work on the arithmetic of modular forms led him to the construction of p -adic L-functions and the theory of modular symbols. In recent years he started a program of algebraic geometric investigation of Diophantine equations with many solutions complementing the circle method when it becomes inapplicable or leads to wrong heuristic conclusions. Among the main ingredients of this program is the general notion of point-accumulating subvarieties and their algebraic geometric characterization, depending on the so-called 'linear growth conjecture'. Recently he has started applying methods of noncommutative geometry to number theory and formulated an approach to the class field theory of real quadratic fields in which quantum tori replace elliptic curves. In the theory of differential equations, he developed a wide extension of the twistor methods using the cohomology theory of coherent sheaves. Building upon the earlier work of R. Penrose and E. Witten, he has shown that the twistor transform of Yang-Mills equations with current is encoded in the formalism of obstruction theory for infinitesimal extensions. His work with B. Kupersmidt and D. Lebedev on the equations of long waves and completely integrable systems led to the group theoretic explanation of their Hamiltonian structure. In mathematical physics, he made a contribution to the theory of quantum strings using algebraic geometric methods for the classification of instantons (jointly with M. Atiyah, N. Hitchin, V. Drinfeld) and the calculation of the Polyakov measure on the moduli spaces of curves. He introduced the technique of quantum spaces and universal coactions in the theory of quantum groups. His latest research is devoted to the quantum cohomology of algebraic varieties which physically is related to the study of partial compactification of the ten-dimensional Universe. From a mathematical viewpoint, this theory opens a new chapter of enumerative algebraic geometry giving a deep insight into the analytic properties of various generating functions. Yuri Manin has devoted a number of publications to the philosophy of science and the problems of the early stages of the development of language and mathematics. In computer science, Yuri Manin studied algebraic-geometric error-correcting codes, and was one of the first proponents of the project of quantum computing.

Main publications Author and co-author of 11 monographs and about 225 papers in Algebraic Geometry, Number Theory, Mathematical Physics, History of Culture, Psycholinguistics. Manin, Yu.I., *Selected Papers*, World Scientific Series in 20th Century Mathematics, vol. 3, World Sci., Singapore, 1996, pp. xii + 600; Manin, Yu.I., *Cubic Forms: Algebra, Geometry, Arithmetic*, Russian: Nauka, Moscow, pp. 307, 1972, English trans., North Holland, Amsterdam, pp. 292, 1974, and pp. 326, 1986; Manin, Yu.I., *Gauge Fields and Complex Geometry*, Russian trans., Nauka, Moscow, pp. 355, 1984, English trans., Springer Verlag, pp. 295, 1988; Kobzarev, I.Yu. and Manin, Yu.I., *Elementary Particles: Mathematics, Physics and Philosophy*, Reidel, Dordrecht, pp. 227, 1989; Manin, Yu.I., *Topics in Non-commutative Geometry*, Princeton University Press, pp. 163, 1991; Manin, Yu.I., *The mythological trickster in psychology and history of culture*, Russian trans., Priroda, 7, pp. 42-52 (1987); Manin, Yu.I., *Archetype of Empty City*, Russian trans., Arbor Mundi, 1, pp. 28-34 (1992), (E. Meletinsky, ed.); Kontsevich, M., Manin, Yu.I., Gromov-Witten classes, quantum cohomology and enumerative geometry, *Comm. Math. Phys.*, 164:3, pp. 525-62 (1994); Gelfand, S.I., Manin, Yu.I., *Methods of homological algebra*, Springer Verlag, pp. xv+372, 1996; Manin, Yu.I., Truth, rigor and common sense, *Truth in Mathematics*, (H.G. Dales and G. Oliveri, eds), Clarendon Press, Oxford, pp. 147-59 (1998); Manin, Yu.I., *Frobenius Manifolds, Quantum Cohomology, and Moduli Spaces*, AMS Colloquium Series, Providence, Rhode Island, pp. 365, 1999; Manin, Yu.I., *Classical computing, quantum computing, and Shor's factoring algorithm*, Séminaire Bourbaki, 862, vol. 266, pp. 375-404, Astérisque (June 1999); Manin, Yu.I. and Marcolli, M., Continued fractions, modular symbols, and noncommutative geometry, *Selecta math.*, new. ser., 8, pp. 475-521 (2002); Manin, Yu.I., *Mathematics as Metaphor (Selected Essays)*, *American Math. Society*, 2007, xi+232 pp.; Arend Bayer, Yu. I. Manin, Stability conditions, wall-crossing and weighted Gromov-Witten invariants, *Mosc. Math. J.*, 9: (1): 3-32, backmatter (2009); Franz Luef, Yuri I. Manin, Quantum theta functions and Gabor frames for modulation spaces, *Lett. Math. Phys.*, 88: (1-3): 131-161 (2009).

Mambillikalathil Govind Kumar Menon



Date of Birth 28 August 1928

Place Mangalore (India)

Nomination 12 May 1981

Field Physics

Title Professor

Menon

Most important awards, prizes and academies *Awards:* Senior Award, Royal Comm. for the Exhbn. of 1851 (1953-55); Shanti Swarup Bhatnagar Award, Physical Sciences, CSIR (1960); Cecil Powell Medal, European Physical Society (1978); Durga Prasad Khaitan Memorial Medal of the Asiatic Society (1978); Kerala State Cte. for Sci. and Technology Prize (1979); Jawaharlal Nehru Award for Science of M.P. State Govt. (1983); J.C. Bose Fourth Triennial Gold Medal of Bose Institute (1985); C.V. Raman Medal of Indian Nat. Sci. Academy (1985), Indian Sci. Congress. *Assn. awards:* G.P. Chatterjee Award (1984); First Sir Asutosh Mookerjee Gold Medal (1988); Shatabdi Puraskar for overall contributions to the development of Science (1999); Millennium Award for lifetime achievements (2001). National Awards from the President of India: Padma Shri (1961); Padma Bhushan (1968); Padma Vibhushan (1985). *Academies:* Fellow, Royal Society; Foreign Honorary Member, American Academy of Arts and Sciences; Foreign Member, USSR Academy of Sciences; Honorary Member, Inst. of Electrical and Electronic Engrs. (IEEE); Honorary Pres., Asia Electronics Union; Fellow and Vice President, Third World Academy of Sciences; Fellow, Indian Nat. Sci. Academy (Pres. 1981-82); Fellow, Indian Academy of Sciences (Pres. 1974-76); Honorary Fellow, National Academy of Science, India; Pontifical Academy of Sciences; Past President of the ICSU (1988-93). For more than two decades, Prof. Menon has been at the highest levels in the Government of India in matters relating to science policy, management and administration.

Summary of scientific research Prof. Menon's principal scientific work has been on: 1) The development of nuclear emulsion techniques and their applications to the elucidation of the properties of the strange particles; in particular, establishing for the first time the existence of muons of varying

energies, mono-energetic high energy charged pions, and of electrons, as secondaries in the decays of heavy mesons, thereby contributing significantly to establishing the $K_{\mu 3}$, $K_{\mu 2}$ and $K_{\mu 3}$ modes of decay; extension of nuclear emulsion work to stacks of very large volume; and the first demonstration of scattering phenomena involving the K-particles, and discussion of this in terms of the 'strangeness' concept which had just then been introduced theoretically. 2) High altitude balloon studies near the geomagnetic equator: for this a dependable high altitude balloon facility was established (and is presently one of the major international facilities used by groups from all over the world with balloons of 10 m. cu. ft. that can carry ton payloads for level flights at 120,000 ft.). This was used initially for studies on the primary cosmic radiation with various electronic detector systems; and now for a range of research on x-rays, gamma rays, particle radiations, atmospheric sciences and the like. 3) Deep underground studies since 1960: Prof. Menon has been connected with the growing programme of deep underground observations on particle intensities, angular distributions and other related phenomena in the Kolar Gold Fields. In these experiments interactions due to natural neutrinos were observed and analyzed for the first time; multiparticle, so-called 'Kolar', events were observed which cannot yet be explained on any known basis, and could represent unknown particle decays or other types of new phenomena; evidence was obtained that muons are essentially produced through decays of pions and kaons even at very high energies and not directly. The later major effort related to a 150-ton detector, and then a 400-ton detector, operated calorimetrically at great depths to search for stability of the nucleon, up to lifetimes of 10^{31} - 10^{32} years, which was the first major experiment operated for this.

Main publications Menon, M.G.K., Nuclear Reactions produced by Slow Negative π -Mesons (with Muirhead, H. and Rochat, O.), *Phil. Mag.*, 41, p. 583 (1950); Menon, M.G.K., Masses and Modes of Decay of Heavy Mesons. Pt. III. Particles (with Fowler, P.H. *et al.*), *Phil. Mag.*, 42, p. 1040 (1951); Menon, M.G.K. *et al.*, A Search for Nuclear Disintegrations Produced by Slow Negative Heavy Mesons, *Proc. Roy. Soc.*, A221, p. 394 (1954); Menon, M.G.K., Observations on the Decay of Heavy Mesons in Photographic Emulsions (with O'Ceallaigh, C.), *Proc. Roy. Soc.*, A221, p. 292 (1954); Menon, M.G.K., Evidence for the β Decay of a K-Meson (with Friedlander, M.W. *et al.*), *Phil. Mag.*, 45, p. 1043 (1954); Menon, M.G.K., The Interaction of Fast K-Mesons (with Friedlander, M.W. and Keefe, D.), *Nuovo Cim.*, 1, p. 694 (1955); Menon, M.G.K. *et al.*, On the Masses and Modes of

Decay of Heavy Mesons Produced by Cosmic Radiation, *Nuovo Cim.*, 2, p. 1063 (1955); Menon, M.G.K., Cosmic Ray Intensity at Great Depths and Neutrino Experiments (with Ramana Murthy, P.V. *et al.*), *Nuovo Cim.*, 30, p. 1208 (1963); Menon, M.G.K., Cosmic Ray Intensities Deep Underground, *Prog. in Cosmic Ray and Elementary Particle Phys.*, IX (with Ramana Murthy, P.V.) (1967); Menon, M.G.K., Studies of Cosmic Ray Neutrino Interactions in the KGF Experiment (with Naranan, S. *et al.*), *Proc. Roy. Soc.*, A301, p. 137 (1967); Menon, M.G.K., The Kolar Gold Field Neutrino Experiment, Pt. I (with Krishnaswamy, M.R. *et al.*), *Proc. Roy. Soc.*, A323, p. 489 (1971); Menon, M.G.K., The Kolar Gold Field Neutrino Experiment, Pt. II (with Krishnaswamy, M.R. *et al.*), *Proc. Roy. Soc.*, A323, p. 511 (1971); Menon, M.G.K. *et al.*, Evidence for the Production of New Particles in Cosmic Ray Experiments Deep Underground, *Pramana*, 2, pp. 59-77 (1975); Menon, M.G.K. *et al.*, Candidate events for Nucleon Decay in the Kolar Gold Field Experiment, *Physics Letters*, 106B, n. 4, p. 339 (1981); Menon, M.G.K. *et al.*, Fully Confined Events indicative of Proton Decay in the Kolar Gold Fields Detector, *Physics Letters*, 115B, n. 4, p. 349 (1982); Menon, M.G.K., Neutrino Backgrounds in the Kolar Gold Field Proton Decay Experiment (with Krishnaswamy, M.R. *et al.*), *Pramana*, 19, p. 552 (1982); Menon, M.G.K., Results on Proton Decay from the Kolar Gold Field Experiments (with Krishnaswamy, M.R. *et al.*), *Pramana*, 5, p. 518 (1983); Menon, M.G.K., Limits on the flux of monopoles from the Kolar Gold Mine Experiments (with Krishnaswamy, M.R. *et al.*), *Physics Letters*, 142B, p. 99 (1984); Menon, M.G.K., Results from the KGF Proton Decay Experiments (with Krishnaswamy, M.R. *et al.*), *Nuovo Cim.*, 9C, p. 167 (1986); Menon, M.G.K. *et al.*, Search for High Energy Neutrinos from SN1987A in KGF Nucleon Decay Experiment, *J. Astrophysics & Astr.*, 11, p. 73 (1990).

Beatrice Mintz



Date of Birth 24 January 1921

Place New York, NY (USA)

Nomination 9 June 1986

Field Genetics

Title Jack Schultz Chair in Basic Science

Most important awards, prizes and academies *Awards:* Bertner Foundation Award in Fundamental Cancer Research (1977); New York Academy of Sciences Award in Biological and Medical Sciences (1979); Papanicolaou Award for Scientific Achievement (1979); Lewis S. Rosenstiel Award in Basic Medical Research (1980); Genetics Society of America Medal (1981); Ernst Jung Gold Medal for Medicine (1990); John Scott Award for Scientific Achievement (1994); March of Dimes Prize in Developmental Biology (1996); American Cancer Society National Medal of Honor for Basic Research (1997); Pearl Meister Greengard Prize (2008); Albert Szent-Györgyi Prize for Progress in Cancer Research (2011). *Academies:* National Academy of Sciences (1973); Fellow, American Association for the Advancement of Science (1976); Honorary Fellow, American Gynecological and Obstetrical Society (1980); American Philosophical Society (1982); Fellow, American Academy of Arts and Sciences (1982); Pontifical Academy of Sciences (1986). *Degrees:* Doctor of Science, New York Medical College (1980); Medical College of Pennsylvania (1980); Northwestern University (1982); Hunter College (1986); Doctor of Humane Letters, Holy Family College (1988).

Summary of scientific research Beatrice Mintz discovered the underlying relationship between development and cancer. She first showed that development is based on an orderly hierarchical succession of increasingly specialized small groups of precursor or “stem” cells, expanding clonally. She proposed that cancer involves a regulatory aberration in this process, especially in the balance between proliferation and differentiation. These views were based on a series of methods of her own design, for construction and analysis of chimeric and transgenic mouse models. The models enabled the experimental study of development and of cancer within the framework of

the whole organism throughout life. She produced chimeric mice (which she at first termed "allophenic") by inclusion of two genetically different cells in the early mouse embryo, thereby revealing the clonal organization. Mintz then devised modifications of chimerism to examine the roles of stem cells in cancer. Her lab found that mouse teratocarcinoma stem cells developed normally in a normal embryo environment. This led to many new kinds of experiments in many laboratories, aimed at defining the role of a normal microenvironment on cancer cells. Her new experiments also showed that stem-like cancer cells could be grown in culture and used as "messengers" to convey specific-DNA into the organism. Later, the DNA was injected directly into the fertilized egg. Her lab. used that method to produce a mouse model of malignant melanoma resembling the human disease, so as to explore possible treatments.

Main publications Mintz, B., 'Genetic mosaicism in adult mice of quadri-parental lineage', *Science*, 148, pp. 1232-3 (1965); Mintz, B., 'Gene control of mammalian pigmentary differentiation. I. Clonal origin of melanocytes', *Proc. Natl. Acad. Sci. USA*, 58, pp. 344-51 (1967); Mintz, B., 'Clonal basis of mammalian differentiation', *Sympos. Soc. Exp. Biol.*, 25, pp. 345-70 (1971) Cambridge University Press; Mintz, B. and Illmensee, K., 'Normal genetically mosaic mice produced from malignant teratocarcinoma cells', *Proc. Natl. Acad. Sci. USA*, 72, 3585-9 (1975); Fleischman, R.A. and Mintz, B., 'Prevention of genetic anemias in mice by microinjection of normal hematopoietic stem cells into the fetal placenta', *Proc. Natl. Acad. Sci. USA*, 76, pp. 5736-40 (1979); Mintz, B. and Cronmiller, C., 'METT 1: A karyotypically normal in vitro line of developmentally totipotent mouse teratocarcinoma cells', *Somatic Cell Genet.*, 7, pp. 489-505 (1981); Stewart, T.A. and Mintz, B., 'Successive generations of mice produced from an established culture line of euploid teratocarcinoma cells', *Proc. Natl. Acad. Sci. USA*, 78, pp. 6314-8 (1981). Wagner, E.F., Stewart, T.A. and Mintz, B., 'The human β -globin gene and a functional viral thymidine kinase gene in developing mice', *Proc. Natl. Acad. Sci. USA*, 78, pp. 5016-20 (1981); Mintz, B. and Silvers, W.K., 'Transgenic mouse model of malignant skin melanoma', *Proc. Natl. Acad. Sci. USA*, 90, pp. 8817-21 (1993).

Jürgen Mittelstraß



Date of Birth 11 October 1936

Place Düsseldorf (Germany)

Nomination 10 April 2002

Field Philosophy

Title Professor

Most important awards, prizes and academies *Awards:* Leibniz-Prize, German Research Society (1989); Arthur Burkhardt Prize (1992); Lorenz Oken Medal, Society of German Scientists and Physicians (1998); Nicholas Rescher Prize for Systematic Philosophy (2013); Order of Merit of the State of Berlin (1993); Officer's Cross of the Order of Merit of the Federal Republic of Germany (1999); Order of Merit of the State of Bavaria; Austrian Cross of Honour for Science and Art, I. Class. *Academies:* Berlin Academy of Sciences (1987-90); Vice-President (1988, 1994-2000) and President (2002-2008), Academia Europaea; Berlin-Brandenburg Academy of Sciences (1992); Corresponding Member, Académie Internationale d'Histoire des Sciences (1993); German Academy of Scientists Leopoldina (1998); Pontifical Academy of Sciences (2002); Corresponding Member, Austrian Academy of Sciences (2003). *Honorary Doctorates:* University of Pittsburgh, PA (2000); Humboldt University of Berlin (2000); University of Iasi, Romania (2000); University of Tartu, Estonia (2003); Technical University of Berlin (2007); University of Duisburg-Essen.

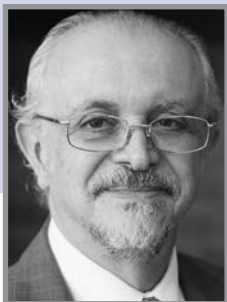
Summary of scientific research Jürgen Mittelstraß' main subject and field of interest is history and philosophy of science, also epistemology, philosophy of language, philosophy of mind, and ethics. His interests developed out of his dissertation which dealt with the history of a Greek research principle in astronomy ('saving the appearances'). These studies were continued with an extensive analysis of the genesis of modern science and philosophy in the 17th and 18th centuries. In philosophy of science he devoted most of his work to models of scientific rationality, particularly to the concepts of justification and reconstruction, and to concepts like the apriori, the unity of science, scientific explanation, and time. He is also editor of an encyclopedia dea-

ling mainly with philosophy of science, history of science, epistemology and scientific methodology (*Enzyklopädie Philosophie und Wissenschaftstheorie*, I-IV, 1980-1996, 2nd ed., I-VIII, 2005 ff.).

Main publications *Die Rettung der Phänomene: Ursprung und Geschichte eines antiken Forschungsprinzips*, Berlin: de Gruyter 1962; *Neuzeit und Aufklärung: Studien zur Entstehung der neuzeitlichen Wissenschaft und Philosophie*, Berlin and New York: de Gruyter 1970; *Das praktische Fundament der Wissenschaft und die Aufgabe der Philosophie*, Konstanz: Universitätsverlag 1972; *Die Möglichkeit von Wissenschaft*, Frankfurt: Suhrkamp 1974; (with Janich, P. and Kambartel, F.) *Wissenschaftstheorie als Wissenschaftskritik*, Frankfurt: Aspekte 1974; *Wissenschaft als Lebensform: Reden über philosophische Orientierungen in Wissenschaft und Universität*, Frankfurt: Suhrkamp 1982; *Die Modernität der Antike: Zur Aufgabe des Gymnasiums in der modernen Welt*, Konstanz: Universitätsverlag 1986; *Nature and Science in the Renaissance*, in: *Metaphysics and Philosophy of Science in the Seventeenth and Eighteenth Centuries*, ed. R.S. Woolhouse, Dordrecht and Boston and London: Kluwer Academic Publishers 1988 (The University of Western Ontario Series in Philosophy of Science 43), 17-43; *World Pictures: The World of the History and Philosophy of Science*, in: *An Intimate Relation: Studies in the History and Philosophy of Science*, ed. J.R. Brown and J. Mittelstrass, Dordrecht and Boston and London: Kluwer Academic Publishers 1989 (Boston Studies in the Philosophy of Science 116), 319-41; *Die Wahrheit des Irrtums: Über das schwierige Verhältnis der Geisteswissenschaften zur Wahrheit und über ihren eigentümlichen Umgang mit dem Irrtum*, Konstanz: Universitätsverlag 1989; (with Carrier, M.) *Geist, Gehirn, Verhalten: Das Leib-Seele-Problem und die Philosophie der Psychologie*, Berlin and New York: de Gruyter 1989, English edition (revised and enlarged): *Mind, Brain, Behavior: The Mind-Body Problem and the Philosophy of Psychology*, Berlin and New York: de Gruyter 1991; *Der Flug der Eule: Von der Vernunft der Wissenschaft und der Aufgabe der Philosophie*, Frankfurt: Suhrkamp 1989; (with Frühwald, W. et al.) *Geisteswissenschaften heute: Eine Denkschrift*, Frankfurt: Suhrkamp 1992, 2nd ed. 1996; (with Pinkau, K. et al.) *Umweltstandards: Grundlagen, Tatsachen und Bewertungen am Beispiel des Strahlenrisikos*, Berlin and New York: de Gruyter 1992, English edition: *Environmental Standards: Scientific Foundations and Rational Procedures of Regulation with Emphasis on Radiological Risk Management*, Boston and Dordrecht and London: Kluwer 1998; *Leonardo-Welt: Über Wissenschaft, Forschung und Verantwortung*, Frankfurt: Suhrkamp 1992; *From Time to*

Time: Remarks on the Difference Between the Time of Nature and the Time of Man, in: *Philosophical Problems of the Internal and External Worlds*, ed. J. Earman et al., Pittsburgh, PA: University of Pittsburgh Press 1993 (Pittsburgh-Konstanz Series in the Philosophy and History of Science I), 83-101; *Die unzeitgemäße Universität*, Frankfurt: Suhrkamp 1994; *Machina mundi: Zum astronomischen Weltbild der Renaissance*, Basel and Frankfurt: Helbing & Lichtenhahn 1995; *Das Udenkbare denken: Über den Umgang mit dem Udenkbaren und Unvorstellbaren in der Wissenschaft*, Konstanz: Universitätsverlag 1998; *Die Häuser des Wissens: Wissenschaftstheoretische Studien*, Frankfurt: Suhrkamp 1998; *Über philosophische Sprache*, Bonn: Bouvier 2000; *Zwischen Naturwissenschaft und Philosophie: Versuch einer Neuvermessung des wissenschaftlichen Geistes*, Konstanz: Universitätsverlag 2000; *Wissen und Grenzen: Philosophische Studien*, Frankfurt: Suhrkamp 2001; On the Philosophy of Time, *European Review: Interdisciplinary Journal of the Academia Europaea* 9 (2001), 19-29; *Konstruktion und Deutung: Über Wissenschaft in einer Leonardo- und Leibniz-Welt*, Berlin: Humboldt-Universität zu Berlin 2001; *Transdisziplinarität: wissenschaftliche Zukunft und institutionelle Wirklichkeit*, Konstanz: Universitätsverlag 2003; *Philosophie in der Psychiatrie: Zur therapeutischen Beziehung in der Psychotherapie*, Konstanz: Universitätsverlag 2007; *Leibniz und Kant. Erkenntnistheoretische Studien*, Berlin and Boston: de Gruyter 2011. Editor of: *Enzyklopädie Philosophie und Wissenschaftstheorie*, vols. I-IV, Stuttgart and Weimar: Metzler 1980-1996, 2nd ed., I-VIII, 2005 ff.)

Mario José Molina



Date of Birth 19 March 1943

Place Mexico City (Mexico)

Nomination 24 July 2000

Field Atmospheric Chemistry

Title Professor, Nobel laureate in Chemistry, 1995

Molina

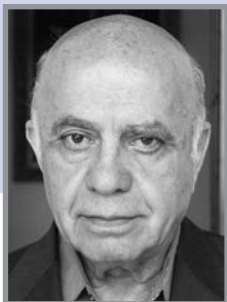
Most important awards, prizes and academies Awards: Tyler Ecology and Energy Prize (1983); UNEP-Sasakawa Prize (1999); Esselen Award (1987); Newcomb-Cleveland Prize (AAAS) (1988); Nobel Prize in Chemistry (1995). Academies: National Academy of Sciences; Institute of Medicine, USA; American Chemical Society; American Physical Society; Fellow, American Geophysical Union; National College of Mexico.

Summary of scientific research Prof. Molina predicted in 1974 (together with F.S. Rowland) that CFC gases being used in spray cans, as refrigerants and solvents, etc., would eventually deplete the ozone layer. This laid the ground for the discovery of the 'ozone hole' over the Antarctic. Subsequent work in large measure explained the mechanism by which ozone depletion over the poles comes about.

Main publications Author or joint author of almost two hundred articles and essays, including: Molina, M.J. and Rowland, F.S., Stratospheric sink chlorofluoromethanes-chlorine atom catalysed destruction of ozone, *Nature*, 249, p. 810 (1974); Molina, M.J., *et al.*, Antarctic Stratospheric chemistry of chlorine nitrate, hydrogen chloride, and ice: release of active chlorine, *Science*, 238, p. 1253 (1987); Molina, *et al.*, Temperature dependance of the rate constant and branching ration for the OH+C1O reaction, *J. Chem. Soc. Faraday Trans.*, 93, p. 2665 (1997); Molina, *et al.*, Development of an electrostatic ion guide in chemical ionisation mass spectrometry, *Rev. Sci. Instrum.*, 69, p. 4002 (1998); Molina, M.J., *et al.*, A new optical technique to study aerosol phase transitions: The nucleation of ice from H₂SO₄ aerosols, *J. Phys. Chem.*, 102, p. 8924 (1998); Molina, *et al.*, Experimental Study of intermediates from OH initiated reactions of toluene, *J. Am. Chem. Soc.*, 121, pp. 10225-6 (1999); Molina, M.J., *et al.*, Production of HC1 in the OH+C₁O: Laboratory measurements and statistical rate theory calcu-

lations, *J. Phys. Chem.*, 103, p. 6540 (1999); Molina, M.J., *et al.*, Phase transitions in aqueous NH_4HSO_4 solutions, *J. Phys. Chem.*, 103, pp. 9042-8 (1999); Molina, M.J., *et al.*, The $\text{HC}_1+\text{C}_1\text{ONO}_2$ reaction rate on various water ice surfaces, *Chem Phys. Lett.*, 315, pp. 7-11 (1999); Molina, M.J., *et al.*, Nucleation rates of nitric acid dihydrate in 1:2 $\text{HNO}_3/\text{H}_2\text{O}$ solutions at stratospheric temperatures, *Geophys. Res. Lett.*, 27, p. 193 (2000); Salcedo, D., L.T. Molina and M.J. Molina, Homogeneous Freezing of Concentrated Aqueous Nitric Acid Solutions at Polar Stratospheric Temperatures, *J. Phys. Chem.*, 105, 1433, 2001; Bertram, A.K., A.V. Ivanov, M. Hunter, L.T. Molina and M.J. Molina, The reaction probability of OH on organic surfaces of tropospheric interest, *J. Phys. Chem.*, 105, 9415-21, 2001; Zuberi, B., A.K. Bertram, C.A. Cassa, L.T. Molina, and M.J. Molina, Heterogeneous Nucleation of Ice in $(\text{NH}_4)_2\text{SO}_4\text{-H}_2\text{O}$ Particles with Mineral Dust Immersions, *Geophys. Res. Lett.*, 29, 1421-4, 2002; Molina, L.T. and M.J. Molina, eds, *Air Quality in the Mexico Megacity: An Integrated Assessment*, 390 pp. Kluwer Academic Publishers, Dordrecht, 2002; Molina, M.J., Aerosol Processes in the Stratosphere. In *Handbook of Weather, Climate and Water*, T.D. Potter and B.R. Colman, eds, 405-14. Wiley Interscience, New Jersey, 2003; Molina L.T., Molina M.J., Improving air quality in megacities – Mexico City Case Study, Urban Biosphere and Society: Partnership of Cities, *Annals of the New York Academy of Sciences*, 1023, 142-58, 2004; Molina, M.J., *et al.*, Atmospheric evolution of organic aerosol, *Geophys. Res. Lett.*, 31, L22104, 2004; Molina M.J., Molina L.T., Megacities and atmospheric pollution., Review, *J Air Waste Manag Assoc*, 54(6):644-80, 2004; Zhang, R., G. Li, J. Fan, D.L. Wu, M.J. Molina., Intensification of Pacific storm track linked to Asian pollution, *Proceedings of the National Academy of Sciences A*, 104(13), 2007; Molina, M.J., Uncertainties in Climate Change Science, *Predictability in Science: Accuracy and Limitations, Proceedings of the Plenary Session of the Pontifical Academy of Sciences*, Vatican City, 2008; Molina, M.J., Nuclear Energy and Climate change, *Proceedings of the Study on Nuclear Disarmament, Non-Proliferation, and Development*, The Pontifical Academy of Sciences, *Scripta Varia* 115, Vatican City, 2010; Steffen, E., Å. Persson, L. Deutsch, J. Zalasiewicz, M. Williams, K. Richardson, C. Crumley, P. Crutzen, C. Folke, L. Gordon, M. Molina, V. Ramanathan, J. Rockström, M. Scheffer, H.J. Schellnhuber and U. Svedin, The Anthropocene: From Global Change to Planetary Stewardship, Royal, *AMBIO: A Journal of the Human Environment*, 40(7), 739-61, 2011. Books: Carabias, J., M.J. Molina, and J. Sarukhán, *El Cambio Climático, Causas, Efectos y Soluciones*, Ed. DGE-Equilibrista, Mexico City, 2010; M. Molina, *et al.*, *HFCs: A Critical Link in Protecting Climate and the Ozone Layer*, UNEP Report, 2011.

Rudolf Muradyan



Date of Birth 19 June 1936
Place Yerevan (Armenia)
Nomination 16 October 1994
Field Physics
Title Professor

Muradyan

Most important awards, prizes and academies Lenin Prize for Physics, 1988; National Academy of Sciences of Armenia, Yerevan (1986); Pontificia Academia Scientiarum (1994).

Summary of scientific research Rudolf Muradyan was educated at Moscow University and received his doctoral degree from the Joint Institute for Nuclear Research, Dubna. His work has covered a wide range of topics in elementary particle physics, mathematical physics, and cosmology. For discovering the Dimensional Quark Counting Rules he shared the 1988 Lenin Prize for Physics. The main results of Prof. Muradian's research can be summarized as follows: 1) Description of bound states and scattering amplitudes in the framework of Quantum Field Theory. 2) Construction of the Mandelstam double spectral function for 6th order diagram using the analytical properties of partial wave amplitudes in the complex angular momentum plane. 3) Investigation of the three nucleon forces in light nuclei in the framework of Quantum Chromodynamics. 4) Exact solution of the random walk problem on a sphere and in the Lobachevsky space. 5) Direct method of constructing irreducible representations for finite rotation groups – tetrahedral, octahedral, and icosahedral – based on the extraction of roots from unit matrices in a definite direction. 6) He is one of the authors of the Dimensional Quark Counting Rules for exclusive processes. This formula provides direct information about the composite quark structure of matter and has a wide application in modern particle and nuclear physics. 7) An important contribution was made by Prof. Muradian to the solution of the old and most difficult problem of cosmogony – the problem of the origin of the rotation of planets, stars and galaxies. 8) By means of Mathematica, the computer algebra system, the package Diana was designed and implemen-

ted for making automatic and quick dimensional analysis of a broad range of problems in physics, engineering, and economics.

Main publications Muradian, R., Solution of the "random walk" problem in the space with constant curvature, *Teoreticheskaya i Matematicheskaya Fizika*, 2, pp. 328-32 (1970); Matveev, V., Muradian, R. and Tavkhelidze, A., Automodelity in strong interactions, *Lettere al Nuovo Cimento*, 5, pp. 907-12 (1972); Matveev, V., Muradian, R. and Tavkhelidze, A., Automodellism in the large-angle elastic scattering and structure of hadrons, *Lettere al Nuovo Cimento*, 7, pp. 719-23 (1973); Matveev, V., Muradian, R. and Tavkhelidze, A., Automodelity in strong interactions, *Teoreticheskaya i Matematicheskaya Fizika*, 15, pp. 332-8 (1973); Muradian, R., On the origin of galaxies rotation in the Ambartsumian cosmogony, *Astrofizika*, 11, pp. 237-48 (1975); Muradian, R., Cosmic numbers and rotation of the Metagalaxy, *Astrofizika*, 13, pp. 63-7 (1977); Muradian, R., The origin of the magnetic fields and superdense cosmogony, *Astrofizika*, 14, pp. 439-46 (1978); Muradian, R., The primeval hadron: origin of stars, galaxies and astronomical universe, *Astrophysics and Space Science*, 69, pp. 325-37 (1980); Muradian, R., On the discrete subgroups of the three dimensional rotation group, *Teoreticheskaya i Matematicheskaya Fizika*, 46, pp. 335-47 (1981); Muradian, R., *Nuclear forces and QCD*, *Izvestiya Akademii Nauk Armyanskoy SSR, Seriya Fizika*, 16, pp. 252-61 (1981); Muradian, R., *On the rotation of astronomical Universe*, Preprint, Yerevan Physics Institute, Yerevan, YePI-636(26) (1983); Muradian, R., *The primeaval hadron: origin of rotation and magnetic fields in the Universe*, Preprint, Yerevan Physics Institute, Yerevan, YePI-701(16) (1984); Muradian, R., 'Cosmological constant and rotation of the Universe', *Astrofizika*, 21, pp. 396-8 (1984); Muradian, R., 'The new form of the Mendeleev table', *Armyanskij Khimicheskij Zhurnal*, 43, pp. 478-81 (1990); Muradian, R., *Regge in the sky: origin of the cosmic rotation*, Preprint, ICTP, Trieste, IC/94/143 (1994); Muradian, R., *Flare stars and Pascal distribution*, Preprint, ICTP, Trieste, IC/94/175 (1994); Muradian, R. and Santana, A., Ilopf structure in Nambu-Zie n-algebras, *Theoretical and Mathematical Physics*, 114, pp. 67-72 (1998).

Sergey Petrovich Novikov



Date of Birth 20 March 1938

Place Gorky (Russia)

Nomination 25 June 1996

Field Mathematics

Title Professor

Most important awards, prizes and academies *Awards:* Fields Medal (1970); Lenin Prize (1967); Lobachevski International Prize (1981); Wolf Prize (2005). *Academies:* USSR/Russian Academy of Sciences (1981); Honorary Member, London Math. Society (1987); US National Academy (1994); Accademia Nazionale dei Lincei (1993); Pontifical Academy of Sciences (1996); European Academy of Sciences, Brussels.

Summary of scientific research *Classical Topology of 60s:* 1. Method of classification of manifolds developed 1961-4 [1]. Proof of topological invariance of rational Pontryagin classes [2]. Novikov Conjecture describing all homotopy invariant expressions from the Riemann Curvature Tensor [3]. 2. Calculation of stable homotopy groups of spheres and cobordism rings [4]; new methods of algebraic topology based on the complex cobordisms [5, 6]. 3. Topology of 2-foliations on 3-manifolds (1963-5): proof of the existence of compact leaf on a 3-sphere, braids and classification of analytical 2-foliations in the solid torus, homotopy obstructions for the Anosov systems [7]. *Topological Phenomena in Physics:* 1. Chern numbers of the dispersion relations for the generic 2D Schrodinger operators in magnetic field and lattice found in 1980 before the discovery of the Integral Quantum Hall Effect [8]. 2. Topology of multivalued functions and functionals (closed 1-forms) gas constructed in 1981-2 [9]. Morse theory and fundamental group, representations and von Neumann factors, Novikov-Shubin invariants [10]. 3. Qualitative theory of the Einstein equation for Homogeneous Cosmological Models as a dynamical system near singularity constructed in 1971-3 [23]. 4. Galvanomagnetic phenomena: universal generic asymptotics for the conductivity tensor of the 3D normal metal with complicated Fermi surface in the strong magnetic field (of the order of magnitude about 10-100t) was found [11].

Solitons and Algebraic Geometry: 1. Periodic Problem for the KdV equation: large family of the exact 'finite-gap' solutions found based on the discovery of finite-gap (algebraic-geometrical) 1D periodic potentials. Riemann surface, θ -functions [12, 13]. KP hierarchy and Krichever solutions found in 1976 as a basis for the Novikov Conjecture on the solution of Riemann-Schottki Problem for θ -functions. Inverse spectral problem for the 2D Schrodinger operators on a single energy level [13]. Higher rank solutions for the KP hierarchy. Explicit calculation of the commuting higher rank linear OD operators, Krichever-Novikov equation [14]. 2. Special Poisson brackets for the finite-dimensional integrable systems [15]. Dubrovin-Novikov Hydrodynamic Type Poisson brackets based on the Riemannian Geometry discovered in 1983. Numerical and analytical integration of the Whitham systems with singularities, dispersive analog of shock wave [15]. 3. Analog of the Laurent-Fourier decompositions on Riemann surface as a tool for the operator quantization of the bosonic strings for any number of loops [16]. 4. Laplace Chains of the 2D Schrodinger operators, new exactly solvable cases in the magnetic field and lattice, discrete systems [16, 17]. Scattering theory on graphs developed on the basis of Symplectic Geometry 1997-8 [18].

Main publications [1] Homotopically equivalent smooth manifolds, I., *Izv. Akad. Nauk SSSR*, 28 (2), pp. 365-474 (1964); [2] On manifolds with free Abelian fundamental group and their application, *Izv. Akad. Nauk SSSR*, 30 (1), pp. 207-46 (1966); [3] Analogues hermitiens de la K-theorie, *Actes Congr. Intern. Math* (Nice, 1970), Gauthier-Villars, Paris, vol. 2, pp. 39-45 (1971); [4] Homotopy properties of Thom complexes, *Mat. Sb.*, 57 (4), pp. 406-42 (1962); [5] Methods of algebraic topology from the point of view of cobordism theory, *Izv. Akad. Nauk SSSR*, 31 (4), pp. 885-951 (1967); [6] Formal groups and their role in the apparatus of algebraic topology (*et al.*), *Uspekhi Mat. Nauk*, 26 (2), pp. 131-54 (1971); [7] The topology of foliations, *Trudy Moskov. Mat. Obshch*, 14, pp. 248-78 (1965); [8] Bloch functions in a magnetic field and vector bundles. Typical dispersion relations and their quantum numbers, *Dokl. Akad. Nauk SSSR*, 257 (3), pp. 538-43 (1981); [9] The Hamiltonian formalism and a many-valued analogue of Morse theory, *Uspekhi Mat. Nauk*, 37 (5), pp. 3-49 (1982); [10] Morse inequalities and von Neumann 1-factors, *Dokl. Akad. Nauk SSSR*, 289 (2), pp. 289-92 (1986); [11] Topological Phenomena in Metals (with Maltsev, A.), *Uspekhi Phys Nauk*, 168 (3), pp. 249-58 (1998); [12] A periodic problem for the Korteweg-de Vries equations, I., *Funktsional Anal. i Prilozhen.*, 8 (3), pp. 54-66 (1974); [13] Non-linear equations of Korteweg-de Vries type, fini-

te zone linear operators, and Abelian varieties (*et al.*), *Uspekhi Mat. Nauk*, 31 (1), pp. 55-136 (1976); [14] Two-dimensional Schrödinger operators: Inverse scattering transform and evolutionary equations (with Veselov, A.P.), *Phys.*, D18, pp. 267-73 (1986); [15] Holomorphic bundles over algebraic curves and nonlinear equations (with Krichever, I.M.), *Uspekhi Mat. Nauk*, 35 (6), pp. 47-68 (1980); [16] Poisson brackets and complex tori, *Trudy Mat. Inst. Steklov*, 165, pp. 49-61 (1984); [17] Hydrodynamics of the soliton lattices. Differential geometry and Hamiltonian formalism (with Dubrovin, B.A.), *Uspekhi Mat. Nauk*, 44 (6), pp. 29-98 (1989); [18] Riemann surfaces, operator fields, strings. Analogues of the Fourier-Laurent bases (with Krichever, I.M.), *Physics and Mathematics of Strings* (L. Brink *et al.*, eds), World Scientific, Singapore, pp. 356-88 (1990); [19] Spectral Symmetries of the Low-dimensional Schrödinger Operators and Laplace Transformations (with Dynnikov, I.A.), *Russia Math Surveys*, 52 (5), pp. 175-234 (1997); [20] Schrödinger Operators on Graphs and Symplectic Geometry, to appear in the Additional Volume of *Arnoldfest*, Toronto, Fields Institute; [21] Topology. 1. *Encyclopedia of Mathematical Sciences*, Springer Verlag, vol. 12, pp. 320 (1996); [22] *Solitons and Geometry. Fermi lectures 1992*, Scuola Norm. Sup. di Pisa, (1994); [23] Singularities of the cosmological model of the Bianchi IX type according to the qualitative theory of differential equations (with Bogoyavlenskii, O.I.), *Zh. Eksper. Teoret. Fiz.*, 64 (5), pp. 1475-94 (1973). *Latest articles*: Dynamical Systems, Topology and Conductivity in Normal Metals, *Journal of Statistical Physics*, 2004, vol 115, iss 1-2, pp. 31-46 (16), (with A. Maltsev); Integable Systems. 1. *Encyclopedia Math. Sciences, Dynamical Systems*, v 4 (edited by V. Arnold and S. Novikov), 2nd exp. and rev. edition, pp. 177-332, Springer, 2001 (with B. Dubrovin and I. Krichever); *Algebraic Topology. Modern Problems of Mathematics. Steklov Math Institute Series*, pp. 1-46 (in Russian). A revised version of this article is published: Topology in the 20th Century: A view from inside, *Uspekhi Math. Nauk=Russian Math Surveys*, vol 59 (2004) n. 5; On the metric independent exotic homology, preprint. *Proceedings (Trudy) of the Steklov Math Institute*, vol 251 (2005), pp. 202-12; Topology of the quasiperiodic functions on the plane and dynamical systems, *Uspekhi Math. Nauk*, 2005, v. 60 n. 1 (with I. Dynnikov); *Topology of foliations given by the real parts of holomorphic 1-forms* (v. 1, 21 Jan 2005, rev. February 2005 and March 2005); Topology of the Generic Hamiltonian Foliations on the Riemann Surface. *Math. GT/0505342*, New version, *Moscow Math. Journal (MMJ)*, vol 5 (2005), n. 3, pp. 633-67.

Ryioji Noyori



Date of Birth 3 September 1938

Place Hyogo (Japan)

Nomination 1 October 2002

Field Chemistry

Title Professor, Nobel laureate in Chemistry, 2001

Most important awards, prizes and academies *Awards:* Japan Academy Prize (1995); Arthur C. Cope Award, American Chemical Society (1997); King Faisal International Prize for Science, Saudi Arabia (1999); Order of Culture, Japanese Emperor/Government (2000); Wolf Prize in Chemistry, Israel (2001); Roger Adams Award in Organic Chemistry, American Chemical Society (2001); Nobel Prize in Chemistry (2001). *Academies:* Foreign Honorary Member of the American Academy of Arts and Sciences (2001); Honorary Member of the European Academy of Sciences and Arts (2001); Pontifical Academy of Sciences (2002); Foreign Associate of the National Academy of Sciences, USA (2003); Foreign Member of the Russian Academy of Sciences. *Honorary Professorships:* Shanghai Institute of Organic Chemistry; Hong Kong Polytechnic University; South China University of Technology. *Honorary Degrees:* Technische Universität Munchen; University of Rennes; University of Bologna; University of Alicante; Uppsala University; University of Ottawa; University of Chicago; RWTH Aachen University.

Summary of scientific research Ryoji Noyori is well known for his initiation (1966) and development of asymmetric catalysis using chiral organometallic compounds. The efficiency of the asymmetric catalysts discovered by Noyori equals or, in certain cases, even exceeds that of enzymes. Applications of his original and versatile chemistry have allowed him and other scientists to achieve truly efficient syntheses of organic molecules of theoretical and practical importance. In particular, chemistry based on the BINAP ligand invented by Noyori in 1980 has been practiced in research laboratories worldwide as well as on an industrial scale. Noyori's major accomplishments include the development of practical asymmetric hydrogenation of functionalized olefins and ketones using chiral Ru-BINAP complexes; Rh

catalyzed asymmetric isomerization of geranylamine to citronellal enamine; the demonstration of the general utility of dynamic kinetic resolution in asymmetric catalysis; the invention of chiral Ru catalysts effecting highly selective asymmetric transfer hydrogenation of ketones and imines; the discovery of highly enantioselective addition of dialkylzincs to aldehydes catalyzed by chiral amino alcohols and the elucidation of the molecular mechanism of the chirality amplification phenomenon. These methods have found application in syntheses of numerous important products including menthol, carbapenem antibiotics, anti-bacterial agents and prostaglandins.

Main publications Miyashita, A., Yasuda, A., Takaya, H., Toriumi, K., Ito, T., Souchi, T. and Noyori, R., Synthesis of 2,2'-Bis(diphenylphosphino)-1,1'-binaphthyl (BINAP), an Atropisomeric Chiral Bis(triaryl)phosphine, and Its Use in the Rhodium(I)-Catalyzed Asymmetric Hydrogenation of α -(Acyloxy)acrylic Acids, *J. Am. Chem. Soc.*, 102, p. 7932 (1980); Noyori, R. and Hayakawa, Y., Reductive Dehalogenation Polyhalo Ketones with Low-Valent Metals and Related Reducing Agents, *Org. React.*, 29, p. 163 (1983); Noyori, R. and Suzuki, M., Prostaglandin Syntheses by Three-Component Coupling, *Angew. Chem. Int. Ed. Engl.*, 23, p. 847 (1984); Hayakawa, Y., Wakabayashi, S., Kato, H. and Noyori, R., The Allylic Protection Method in Solid-Phase Oligonucleotide Synthesis. An Efficient Preparation of Solid-Anchored DNA Oligomers, *J. Am. Chem. Soc.*, 112, p. 1691 (1990); Noyori, R. and Suzuki, M., An Organometallic Way to Prostaglandins: The Three-Component Coupling Synthesis, *Chemtracts-Org. Chem.*, 3, p. 173 (1990); Noyori, R., Chiral Metal Complexes as Discriminating Molecular Catalysts, *Science*, 248, p. 1194 (1990); Noyori, R. and Takaya, H., BINAP: An Efficient Chiral Element for Asymmetric Catalysis, *Acc. Chem. Res.*, 23, p. 345 (1990); Noyori, R. and Kitamura, M., Enantioselective Addition of Organometallic Reagents to Carbonyl Compounds: Chirality Transfer, Multiplication, and Amplification, *Angew. Chem. Int. Ed. Engl.*, 30, p. 49 (1991); Noyori, R., *Asymmetric Catalysis in Organic Synthesis*, John Wiley & Sons, New York (1994); Noyori, R., Tokunaga, M. and Kitamura, M., Stereoselective Organic Synthesis via Dynamic Kinetic Resolution, *Bull. Chem. Soc. Jpn.*, 68, p. 36 (1995); Jessop, P.G., Ikariya, T. and Noyori, R., Homogeneous Catalysis in Supercritical Fluids, *Science*, 269, p. 1065 (1995); Noyori, R. and Hashiguchi, S., Asymmetric Transfer Hydrogenation Catalyzed by Chiral Ruthenium Complexes, *Acc. Chem. Res.*, 30, p. 97 (1997); Sato, K., Aoki, M. and Noyori, R., A "Green" Route to Adipic Acid: Direct Oxidation of Cyclohexenes with 30% Hydrogen Peroxide, *Science*, 281, p. 1646 (1998); Noyori, R.

and Ohkuma, T., Asymmetric Catalysis by Architectural and Functional Molecular Engineering: Practical Chemo- and Stereoselective Hydrogenation of Ketones, *Angew. Chem. Int. Ed.*, 40, p. 40 (2001); Noyori, R., Suga, S., Oka, H. and Kitamura, M., Self and Nonself Recognition of Chiral Catalysts: The Origin of Nonlinear Effects in the Amino-Alcohol Catalyzed Asymmetric Addition of Diorganozincs to Aldehydes, *Chem. Rec.*, 1, p. 85 (2001); Noyori, R., Yamakawa, M. and Hashiguchi, S., Metal-Ligand Bifunctional Catalysis: A Nonclassical Mechanism for Asymmetric Hydrogen Transfer between Alcohols and Carbonyl Compounds, *J. Org. Chem.*, 66, p. 7931 (2001); Noyori, R., Asymmetric Catalysis: Science and Opportunities (Nobel Lecture), *Angew. Chem. Int. Ed.*, 41, p. 2008 (2002).

Czesław Olech



Date of Birth 22 May 1931

Place Pinczów (Poland)

Nomination 9 June 1986

Field Mathematics

Title Professor

Most important awards, prizes and academies *Awards:* State Prize of Poland; Bernard Bolzano Golden Medal of the Czechoslovak Academy of Sciences; Martin Drinov Golden Medal of the Bulgarian Academy of Sciences; Stefan Banach Medal and Nikolaj Kopernik Medal, both of the Polish Academy of Sciences. *Academies:* Full member, Polish Academy of Sciences; Pontifical Academy of Sciences; Foreign member, Russian Academy of Sciences; Polish Academy of Arts and Sciences. *Honorary doctorate:* University of Vilnius.

Summary of scientific research Main fields of research interest: ordinary differential equations and mathematical theory of optimal control. *Contributions to O.D.E.:* various applications of Wazewski topological method in studying asymptotic behaviour of solutions; exact estimates of exponential growth of solution of linear second order differential equations with bounded coefficients; theorems concerning global asymptotic stability of the autonomous system on the plane with stable Jacobian matrix at each point of the plane, results establishing relation between question of global asymptotic stability of an autonomous system and that of global one-to-oneness of a differentiable map; contribution to the question whether unicity condition implies convergence of successive approximation to solutions of ordinary differential equations. *Contribution to control theory:* establishing a most general version of the so-called bang-bang principle for linear control problem by detailed study of the integral of set valued map; existence theorems for optimal control problem with unbounded controls and multidimensional cost functions; existence of solution of differential inclusions with nonconvex right-hand side; characterization of controllability of convex processes.

Main publications Olech, C., On the asymptotic behaviour of the solutions of a system of ordinary non-linear differential equations, *Bull. Acad.*

Polon. Sci., Cl. III 4, pp. 555-61 (1956); Olech, C., Asymptotic behaviour of the solutions of second order differential equations, *Bull. Acad. Polon. Sci., Série des Sci. Math. Astr. et Phys.*, 7, pp. 319-26 (1959); Olech, C., Remarks concerning criteria for uniqueness of solutions of ordinary differential equations, *Bull. Acad. Polon. Sci., Série des Sci. Math. Astr. et Phys.*, 8, pp. 661-6 (1960); Olech, C., On the global stability of an autonomous system on the plane, *Contr. Diff. Equations*, 1, pp. 389-400 (1963); Olech, C., (with Hartman, P.) On global stability of solutions of differential equations, *Trans. Amer. Math. Sci.*, 104, pp. 154-78 (1962); Olech, C., Extremal solution of a control system, *Journal of Diff. Eq.*, 2, pp. 74-101 (1966); Olech, C. (with Plis, A.), Monotonicity assumption in uniqueness criteria for differential equations, *Coll. Math.*, 18, pp. 43-58 (1967); Olech, C., Approximation of set-valued functions by continuous functions, *Coll. Math.*, 19, pp. 285-93 (1968); Olech, C., Existence theorems for optimal problems with vector-valued cost function, *Trans. Amer. Math. Soc.*, 136, pp. 159-80 (1969); Olech, C., Existence theorems for optimal control problems involving multiple integrals, *Journal of Diff. Eq.*, 6, pp. 512-26 (1969); Olech, C. (with Kaczynski, H.), Existence of solutions of orientor fields with nonconvex right-hand side, *Annal. Polon. Math.*, 29, pp. 61-6 (1974); Olech, C. (with Frankowska, H.), Boundary solutions of differential inclusion, *Journal of Diff. Eq.*, 44 (1982); Olech, C. (with Meisters, G.), Solution of the global asymptotic stability jacobian conjecture for polynomial case, *Analyse mathématique et applications*, pp. 373-81, Gauthier-Villars (Paris, 1988).

Sergio B. Pagano



Date of Birth 6 November 1949

Place Genoa (Italy)

Nomination 7 January 1997

Field Pontifical Diplomacy

Title Professor

Most important awards, prizes and academies Msgr Pagano is a Member by *perdurante munere* right of the Pontifical Academy of Sciences and of the Pontifical Committee of Historical Sciences. Since March 2000, he is a Corresponding Member of *Monumenta Germaniae Historica*, since July 2000, of the *Società Romana di Storia Patria*, since January 2005 an honorary member of the Executive Board of the Italian Association for Healthcare, Religious and Hagiographic Studies and Member of *Fondazione Latinitas* for the promotion and study of Latin since July 2005.

Summary of scientific research Born in Genoa on 6 November 1948, he became a member of the Congregation of the Barnabites in 1966, he completed his studies in philosophy and theology in Rome, where he was ordained priest on 28 May 1977, he graduated in Theology with a specialization in Liturgy in 1978, he obtained a Diploma as Archivist Paleographer at the Vatican School of Paleography, Diplomatics and Archives Administration always in 1978; in this same year he was also appointed *Scrittore* of the Vatican Secret Archives; he is a Lecturer of Papal Diplomatics in the aforementioned School (where he has also been a Lecturer of Archives Administration), Academician of the S. Carlo Academy of Milan, representative of the Secret Archives at the *Comité International d'Archivistique*, Historical Councillor of the Congregation for the Causes of the Saints since May 1985 and Councillor of the Pontifical Commission for the Cultural Heritage of the Church since 1997, he was elected Vice-Prefect of the Vatican Secret Archives by Pope John Paul II on 30 January 1995, and a few days later he was appointed Vice-Director of the Vatican School of Paleography, Diplomatics and Archives Administration. From 1989 to 2001, he was Director of the Historical Studies Centre of the Barnabite Fathers of Rome. On 7 January 1997, he was appointed Prefect of

the Vatican Secret Archives and Director of the Vatican School of Paleography, Diplomatics and Archives Administration. On 18 October 2007, he was appointed Scientific Director of the Historical Archives of the Archdiocese of Lucca from 2007 to 2012. Elected Titular Bishop of Celene on 4 August 2007, he was consecrated by His Holiness Pope Benedict XVI on 29 September 2007. In December 2007 he was nominated Member of the Papal Commission for the Cultural Heritage of the Church.

Main publications Pagano, S., *Schedario Baumgarten*, vol. III. *Bolle e brevi da Clemente V a Martino V (an. 1305-1431)*, Città del Vaticano (1983); Pagano, S., *I documenti del processo di Galileo Galilei* (in collaborazione con Luciani, A.G.), Città del Vaticano (1984) [Pontificiae Academiae Scientiarum Scripta Varia 53; Collectanea Archivi Vaticani, 21]; Pagano, S., *Nuovi documenti su Vittoria Colonna e Reginald Pole* (in collaborazione con Concetta Ranieri), Città del Vaticano (1989) [Collectanea Archivi Vaticani, 24]; Pagano, S., *Il processo di Endimio Calandra e l'Inquisizione a Mantova nel 1567-1568*, Città del Vaticano (1991) [Studi e Testi, 339]; Pagano, S., *Il cardinale Uberto Gambarara vescovo di Tortona (1489-1549)*, Firenze, Leo S. Olschki (1995); Pagano, S., *L'epistolario 'vaticano' di Lorenzo Perosi (1867-1956)*, Genova, Marietti (1997); Pagano, S., *Le ragioni temporali di un vescovo – Maffeo Gambarara Vescovo di Tortona e il conflitto giurisdizionale con il senato di Milano 1593-1596*, Roma, Gangemi Editore (2000); *Novarien. Beatificationis et canonizationis Servi Dei Caroli a Basilica Petri (in saec.: Ioannis Francisci Bascapè) Religiosi professi Congregationis Clericorum Regularium S. Pauli ('Barnabiti') Episcopi Novariensis (1550-1615). Positio super vita, virtutibus et fama sanctitatis*, Voll. I-II, Sergius Pagano curavit, Romae, Typis Nova Res (2003) [Congregatio De Causis Sanctorum, Prot. N. 1311]; Pagano, S., *Paesi infetti. Magia, eresia e faide familiari nel tortonese durante il secolo XVI*, Roma, Gangemi (2003); *Bibliografia dell'Archivio Vaticano*, nuova versione, IX (1997-1999), direzione redazionale a cura di S. Pagano, Città del Vaticano (2003); Firpo, M., Pagano, S., *I processi inquisitoriali di Vittore Soranzo (1550-1558). Edizione Critica*, Tomi I-II, Archivio Segreto Vaticano, Città del Vaticano 2004, pp. XCVII-1061 [Collectanea Archivi Vaticani, 53]; *Guida delle fonti per la storia dell'Africa del Nord, Asia e Oceania nell'Archivio Segreto Vaticano*, a cura di Di Giovanni, F., Pagano, S., Roselli, G., Archivio Segreto Vaticano, Città del Vaticano (2005), pp. XXVI-564 [Collectanea Archivi Vaticani, 37]; Dieguez, A.M., Pagano, S., *Le carte del "Sacro Tavolo". Aspetti del pontificato di Pio X dai documenti del suo archivio privato*, Volumi I-II, Archivio Segreto Vaticano, Città del Vaticano (2006), pp. CXVI-1072 [Collectanea Archivi Vaticani, 60].

Cesare Pasini



Date of Birth 3 February 1950

Place Milan (Italy)

Nomination 25 June 2007

Field Patrology

Title Professor

Most important awards, prizes and academies Member of the Accademia di sant' Ambrogio since its foundation on 24 April 2003; Association International des Études Patristiques (AIÉP); Associazione Italiana di Studi Bizantini (AISB); Associazione Italiana per lo Studio dei Santi, dei Culti e dell' Agiografia (AISSCA).

Main publications *Vita di S. Filippo d' Agira attribuita al monaco Eusebio*. Introduzione, edizione critica, traduzione e note, Roma, Pontificium Institutum Orientalium Studiorum, 1981 (*Orientalia Christiana Analecta*, 214); *Le fonti greche su sant' Ambrogio*, Milano-Roma, Biblioteca Ambrosiana – Città Nuova Editrice, 1990 (Tutte le opere di sant' Ambrogio. Sussidi, 24/1); *Ambrogio di Milano. Azione e pensiero di un vescovo*, Cinisello Balsamo, San Paolo, 1996, 19972 (*Grandi biografie*, 6); *Manoscritti e frammenti greci dell' Ambrosiana. Integrazioni al catalogo di Emidio Martini e Domenico Bassi*, Roma, Università di Roma "La Sapienza", 1997 (*Testi e studi bizantino-neoellenici*, 9); *Inventario agiografico dei manoscritti greci dell' Ambrosiana*, Bruxelles, Société des Bollandistes, 2003 (*Subsidia Hagiographica*, 84); *Bibliografia dei manoscritti greci dell' Ambrosiana (1857-2006)*, Milano, Vita e Pensiero, 2007 (*Bibliotheca erudita*, 30).

William D. Phillips



Date of Birth 5 November 1948

Place Wilkes-Barre, PA (USA)

Nomination 7 April 2004

Field Physics

Title Professor, Nobel laureate in Physics, 1997

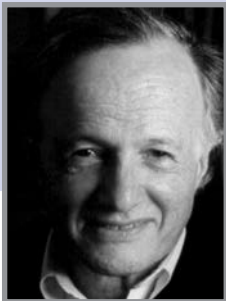
Most important awards, prizes and academies *Awards:* Gold Medal, Dept. of Commerce (1993); Michelson Medal, Franklin Institute (1996); Nobel Prize in Physics, shared with Steven Chu of Stanford University and Claude Cohen-Tannoudji of the École Normale Supérieure, Paris (1997). *Nobel Prize Citation:* 'for development of methods to cool and trap atoms with laser light'. *Academies:* Fellow, American Physical Society; Fellow, Optical Society of America; Fellow, American Academy of Arts and Sciences; Pontifical Academy of Sciences.

Summary of scientific research Recent scientific activities center on the manipulation of matter with light, and its applications. This includes laser cooling of atoms; trapping of atoms in laser, magnetic, and microwave fields; the study of Bose-Einstein condensation of cold atomic gases; the quantum motion of atoms trapped in optical lattices, including the study of interacting, degenerate gases in one, two and three-dimensions; the study of collisions between lasercooled atoms and between atoms in a BEC, including photoassociative spectroscopy and the precision determination of atomic lifetimes and scattering lengths; the use of lasercooled atoms in atomic frequency standards, including atomic fountain clocks; atom optics and atom lasers – the study of coherent atomic deBroglie waves and their use in devices like interferometers; microgravity applications of laser-cooled atoms, including atomic clocks and atomic interferometry; atom lithography – the use of atom optics to write patterns on surfaces; optical tweezers – the use of laser beams to manipulate biological cells and other small objects – for studies of biochemical binding, bioadhesion, and other biochemical and biomedical applications; and quantum information, in which cold atoms are used as qubits.

Main publications Phillips, W.D., Strongly inhibited transport of a dege-

nerate 1D Bose gas in a lattice, C. Fertig *et al.*, *Phys. Rev. Lett.*, **94**, 120403 (2005); Laburthe Tolra, B., O'Hara, K.M., Huckans, J.H., Phillips, W.D., Roiston, S.L. and Porto, J.V., Observation of Reduced Three-Body Recombination in a Correlated 1D Degenerate Bose Gas, *Phys. Rev. Lett.*, **92**, pp. 190-401 (2004); McKenzie, C., Hecker Denschlag, J., Häffner, H., Browaeys, A., de Araujo, L.E.E., Fatemi, F.K., Jones, K.M., Simsarian, J.E., Cho, D., Simoni, A., Tiesinga, E., Julienne, P.S., Helmerson, K., Lett, P.D., Rolston, S.L. and Phillips, W.D., Photoassociation of Sodium in a Bose-Einstein Condensate, *Phys. Rev. Lett.*, **88**, pp. 120-403 (2002); Denschlag, J., Simsarian, J.B., Feder, D.L., Clark, C.W., Collins, L.A., Cubizolles, J., Deng, L., Hagley, E.W., Helmerson, K., Reirihardt, W.P., Rolston, S.L., Schneider, B.I. and Phillips, W.D., Generating Solitons by Phase Engineering of a Bose-Einstein Condensate, *Science*, **287**, p. 97 (2000); Deng, L., Hagley, E.W., Wen, J., Trippenbach, M., Band, Y., Julienne, P.S., Simsarian, J.E., Helmerson, K., Roiston, S.L. and Phillips, W.D., Four-wave mixing with matter waves, *Nature*, **398**, p. 218 (1999); Hagley, E.W., Deng, L., Kozuma, M., Wen, J., Helmerson, K., Rolston, S.L. and Phillips, W.D., A Well-Collimated Quasi-Continuous Atom Laser, *Science*, **283**, p. 1706 (1999); Kozuma, M., Den, L., Hagley, E.W., Wen, J., Lutwak, R., Helmerson, K., Rolston, S.L. and Phillips, W.D., Coherent Splitting of Bose-Einstein Condensed Atoms with Optically Induced Bragg Diffraction, *Phys. Rev. Lett.*, **82**, pp. 871-5 (1999); Phillips, W.D., Laser cooling and trapping of neutral atoms, *Rev. Mod. Phys.*, **70**, pp. 721-41 (1998)(Nobel Lecture); Kastberg, A., Phillips, W., Rolston, S., Spreew, R. and Jessen, P., Adiabatic cooling of cesium to 700 nK in an optical lattice, *Phys. Rev. Lett.*, **74**, p. 1542 (1995); Lett, P., Watts, R., Westbrook, C., Phillips, W.D., Gould, P. and Metcalf, H., Observation of Atoms Laser Cooled Below the Doppler Limit, *Phys. Rev. Lett.*, **61**, p. 1169 (1988); Alan L. Migdall, John V. Prodan, William D. Phillips, Thomas H. Bergeman, and Harold J. Metcalf, First Observation of Magnetically Trapped Neutral Atoms, *Physical Review Letters*, **54**, n. 24, pp. 2596-9 (June 17, 1985); William D. Phillips and Harold Metcalf, Laser Deceleration of an Atomic Beam, *Physical Review Letters*, **48**, n. 9, pp. 596-9 (1982).

John Charles Polanyi



Date of Birth 23 January 1929

Place Berlin (Germany)

Nomination 9 June 1986

Field Chemistry

Title Professor, Nobel laureate in Chemistry, 1986

Most important awards, prizes and academies *Awards:* Marlow Medal of the Faraday Society, UK (1962); Steacie Prize for the Natural Sciences (1965); Henry Marshall Tory Medal of the Royal Society of Canada (1977); Wolf Prize in Chemistry, shared with G. Pimentel (1982); Nobel laureate in Chemistry (1986). *Academies:* Royal Society of Canada; Royal Society of London; American Academy of Arts and Sciences; National Academy of Sciences, USA; Companion of the Order of Canada; Pontifical Academy of Sciences; Russian Academy of Sciences.

Summary of scientific research The past decades have seen the birth of a field of chemical physics termed 'reaction dynamics', the study of the atomic and molecular motions underlying chemical reaction. Starting in 1956, J.C. Polanyi's laboratory at the University of Toronto attempted to detect and measure the extent of vibration and rotation in reaction products from gaseous reaction by recording their emission in the infrared. Ultimately these experiments yielded quantitative data concerning the motions in molecules at the instant of their formation, and also the effect on these product motions of systematic alterations in the corresponding motions in the reagents. From these data it was possible, by means of Monte Carlo trajectory computations performed in this and other laboratories, to obtain some insight into the patterns of motion in the course of transition from reagents into products. More recently Polanyi's laboratory has been involved in an attempt to establish, through theory and experiment, a means of probing the subpicosecond 'transition state' directly, either by recording feeble emission or by laser absorption; this area of research (still in its infancy) constitutes 'transition state spectroscopy'. In a second recent departure this laboratory has turned its attention to the dynamics of simple reactions occurring at surfaces.

Following adsorption of submonolayers on the surface, reaction is initiated by ultraviolet light. The present indication is that this procedure can result in reaction between coadsorbed species, both held at the surface, with preferred locations and orientations. Most recently his laboratory has been involved in studying photoreaction one molecule at a time, beneath the tip of a Scanning Tunneling Microscope. The hope, therefore, is to exploit this 'surface aligned photochemistry' as a means of improving our understanding, and therefore our control, over microscopic reaction pathways – the molecular choreography of the reactive process.

Main publications Cashion, J.K. and Polanyi, J.C., Infrared Chemiluminescence from the Gaseous Reaction Atomic H Plus Cl_a , *J. Chem. Phys.*, 29, p. 455 (1958); Polanyi, J.C., Energy Distribution Among Reagents and Products of Atomic Reactions, *J. Chem. Phys.*, 31, p. 1338 (1959); Polanyi, J.C., Proposal for an Infrared Maser Dependent on Vibrational Excitation, *J. Chem. Phys.*, 34, p. 347 (1961); Polanyi, J.C., The Iraser and Vaser. A Proposal for an Infrared and Visible Analogue of the Maser, *Proc. Roy. Soc. (Canada)*, 54(C), p. 25 (1960); Polanyi, J.C., Vibrational-Rotational Population Inversion, *J. Appl. Optics. Chemical Laser Supplement*, pp. 109-127 (1965); Kuntz, P.J., Nemeth, E.M., Polanyi, J.C., *et al.*, Energy Distribution Among Products of Exothermic Reactions. II. Repulsive, Mixed and Attractive Energy Release, *J. Chem. Phys.*, 44, p. 1168 (1966); Polanyi, J.C. and Wong, W.H., Location of Energy Barriers. I. Effect on the Dynamics of Reaction $\text{A}+\text{BC}$, *J. Chem. Phys.*, 51, p. 1439 (1969); Mok, M.H. and Polanyi, J.C., Location of Energy Barriers. II. Correlation with Barrier Height, *J. Chem. Phys.*, 51, p. 1451 (1969); Ding, A.M.G., Kirsch, L.J., Perry, D.S., Polanyi, J.C. and Schreiber, J.L., The Effect of Changing Reagent Energy on Reaction Probability, and Product Energy-Distribution, *Faraday Disc. Chem. Soc.*, 55, p. 252 (1973); Polanyi, J.C. and Schreiber, J.L., The Reaction $\text{F}+\text{H}_2\rightarrow\text{HF}+\text{H}$: A Case Study in Reaction Dynamics, *Faraday Disc. Chem. Soc.*, 62, p. 267 (1977); Foth, H.-J., Polanyi, J.C. and Telle, H.H., Emission from Molecules and Reaction Intermediates in the Process of Falling Apart, *J. Phys. Chem.*, 86, p. 5027 (1982); Arrowsmith, P., Bly, S.H.P., Charters, P.E. and Polanyi, J.C., Spectroscopy of the Transition State. II. $\text{F}+\text{Na}_2\rightarrow\text{FNaNa}^+\rightarrow\text{NaF}+\text{Na}^+$, *J. Chem. Phys.*, 79, p. 283 (1983); Bourdon, E.B.D., Cowin, J.P., Harrison, I., Polanyi, J.C., *et al.*, UV Photodissociation and Photodesorption of Adsorbed Molecules. I: CH_2Br on $\text{LiF}(001)$, *J. Phys. Chem.*, 88, p. 6100 (1984); Bourdon, E.B.D., Das, P., Harrison, I., Polanyi, J.C., *et al.*, Photodissociation, Photoreaction and Photodesorption of Adsorbed Species. II. CH_2Br and H_2S

on LiF(001), *Faraday Disc. Chem. Soc.*, 82 (1986); Lu, P.H., Polanyi, J.C. and Rogers, D., Photoinduced Localized Atomic Reaction (LAR) of 1,2- and 1,4-dichlorobenzene with Si(111)7x7, *J. Chem. Phys.*, 112, p. 11005 (2000); Jiang, G., Polanyi, J.C., Rogers, D., Electron and Photon Irradiation of Benzene and Chlorobenzene on Si(111)7x7, *Surface Science*, 544, p. 147 (2003); I.D. Petsalakis, J.C. Polanyi and G. Theodorakopoulos, Theoretical Study of the Induced Attachment of Benzene to Si(111)-7x7, *Surface Science* 544, 162 (2003); S. Dobrin, H. He, F.Y. Naumkin, J.C. Polanyi, and S.A. Raspopov, Photoinduced Charge-Transfer Reaction at Surfaces. Part II: HBr...Nan/LiF(001) + hf(610 nm) → Br-Na+n/LiF(001) + H(g), *J. Chem. Phys.* 119, 9795 (2003); F.Y. Naumkin, J.C. Polanyi, *et al.*, Electron-Induced Attachment of Chlorinated Benzenes to Si(100)-2x1, *Surface Science* 547, 324 (2003); C.F. Matta and J.C. Polanyi, Chemistry on a Peg-Board: The Effect of Adatom-to-Adatom Separation on the Reactivity of Dihalobenzenes at Si(111)-7x7 Surfaces, *Phil. Trans. Royal Soc. London A*, 362, 1185 (2004); S. Dobrin, K. Rajamma Harikumar and J.C. Polanyi, An STM Study of the Localized Atomic Reaction of 1,2 and 1,4-diBrPh at Si(111)-7x7, *Surface Science* 561, 11 (2004); K. Rajamma Harikumar, I.D. Petsalakis, J.C. Polanyi and G. Theodorakopoulos, Parent- and Daughter-Mediated Halogenation Reactions Modeled For 1,2- and 1,4-Dibromobenzene at Si(111)-7x7, *Surface Science* 572, 162 (2004); S. Dobrin, X. Lu, F.Y. Naumkin, J.C. Polanyi and J. (S.Y.) Yang, Imprinting Br-Atoms at Si(111) from a SAM of CH₃Br(ad), with Pattern Retention, *Surf. Sci. Letters* 573, L363 (2004); S. Dobrin, J.B. Giorgi, F.Y. Naumkin and J.C. Polanyi, Photoinduced Charge Transfer Reaction at Surfaces. III. (HF)₂...Na_n/LiF(001) + hf(640 nm) → HFF-Na_n+/LiF(001) + H(g), *J. Chem. Phys.* 122, 14705 (2005); S. Dobrin, K. Rajamma Harikumar, C.F. Matta and J.C. Polanyi, An STM Study of the Localized Atomic Reaction of 1,2 and 1,4-Dibromoxylene at Si(111)-7x7, *Surf. Sci.*, 580, 39 (2005); H.E. Ruda, J.C. Polanyi, *et al.*, Developing 1D Nanostructure Arrays for Future Nanophotonics, *Nanoscale Research Letters*, 1, 99 (2006); S. Dobrin, K. Rajamma Harikumar and J.C. Polanyi, STM Study of the Conformation and Reaction of Long-Chain Halo Alkanes at Si(111)-7x7, *J. Phys. Chem. B* 110, 8010 (2006); X. Lu, J.C. Polanyi and J. (S.Y.) Yang, A Reversible Molecular Switch Based on Pattern-Change in Chlorobenzene and Toluene on a Si(111)-(7x7) Surface, *Nano Lett.* 6, 809 (2006); S. Dobrin, K.R. Harikumar, R.V. Jones, I.R. McNab, J.C. Polanyi, *et al.*, Molecular Dynamics of Haloalkane Corral-Formation and Surface Halogenation at Si(111)-7x7, *J. Chem. Phys.* 125, 133407 (2006); K.R. Harikumar, J.C. Polanyi, *et*

al., Electronic Switching of Single Silicon Atoms by Molecular Field Effects, *J. Am. Chem. Soc.*, 128, 16791 (2006); S. Dobrin, K.R. Harikumar, T.B. Lim, L. Leung, I.R. McNab, J.C. Polanyi, *et al.*, Maskless nanopatterning and formation of nano-corrals and switches, for haloalkanes at Si(111)-7x7, *Nanotechnology*, 18, 044012 (2007).

Ingo Potrykus



Date of Birth 5 December 1933

Place Hirschberg (Germany)

Nomination 10 March 2005

Field Plant Sciences

Title Professor em. (ETH, Zürich)

Most important awards, prizes and academies *Honours*: ISPMB International Award in Plant Molecular Biology and Biotechnology 2000; American Society of Plant Biologists (ASPB) Leadership in Science Public Service Award 2001; Crop Science of America (CSSA) 2001; CSSA President's Award 2002; European Culture Award in Science 2002; Honorary Doctor, Swedish University of Agricultural Sciences 2002; University of Freiburg, Germany 2007; "The most influential scientist" in the area of Agricultural, Industrial, and Environmental Biotechnology for the decade 1995-2005, elected by the peers of *Nature Biotechnology* 2006; Cover *TIME Magazine* July 31, 2000. *Academies*: Academia Europaea, Swiss Academy of Technical Sciences, Hungarian Academy of Sciences, Pontifical Academy of Sciences.

Summary of scientific research Prof. Potrykus' work centred on the development and application of genetic engineering technology for and to 'food security' crops such as rice (*Oryza sativa*), wheat (*Triticum aestivum*), sorghum (*Sorghum bicolor*), and cassava (*Manihot esculenta*), in order to solve problems that are difficult to treat with traditional techniques. He also focused on the areas of disease and pest resistance, improved food quality, improved yield, improved exploitation of natural resources, and improved bio-safety. He is the inventor and promoter of 'Golden Rice', a sustainable contribution to reduce vitamin A-malnutrition (www.goldenrice.org).

Main publications Ca. 340 publications in refereed journals; ca. 30 international patents. Potrykus, I. (1971) Intra and interspecific fusion of protoplasts from petals of *Torrenia baillioni* and *Torrenia fournierii*. *Nature* 231, 57-8; Potrykus, I. and Durand J. (1972) Callus formation from single protoplasts of *Petunia*. *Nature* 327, 286-7; Potrykus, I. (1973) Transplantation of chloroplasts into protoplasts of *Petunia*. *Z.Pflanzenphysiol.* 70, 364-6;

Potrykus, I. and Hoffmann, F. (1973). Transplantation of nuclei into protoplasts of higher plants. *Z.Pflanzenphysiol.* 69, 287-9, 1976; Potrykus, I., Harms, C.T. and Lörz, H. (1976) Problems in culturing cereal protoplasts. In: *Cell Genetics in Higher Plants*. D. Dudits *et al.* (eds), Akademiai kiado, Budapest, 129-40; Potrykus, I., Harms, C.T., Lörz, H. and Thomas, E. (1977). Callus formation from stem protoplasts of corn (*Zea mays* L.). *Mol. Gen. Genet.* 156, 347-50; Callus formation from cell culture protoplasts of corn (*Zea mays*). Brisson, N., Paszkowski, J., Penswick, J., Gronenborn, B., Potrykus, I. and Hohn, T. (1984). Expression of a bacterial gene in plants using a viral vector. *Nature* 310, 511-4; Paszkowski, J., Shillito, R.D., Saul, M.W., Mandak, V., Hohn, T., Hohn, B., Potrykus, I. (1984) Direct gene transfer to plants. *EMBO J.* 3, 2717-22; Potrykus, I., Paszkowski, J., Saul, M.W., Petruska, J., Shillito, R.D. (1985). Molecular and general genetics of a hybrid foreign gene introduced into tobacco by direct gene transfer. *Mol. Gen. Genet.* 199, 169-77; Potrykus, I., Saul, M.W., Petruska, J., Paszkowski, J. and Shillito, R.D. (1985). Direct gene transfer to cells of a graminaceous monocot. *Mol. Gen. Genet.* 199, 183-8; Shillito, R.D., Saul, M.W., Müller, M., Paszkowski, J. and Potrykus, I. (1985). High efficiency direct gene transfer to plants. *Bio/Technology* 3, 1099-103; Schocher, R.J., Shillito, R.D., Saul, M.W., Paszkowski, J. and Potrykus, I. (1986). Co-transformation of unlinked foreign genes into plants by direct gene transfer. *Bio/Technology* 4, 1093-6; Paszkowski, J., Baur, M., Bogucki, A. and Potrykus, I. Gene targeting in plants. *EMBO J.* 7, 4021-6 (1988); Potrykus, I. Gene transfer to cereals: an assessment. *Bio/Technology* 8, 535-42 (1990); Baur M, Potrykus I., Paszkowski J. (1990) Intermolecular homologous recombination in plants. *Mol. Cell. Biol.* 10, 492-500; Mittelsten Scheid, O., Paszkowski, J., and Potrykus, I. Reversible inactivation of transgene in *Arabidopsis thaliana*. *Mol. Gen. Genet.* 228, 104-12 (1991); Potrykus, I. Gene transfer to plants: Assessment of Published Approaches and Results. *Annu. Rev. Plant Physiol. Plant Mol. Biol.* 42, 205-25 (1991); Sautter, C., Waldner, H., Neuhaus-Url, G., Galli, A., Neuhaus, G. and Potrykus, I. Micro-Targeting: High efficiency gene transfer using a novel approach for the acceleration of microprojectiles. *Bio/Technology* 9, 1080-5 (1991); Spangenberg, G., Freydl, E., Osusky, M., Nagel, J. and Potrykus, I. Organelle transfer by microfusion of defined protoplast-cytoplasm pairs. *Theor. Appl. Genet.* 81, 477-86 (1991); Datta, S.K., Datta, K., Soltanifar, N., Donn, G. and Potrykus, I. Herbicide resistant Indica rice plants from Indica breeding line IR72 after PEG-mediated transformation of protoplasts. *Plant Mol. Biol.* 20, 619-29 (1992); Iida, S., Mittelsten

Scheid, O., Saul, M.W., Seipel, K., Miyazaki, Ch. and Potrykus, I. Expression of a downstream gene from a bicistronic transcription unit in transgenic tobacco plants. *Gene* 119, 199-205 (1992); Takamizo, T., Spangenberg, G., Suginobu, K. and Potrykus, I. Intergeneric somatic hybridization in *Gramineae*: Somatic hybrid plants between tall fescue (*Festuca arundinacea* Schreb.) and Italian ryegrass (*Lolium multiflorum* Lam.). *Mol. Gen. Genet.* 231, 1-6 (1992); Wang, Z.Y., Takamizo, T., Iglesias, V.A., Osusky, M., Nagel, J., Potrykus, I. and Spangenberg, G. Transgenic plants of tall fescue (*Festuca arundinacea* Schreb.) obtained by direct gene transfer to protoplasts. *Bio/Technology* 10, 691-6 (1992); Spangenberg, G., Wang, Z.Y., Wu, X.L., Nagel, J., Iglesias, V.A., and Potrykus, I. (1995) Transgenic Tall Fescue (*Festuca arundinacea* Schreb.) and Red Fescue (*Festuca pratensis* Huds) Plants from Microprojectile Bombardment of Embryogenic Suspension Cells. *J. Plant Physiol.* 145: 693-701; Spangenberg, G., Wang, Z.A., Wu, X.L., Nagel, J., Potrykus, I. (1995); Potrykus, I., Schlüter, K., Fütterer, J., Potrykus, I. (1995) 'Horizontal' gene transfer from a transgenic potato line to a bacterial pathogen (*Erwinia chrysanthemi*) occurs – if at all – at an extremely low frequency. *Bio/Technology* 13, 1094-8; Linn, W., Datta, K., Potrykus, I., Muthukrishnan, S., Datta, S.K. (1995) Genetic engineering of rice for resistance to sheath blight. *Bio/Technology* 13, 686-91; Wünn, J., Klöti, A., Burkhardt, P., Ghosh-Biswas, G.C., Launis, K., Iglesias, V.A., Potrykus, I. (1996) Transgenic Indica rice breeding line IR58 expressing a synthetic CryA(b) gene from *Bacillus thuringiensis* provides effective insect pest control. *Bio/Technology* 14, 171-6; Li, H.Q., Sautter, C., Potrykus, I., Puonti-Kaerlas, J. (1996) Genetic transformation of cassava (*Manihot esculenta* Crantz). *Nature Biotechnol.* 14, 736-40; Burkhardt, P.K., Beyer, P., Wünn, J., Klöti, A., Armstrong, G., Schledz, M., von Lintig, J., Potrykus, I. (1997) Transgenic rice (*Oryza sativa*) endosperm expressing daffodil (*Narcissus pseudonarcissus*) phytoene synthase accumulates phytoene, a key intermediate of provitamin A biosynthesis. *Plant J.* 11, 1071-8; Fütterer J., Rothnie H.M., Hohn T., Potrykus I. (1997) Rice tungro bacilliform virus open reading frames II and III are translated from polycistronic pregenomic RNA by leaky scanning. *J. Virol.* 71, 7984-9; Klöti, A., Henrich, C., Bieri, S., He, X., Chen, G., Burkhardt, P.K., Wünn, J., Lucca, P., Hohn, T., Potrykus, I., Fütterer, J. (1999) Upstream and downstream sequence elements determine the specificity of the rice tungro bacilliform virus promoter and influence RNA production after transcription. *Plant Mol Biol.* 40, 249-66; Ye, X., Al-Babili, S., Klöti, A., Zhang, J., Lucca, P., Beyer, P., Potrykus, I. (2000). Engineering provitamin A (β-carotene) biosynthetic

pathway into (carotenoid-free) rice endosperm. *Science* 287, 303-5; Clausen, M., Krauter, R., Schachermeyer, G., Potrykus, I., Sautter, C. (2000). Antifungal activity of a virally encoded gene in transgenic wheat. *Nature/Biotechnol.* 18, 446-9; Lucca P., Hurrell R., Potrykus I. (2000). Genetic engineering approaches to improve the bioavailability and the level of iron in rice grains. *Theor. Appl. Genetics* 102, 392-7 (2001). Potrykus, I. (2005). GMO-Technology and Malnutrition – Public Responsibility and Failure. *Electronic Journal for Biotechnology* [online]. 15 December 2005, vol. 8, no. 3 [cited 16 June 2006]. Available from: <http://www.ejbiotechnology.info/content/vol18/issue3/editorial.html>. ISSN 0717-3458; Potrykus, I. & Ammann, K., eds (2010) *Transgenic Plants for Food Security in the Context of Development*, Vol. 27/5, pp. 445-718, Proceedings of a Study Week of the Pontifical Academy of Sciences, Elsevier, Amsterdam, IS: ISSN 1871-6784; Potrykus, Ingo. Regulation must be revolutionized. *Nature*, Vol 466, 29 July 2010.

Frank Press



Date of Birth 4 December 1924

Place New York, NY (USA)

Nomination 3 September 1999

Field Geophysics

Title Professor

Most important awards, prizes and academies *Awards:* Légion d'honneur, France (1989); Japan Prize (1993); US National Medal of Science (1994); Cross of Merit, Germany (1993); Lomonosov Gold Medal of Russian Academy of Sciences (1998). *Academies:* US National Academy of Sciences; Royal Society of London; Académie des sciences, France; Russian Academy of Sciences; American Philosophical Society; Japan Academy of Engineering; American Academy of Arts and Sciences. *Honorary Degrees:* Princeton, Yale, Columbia, Sorbonne, Notre Dame, others.

Summary of scientific research Research and teaching in earth and planetary sciences with specialization in geophysics and oceanography.

Main publications Press, F. and Ewing, M., Propagation of explosive sound in a liquid layer overlying a semi-infinite elastic solid, *Geophysics*, 15, pp. 426-46 (1950); Press, F. and Ewing, M., Crustal structure and surface wave dispersion, Part II: Solomon Island earthquake of 29 July 1950, *Bull. Seism. Soc. Am.*, 42, pp. 315-25 (1952); Press, F. and Ewing, M., Mantle Rayleigh waves from the Kamchatka earthquake of 4 November, 1952, *Bull. Seism. Soc. Am.*, 44, pp. 471-9 (1954); Press, F., Oliver, J.E., and Ewing, M., Crustal structure and surface wave dispersion, Part IV: Atlantic and Pacific Ocean Basins, *Bull. Geol. Soc. Am.*, 66, pp. 913-46 (1953); Press, F. and Ewing, M., Rayleigh wave dispersion in the period range 10-500 seconds, *Trans. Am. Geophys. Union*, 37, pp. 213-5 (1956); Press, F., Determination of crustal structure from phase velocity of Rayleigh waves, Part I: Southern California, *Bull. Geol. Soc. Am.*, 67, pp. 1647-58 (1956); Press, F., Ewing, M., and Jardetsky, W.S., *Elastic Waves in Layered Media* (McGraw-Hill Book Co., New York, 1957); Press, F. and Ewing, M., Determination of crustal structure from phase velocity of Rayleigh waves, Part III: The United States,

Bull. Seism. Soc. Am., 70, pp. 229-44 (1959); Press, F., Benioff, H. and Smith, S., Excitation of the free oscillations of the earth by earthquakes, *J. Geophys. Res.*, 66, pp. 605-19 (1961); Press, F., Ben Menahem, A. and Toksoz, M.N., Experimental determination of earthquake fault length and rupture velocity, *J. Geophys. Res.*, 66, pp. 3471-85 (1961); Press, F. and Harkrinder, D., Propagation of acoustic-gravity waves in the atmosphere, *J. Geophys. Res.*, 67, pp. 3889-3908 (1962); Press, F. and Biehler, S., Influences on crustal velocities and densities from P-wave delays and gravity anomalies, *J. Geophys. Res.*, 69, pp. 2979-95 (1964); Press, F., Displacements, strains and tilts at teleseismic distances, *J. Geophys. Res.*, 70, pp. 2395-2412 (1965); Press, F., Earth models obtained by Monte Carlo inversion, *J. Geophys. Res.*, 73, p. 16 (1968); Press, F., Regionalized earth models, *J. Geophys. Res.*, 75, pp. 6575-81 (1970); Press, F., The earth and the moon, *Quarterly J. Roy. Astron. Soc.*, 12, pp. 232-43 (1971); Press, F., Science and Technology in the White House, 1977 to 1980: Parts 1 and 2, *Science*, 211, pp. 139-45, pp. 249-56 (1981); Press, F., Science: The best and the worst of times, *Science*, 231, pp. 1351-2 (1986); Press, F., Growing up in the golden age of science, *Annual Review of Earth and Planetary Science*, 231, pp. 1351-2 (1986); Press, F., Patterns of seismic release in the Southern Californian region, *J. of Geophys. Res.*, 100, n. B4, pp. 6421-30 (1995); Press, F., The dilemma of the golden age (address to the members of the National Academy of Sciences at the 125th annual meeting), *Science, Technology, and Human Values*, 13, nos. 3 and 4 (summer and autumn, 1988); Press, F., Science and society in the years ahead, *1995 Sigma Xi Forum, Vannevar Bush II: Science for the 21st Century*, March 2-3 (1995); Press, F. and Siever R., *Understanding Earth*, 4th edn. (W.H. Freeman and company, New York, 2003).

Yves Quéré



Date of Birth 30 June 1931

Place Commercy (France)

Nomination 20 October 2003

Field Physics

Title Professor and Co-Chair of the Inter Academy Panel on International Issues

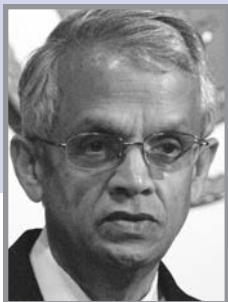
Most important awards, prizes and academies *Awards:* Officier, Légion d'honneur; Commandeur, Légion d'honneur. *Academic Appointments:* Chairman, Department of Physics, École Polytechnique (1987); Chairman, Senate of Professors, École Polytechnique (1989). *Academies:* Corresponding Member (1980), Member (1991) and Foreign Secretary (1993), Académie des sciences; Co-Chairman of InterAcademy Panel for International Issues (IAP) (2000, 2003); Pontificia Academia Scientiarum (2003). *Honorary Degrees:* Polytechnic University, Bucharest (1996); Science Academy of Belarus (2003).

Summary of scientific research Main domains of research, in experimental solid state physics, have been: 1) Determination of properties of point defects (like: vacancies, or interstitials) in metals such as silver, gold, uranium, etc. 2) Observation of radiation damage (neutrons, protons, heavy ions, etc.) in metals and ionic crystals. Study, in particular, of irradiation swelling and growth in nuclear materials. 3) Scientific leadership of a lab devoted to electronic and physical properties of Pu, Np, etc. 4) Study of the interactions between particles and solids, particularly in the case of Ion Channeling: first observations and theoretical models of dechanneling by crystal defects.

Main publications *Books:* *Irradiation effects in fissile materials*, with Jean Leteurtre, North Holland (1966); *Physics of Materials*, Gordon and Breach (1998); *La science institutrice*, Odile Jacob (2002); *La sagesse du physicien, L'œil neuf* (2005); *L'enfant et la science* (avec G. Charpak et P. Léna), Odile Jacob (2005); *La culture, en mémoire de France Quéré* (collectif), Odile Jacob (2006). *Articles:* Quéré, Y., Nakache, F., Évaluation du volume d'une pointe de fission dans l'uranium, *J. Nat. Nucl.*, 2, p. 203 (1959); Quéré, Y., Pham, F., Blin, J., Sur le gonflement exagéré dans les combustibles nucléaires

(a theory of "Breakaway Swelling"), *Reactor Science and Techn.*, 17, p. 15 (1963); Quéré, Y., Interactions between quenched vacancies and oxygen in silver, *J. Phys. Soc. Japan*, 18 sup. III, p. 91 (1963); Quéré, Y., Dechanneling cylinder of dislocations, *Phys. Stat. Solids*, 30, p. 713 (1968); Quéré, Y., Couve, H., Radiography of platinum by means of channeled particles, *J. Appl. Phys.*, 39, p. 4012 (1968); Quéré, Y., Dechanneling of fast particles by lattice defects, *J. Mat. Nucl.*, 53, p. 262 (1974); Quéré, Y., Uggerhoj, E., The use of accelerators to obtain channeling micrographs of polycrystalline foils, *Phil. Mag.*, 34, p. 1197 (1976); Rullier, F., Quéré, Y., An experimental argument – in Nb_3Ge – for the Labbé-Barisic-Friedel theory of superconductivity, *Phys. Letters*, 81 A, p. 232 (1981); Beuneu, B., Quéré, Y., Un interstitiel paraélastique dans le molybdène, *J. Physique Lettres*, 42, p. 465 (1981); Boucher, R., Quéré, Y., Sources d'énergie au plutonium pour stimulateurs cardiaques (energy sources for pacemakers), *J. Mat. Nucl.*, 100, p. 132 (1981); Quéré, Y., The virtues of a scientific education, *Nucl. Inst. Meth.*, B.164, p. 23 (2000); Beuneu, B., Quéré, Y., Paraelasticity in electron irradiated molybdenum, *Yamada Science Found.*, Univ. Tokyo Press, 156 (1982); Gély, M.H., Dunlop, A., Quéré, Y., Une paire de Frenkel éphémère dans l'iridium, *J. Physique Lettres*, 44, p. 219 (1983); Quéré, Y., Radiation effects in (old and new) superconductors, *Nucl. Instr. Meth.*, B33, p. 906 (1988); Rullier-Albenque, F., Bielska, H., Quéré, Y., Wallner, G., Müller, P., Defect production rates in normal and in superconducting states, *J. Nucl. Mater.*, 151, p. 245 (1988); Quéré, Y., Rullier-Albenque, F., Point defects in superconductors, *J. Nucl. Mater.*, 169, p. 19 (1989); Cohen, C., Dural, J., Gaillard, M.J., Genre, R., Grob, J.J., Hage-Ali, M., Kirsch, R., L'Hoir, A., Mory, J., Poizat, J.C., Quéré, Y., Remillieux, J., Schmaus, D., Toulemonde, M., Channeling of 2.4 GeV Ar ions in a germanium crystal, *J. Physique Lettres*, 46, p. 1565 (1985); Same authors, Electron-impact ionization and energy loss of 27 MeV u Xe^{35+} incident ions channeled in silicon, *Phys. Rev. Lett.*, 63, p. 1930 (1989); Ganne, J.P., Quéré, Y., Intrinsic thermal expansion of point defects in metals, *Yamada Sc. Found.*, Univ. Tokyo Press, 232 (1992); Quéré, Y., Science et Droits de l'Homme, *Science et Liberté* (about A. Sakharov), Edition de Physique (1990); Quéré, Y., The Jahn-Teller effect: a pedagogical approach, *Acta Phys. Polon.* (1992).

Veerabhadran Ramanathan



Date of Birth 24 November 1944

Place Chennai, Madras (India)

Nomination 7 October 2004

Field Atmospheric Sciences

Title Professor

Most important awards, prizes and academies *Academies:* American Association for the Advancement of Science; American Geophysical Union; American Meteorological Society; 2002-date Member of U.S. National Academy of Sciences; Foreign Member, Academia Europea, Third World Academy of Sciences. *Awards:* 1995 Buys Ballot Medal, Royal Netherlands Academy of Sciences; 1997 Volvo Environment Prize; 2002 Rossby Medal, American Meteorological Society; 2004 Gutenberg Lecture.

Summary of scientific research My fundamental interest is in understanding how human activities are influencing the climate and environment of this planet. In particular, I am focusing on how atmospheric gases, clouds and aerosols regulate the planetary greenhouse effect, solar radiative heating and climate. As a post doctoral fellow I identified the greenhouse effect of the vibration-rotation bands of chlorofluorocarbons (CFCs); on a per molecule basis, CFCs were about 10000 times more effective than CO₂ as a greenhouse gas. This surprising finding opened the door to the discovery of the greenhouse effect of numerous other trace gases and the field of trace gases-climate-chemistry interactions. Clouds, the Gordian knot of the climate problem, were my next focus. I designed a satellite radiation budget experiment along with NASA scientists, and demonstrated that clouds had a net cooling effect on the planet; i.e. the reflection of solar radiation to space by clouds far exceeded their greenhouse effect. This cloud radiative forcing data is still being used to validate climate models. My current interest is to understand the influence of sub-micron size manmade particles in the atmosphere. I designed (along with P.J. Crutzen) the Indian Ocean Experiment, which led to the discovery of the widespread South Asian Brown haze, and its surprisingly large impact in reducing the solar radiation at the surface, as it not only cools

the region but could also lead to global drying. This work led to a UN initiated project to study the impact of such brown clouds worldwide. I am now designing an experiment using miniaturized instruments and unmanned aircraft to understand how the planet regulates its albedo.

Main publications Ramanathan's principal publications include over 150 journal papers and articles in books on Atmospheric and Climate Sciences and Planetary Atmospheres. Selected publications are listed here: Ramanathan, V., 1975, Greenhouse Effect Due to Chlorofluorocarbons: Climatic Implications, *Science*, 190: 50-1; Ramanathan, L.B. Callis and R.E. Boughner, 1976, Sensitivity of Atmospheric and Surface Temperature to Perturbations in Stratospheric Concentration of Ozone and Nitrogen Dioxide, *J. Atmos. Sci.*, 33: 1092-112; Fishman, J., V. Ramanathan, P.J. Crutzen and S.C. Liu, 1980, Tropospheric Ozone and Climate, *Nature*, 282: 818-20; Madden, R.A. and V. Ramanathan, 1980: Detecting Climate Change Due to Increasing CO₂, *Science*, 209, 763-8; Ramanathan, V., R.J. Cicerone, H.B. Singh and J.T. Kiehl, 1985, Trace Gas Trends and Their Potential Role in Climate Change, *J. Geophys. Res.*, 90: 5547-66; Ramanathan, V., L. Callis, R. Cess, J. Hansen, I. Isaksen, W. Kuhn, A. Lacis, F. Luther, J. Mahlman, R. Reck and M. Schlesinger, 1987, Climate-Chemical Interactions and Effects of Changing Atmospheric Trace Gases, WMO Report#1, Volume III on *Atmospheric Ozone*, Chapter 15 on Trace gas Effects on Climate; 821-94; Ramanathan, V., 1981, The Role of Ocean-Atmosphere Interactions in the CO₂-Climate Problems, *J. Atmos. Sci.*, 38: 918-30; Ramanathan, V., E.J. Pitcher, R.C. Malone and M.L. Blackmon, 1983, The Response of a Spectral General Circulation Model to Refinements in Radiative Processes, *J. Atmos. Sci.*, 40: 605-30; Ramanathan, V., R.D. Cess, E.F. Harrison, P. Minnis, B.R. Barkstrom, E. Ahmad, and D. Hartmann, 1989, Cloud-Radiative Forcing and Climate: Results from the Earth Radiation Budget Experiment, *Science*, 243: 57-63; Raval, A. and V. Ramanathan, 1989, Observational Determination of the Greenhouse Effect, *Nature*, 342: 758-61; Ramanathan, V. and W. Collins, 1991, Thermodynamic Regulation of Ocean Warming by Cirrus Clouds Deduced from Observations of the 1987 El Niño, *Nature*, 351: 27-32; Zhang, G.J., V. Ramanathan and M.J. McPhaden, 1995, Convection-Evaporation Feedback in the Equatorial Pacific, *J. Climate*, 8: 3040-51; Ramanathan, V., B. Subasilar, G. Zhang, W. Conant, R. Cess, J. Kiehl, H. Grassl and L. Shi, 1995, Warm Pool Heat Budget and Shortwave Cloud Forcing: A Missing Physics?, *Science*, 267: 499-503; Ramanathan, V., and 40 co-authors, 2001, The Indian Ocean Experiment: An Integrated Assessment of

the Climate Forcing and Effects of the Great Indo-Asian Haze, *J. Geophys. Res.*, 106, (D 22), 28,371-28,399; Satheesh, S.K. and V. Ramanathan, 2000, Large Differences in Tropical Aerosol Forcing at the Top of the Atmosphere and Earth's surface, *Nature*, 405: 60-3; Ramanathan, V., P.J. Crutzen, J.T. Kiehl and D. Rosenfeld, 2001, Aerosols, Climate and The Hydrological Cycle, *Science*, 294, 2119-24; Ramanathan, V., and P.J. Crutzen, 2003, Atmospheric Brown 'Clouds', *Atmospheric Environment*, 37, 4033-5; V. Ramanathan and M.V. Ramana, Atmospheric Brown Clouds, Long Range Transport and Climate Impacts, *EM*, 28-33, December 2003; Ramanathan, V., and M.V. Ramana, Persistent, widespread and strongly absorbing haze over the Himalayan foothills and the Indo-Gangetic Plains, *Pure and Applied Geophysics*, 162, 8-9 (2005), pp. 1609-26; Jacob, D., R. Avissar, G.C. Bond, S. Gaffin, J. Kiehl, J. Lean, U. Lohmann, M. Mann, R. Pielke, Jr., V. Ramanathan, and L. Russell, 2005, *Radiative Forcing of Climate Change: Expanding the Concept and Addressing Uncertainties* (Washington, DC: The National Academies Press, 2005), pp. 224; Ramanathan, V., 2006, Atmospheric Brown Clouds: Health, Climate and Agriculture Impacts, Pontifical Academy of Sciences *Scripta Varia* 106, Interactions Between Global Change and Human Health (Pontificia Academia Scientiarvm 2006), pp. 47-60; Kiehl, J.T. and V. Ramanathan, eds (2006), *Frontiers of Climate Modeling*, Cambridge University Press, Cambridge; Ramanathan, V. and A. Inamdar, 2006: The Radiative Forcing due to Clouds and Water Vapor, *Frontiers of Climate Modeling*, J.T. Kiehl and V. Ramanathan, eds (Cambridge University Press 2006), pp. 119-51; Ramanathan, V., et al., (2007), *Evaluating Progress of the U.S. Climate Change Science Program: Methods and Preliminary Results*, National Academies Press, Washington DC; Ramanathan, V., Role of Black Carbon in Global and Regional Climate Change, *Testimonial to the House Committee on Oversight and Government Reform*, October 18, 2007; Ramanathan, V. (2007), Global Dimming by Air Pollution and Global Warming by Greenhouse Gases: Global and Regional Perspectives, in C.D. O'Dowd and P.E. Wagner, eds, *Nucleation and Atmospheric Aerosols: 17th International Conference Galway, Ireland*, pp. 473-83; Ramanathan, V. (2008), Why is the Earth's Albedo 29% and was it always 29%?, *ILEAPS Newsletter*, Issue 5 (April), pp. 18-20.

Chintamani N.R. Rao



Date of Birth 30 June 1934

Place Bangalore (India)

Nomination 25 June 1990

Field Chemical Science

Title Albert Einstein Research Professor

Most important awards, prizes and academies Among the various medals, honours and awards received by him, mention must be made of the Marlow Medal of the Faraday Society (1967), Bhatnagar Prize (1968), Jawaharlal Nehru Fellowship (1973), Padma Shri (1974), Centennial Foreign Fellowship of the American Chemical Society (1976), Royal Society of Chemistry (London) Medal (1981), Padma Vibhushan (1985), Honorary Fellowship of the Royal Society of Chemistry, London (1989), Hevrovsky Gold Medal of the Czechoslovak Academy (1989), Blackett Lectureship of the Royal Society (1991), Einstein Gold Medal of UNESCO (1996), Linnett Professorship of the University of Cambridge (1998), Centenary Medal of the Royal Society of Chemistry, London (2000), the Hughes Medal of the Royal Society, London, for original discovery in physical sciences (2000), Karnataka Ratna (2001) by the Karnataka Government, the Order of Scientific Merit (Grand-Cross) from the President of Brazil (2002), Gauss Professorship of Germany (2003) and the Somiya Award of the International Union of Materials Research (2004). He is the first recipient of the India Science Award by the Government of India (2005) and received the Dan David Prize for science in the future dimension for his research in Materials Science. He was named Chemical Pioneer by the American Institute of Chemists (2005), Chevalier de la Légion d'Honneur by the President of the French Republic (2005) and received the Honorary Fellowship of the Institute of Physics, London (2006) and Honorary Fellowship of St. Catherine's College, Oxford (2007). He received the Nikkei Asia Prize for Science, Technology and Innovation (2008). He was awarded the Royal Medal by the Royal Society (2009) and the August-Wilhelm-von-Hoffmann Medal for his outstanding contributions to chemistry by the German Chemical Society (2010). He

received the Ernesto Illy Trieste Science Prize for materials research in (2011).

Summary of scientific research C.N.R. Rao had just joined college after high school studies when India gained freedom in 1947. After his undergraduate studies in Bangalore, he obtained a Master of Science degree from Banaras Hindu University. He obtained the Ph.D degree in chemical physics from Purdue University and carried out postdoctoral research work in the University of California, Berkeley. He returned to India in 1959 as a young faculty member at the Indian Institute of Science, Bangalore, which is the oldest and the most well-known research institute of India. Four years later, he moved to the new Indian Institute of Technology (IIT), Kanpur where he soon became head of the chemistry department. Rao's early research was mainly on spectroscopy and molecular structure. Rao's first book on *Ultraviolet and Visible Spectroscopy* got published from London in 1960 and his second book on *Infrared Spectroscopy* from the US in 1963. He slowly started working on solid state and materials chemistry, his earliest paper in this area being in 1958. He faced immense difficulties in starting research in India during those years, because of financial constraints and limited experimental facilities. However, some of his papers from 1960 are still being cited. Rao slowly built facilities for research in solid state and materials chemistry in IIT Kanpur and started research on metal oxides which constitute the largest family of materials with the widest range of properties. There were very few practitioners of solid state chemistry at that time. His one-year stay in Oxford as a Visiting Commonwealth professor during 1973-74 made him realize the need to build a dedicated, well-equipped laboratory for solid state and materials chemistry which would compare favourably with laboratories in the advanced countries. With this purpose, after 14 years in IIT Kanpur, he returned back to the Indian Institute of Science to build new departments devoted to solid state chemistry and also materials science. He succeeded in building good facilities for research by the late 1970s. In his effort to build a major research programme in solid state and materials chemistry, he was inspired by his association with Prof. J.S. Anderson and Prof. Nevill Mott. He was director of the Indian Institute of Science during 1984-94. The Government of India decided to establish Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR) in 1989 to celebrate the birth centenary of India's first Prime Minister with Rao as the founding president. JNCASR has emerged to be one of India's premier research institutions and Rao was President of the Centre till 1999. He continues to work there as Linus Pauling Professor and honorary president. One of the main areas of research at

JNCASR is chemistry and physics of materials. Rao has been publishing extensively on a variety of aspects of chemistry of materials including novel methods of synthesis, discovery of new materials, tailor-making materials with desired properties and so on, for over half a century. He has worked on high-temperature superconductivity, colossal magneto-resistance, multiferroics and open-framework materials. In the last 20 years, he has been investigating various nanomaterials, specially nanotubes, nanowires and graphene. As of today, Rao has published around 1500 research papers and 44 books. He has around 44,000 citations with an H-index of 93+. C.N.R. Rao is on the editorial boards of several journals dealing with chemistry, chemical physics, materials science and solid state chemistry. Rao feels that the most enjoyable aspect of his career has been working with young students. Over 150 persons have received Ph.D. degrees working with him. Besides young coworkers and post-doctoral fellows, Rao has collaborated widely with scientists in Europe and the US. In the last 10 to 15 years, Rao has been making considerable effort to bring out science education materials (books, CDs etc.) for school children. He regularly delivers lectures to children in various parts of India. Prof. Rao is proud that he spent his entire professional life of over 52 years in India. While it was difficult to do research at the frontier during the early years of his career, he feels happy that he has been able to accomplish whatever he could and to witness India transforming slowly from a very poor country to an emerging economy. It has also been a pleasure to grow with the subject of his research which was at its infancy when he started working in the 1950s.

Main publications *Some of the important contributions of C.N.R. Rao to materials research with key references to his work:* 1. New Methods of synthesis of metal oxides and other inorganic materials. *J. Mater. Res.* (1986), *Acc. Chem. Res.* (1987), *Mat. Sci. Engg. B* (1993); 2. First synthesis of the liquid-nitrogen cuprate superconductor and related contributions. *Nature* (1987), *Phil. Trans. Royal Soc. (Lond)* (1991); 3. Colossal magneto-resistance in manganites and related effects. *Phys. Rev. B* (1996), *Adv. Mater.* (1997), *Chem. Mater.* (1998), *J. Phys. Chem.* (2000); 4. Metal-insulator transitions in metal oxides, and marginally metallic systems. *J. Phys. Chem.* (1995), *Chem. Commun.* (1996), *Solid State Phys.* (1999); 5. Large-scale electronic phase separation in metal oxides. *Chem. Mater.* (1999), *Phil. Trans. Royal Soc. (Lond)* (2008); 6. Precursor synthesis of carbon nanotubes, and generation of junction nanotubes and doped nanotubes. *Appl. Phys. Lett.* (1996), *Acc. Chem. Res.*(2002), *ACS Nano* (2007), *Nanoscale* (2010); 7.

Building inorganic frameworks and molecule-material transformations. *Acc. Chem. Res.* (2001, 2004), *Chem. Commun.* (2006); 8. New synthesis of inorganic nanomaterials and the use of the liquid-liquid interface for the purpose. *J. Colloid Interf. Sci.* (2005), *Dalton Trans.* (2007), *Acc. Chem. Res.* (2008); 9. New routes to multiferroics. *J. Mater. Chem.* (2007); 10. Nanotubes of inorganic materials. *Adv. Mater.* (2009); 11. Separation of semiconducting and metallic carbon nanotubes. *Nano Research* (2009), *J. Am. Chem. Soc.* (2010); 12. Novel synthesis and properties of graphene, chemical doping of graphene and molecular charge-transfer with graphene. *Adv. Mater.* (2009), *Angew. Chem. Int. Ed.* (2009), *Materials Today* (2010); 13. Universal ferromagnetism in all inorganic nanoparticles. *Nanotoday* (2009); 14. Chemical storage of hydrogen in graphene, Synergy in mechanical properties of composites containing two-nanocarbons and IR detectors based on graphene. *PNAS* (2009), *PNAS* (2011), *Adv. Mater.* (2011). *Some of the books on materials written or edited by C.N.R. Rao:* 1. *Modern aspects of Solid State Chemistry*, Plenum Press (1970); 2. *Phase Transitions in Solids*, McGraw-Hill (1978); 3. *Preparation and Characterization of Materials*, Academic Press (1981); 4. *New Directions in Solid State Chemistry*, Cambridge University Press (1986, 1997); 5. *Superconductivity Today*, Universities Press (1992); 6. *Chemistry of Advanced Materials*, Blackwell (1992); 7. *Chemical Approaches to the Synthesis of Inorganic Materials*, John Wiley (1994); 8. *Metal-Insulator Transitions Revisited*, Taylor & Francis (1995); 9. *Transition Metal Oxides*, Wiley-VCH (1995); 10. *Colossal Magnetoresistance and related phenomena*, World Scientific (1998); 11. *Nanotubes and Nanowires*, Royal Soc. of Chemistry, (2005, 2011); 12. *Nanochemistry*, Wiley-VCH (2007); 13. *Trends in Chemistry of Materials*, World Scientific (2008); 14. *Graphene and its fascinating properties*, World Scientific (2011).

Peter Hamilton Raven



Date of Birth 13 June 1936

Place Shanghai (PRC)

Nomination 4 October 1990

Field Biology

Title Professor

Raven

Most important awards, prizes and academies *Awards:* Distinguished Service Award, American Inst. of Biological Studies (1981); Int. Environmental Leadership Medal of UNEP (1982); Int. Prize in Biology, Japanese Government (1986); United States National Medal of Science (2000); International Cosmos Prize (2003). *Academies:* US National Academy of Sciences (1977); Fellow, American Academy of Arts and Sciences (1977); Foreign Member, Royal Danish Academy of Sciences and Letters (1980); Foreign Member, Royal Swedish Academy of Sciences (1982); Honorary Member, Royal Society of New Zealand (1984); Foreign Member, Academy of Sciences of the USSR (1988-91); Russian Academy of Sciences (1991); Corresponding Member, Australian Academy of Science (1990); Foreign Fellow, National Academy of Sciences of India (1990); Foreign Fellow, Indian National Science Academy (1990); Pontifical Academy of Sciences (1990); Corresponding Member, Academia de Ciencias Exactas, Físicas y Naturales, Argentina (1991); Corresponding Member, Austrian Academy of Sciences (1992); Honorary Member, Academia Chilena de Ciencias (1993); Corresponding Member, Academia Nacional de Ciencias, Córdoba, Argentina (1993); Foreign Member, Academy of Sciences of the Ukraine (1994); Foreign Member, Chinese Academy of Sciences (1994); Honorary Member, Hungarian Academy of Sciences (1998).

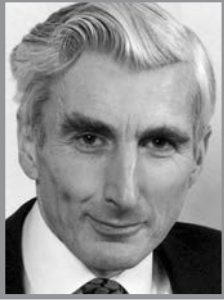
Summary of scientific research Dr. Peter Raven is one of the world's leading authorities on plant systematics and evolution, who has published more than 480 books and papers in the fields of taxonomy, population biology, biogeography, reproductive biology, ethnobotany, and conservation biology. His initial work centered around his broad and outstanding investigations of the systematics and evolution of the plant family *Onagraceae*, the

evening primrose family. This research, augmented by that of his students and collaborators and embracing morphology, anatomy, cytology, palynology, embryology, ecology, reproductive biology, population genetics, and, most recently, molecular biology, has made this family of plants one of the best known of any size, and a valuable model for evolutionary studies. Working from this center in systematics, Raven pursued wide-ranging studies that encompassed and even helped to define many aspects of evolutionary and population biology. His 1965 paper with Paul Ehrlich on butterflies and plants coined the term co-evolution and helped to refocus much subsequent evolutionary research by its emphasis on the importance of mutual co-adaptation. Another paper with Ehrlich in 1969 challenged the prevailing dogma that species cohesion was maintained primarily by gene flow (the 'biological species concept'), arguing instead that gene flow was highly restricted in natural populations. In these and other papers, Raven helped lay the groundwork for the ongoing reevaluation of the nature and concept of biological species. Early studies of pollination in *Onagraceae* led him in 1972 to propose that the mutualistic interactions between plants and their pollinators could be analyzed in energetic terms. This idea anticipated and stimulated an explosive growth in pollination biology, and led to more rigorous and predictive models about pollinator specificity and floral rewards. Another seminal paper from this period proposed a multiple origin of plastids and mitochondria, based on Raven's perceptive reading of the detailed ultrastructural data emerging from the field of cell biology. Raven was among the first botanists to realize the significance for evolutionary biology of the earlier-discredited concept of continental drift. In 1974 he wrote with Daniel Axelrod a now-classic analysis of angiosperm biogeography by examining the relationship and distributions of major plant groups in the context of the new geological paradigm of plate tectonics. His synthetic analyses have helped to illuminate the early radiation of angiosperms, especially in the Southern Hemisphere. On an other front, his collaborative studies in the early 1960s on Mayan folk taxonomy helped to establish this new area of ethnobotany on the interface between biology and anthropology. Since 1971, Raven has developed the Missouri Botanical Garden into the world's pre-eminent center for the study of plant diversity, with exploring and collecting programs throughout North and South America, Africa and Madagascar, and China. At the same time, he has become one of the most influential spokespersons for the importance of understanding and preserving biological diversity. He has championed the concept of national biological resources surveys in the USA, Taiwan, Mexico,

and else where, helping to establish a pattern that will be critical for the preservation of ecosystems and their plants, animals, fungi, and microorganisms throughout the world.

Main publications Raven, P.H., *Papers on Evolution*, Little, Brown & Co., Boston, pp. xii+564 (with Ehrlich, P.R. and Holm, R.W.), 1969; Raven, P.H., *Principles of Tzeltal Plant Classification. An Introduction to the Botanical Ethnography of a Mayan-Speaking People of Highland Chiapas*, Academic Press, New York and London, pp. xxii+660 (with Berlin, B. and Breedlove, D.E.), 1974; Raven, P.H., *Coevolution of Animals and Plants*, University of Texas Press, Austin and London, pp. xiii+246, (L.E. Gilbert and P.H. Raven, eds), 1975, revised edition, 1981; Raven, P.H., *Topics in Plant Population Biology*, Columbia Univ. Press, New York, pp. xvii+589, (O.T. Solbrig, S. Jain, G.B. Johnson and P.H. Raven, eds), 1979; Raven, P.H., *Advances in Legume Systematics*, Royal Botanic Gardens, Kew, pp. 1-1049 (2 vols.), (R.M. Polhill and P.H. Raven, eds), 1981; Raven, P.H., *Biology*, C.V. Mosby Publishers, St. Louis, pp. xxx+1198 (with Johnson, G.B.), 1986; 2nd edn., 1989; 3rd edn., 1992, 4th edn., Wm. C. Brown, 1996, 6th edn., McGraw-Hill, 2002, 7th edn., McGraw-Hill, 2005 (released January 2004); Raven, P.H., *Modern Aspects of Species*, Univ. Tokyo Press, Tokyo, pp. 240, (H. Iwatsuki, P.H. Raven and W.J. Bock, eds), 1986; Raven, P.H., *Understanding Biology*, C.V. Mosby Publishers, St. Louis, pp. xxx+799 (with Johnson, G.), 1988; 2nd edn., 1991; 3rd edn., Wm. C. Brown, 1995.

Martin John Rees



Date of Birth 23 June 1942

Place York (UK)

Nomination 25 June 1990

Field Astronomy

Title Professor

Most important awards, prizes and academies *Awards:* Heine-
mann Prize of Amer. Inst. Phys. (1984); Bappu Medal, Indian Nat. Sci.
Acad. (1986); Gold Medal, Royal Astronomical Society (1988); Schwarzschild Medal, Astronomische Gesellschaft (1989); Guthrie Prize, Institute of
Physics (1989); Balzan International Prize (1989); Robinson Prize for Cosmo-
logy (1990); Bruce Medal, Astron. Soc. Pac. (1993); Science writing award,
Amer. Inst. Phys. (1996); Bower Prize for Science, Franklin Institute (1998);
Rossi Prize, Amer. Astro. Soc. (2000); Gruber Prize for Cosmology (2001);
Albert Einstein Award of World Cultural Congress (2003); Descartes Prize
(2004); Faraday Award, Roy Soc (2004); Crafoord Prize, Royal Swedish
Academy (2005); Life Peerage (2005); Niels Bohr Medal, UNESCO (2005);
Order of Merit (2007); Caird Medal, National Maritime Museum (2007);
Templeton Prize (2011); Isaac Newton Medal (2012). *Academies:* Fellow,
Royal Society (1979); Foreign Associate, Nat. Acad. Sci. (1982); Foreign
Hon. Mem., Amer. Acad. of Arts and Sci. (1975); Foreign Member, Amer.
Phil. Soc. (1993); Associate Fellow, TWAS (2007). Hon. Fellow: Indian Nat.
Sci. Acad. (1990); Royal Swedish Academy of Sciences (1993); Russian
Academy of Sciences (1994); Norwegian Academy of Science (1996);
Accademia dei Lincei (1996); Royal Netherlands Academy of Science
(1997); Finnish Society of Sciences and Letters (2003); Darwin College,
Cambridge (2004), King's College, Cambridge (2007); Royal Academy of
Engineering (2007). Hon. Degrees: Sussex, Leicester, Uppsala, Keele, New-
castle, Copenhagen, Toronto, Cardiff, Durham, Oxford, Ohio, Exeter, Hull.

Summary of scientific research Research has been mainly on topics in
high energy astrophysics, cosmology and galaxies, and space science. Early
work concerned the nature of cosmic radio sources, and interpreting the data

that first became available in the 1960s on cosmology and very remote objects at high redshifts. Other topics have included the nature of the compact objects emitting strong x-rays, quasars, pulsars, gravitational waves, background radiation, the formation of galaxies, and physical processes in the early universe. He has also been interested in the interface between cosmology and philosophy. Outside the primarily academic sphere, he has also been involved in international space research, and in projects for education, etc. in developing countries.

Main publications *Books: Cosmic Coincidences*, Bantam (USA) published by Heinemann (UK) under the title *The Stuff of the Universe* (with J. Gribbin), 1989 (+ German, Japanese, Danish, Polish and Spanish translations); revised by Penguin 1995; *New perspectives in astrophysical cosmology* (CUP, 1995. New expanded edition 2000); *Before the beginning – our universe and others* (published January 1997) (Simon & Schuster, UK; Perseus, USA; Fischer, Germany, and Italian and Spanish translations); *Gravity's fatal attraction: black holes in the universe*, published December 1995 (Freeman, NY) pp. 246 (with M.C. Begelman). (Paperback updated edition March 1998, translated into 7 languages. New edition in preparation); *Just Six Numbers* (in Science Masters series: Basic Books (US) (Feb. 2000, paperback April 2001) and Wiedenfeld and Nicolson (UK)) (Oct. 1999, paperback Oct 2000) translation into approx 20 languages; *Our Cosmic Habitat*, Princeton University Press, US (2001) Weidenfeld & Nicolson (UK) (2002) & various foreign editions; *Our Final Century*, Random House (UK) (published in US as *Our Final Hour* by Basic Books) plus various foreign editions (2003); *La Luciola e il Riflettore (The Searchlight and the Firefly)* Di Renzo Editore (Publication April 2004) (in Italian only); *Universe*, published October 2005 by Dorling Kindersley (general editor); *What we still don't know*, Allen Lane (UK), Pantheon Press (US) (publication 2013); *From Here to Infinity: Scientific Horizons*, Profile Books (2011). *Papers*: Approximately 500 research publications, plus many general articles, reviews, etc. TV series for Channel 4 shown in 2004.

Alexander Rich



Date of Birth 15 November 1924

Place Hartford, CT (USA)

Nomination 17 April 1978

Field Biophysics

Title Professor

Most important awards, prizes and academies *Awards:* Welch Award in Chemistry (2008); Sigma Xi Proctor Prize, Raleigh, NC (2001); Bower Award and Prize, the Franklin Institute, Philadelphia, PA (2000); National Medal of Science, Washington, DC (1995); Linus Pauling Medal, American Chemical Society, Northwest Sections (1995); Lewis S. Rosenstiel Award in Basic Biomedical Research, Brandeis Univ., Waltham, MA (1983); James R. Killian Faculty Achievement Award, Massachusetts Institute of Technology (1980); Presidential Award, New York Academy of Science, New York, NY (1977); Theodore van Karmen Award for Viking Mars Mission, Washington, DC (1976); Skylab Achievement Award, National Aeronautics and Space Administration, Washington, DC (1974). *Academies:* Foreign Member, Russian Academy of Sciences, Moscow, Russia (1994); Honorary Member, Japanese Biochemical Society, Tokyo, Japan (1986); Foreign Member, French Academy of Sciences, Paris, France (1984); Honorary Doctorate, Federal University of Rio de Janeiro, Brazil (1981); American Philosophical Society, Philadelphia, PA (1980); Pontifical Academy of Sciences (1978); National Academy of Sciences, Washington, DC (1970); Fellow, American Association for the Advancement of Science, Washington, DC (1965); Fellow, Guggenheim Foundation (1963); Fellow, American Academy of Arts and Sciences, Boston, MA (1959); Fellow, National Research Council, Washington, DC (1949-51).

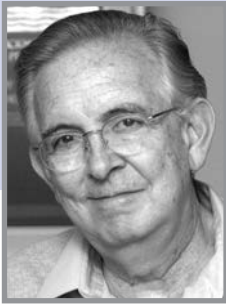
Summary of scientific research The central thrust of my research has been an attempt to understand the relationship between molecular structure and biological function especially of nucleic acids and proteins. While working as a postdoctoral fellow with Linus Pauling at Caltech, I was strongly impressed with the power of x-ray diffraction analysis in defining structure.

re. Some of my earlier work at the time concerned the then unknown structure and function of ribonucleic acid. In the mid 50s, I studied the structure of natural and synthetic polynucleotides using fiber x-ray diffraction. A variety of different helical molecules were discovered containing two, three or four strands. These studies were later complemented by using single crystal x-ray diffraction analysis with purine-pyrimidine intermolecular complexes. These demonstrated the wide variety of hydrogen bonding interactions of nucleic acid bases. Some of my earlier work concerned the structure of polypeptides. We determined the structure of polyglycine-II, a molecule which contains a unique hydrogen bonding system. This served as a clue for our discovering the structure of collagen, the fibrous protein of skin and connective tissue. In the early 1960s great interest was associated with the role of messenger RNA in protein synthesis. By its length, it seemed apparent to me that messenger RNA was long enough to associate simultaneously with several ribosomes while it was being translated. Out of this we discovered polyribosomes and carried out a series of studies dealing with the nature of the polyribosomal protein synthetic system. This led to a detailed analysis of events in the ribosome and the role of transfer RNA. In the late 60s we discovered we could crystallize pure species of transfer RNA. Solution of its three-dimensional structure by x-ray diffraction would produce information to help understand its mode of action in protein synthesis. Crystals were discovered that diffracted to high resolution and by 1973 we had traced the chain of yeast phenylalanine tRNA. In 1974 at 3 Å resolution we could discern the entire structure. It was an unusual structure, bent so that one end interacts with the messenger RNA during protein synthesis while the other end 75 Å away has the amino acid attached. We continue to address the problem of how this molecule works. In 1979 we solved the structure of a fragment of RNA that was found to be in a novel left-handed form. This conformation of the double helix, called Z-DNA, is a high energy form of the more familiar right-handed helix. For several years we have studied both its chemistry and biology. We now know which forces inside the cell act to stabilize Z-DNA and we understand a great deal about its conformation. A class of proteins were discovered that bind specifically to Z-DNA, many in regulatory regions. Co-crystallization of these proteins with Z-DNA has led to an understanding of how Z-DNA is recognized. In turn, this has led to other biological activities.

Main publications Rich, A. (with Crick, F.H.C.), The Structure of Collagen, *Nature*, 176, pp. 915-6 (1955); Rich, A. (with Davies, D.R.), A New Two-Stranded Helical Structure: Polyadenylic Acid and Polyuridylic Acid, *J. Amer.*

Chem. Soc., 78, p. 3548 (1956); Rich, A. (with Felsenfeld, G. and Davies, D.R.), Formation of a Three-Stranded Polynucleotide Molecule, *J. Amer. Chem. Soc.*, 79, pp. 2023-4 (1957); Rich, A., A Hybrid Helix Containing Both Deoxyribose and Ribose Polynucleotides and its relation to the Transfer of Information Between the Nucleic Acids, *Proc. Nat. Acad. Sci. USA*, 46, pp. 1044-53 (1960); Rich, A. (with Davies, D.R., Crick, F.H.C. and Watson, J.D.), The Molecular Structure of Polyadenylic Acid, *J. Molec. Bio.*, pp. 71-86 (1961); Rich, A. (with Warner, J.R. and Knopf, P.M.), A Multiple Ribosomal Structure in Protein Synthesis, *Proc. Nat. Acad. Sci. USA*, 49, pp. 122-9 (1963); Rich, A. (with Warner, J.R. and Goodman, H.M.), The Structure and Function of Polyribosomes, *Cold Spring Harbor Symposium*, 28, pp. 269-85 (1963); Rich, A. (with Kim, S.H., Quigley, G.J., Suddath, F.L., McPherson, A., Sneden, D., Kim, J.J. and Weinzierl, J.), Three-Dimensional Structure of Yeast Phenylalanine Transfer RNA: Folding of the Polynucleotide Chain, *Science*, 179, pp. 285-8 (1973); Rich, A. (with Kim, S.H., Suddath, F.L., Quigley, G.J., McPherson, A., Kim, J.J., Sussman, J.L., Wang, A.H.-J. and Seeman, N.C.), Three-Dimensional Tertiary Structure of Yeast Phenylalanine Transfer RNA, *Science*, 185, pp. 435-9 (1974); Rich, A. (with Wang, A.H.-J., Quigley, G.J., Kolpak, F.J., Crawford, J.L., van Boom, J.H. and van der Marel, G.), Molecular Structure of a Left-Handed Double Helical DNA Fragment at Atomic Resolution, *Nature*, 282, pp. 680-6 (1979); Rich, A. (with Wittig, B., Wölfl, S., Dorbic, T. and Vahrson, W.), Transcription of Human c-myc in Permeabilized Nuclei is Associated with Formation of Z-DNA in Three Discrete Regions of the Gene, *Embo J.*, 11, pp. 4653-63 (1992); Rich, A. (with Su, L., Chan, L., Egli, M. and Berger, J.M.), A Minor Groove RNA Triplex in the Crystal Structure of a Viral Pseudoknot Involved in Ribosomal Frameshifting, *Nature Structural Biology*, 6, pp. 285-92 (1999); Rich, A. (with Schwartz, T., Rould, M.A., Lowenhaupt, K. and Herbert, A.), Crystal Structure of the α Domain of the Human Editing Enzyme ADAR1 Bound to Left-Handed Z-DNA, *Science*, 284, pp. 1841-5 (1999); Brown, B.A., II, Lowenhaupt, K., Wilbert, C.M., Hanlon, E.B., and Rich, A., The α domain of the editing enzyme dsRNA adenosine deaminase binds left-handed Z-RNA as well as Z-DNA, *Proc. Nat'l. Acad. Sci. USA*, 97: 13531-86 (2000); Kim, Y.-G., Lowenhaupt, K., Maas, S., Herbert, A., Schwartz, T. and Rich, A., The Zab domain of the human RNA editing enzyme ADAR1 recognizes Z-DNA when surrounded by B-DNA, *J. Biol. Chem.* 275: 26828-33 (2000).

Ignacio Rodríguez-Iturbe



Date of Birth 8 March 1942

Place Caracas (Venezuela)

Nomination 25 October 2007

Field Hydrological Sciences

Title Professor

Rodríguez-Iturbe

Most important awards, prizes and academies Awards: 'Máxima Calificación' Graduation Prize of the Engineering Class of 1963, Universidad del Zulia, Venezuela, 1963; Research Prize, Venezuelan Society of Hydraulic Engineers, Caracas, 1968; Plaque for Outstanding Teaching, Civil Engineering School, Universidad del Zulia, 1969; 'Conspicuously Effective Teaching Award', Civil Engineering Department, M.I.T., 1974; Huber Research Prize, American Society for Civil Engineers, 1975; Hydrologic Sciences Award, American Geophysical Union, 1975; James B. Macelwane Award, American Geophysical Union, 1977; 'Orden 27 de June' Medal for Merits in Education, Government of Venezuela, 1977; 'Francisco J. Torrealba' prize awarded by the Universidad Simón Bolívar for outstanding research accomplishments, Caracas, Venezuela, 1985; National Prize for best research paper in all branches of Engineering, National Council for Sciences and Technological Research, Caracas, 1987; Order 'Andrés Bello' 1st Class, Venezuela, 1988; National Science Prize, National Council for Sciences and Technological Research, Venezuela 1991; Academic Medal of the University of Florence, Italy, 1991; Academic Medal of the University of Padua, Italy, 1992; Premio México de Ciencia y Tecnología 1994, República de México, 1994; Robert E. Horton Medal, American Geophysical Union, 1998; National Engineering Research Prize. Venezuela, 1998; Order Francisco Miranda (1st Class) for academic merits, Government of Venezuela, 1998; Ven Te Chow Award for lifetime achievements in the field of hydrology, awarded by the Environmental Water Resources Institute/American Society of Civil Engineers, 2001; Hydrology Days Award 2002, Colorado State University, 2002; Stockholm Water Prize, 2002; Blusa del Agua, awarded by the Tribunal de las Aguas, Valencia, Spain, 2007. Academies: American Geophysi-

cal Union, 1977; Vice President, International Commission on Water Resources Systems, International Association of Hydrological Sciences, 1980-1983; First Vice President, International Association of Hydrological Sciences (IAHS), 1983-1986; Latin American Academy of Sciences, 1983; United States National Academy of Engineering, 1988; Third World Academy of Sciences, 1988; American Meteorological Society, 1992; Real Academia de Ciencias Exactas, Físicas y Naturales, Spain, 2003; Academia de Ingeniería de México, 2004; Istituto Veneto di Scienze, Lettere ed Arti, 2004; National Academy of Engineering of Venezuela, 2006

Summary of scientific research The dynamics of the interaction between climate, soil, and vegetation are the main focus of Rodríguez-Iturbe's research group. These dynamics are crucially influenced by the scale at which the phenomena are studied as well as by the type of climate, the physiological characteristics of the vegetation, and the pedology of the soil. Moreover, not only the temporal aspects but also the spatial aspects of the dynamics are crucially dependent on the above factors. Soil moisture plays a key role in the above dynamics, and his group is involved in its space-time characterization. This involves a range of approaches that include challenging problems in the physics of the interaction as well as on its mathematical description. It is necessary to account for the random character of precipitation, both in occurrence and intensity, as well as for the nonlinear dependence of infiltration, evapotranspiration, and leakage on the soil moisture state. His group's approach has been to understand and model first the balance of soil moisture at a point under the above conditions. The solution of the stochastic differential equations corresponding to the point dynamics have provided the probabilistic description of the soil-plant-climate interaction at a site. The spatial interaction between different sites with the same or with different types of vegetation is being implemented via cellular automatons operating under rules governed by the characteristics of the stress existing in the vegetation. At larger spatial scales, precipitation itself is influenced by the soil moisture present in the region and this phenomenon needs to be incorporated into the modeling scheme. At intermediate scales involving river basins, the geomorphologic characteristics of the drainage network is a commanding factor in the spatial organization of soil moisture. Rodríguez-Iturbe's group is trying to link the recent advances on the scaling characteristics of the network with the dynamics of the soil moisture. With the above framework the group hopes to elucidate some of the most fundamental issues of the climate-soil-atmosphere interaction that lie at the heart of hydrology.

Main publications *Books: Ecohydrology of Water Controlled Ecosystems: Soil Moisture and Plant Dynamics*, by I. Rodríguez-Iturbe and A. Porporato, Cambridge University Press, 450 pp., Dec. 2004; *Fractal River Basins: Chance and Self-Organization*, by I. Rodríguez-Iturbe and A. Rinaldo, Cambridge University Press, 580 pp., May 1997; *Rainfall Fields: Estimation Analysis and Prediction*, edited by H.R. Cho, M. Fritsch, V.K. Gupta, I. Rodríguez-Iturbe, and M. Taqqu, published as a special volume by the American Geophysical Union from the *Journal of Geophysical Research*, Vol. 92, D8, Aug. 1987; *Scale Problems in Hydrology: Runoff Generation and Basin Response*, edited by V.K. Gupta, I. Rodríguez-Iturbe, and E.F. Wood, FD. Reidel Publishing Company, 244 pp., May 1986; *Random Functions and Hydrology*, by R.L. Bras and I. Rodríguez-Iturbe, Addison-Wesley Publishing Company, Reading, MA, 590 pp., January 1985; Unabridged Dover republication of this edition, 1993; *Scale Problems in Hydrology*, edited by I. Rodríguez-Iturbe and V.K. Gupta, published as a double issue of the *Journal of Hydrology*, Elsevier Publishing Company, 257 pp., Aug. 1983. *Video: Willgoose, G., R.L. Bras, and I. Rodríguez-Iturbe, A Model of Catchment Evolution: A Computer Animation*, 1990. *Most recent papers in journals: Botter, G., Porporato, A., Rodríguez-Iturbe, I., and A. Rinaldo, Basin-scale and moisture dynamics and the probabilistic characterization of carrier hydrologic flows: Slow, leaching-prone components of the hydrologic response, Water Resources Research*, Vol. 43, W02417, 2007; Bertuzzo, E., Azaele, S., Maritan, A., Gatto, M., Rodríguez-Iturbe, I., and A. Rinaldo, On the space-time evolution of a cholera epidemic, *Water Resources Research*, 2007; Muneeppeerakul, R., Rinaldo, A., and I. Rodríguez-Iturbe, Effects of river flow scaling properties on riparian width and vegetation biomass, *Water Resources Research*, 2007; Muneeppeerakul, R., Rinaldo, A., Levin, S.A., and I. Rodríguez-Iturbe, Signatures of vegetation functional diversity in river basins, *Water Resources Research*, 2007; Convertino, M., R. Rigon, A. Maritan, I. Rodríguez-Iturbe, A. Rinaldo, Probabilistic structure of tributaries in river networks, *Water Resources Research*, Vol. 43, W11418, 2007; Botter, G., F. Peratoner, A. Porporato, I. Rodríguez-Iturbe, A. Rinaldo, Signatures of large-scale soil moisture dynamics on streamflow statistics across U.S. climate regions, *Water Resources Research*, Vol. 43, W11413, 2007; Scanlon, T.M., K.K. Caylor, S.A. Levin, I. Rodríguez-Iturbe, Positive feedbacks promote power-law clustering of Kalahari vegetation, *Nature*, Vol. 449, Sept. 2007; Rodríguez-Iturbe, I., *et al.*, Challenges in humid land ecohydrology: interactions of water table and unsaturated zone with climate, soil, and vegetation, *Water Resources*

Research, Vol. 43, 2007; Manfreda, S., M.F. McCabe, M. Fiorentino, I. Rodríguez-Iturbe, E. Wood, Scaling characteristics of spatial patterns of soil moisture from distributed modelling, *Advances in Water Resources*, Vol. 30, 2145-50, 2007; Grimaldi, S., I. Rodríguez-Iturbe, L. Ubertini, (2007), Recent developments in hydrologic analysis, *Advances in Water Resources*, Vol. 30, 2007; Mueepeerakul, R., J.S. Weitz, S.A. Levin, A. Rinaldo, and I. Rodríguez Iturbe, A neutral metapopulation model of biodiversity in river networks, *Journal of Theoretical Biology*, 245, 351-63, 2007; Nordbotten J.M., I. Rodríguez-Iturbe, M.A. Celia, Stochastic coupling of rainfall and biomass dynamics, *Water Resources Research*, 43, W01408, 2007; Bertuzzo, E., A. Maritan, M. Gatto, I. Rodríguez-Iturbe, A. Rinaldo, River networks and ecological corridors: Reactive transport on fractals, migration fronts, hydrochory, *Water Resources Research*, 43, W04419, 2007; Botter G., A. Porporato, E. Daly, I. Rodríguez-Iturbe, A. Rinaldo, Probabilistic characterization of base flows in river basins: Roles of soil, vegetation, and geomorphology, *Water Resource Research*, 43, W06404, 2007; Muneeppeerakul R., S.A. Levin, A. Rinaldo, I. Rodríguez-Iturbe, On biodiversity in river networks: A trade-off metapopulation model and comparative analysis, *Water Resources Research*, 43, W07426, 2007; Puma, M.J. Rodríguez-Iturbe, I., et al., Implications of rainfall temporal resolution for soil moisture and transpiration modeling, *Transport in Porous Media*, 2006; Rodríguez-Iturbe, I., et al., Space-time modeling of soil moisture: stochastic rainfall forcing with heterogeneous vegetation, *Water Resources Research*, Vol. 42 W06D05, 11 p., 2006; Paola, C. Foufoula-Georgou, E. Dietrich, W.E., Hondzo, M. Mohrig, D., Parker, G., Power, M.E., Rodríguez-Iturbe I., et al., Towards a unified science of the earth's surface: opportunities for synthesis among hydrology, geomorphology, geochemistry and ecology, *Water Resources Research*, Vol. 42, W03S10, 6 p., 2006; Caylor, K.K., D'Odorico, P., and I. Rodríguez-Iturbe, On the ecohydrology of structurally heterogeneous semi-arid landscapes, *Water Resources Research*, Vol. 42, W07424, 13 p., 2006; Grimaldi, S., I. Rodríguez-Iturbe, L. Ubertini (2005), New frontiers of hydrology, *Advances in Water Resources*, Volume 28, issue 6, June 2005, pp 541-2; Caylor, K. Manfreda, S. and I. Rodríguez-Iturbe, On the coupled geomorphological and ecohydrological organization of river basins, *Advances in Water Resources*, 28, pp. 69-86, 2005; Manzoni S., Porporato A., D'Odorico P., Laio F., Rodríguez-Iturbe I., Soil nutrient cycles as a nonlinear dynamical system, *Nonlinear Processes in Geophysics*, 11 (5-6), 2005; Daly, E., Porporato, A. and I. Rodríguez-Iturbe, Coupled dynamics of photosynthesis, transpiration and soil water

balance: I. Upscaling from hourly to daily level, *Journal of Hydrometeorology*, Vol. 5. No. 3, 546-58, 2004; Daly, E., Porporato, A., and I. Rodríguez-Iturbe, Coupled dynamics of photosynthesis, transpiration and soil water balance: II. Stochastic analysis and ecohydrological significance, *Journal of Hydrometeorology*, Vol. 5 No. 3 559-66, 2004; Caylor, K.K., Scanlon, T.M., and I. Rodríguez-Iturbe, Feasible optimality of vegetation patterns in river basins, *Geophysical Research Letters*, Vol. 31, L13502, 1-4, 2004.

Carlo Rubbia



Date of Birth 31 March 1934

Place Gorizia (Italy)

Nomination 14 December 1985

Field Physics

Title Professor, Nobel laureate in Physics, 1984

Most important awards, prizes and academies *Awards:* He has been awarded numerous prizes, including the Nobel Prize in Physics (1984). *Academies:* He is a member of 27 Academies, among which: Accademia Nazionale dei Lincei; Accademia dei XL; American Academy of Arts and Sciences; Pontifical Academy of Sciences; Foreign Member, Polish Academy of Sciences; Foreign Member, Croatian Academy of Sciences and Arts; Foreign Member, Royal Society; Foreign Member, USA National Academy of Sciences; Foreign Member, USSR Academy of Sciences; Third World Academy of Sciences; European Academy of Sciences; Société Européenne de Culture; Ateneo Veneto; Société Française de Physique; Istituto Lombardo; Austrian Academy of Sciences. *Honours:* Cavaliere di Gran Croce (Knight of the Grand Cross) from the President of the Italian Republic, Sandro Pertini (1985); Officier de la Légion d'Honneur, from the President of the French Republic, François Mitterrand (1989); Polish Order of Merit at the conclusion of his mandate as Director General of CERN (1993). *Honorary degrees:* University of Geneva, Switzerland (1983); Carnegie Mellon University, USA (1985); University of Genoa, Italy (1985); University of Udine, Italy (1985); University of La Plata, Argentina (1986); Northwestern University, USA (1986); University of Camerino, Italy (1987); University of Chicago, USA (1987); Loyola University, USA (1987); Boston University, USA (1988); University of Sofia, Bulgaria (1990); University of Moscow, USSR (1991); University of Chile, Santiago (1991); Polytechnic University of Madrid, Spain (1992); University of Padua, Italy (1992); Technical University of Rio de Janeiro, Brazil (1993); University of Trieste, Italy (1994); University of Oxford, UK (1994); Catholic University of Lima, Peru (1994); National University of St. Antonio Abad of Cusco, Peru (1994); University of Bordeaux,

France (1998); University of Haute Savoie, France (1999); St John's University, USA-Italy (2003); University of Turin, Italy (2004). *Lectures*: Enrico Fermi Lecturer at the Scuola Normale, Pisa, Italy; Philip-Burton-Moon Lecturer, Birmingham, UK (1984); Bakerian Lecturer, London, UK (1985); Weizmann Lecturer, Rehovot, Israel (1986); Primakoff Lecturer, Pennsylvania, USA (1986); Dirac Lecturer, Sydney, Australia (1989); Heisenberg Lecturer (1992); Max Von Laue Colloquium (1993); Werner Von Siemens Chair (1994); Hitchcock Professorship, Berkeley, USA (1994); Einstein Lecturer, Jerusalem (1998); Rheinisch Westfälische Technische Hochschule (RWTH), Aachen (2004); Pontificia Universidad Católica de Chile, Santiago (2008).

Summary of scientific research Soon after his degree on Cosmic Ray Experiments at the Scuola Normale in Pisa, Rubbia spent one and a half years at Columbia University (USA) performing experiments on the decay and the nuclear capture of μ mesons at the Nevis Cyclotron. This was the first of a long series of experiments which Rubbia performed in the field of Weak Interactions and which culminated in the observation of the charged and neutral intermediate vector bosons, believed to be the mediators of such a force. From 1970 to December 1988 Rubbia spent one semester each year at Harvard University (Cambridge, Massachusetts), where he was Higgins Professor of Physics. He performed experiments with different accelerators in the United States (Fermilab, near Batavia, Illinois, and Brookhaven National Laboratory on Long Island, NY) and with the three major accelerators of CERN, the European Laboratory of Particle Physics, near Geneva, Switzerland (the Synchro-Cyclotron, the Proton Synchrotron and the Super Proton Synchrotron). Early in 1983 at CERN, an international team of more than 100 physicists headed by Rubbia, known as the UA1 Collaboration, detected the intermediate vector bosons, a triplet of particles, the W^+ , the W^- and the Z^0 , which had become a cornerstone of modern theories of elementary particle physics, long before they were observed by Rubbia and collaborators. They are believed to carry the weak force that causes radioactive decay in the atomic nucleus and controls the combustion of the Sun, just as photons, massless particles of light, carry the electromagnetic force which causes most physical and biochemical reactions. To achieve energies high enough to create the intermediate vector bosons (particles roughly one hundred times as heavy as the proton), Rubbia proposed, with David Cline and Peter McIntyre, the use of a beam of protons and a beam of antiprotons, their antimatter twins, counter-rotating and colliding head-on. These revolutionary techniques were developed with Simon van der Meer, with whom Rubbia shared the

1984 Nobel Prize in Physics. Rubbia was one of the leaders in a collaboration effort based deep in the Gran Sasso Laboratory designed to detect any sign of decay of the proton. The experiment seeks evidence that would disprove the conventional belief whereby matter is stable. The experiment, known as ICARUS and based on a new technique of electronic detection of ionizing events in ultra-pure liquid Argon, is now operational at the University of Pavia, awaiting its transfer to the Gran Sasso Laboratory. More recently he proposed the concept of an Energy Amplifier – a novel and safe way of producing nuclear energy exploiting present-day accelerator technologies, which is actively being studied worldwide in order (1) to incinerate high activity waste from accelerators and (2) to produce energy from natural thorium and depleted uranium. The energy resources which potentially could derive from these fuels will be practically unlimited and comparable to those from Fusion. His activities are presently concentrated on the problem of energy supply for the future.

Main publications Carlo Rubbia is the co-author of 546 scientific publications, 245 of which have been published in major scientific journals. For a complete list please email a request to carlo.rubbia@cern.ch.

Vera C. Rubin



Date of Birth 23 July 1928

Place Philadelphia, PA (USA)

Nomination 25 June 1996

Field Astronomy

Title Professor

Rubin

Most important awards, prizes and academies *Awards:* US National Medal of Science (1993); Antoinette de Vaucouleurs Medal (1993); Dickson Prize (1994); Russell Prize, American Astronomical Society (1994); Weizmann Women and Science Award (1996); Gold Medal, Royal Astronomical Society (1996); City of Philadelphia John Scott Award (2001); Peter Gruber International Cosmology Prize (2002); Bruce Medal, Astronomical Society of the Pacific (2003); Watson Medal, US National Academy of Sciences (2004). *Academies:* US National Academy of Sciences (1981); American Academy of Arts and Sciences (1982); American Philosophical Society (1995). *Honorary Degrees:* Creighton Univ. (1978); Harvard Univ. (1988); Yale Univ. (1990); Williams College (1993); Univ. Michigan (1996); Georgetown Univ. (1997); Ohio State Univ. (1998); Smith College (2001); Grinnell College (2001); Ohio Wesleyan University (2004); Princeton University (2005).

Summary of scientific research Vera C. Rubin has devoted her professional career to the study of motions of stars and gas in galaxies, and galaxies in the universe. Her earliest studies (1951) examined the motions of galaxies to see if they exhibited large scale systematic motions, in addition to the general expansion of the universe. She returned to this subject 25 years later with her long-time collaborator, Dr. W. Kent Ford, Jr., this time obtaining new data on the velocities and the brightnesses of the galaxies. These results indicated a large motion for our Galaxy, and initiated a series of long-term studies still underway today, in an effort by many astronomers to sort out these complex motions. In 1987, she chaired a Vatican Study-Week on Large Scale Motions in the Universe. The major thrust of Dr. Rubin's observations for the past 30 years has been the study of the orbital velocities of stars and gas in galaxies. This work led to the discovery that orbital velocities far from the

centers of galaxies are high, too high to be accounted for by the luminous matter observed in galaxies. Hence these studies played an important role in the realization that most of the matter in the universe is dark. Ultimately, Dr. Rubin and her colleagues produced a systematic study of rotational properties for normal galaxies of different classes. Dr. Rubin has extended her observational studies to rotation motions within galaxies located in dense clusters of galaxies, and to galaxies with peculiar morphologies, in an effort to understand the history and evolution of such objects. In this study, she has discovered curious galaxies, such as NGC 4550, a disk galaxy in which half the stars orbit clockwise, and half the stars orbit counterclockwise. She and her colleagues understand this as a galaxy which acquired a substantial amount of gas, after the initial stellar disk was in place. The new gas later precessed to the principal plane and formed stars, whose reverse orbital sense reflected the angular momentum of the acquired gas. Currently, Dr. Rubin and her collaborators are analyzing the motion of stars in low surface brightness galaxies, and in dwarf irregular galaxies. Little is known about stellar motions in these small, undistinguished stellar agglomerations, which are the most numerous galaxies in the universe. The new, large telescopes make these studies possible.

Main publications Rubin, V.C., Rotation of the Metagalaxy, *Astron. J.*, 56, p. 47 (1951); Rubin, V.C. and Burley, J., Kinematics of Early-Type Stars. II. The Velocity Field within 2 kiloparsecs of the Sun, *Astron. J.*, 69, p. 92 (1964); Burbidge, E.M., Burbidge, G.R. and Rubin, V.C., A Study of the Velocity Field in M82 and Its Bearing on Explosive Phenomena in that Galaxy, *Astrophys. J.*, 140, p. 942 (1964); Rubin, V.C., Radial Velocities of Distant O B Stars in the Anticenter Region of the Galaxy, *Astrophys. J.*, 142, (Oct. 1965); Rubin, V.C. and Ford, W.K. Jr., Rotation of the Andromeda Nebula from a Spectroscopic Survey of Emission Regions, *Astrophys. J.*, 159, p. 379 (1970); Rubin, V.C., Ford, W.K. Jr. and D'Odorico, S., Emission-line Intensities and Radial Velocities in the Interacting Galaxies NGC 4038-4039, *Astrophys. J.*, 160, p. 801 (1970); Rubin, V.C., Ford, W.K. Jr., Thonnard, N. and Roberts, M.S., Motion of the Galaxy and the Local Group of Galaxies Determined from the Velocity Anisotropy of Distant Scl Galaxies. II. The analysis for the Motion, *Astron. J.*, 81, p. 719 (1976); Rubin, V.C., Ford, W.K. Jr. and Oort, J.H., New Observations of the NGC 1275 Phenomenon, *Astrophys. J.*, 211, p. 697 (1977); Rubin, V.C., Burstein, D., Ford, W.K. Jr. and Thonnard, N., Rotation Velocities of 16 Sa Galaxies and a Comparison of Sa, Sb and Sc Rotation Properties, *Astrophys. J.*, 289, p. 81 (1985);

Rubin, V.C. and Coyne, G.V., S.J., *Large-Scale Motions in the Universe: A Vatican Study Week*, eds Princeton University Press, 1988; Rubin, V.C., Graham, J.A. and Kenney, J.P.D., Cospacial Counterrotating Stellar Disks in the Virgo E7/S0 Galaxy NGC 4550, *Astrophys. J. (Lett.)*, 394, L9-L12 (1992); Rubin, V.C., Galaxy Dynamics and the Mass Density of the Universe, *Physical Cosmology* (D. Schramm, ed.), *Proc. Nat. Ac. Sci.*, 90, p. 4814 (1993); Rubin, V.C., A Century of Galaxy Spectroscopy, *Astrophys. J.*, 451, p. 419 (1995); Rubin, V.C., *Bright Galaxies Dark Matters* (Masters of Modern Physics), AIP Press, 1996; Rubin, V.C., Kenney, J.D.P., and Young, J.S., Rapidly Rotating Circumnuclear Gas Disks in Virgo Disk Galaxies, *Astron. J.*, 113, p. 1250 (1997); Rubin, V.C., Waterman, A.H., and Kenney, J.P.D., Kinematic Disturbances in Optical Rotation Curves among 89 Virgo Disk Galaxies, *Astron. J.*, 118, (1999); Rubin, V.C., A Brief History of Dark Matter, *The Dark Universe: Matter, Energy, and Gravity* (M. Livio, ed.), Cambridge University Press, 1 (2003); Swaters, R.A. and Rubin, V.C., Stellar Motions in the Polar Ring Galaxy NGC4650A, *Astrophysical J. (Lett)*, 587, L23-L26 (2003).

Roald Zinnurovich Sagdeev



Date of Birth 26 December 1932

Place Moscow (Russia)

Nomination 4 October 1990

Field Physics

Title Professor

Most important awards, prizes and academies *Awards:* Lenin Prize (1984); Hero of Socialist Labour (1986); Tate Medal, American Institute of Physics (1992); Science for Peace, Italy (1994); Leo Scillard Award, American Physical Society (1994); Von Karman Lectureship Award, American Institute of Aeronautics and Astronautics (2001); Hannes Alufen Memorial Lectureship, Sweden (2001); Maxwell Prize, American Physical Society (2001); Order of the October Revolution; Order of the Red Banner; Carl Sagan Memorial Award (2003). *Academies:* Russian Academy of Sciences; Council of Dirs. Int. Fund for Survival and Devt. of Mankind; National Academy of Sciences, USA; American Academy of Arts and Sciences, USA; Royal Swedish Academy; Royal Astronomical Society, UK; Max Planck Society; International Academy of Astronomics; Hungarian Academy of Sciences; Czech Academy of Sciences; Third World Academy; Pontifical Academy of Sciences. *Honorary Degrees:* UCLA; New York University; University of Michigan; Toulouse University, France; Technical University of Graz, Austria; USSR People's Deputy (1989-91).

Summary of scientific research He began his studies in atomic energy, becoming Head of the Lab. Inst. of Nuclear Physics, Siberian Dept., Academy of Sciences (1961-70). After continuing his interests in nuclear physics he turned increasingly to high temperature physics and space research, being Director of the USSR Space Research Institute (1973-88). At a more detailed level he is a specialist in global warming, plasma physics, controllable thermonuclear synthesis, and cosmic ray physics.

Main publications A large number of books and articles in Russia and abroad on his principal areas of scientific research.

Marcelo Sánchez Sorondo



Date of Birth 8 September 1942

Place Buenos Aires (Argentina)

Nomination 5 October 1998

Field History of Philosophy

Title Professor

Sánchez Sorondo

Most important awards, prizes and academies *Academic appointments:* Lecturer in the History of Philosophy (1976-1982) and Full Professor (1982-1998), Pontifical Lateran University; Dean of the Faculty of Philosophy, Pontifical Lateran University (1987-1996); Professor of the History of Philosophy, Libera Università Maria SS. Assunta (1998-2012); Ordained Bishop by His Holiness John Paul II on 19 March 2001. *Awards:* Cavaliere di Gran Croce, Italy (1999); Officier de la Légion d'honneur, France (2000); Grão Mestre da Ordem de Rio Branco, Brazil (2004); Official of the Republic of Austria (2004); Knight of the Republic of Chile (2006); Francesco Vito Award, Univ. Cattolica del Sacro Cuore, Milan (2001); Neruda Prize, Chile (2004); "Bernardo O'Higgins" Grand Officer, Chile (2005); Award of the International Association of Catholic Doctors (2010). *Academies:* Member of the Pontifical Academy of St. Thomas Aquinas (1989) and Secretary Prelate (1999-); Chancellor, Pontifical Academy of Sciences (1998-); Chancellor, Pontifical Academy of Social Sciences (1998-); Member of the Accademia dei Gergofili (2008); Member of the Accademia Italiana del Vino (2010); Corresponding Member of the Academia de Ciencias de Cuba (2011); Member of the Académie catholique de France, Paris (2012).

Summary of scientific research My early work centred around an innovative examination of the primary function of the idea of participation in the core theological approach of St. Thomas Aquinas, especially with regard to the crucial point of the question of the "participation (of man) in the divine nature" (2 Pt 1:4). The main and new conclusion was that man, because he is free, i.e. *causa sui*, is his own cause in the order of the re-creation not only of his own growth but also of the communication (*κοινωνία*) of divine grace to another human being, to a "you" who freely wants that grace. As a

subsequent follower of the contemporary philosophical current which seeks the "rehabilitation" of Aristotle, I emphasized that the "Stagirite" was the first to expound a positive notion of spiritual reality beginning with the human experience of superior activities such as feeling, thinking, wanting and enjoying. Aristotle did this through his meta-categories of power (*δυναμεις*) and energy (*ενεργεια*) which, although they serve initially to explain movement, subsequently allow a metaphysical explanation of the living human subject, of the suffering and acting "self" – a question discussed in detail by modern philosophy. Drawing upon the most recent developments in critical research into the structure of the thought of Aristotle (N. Hartman, P. Ricoeur and my teacher C. Fabro), I examined the different interpretations of this philosopher, especially those propounded during the medieval period by Thomas Aquinas and during the modern era by Hegel. In his *Encyclopaedia* (482) Hegel rightly observes that no concept has been more subject to misunderstanding than that of freedom, which expresses the essence of the spirit. This was the new anthropological idea that the classical world, including Aristotle, was light years away from. For this reason, I have recently argued, "realised freedom" or freedom achieved by the truth (John Paul II) became the new criterion for the hermeneutics of history, culture and religions. I also proposed that realised freedom, as a real quality of the human being and not mere potentiality, should be the criterion to be employed in the analysis of Christian history.

Main publications *La Gracia como Participación de la Naturaleza Divina según Santo Tomás de Aquino* (Buenos Aires-Letrán-Salamanca, 1979), 360 pp.; *Aristotele e San Tommaso* (Città Nuova, Roma, 1981), 120 pp.; *Aristóteles y Hegel* (Herder, Buenos Aires-Rome, 1987), 368 pp.; *La Positività dello Spirito in Aristotele, Aquinas*, 21, fas. 1 (Rome, 1978), pp. 126 ss.; *La Querella Antropológica del Siglo XIII (Sigerio y Santo Tomás)*, *Sapientia*, 35, 137-8 (Buenos Aires, 1980), pp. 325-58; *Aristóteles y Hegel* (N. Hartmann), introduction, translation and notes by M.S.S., *Pensamiento*, 154, vol. 39 (Madrid, 1983), pp. 177-222; *Partecipazione e Refusione della Grazia, Essere e Libertà* (studi in onore di C. Fabro, Perugia, 1984), pp. 225-51; *L'Unità dei Comandamenti, Coscienza*, 1 (Rome, 1985), pp. 20 ss.; *La Libertà nella Storia, Ebraismo, Ellenismo, Cristianesimo, Archivio di Filosofia*, 53, 2-3 (Rome, 1985), pp. 89-124; *L'Evoluzione (Entwicklung) Storica della Libertà come Stimolo per la Filosofia Cristiana, Aquinas*, 30, 1 (Rome, 1988), pp. 30-60; *Der Weg der Freiheit nach Hegel, Der Freiheitsgedanke in den Kulturen des Italienischen und Deutschen Sprachraumes* (Akademie Deutsch-Italie-

nischer Studien, *Akten der XXI internationalen Tagung*, Meran 10-15. April 1989), pp. 457-81; *L'Energiea Noetica Aristotelica come Nucleo Speculativo del Geist Hegeliano*, M.S.S. (ed.), *L'Atto Aristotelico e le sue Ermeneutiche* (Rome, 1990), pp. 179-201; *L'Atto Aristotelico e le sue Ermeneutiche*, Introduction and ed. by M.S.S. (Herder, Università Lateranense, Rome, 1990), pp. I-XII-388; *I Valori Culturali dell'America Latina per la Nuova Evangelizzazione*, *Euntes Docete*, 45, 2 (Rome, 1992), pp. 191-204; Francisco de Vitoria: *Artefice della Nuova Coscienza sull'Uomo*, *Vangelo Religioni Cultura* (Turin, 1993), pp. 263-77; *Stato, Libertà e Verità*, *La Forma Morale dell'Essere* (Rosminiane, Stresa, 1995), pp. 91-133; Francis of Vitoria, *Hispanic Philosophy in the Age of Discovery* (The Catholic University of America, Washington, 1995), pp. 250-75; *La Libertà in C. Fabro*, *Studi Cattolici*, September 1995, 415, pp. 529-33; *La Vita*, Introduction and ed. by M.S.S. (Mursia, Università Lateranense, Rome, 1998), pp. I-XXVIII-316; *In che Cosa Credono quelli che non Credono?*, *Aquinas*, XLI, fas. 3 (Rome, 1998), pp. 465-81; *Aristotele*, *Lexicon, Dizionario dei Teologi* (P.M., Casale Monferrato, 1998), pp. 101-4; *Znaczenie filozofii wiedzy i umiejtno i jako filozofii człowieka*, *Człowiek i jego wiat na przełomie XX/XXI wieku* (Czestochowa, 1998), pp. 37-44, 81-9; *Hegel: Life between Death and Thought*, *Analecta Husserliana*, LIX (Kluwer, Holland, 1999), pp. 189-203; *Comentario a la Enc. Fides et Ratio*, *Cuenta y Razón* (Madrid, April 1999), pp. 7-18; *Per una Istanza Metafisica Aperta alla Fede*, *Per una Lettura dell'Enciclica Fides et Ratio* (Quaderni di L'Oss. Romano, Vatican City, 1999), pp. 158-71; *Globalisation and Humanity: New Perspectives*, AA.VV., *A Dialogue on Globalization: Challenges and Opportunities for Countries* (The Asia Group, Rome 2001), pp. 11-28; *For a Catholic Vision of the Economy*, *Journal of Markets & Morality*, Vol. 6, No. 1 (Michigan 2003), pp. 7-31; *Il Padre e il Figlio amano se stessi e noi per lo Spirito Santo* (*Sth* I 37 2), *Doctor Communis*, fasc. 2, (Vatican City 2003), pp. 41-57; *The Truth Is the Goal of the Universe*, *E. Majorana Centre for Scientific Culture* (Erice, Italy, 10-15 May 2003), pp. 191-6; *Per una cultura aperta alla fede*, *La Chiesa a servizio dell'uomo*, *Giovanni Paolo II XXV anni di Pontificato* (Roma 2003), pp. 144-52; *Il Magistero dei Papi per la Pace e l'Accademia delle Scienze*, G. Prestipino (ed.), *Guerra e Pace* (Napoli 2004), pp. 83-110; *Science and Reality*, *Analecta Husserliana*, LXXIX (Kluwer, Holland, 1999), pp. 821-33; *The Four-Hundredth Anniversary of the Pontifical Academy of Sciences*, edited with an Introduction and index by M.S.S., The Pontifical Academy of Sciences, *Acta* 17 (Vatican City 2004), pp. 170; *The Governance of Globalisation*, E. Malinvaud, L. Sabou-

rin and M.S.S. (eds), (Vatican City 2004), pp. XXXV-403; *Globalizar la solidaridad*, Ciclo de Conferencias CEFOP, (La Plata, Provincia de Buenos Aires, 2004) pp. 58; *Il Magistero dei Papi per la Pace e l'Accademia delle Scienze*, G. Prestipino (ed.), Guerra e Pace, (Napoli 2004), pp. 83-110; Globalisation and Solidarity, A.D. Rotfeld (ed.), *New Political Act for the United Nations* (Warsaw 2004), pp. 160-205; Human Security, Charity and Justice, A.D. Rotfeld (ed.), *New Threats, New Responses (Towards the UN Reform)*, (Warsaw 2004), pp. 130-5; *Globalisation, Justice and Charity, Extra Series 20* (Vatican City 2004), 20 pp.; *Globalizacion y Justicia Social, Extra Series 21* (Vatican City 2004), 28 pp.; *Globalizzare la giustizia, I diritti umani nel mondo globalizzato*, a cura di E. Conti (Brescia 2004), pp. 61-74; The Pontifical Academy of Sciences, *Interdisciplinary Encyclopaedia of Religion and Science*, ed. by G. Tanzella and A. Strumia, Roma 2005; Globalisation and Learning, *Electronic Journal of Biotechnology*, Vol. 8, No. 1, Issue of April 15, Pontificia Universidad Católica de Valparaíso (Chile 2005); El Padre y el Hijo se aman y nos aman por el Espíritu Santo, A. Galli, *Homenaje al P. Ricardo Ferrara* (Buenos Aires, 2006), pp. 80-120; The Various Transcendent Levels of the Sacred in History: The East, Natural Religion, and Revealed Religion, M.S.S. (ed.), *The Sacred* (The Pontifical Academy of St. Thomas Aquinas, Vatican City, 2006) pp. 69-81; Femminismo e filosofia contemporanea, A. Luciani (ed.), *Nuovo Femminismo* (Carità Politica, Roma, 2006), pp. 35-64; La educación como el arte de devenir sí mismo en un mundo globalizado, AA.VV. *La educación hoy* (Banco de Galicia, Buenos Aires, 2006), pp. 35-58; La Libertà della Scienza, E. Conti (ed.), *Le libertà* (Brescia, 2006), pp. 25-39; Globalización y justicia internacional, E.D. Bautista (ed.), *Globalización y justicia internacional* (Fondo de Cultura Económica, México, 2006), pp. 263-91; Why the Concept of Brain Death is Valid as a Definition of Death, M.S.S. (ed.), *The Signs of Death* (The Pontifical Academy of Sciences, Vatican City, 2007), pp. xxi-xxix, 388-394; Statement on Globalization and Education, M.S.S. (ed.), *Globalisation and Education* (W. de Gruyter, Berlin, 2007), pp. 257-85; Philosophy, Science, Faith, M.S.S. (ed.), *What is our Real Knowledge about the Human Being* (The Pontifical Academy of Sciences, Vatican City, 2007), pp. 69-81; Introduction, M.S.S. (ed.), *Stem Cells Technology and Other Innovative Therapies* (The Pontifical Academy of Sciences, Vatican City 2007), pp. vii-xi; Justice in Potency, M.S.S. (ed.), *Charity and Justice in the Relations Among Peoples and Nations* (The Pontifical Academy of Social Sciences, Vatican City 2007), pp. 150-65; *I papi e la scienza* (Jaca Book, Milano 2009), vol. 1, p. I-LXXXIV-562; Grace As 'New

Creation', *Doctor Communis* (Vatican City 2009), vol. 1-2, pp. 219-36; Qu'est-ce que la vie?, *Transversalités* (Institute Catholique de Paris, 2010, vol. 114, pp.211-36; La globalización es ante todo una realidad fisicoquímica que altera el clima del planeta, in AA.VV., Pontificia Comisión para América Latina, Aparecida 2007, *Luces para América Latina* (Roma, Libreria Editrice Vaticana, 2008), vol. I, pp. 389-405; La educación para el ciudadano del mundo globalizado: el arte de devenir sí mismo, in Roberto Cortes Conde, 25 de mayo de 2010: *Una Argentina posible* (Biblioteca Nacional, Buenos Aires 2010), vol. 1, pp. 307-26; L'olivo e il suo frutto, *L'olivo e il suo olio*, Accademia dei Gergofili, Casina Pio IV, 16 dicembre 2008, vol. Quaderni 2008-V, pp. 7-14 (Firenze 2009); *Predictability in Science: Accuracy and Limitations*, W. Arber, N. Cabibbo and M.S.S. (eds), *Acta 19* (The Pontifical Academy of Sciences, Vatican City 2008), XLII-277 pp.; *Scientific Insights into the Evolution of the Universe and of Life*, W. Arber, N. Cabibbo, and M.S.S. (eds), *Acta 20* (The Pontifical Academy of Sciences, Vatican City, 2009), LXVII-622 pp.; *The Status of the Human Being in the Age of Science, Extra Series 32* (The Pontifical Academy of Sciences, Vatican City 2008), 14 pp.; *La Verità della Scienza per la Giustizia e la Pace, Extra Series 34* (The Pontifical Academy of Sciences, Vatican City 2010), 24 pp.; *The Scientific Legacy of the 20th Century*, W. Arber, J. Mittelstrass, M.S.S. (eds), *Acta 21* (The Pontifical Academy of Sciences, Vatican City 2011), 376 pp.; *Atherosclerosis: The 21st Century Epidemic*, C.J. Estol and M.S.S. (eds), *Scripta Varia 116* (The Pontifical Academy of Sciences, Vatican City, 2011), 199 pp.; *The Pontifical Academy of Sciences: A Historical Profile, Extra Series 38* (The Pontifical Academy of Sciences, Vatican City 2012), 24 pp.; Interaction Between Two Readings: The Naturalistic and the Socratic "Know Thyself", *Neurosciences and the Human Person: New Perspectives on Human Activities, Scripta Varia 121* (The Pontifical Academy of Sciences, Vatican City, 2013).

Michael Sela



Date of Birth 6 March 1924
Place Tomaszow (Poland)
Nomination 2 December 1975
Field Biology
Title Professor

Most important awards, prizes and academies *Prizes:* Israel Prize in Natural Sciences (1959); Rothschild Prize in Chemistry (1968); Otto Warburg Medal, German Society of Biological Chemistry (1968); Emil von Behring Prize of the Phillips University (1973); Gairdner Foundation International Award, Toronto (1980); Prize of the Institut de la Vie, Fondation Electricité de France (1984); Albert Einstein Golden Medal, UNESCO (1995); Harnack Medal of the Max-Planck Society (1996); Interbrew-Latour Health Prize, Belgium (1997); Wolf Prize in Medicine (1998). *Honorary Doctorates:* Université de Bordeaux II (1985); National Autonomous University of Mexico (1985); Tufts University, Medford, MA (1989); Colby College, Maine (1989); Université Louis Pasteur, Strasbourg (1990); Hebrew University, Jerusalem (1995); Tel Aviv University (1999); Ben-Gurion University of the Negev (2001). *Academies:* Israel Academy of Sciences and Humanities; American Academy of Arts and Sciences; Pontifical Academy of Sciences; US National Academy of Sciences; Deutsche Akademie der Naturforscher Leopoldina; Russian Academy of Sciences; French Académie des sciences; Italian Academy of Sciences; American Philosophical Society; Romanian Academy; Polish Academy of Arts and Sciences. *Honours:* Commander's Cross of the Order of Merit of the Federal Republic of Germany (1986); Officer de l'Ordre de la Légion d'honneur, France (1987); Caballero, Order de San Carlos, Colombia.

Summary of scientific research 1) The development of synthetic antigens. 2) Their use to elucidate the molecular basis of antigenicity (role of steric conformation, electric charge, shape, size, composition, optical configuration of component building stones, etc.). 3) The establishment, making use of synthetic antigens, of the genetic control of immune response. 4) The development of the notion of synthetic vaccines, including the first synthesis of anti-

gens capable of provoking antibodies that neutralize a virus (MS2 bacteriophage) and bacterial toxins (diphtheria and cholera). 5) The combined use of synthetic antigens and synthetic adjuvants, covalently linked to a synthetic polymer carrier, leading to antigens capable of provoking in aqueous solution protection against a virus and a bacterial toxin. 6) The development of a synthetic amino acid copolymer which serves as a specific drug against multiple sclerosis. 7) Monoclonal antibodies against the ErbB2 receptor, present in high density in breast cancer, either inhibited or enhanced tumor growth. The inhibitory antibodies induced differentiation of human breast cancer into normal milk-producing breast cells. 8) Synthesis of peptide antagonists to the most myasthenogenic T cell epitopes derived from the acetylcholine receptor, in an effort to find drugs against myasthenia gravis.

Main publications Synthesis, characterization and immunogenicity of some multichain and linear polypeptides containing tyrosine (with Fuchs, S. and Arnon, R.), *Biochem. J.*, 85, p. 223 (1962); Antibodies to sequential and conformational determinants (with Schechter, B., Schechter, I. and Borek, F.), *Cold Spring Harbor Symposia on Quantitative Biology*, 32, p. 537 (1967); Antigenicity: some molecular aspects, *Science*, 166, p. 1365 (1969); Demonstration of determinant-specific differences in response to synthetic polypeptide antigens in two strains of inbred mice (with McDevitt, H.O.), *J. Exp. Med.*, 122, p. 517 (1965); Antibodies Reactive with Native Lysozyme Elicited by a Completely Synthetic Antigen (with Arnon, R., Maron, E. and Anfinsen, C.B.), *Proc. Natl. Acad. Sci. USA*, 68, p. 1450 (1971); A pilot trial of Cop 1 in exacerbating-remitting multiple sclerosis (with Bornstein, M.B., Miller, A., Slagle, S., Weitzman, M., Crystal, H., Drexler, E., Keilson, M., Merriam, A., Wassertheil-Smoller, S., Spada, V., Weiss, W., Arnon, R., Jacobsohn, I. and Teitelbaum, D.), *The New England Journal of Medicine*, 317, p. 408 (1987); Mechanistic aspects of the opposing effects of monoclonal antibodies to the ErbB2 receptor on tumor growth (with Stancovski, I., Hurwitz, E., Leitner, D., Ullrich, A. and Yarden, Y.), *Proc. Natl. Acad. Sci. USA*, 88, p. 8691 (1991); Peptide analogs to pathogenic epitopes of the human acetylcholine receptor α -subunit as potential modulators of *myasthenia gravis* (with Zisman, E., Katz-Levy, Y., Dayan, M., Kirshner, S.L., Paas-Rosner, M., Karni, A., Abramsky, O., Brautbar, C., Fridkin, M. and Mozes, E.), *Proc. Natl. Acad. Sci. USA*, 93, p. 4492 (1996); A synthetic random basic copolymer with promiscuous binding to class II MHC molecules inhibits T-cell proliferative responses to major and minor histo-compatibility antigens in vitro and confers the capacity to prevent murine graft-versus-host disease

in vivo (with Schlegel, P.G., Aharoni, R., Chen, Y., Chen, J., Teitelbaum, D., Arnon, R., Sela, M. and Chao, N.J.), *Proc. Natl. Acad. Sci. USA*, 93, p. 501 (1996); A peptide composed of tandem analogs of two myasthenogenic T cell epitopes interferes with specific autoimmune responses (with Katz-Levy, Y., Paas-Rozner, M., Kirshner, S., Dayan, M., Zisman, E., Fridkin, M., Wirguin, I., Sela, M. and Mozes, E.), *Proc. Natl. Acad. Sci. USA*, 94, p. 3200 (1997); Copolymer 1 induces T-cells of the T helper Type 2 that cross-react with myelin basic protein and suppress experimental autoimmune encephalomyelitis (with Aharoni, R., Teitelbaum, D. and Arnon, R.), *Proc. Natl. Acad. Sci. USA*, 94, p. 10821 (1997); Copolymer 1 acts against the immunodominant epitope 82-100 of myelin basic protein by T cell receptor antagonism in addition to the MHC blocking (with Aharoni, R., Teitelbaum, D. and Arnon, R.), *Proc. Natl. Acad. Sci. USA*, 96, p. 634 (1999); Immunomodulation of experimental autoimmune encephalomyelitis by oral administration of copolymer 1 (with Teitelbaum, D. and Arnon, R.), *Proc. Natl. Acad. Sci. USA*, 96, p. 3842 (1999); T-cell immunity to copolymer-1 confers neuroprotection on the damaged optic nerve: possible therapy for optic neuropathies (with Kipnis, J., Yoles, E., Porat, Z., Cohen, A., Mor, F., Cohen, I.R. and Schwartz, M.), *Proc. Natl. Acad. Sci. USA*, 97, p. 7446 (2000); Copolymer 1 inhibits manifestations of graft rejection (with Aharoni, R., Teitelbaum, D. and Arnon, R.), *Transplantation*, 72, p. 598 (2001); Glatiramer acetate specific T-cells in the brain express Th2/3 cytokines as well as Brain derived neurotrophic factor (BDNF) in situ (with Aharoni, R., Kayhan, B., Eilam, R. and Arnon, R.), *Proc Natl. Acad. Sci.*, 100, p. 14157 (2003); Therapeutic vaccines – realities of today and hopes for the future (with Arnon, R. and Schechter, B.), *Drug Discovery Today*, 7, p. 664 (2002); From proteins and protein models to their use in immunology and Immunotherapy, *Reflections, J. Biol. Chem.*, 278, p. 48507 (2003).

Maxine F. Singer



Date of Birth 15 February 1931

Place New York, NY (USA)

Nomination 9 June 1986

Field Biochemistry

Title Professor

Singer, M.F.

Most important awards, prizes and academies *Awards:* US Government Senior Executive Service Outstanding Performance Award; National Medal of Science (1992); Vanneva-Bush Award (1999); National Academy of Science, USA; American Academy of Arts and Sciences; Institute of Medicine, National Academy of Sciences; American Philosophical Society; Public Welfare Medal (2007). *Academies:* American Society of Biological Chemists; American Association for the Advancement of Science; American Chemical Society; American Society of Microbiologists; American Society for Cell Biology; Pontifical Academy of Sciences. *Honorary Degrees:* Swarthmore College; Wesleyan University; Harvard University; Yale University.

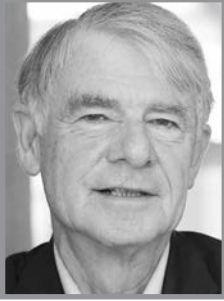
Summary of scientific research Maxine Singer received the Ph.D. degree in Biochemistry in 1957 from Yale University. Her interest in nucleic acids (DNA and RNA) began during her post-doctoral work in Leon Heppel's laboratory at the National Institute of Health. Until 1975, she was a Research Biochemist in the Institute of Arthritis and Metabolic Diseases, NIH. During that period she worked on the synthesis and structure of RNA and applied this experience to the work that elucidated the genetic code. She described and studied enzymes that degraded RNA in bacteria. By 1970 she became interested in animal viruses and took a sabbatical leave in the laboratory of Ernest Winocour (1971-2) at the Weizmann Institute of Science, Israel. There she began work on aspects of simian virus 40. Moving to the National Cancer Institute in 1975, she continued this work studying defective SV40 viruses whose genomes contain regions of DNA from the host monkey cells. She also carried out investigations on interaction between histone H1 and DNA as it relates to the structure of chromatin. In the same year she served on the organizing committee for the Asilomar Meeting on Recombinant DNA

molecules, the first public discussion of the implication of these new methods. The work on defective SV40 led to an interest in highly repeated DNA sequences in primate, including human genomes. This led, in turn, to the discovery of a transposable element (jumping gene) in human DNA, the topic that was the subject of her most recent research. Looking back, Dr. Singer's scientific interests have evolved from an emphasis on chemistry to an increasing interest in biological phenomena. Her most recent research aimed to elucidate the mechanism whereby the human transposable element replicates and disperses copies to new genomic locations, a process which can be mutagenic. In 1988 she became President of the Carnegie Institution of Washington, retaining her laboratory and the title Scientist Emeritus at the NIH. At Carnegie she renewed her interest in the range of sciences investigated at the Institution's departments: earth science, astronomy, plant and development biology. She also initiated programs designed to improve scientific understanding by the general public including the training of elementary school teachers and a Saturday program for children – *First Light*. She became President Emerita in 2003. Dr. Singer served as chairman of the Editorial Board of the *Proceedings of the National Academy of Sciences of the USA*. Previously she served on the editorial boards of the *Journal of Biological Chemistry* and *Science Magazine*. Dr. Singer was a fellow (trustee) of the Yale Corporation (1975-90), is a member of the Governing Board of the Weizmann Institute of Science and was co-chairman of its Scientific and Academic Advisory Committee, and was a member of the Board of Johnson & Johnson.

Main publications Singer, M.F., Jones, O.W. and Nirenberg, M.W., The effect of secondary structure on the template activity of polyribonucleotides, *Proc. Natl. Acad. Sci. USA*, 29, pp. 392-9 (1963); Leder, P., Singer, M.F. and Brimacombe, R.L.C., Synthesis of trinucleoside diphosphates with polynucleotide phosphorylase, *Biochemistry*, 4, pp. 1561-7 (1965); Nossal, N.G. and Singer, M.F., The processive degradation of individual polyribonucleotide chains. I. *Escherichia coli* ribonuclease II, *J. Biol. Chem.*, 243, pp. 913-22 (1968); Moses, R.E. and Singer, M.F., Polynucleotide phosphorylase of *Micrococcus luteus*. Studies on the polymerization reaction catalyzed by primer-dependent and primer-independent enzymes, *J. Biol. Chem.*, 245, pp. 2414-22 (1970); Singer, D.S. and Singer, M.F., Studies on the interaction of H1 histone with superhelical DNA; Characterization of the recognition and binding regions of H1 histone, *Nucleic Acids Res.*, 3, pp. 2531-47 (1976); Rosenberg, H., Singer, M.F. and Rosenberg, M., Highly reiterated sequences of SIMIANSIMIANSIMIANSIMIANSIMIAN, *Science*, 200, pp. 394-402

(1978); Grimaldi, G. and Singer, M.F., A monkey *Alu*-sequence is flanked by 13-base pair direct repeats of an interrupted α -satellite DNA sequence, *Proc. Natl. Acad. Sci. USA*, 79, pp. 1497-1500 (1982); Skowronski, J. and Singer, M.F., Expression of a cytoplasmic LINE-1 transcript is regulated in a human teratocarcinoma cell line, *Proc. Natl. Acad. Sci. USA*, 82, pp. 6050-4 (1985); Skowronski, J., Fanning, T.G. and Singer, M.F., Unit length LINE-1 transcripts in human teratocarcinoma cells, *Mol. Cell. Biol.*, 8, pp. 1385-97 (1988); Singer, M.F. and Berg, P., *Genes and Genomes*, University Science Books (1990); Singer, M.F. and Berg, P., *Dealing with Genes: The Language of Heredity*, University Science Books (1992); Hohjoh, H. and Singer, M.F., Sequence specific single-strand RNA-binding protein encoded by the human LINE-1 retrotransposon, *EMBO J.*, 16, pp. 6034-43 (1997); Clements, A.P. and Singer, M.F., The human LINE-1 reverse transcriptase: Effects of deletions outside the common reverse transcriptase domain, *Nucleic Acids Research*, 26, pp. 3528-35 (1998); Berg, P. and Singer M., *George Beadle An Uncommon Farmer: The Emergence of Genetics in the 20th Century*, pp. 383, Cold Spring Harbor Laboratory Press (April 30, 2005).

Wolf Joachim Singer



Date of Birth 9 March 1943

Place München (Germany)

Nomination 18 September 1992

Field Physiology

Title Professor

Most important awards, prizes and academies *Awards:* Prize of the IPSEN Foundation (1991); Ernst Jung Prize for Science and Research (1994); Zülch Prize (1994); Hessischer Kulturpreis (1998); Körber Prize for European Sciences (2000); Max Planck Prize for Public Science (2001); La Médaille de la Ville de Paris (2002); Chevalier de la Légion d'honneur (2002); Ernst Hellmut Vits Prize (2002); Krieg Cortical Discoverer Award of the Cajal Club (2003); Betty und David Koetser Prize (2002); Communicator Prize (2003); Hans Berger Prize (2003); Dr. *honoris causa*, Univ. Oldenburg (2005); Aschoff Prize, Univ. Freiburg (2005); INNS Hebb Award (2006); Dr. *honoris causa*, Rutgers University (NJ) (2008); Kaloy Prize, University Geneva (2009); Order of Merit (First Class) of the Federal Republic of Germany (2011). *Academies:* Academia Europaea (1989); Pontifical Academy of Sciences (1992); Berlin-Brandenburgische Academy of Sciences (1993); Scientific Academy of the Johann Wolfgang Goethe University Frankfurt (1993); Bavarian Academy of Sciences (1996); Academia Scientiarum et Artium Europaea (1997); Leopoldina (1999); Member of Collegium Europaeum Jenense, Jena (2002); Honorary Member of the World Innovation Foundation (2005); Foreign Member of the Russian Academy of Sciences (2006); Consultant of the Pontifical Council for Culture (2011).

Summary of scientific research Initially Prof. Wolf Singer's research concentrated on the physiology of thalamic transmission (summarized in *Phys. Rev.*, 1977). Subsequently it turned towards studies of the development and the functional organization of the cerebral cortex using the visual system as a model. This led to a number of discoveries concerning mechanisms of experience-dependent development and synaptic plasticity (summarized in *J. Exp. Biol.*, 1990, and *Science*, 1995). A new line of research began with the

discovery that neurons of the neocortex synchronize their responses within and across cortical areas in a context and goal specific way. This finding has been interpreted as support for the hypothesis that the brain might use synchronization of discharges as a mechanism in order to select neuronal responses, to bind them together into functionally coherent assemblies for joint interpretation and to dynamically associate neurons into specific functional networks. Since then numerous experiments have been performed to test the predictions derived from this hypothesis (reviewed in *Annu. Rev. Physiol*, 1993, *Annu. Rev. Neurosci.*, 1995, *Neuron*, 1999, *Trends Cogn. Sci.*, 2001, *Neuron*, 2006, *Trends Neurosci.*, 2007). This work emphasizes the dynamic nature of cortical processes and provides potential solutions for a wide range of coordination functions related to parallel distributed processing. It was also observed that the occurrence of synchronization is frequently associated with an oscillatory patterning of neuronal responses. This established new links between measurements of oscillatory brain activity in humans and micro-electrode investigations in animals. It also stimulated the search for oscillatory phenomena in general and led to numerous discoveries of oscillatory activity in a wide variety of brain structures of different species. The new approach to search for temporal relations among distributed neuronal responses rather than merely their amplitude revealed that cortical and sub-cortical networks exhibit surprisingly complex dynamics. It encouraged theoreticians in the field of neuronal computation to apply the methods of non-linear dynamics for the analysis of artificial networks and led to experimentation with models which use this putative coding strategy to resolve problems of dynamic coordination in a host of cognitive and executive functions. Recently this approach has been extended to clinical studies and revealed close correlations between clinical symptoms and disturbances in synchronized oscillatory activity in psychiatric diseases such as schizophrenia, autism and Alzheimer.

Main publications Singer, W., Control of thalamic transmission by cortico-fugal and ascending reticular pathways in the visual system, *Physiol. Rev.*, 57, pp. 386-420 (1977); Rauschecker, J.P. and Singer, W., Changes in the circuitry of the kitten visual cortex are gated by postsynaptic activity, *Nature*, 280, pp. 58-60 (1979); Kleinschmidt, A., Bear, M.F. and Singer, W., Blockade of NMDA receptors disrupts experience-dependent plasticity of kitten striate cortex, *Science*, 238, pp. 355-8 (1987); Gray, C.M. and Singer, W., Stimulus-specific neuronal oscillations in orientation columns of cat visual cortex, *Proc. Natl. Acad. Sci. USA*, 86, pp. 1698-1702 (1989); Gray, C.M.,

König, P., Engel, A.K. and Singer, W., Oscillatory responses in cat visual cortex exhibit inter-columnar synchronization which reflects global stimulus properties, *Nature*, 338, pp. 334-7 (1989); Singer, W., The formation of cooperative cell assemblies in the visual cortex, *J. Exp. Biol.*, 155, pp. 177-97 (1990); Singer, W., Search for coherence: A basic principle of cortical self-organization, *Concepts Neurosci.*, 1, pp. 1-26 (1990); Singer, W., Synchronization of cortical activity and its putative role in information processing and learning, *Annu. Rev. Physiol.*, 55, pp. 349-74 (1993); Singer, W. and Gray, C.M., Visual feature integration and the temporal correlation hypothesis, *Annu. Rev. Neurosci.*, 18, pp. 555-86 (1995); Singer, W., Development and plasticity of cortical processing architectures, *Science*, 270, pp. 758-64 (1995); Neuenschwander, S. and Singer, W., Long-range synchronization of oscillatory light responses in the cat retina and lateral geniculate nucleus, *Nature*, 379, pp. 728-33 (1996); Munk, M.H.J., Roelfsema, P.R., König, P., Engel, A.K. and Singer, W., Role of reticular activation in the modulation of intracortical synchronization, *Science*, 272, pp. 271-4 (1996); Fries, P., Roelfsema, P.R., Engel, A.K., König, P. and Singer, W., Synchronization of oscillatory responses in visual cortex correlates with perception in interocular rivalry, *Proc. Natl. Acad. Sci. USA*, 94, pp. 12699-704 (1997); Activation of Heschl's gyrus during auditory hallucinations, *Neuron*, 22, pp. 615-21 (1999); Singer, W., Neuronal synchrony: a versatile code for the definition of relations?, *Neuron*, 24, pp. 49-65 (1999); Castelo-Branco, M., Goebel R., Neuenschwander S. and Singer, W., Neural synchrony correlates with surface segregation rules, *Nature*, 405, pp. 685-9 (2000); Singer, W., Phenomenal awareness and consciousness from a neurobiological perspective, *Neural Correlates of Consciousness* (T. Metzinger, ed.), Cambridge, MA, MIT Press, pp. 121-37 (2000); Engel, A.K. and Singer, W., Temporal binding and the neural correlates of sensory awareness, *Trends Cogn. Sci.*, 5, pp. 16-25 (2001); Fries, P., Neuenschwander, S., Engel, A.K., Goebel, R. and Singer, W., Rapid feature selective neuronal synchronization through correlated latency shifting, *Nature Neurosci.*, 4, pp. 194-200 (2001); Singer, W., Consciousness and the binding problem. Marijuán, P.C. Cajal and Consciousness: Scientific Approaches to Consciousness on the Centennial of Ramón y Cajal's *Textura*, *Ann. New York Acad. Sci.*, New York, 929, pp. 123-46 (2001); Dierks, T., Linden, D.E.J., Jandl, M., Formisano, E., Goebel, R., Lanfermann, H. and Singer, W.; Fries, P., Schröder, J.-H., Roelfsema, P.R., Singer, W. and Engel, A.K., Oscillatory neuronal synchronization in primary visual cortex as a correlate of stimulus selection, *J. Neurosci.*, 22, pp. 3739-

54 (2002); Singer, W., Synchrony, oscillations, and relational codes, *The Visual Neurosciences*, Vol. 2, (L.M. Chalupa and J.S. Werner, eds), Cambridge, MA, MIT Press, pp. 1665-81 (2004); Brecht, M., Singer, W. and Engel, A.K., Amplitude and direction of saccadic eye movements depend on the synchronicity of collicular population activity, *J. Neurophysiol.*, pp. 424-32 (2004). *Latest publications:* Weigelt, S., Singer, W. and Muckli, L., Separate cortical stages in amodal completion revealed by functional magnetic resonance adaptation, *BMC Neuroscience*, 8: 70 (1-11); Weigelt, S., Kourtzi, Z., Kohler, A., Singer, W. and Muckli, L., The cortical representation of objects rotating in depth, *The Journal of Neuroscience*, 27, pp. 3864-74 (2007); Uhlhaas, P.J. and Singer, W., What can neural synchrony tell us about autism?, *Biol. Psychiatry*, 62, pp. 190-1 (2007); Schwiedrzik, C.M., Alink, A., Kohler, A., Singer, W. and Muckli, L., A spatio-temporal interaction on the apparent motion trace, *Vision Res.* 47(28), 3424-33 (2007); Singer, W., Understanding the brain, *EMBO reports*, Vol. 8 Special Issue 2007, pp. 16-9; Singer, W., Binding by Synchrony, *Scholarpedia, the free peer-reviewed encyclopedia* (2007); Nikolic, D. and Singer, W., Creation of visual long-term memory, *Percept. Psychophys.*, 69: 904-12 (2007); Nikolic, D., Lichti, P. and Singer, W., Color-opponency in synesthetic experiences, *Psychol. Sci.*, 18(6):481-6 (2007); Nikolic, D., Häusler, S., Singer, W. and Maass, W., Temporal dynamics of information content carried by neurons in the primary visual cortex, *Adv. in Neural Inf. Process. Syst.* 19, pp. 1041-8 (2007); Melloni, L., Molina, C., Pena, M., Torres, D., Singer, W. and Rodriguez, E., Synchronization of neural activity across cortical areas correlates with conscious perception, *J. Neurosci.*, 27, pp. 2858-65 (2007); Meinenbrock, A., Naumer, M.J., Doehrmann, O., Singer, W. and Muckli, L., Retinotopic effects during spatial audio-visual integration, *Neuropsychologia*, 45, pp. 531-9 (2007); Haenschel, C., Uhlhaas, P.J. and Singer, W., Synchronous oscillatory activity and working memory in schizophrenia, *Pharmacopsychiatry*, 40 Suppl 1, pp. 54-61 (2007); Haenschel, C., Bittner, R.A., Haertling, F., Rotarska-Jagieła, A., Maurer, K., Singer, W. and Linden, D.E.J., Contribution of impaired early-stage visual processing to working memory dysfunction in adolescents with schizophrenia, *Arch. Gen. Psychiatry*, 64, pp. 1229-40 (2007); Fries, P., Nikolic, D. and Singer, W., The gamma cycle, *Trends Neurosci.*, 30, pp. 309-16 (2007); Schmidt, K.E., Singer, W. and Löwel, S., Binocular phasic coactivation does not prevent ocular dominance segregation, *Frontiers in Bioscience* 13, 3381-90 (2008); Nikolic, D., Moca, V.V., Singer, W. and Muresan, R.C., Properties of multivariate data investigated by fractal dimensiona-

lity, *J. Neurosci. Methods* 172, pp. 27-33 (2008); Muresan, R.C., Jurjut, O.F., Moca, V.V., Singer, W. and Nikolic, D., The oscillation score: An efficient method for estimating oscillation strength in neuronal activity, *J. Neurophysiol.* 99, pp. 1333-53 (2008); Kohler, A., Haddad, L., Singer, W. and Muckli, L., Deciding what to see: The role of intention and attention in the perception of apparent motion, *Vision Res.*, 48, pp. 1096-1106 (2008); Alink, A., Singer, W. and Muckli, L., Capture of auditory motion by vision is represented by an activation shift from auditory to visual motion cortex, *J. Neurosci.* 28, pp. 2690-7 (2008); Singer, W. and M. Ricard, *Hirnforschung und Meditation. Ein Dialog*, Edition Unseld 4. Suhrkamp Verlag, Frankfurt am Main (2008), Singer, W. Synchronous oscillations and memory formation, *Learning and Memory: A Comprehensive Reference*, Vol. I (J. Byrne, ed.) *Learning, Theory and Behavior* (R. Menzel, Ed.), Oxford, Elsevier, pp. 721-8 (2008); Singer, W. Consciousness and neuronal synchronization, *The Neurology of Consciousness* (Laureys, S., Tononi, G., eds), Oxford, Elsevier, pp. 43-52 (2009); Singer, W., Neural synchrony and feature binding, *Encyclopedia of Neuroscience*, Vol. 6, Oxford, Academic Press, pp. 253-9 (2009); Uhlhaas, P.J., Pipa, G., Lima, B., Melloni, L., Neuenschwander, S., Nikolic, D. and Singer, W., Neural synchrony in cortical networks: History, concept and current status, *Front. Integrative Neurosci.*, 3, pp. 1-19 (2009); Muckli, L., Naumer, M.J. and Singer, W., Bilateral visual field maps in a patient with only one hemisphere, *Proc. Natl. Acad. Sci. USA*, 106(31), pp. 13034-9 (2009); Nikolic, D., Haeusler, S., Singer, W. and Maass, W., Distributed fading memory for stimulus properties in the primary visual cortex, *PLoS Biology*, 7, pp. 1-19 (2009); Uhlhaas, P.J. and Singer, W., Abnormal neural oscillations and synchrony in schizophrenia, *Nature Rev. Neurosci.*, 11, pp. 100-13 (2010); Vinck, M, Lima, B., Womelsdorf, T., Oostenveld, R., Singer, W., Neuenschwander, S. and Fries, P., Gamma phase shifting in awake monkey visual cortex, *J. Neurosci.*, 30, pp. 1250-7 (2010); Uhlhaas, P.J., Roux, F., Rodriguez, E., Rotarska-Jagiela, A. and Singer, W., Neural synchrony and the development of cortical networks, *Trends Cogn. Sci.*, 14, pp. 72-80 (2010); Grützner, C., Uhlhaas, P.J., Genc, E., Kohler, A., Singer, W. and Wibral, M., Neuroelectromagnetic correlates of perceptual closure processes, *J. Neurosci.*, 30, pp. 8342-52 (2010); Singer, W. Neocortical rhythms. An overview, *Dynamic Coordination in the Brain. From Neurons to Mind*, Vol. 5, Strüngmann Forum Report (C. von der Malsburg, W.A. Phillips and W. Singer, eds), Cambridge MA, MIT Press, pp. 159-68 (2010); Singer, W., A determinist view of the brain, mind and consciousness. *Brain Waves*

Module 1: Neuroscience, Society and Policy, London, The Royal Society, pp. 41-8 (2011), Schwiedrzik, C.M., Singer, W. and Melloni, L., Subjective and objective learning effects dissociate in space and in time, *Proc. Natl. Acad. Sci. USA*, 108(11), pp. 4506-11 (2011); Uhlhaas, P. and Singer, W., The development of neural synchrony and large-scale cortical networks during adolescence: Relevance for the pathophysiology of schizophrenia and neurodevelopmental hypothesis, *Schizophr. Bull.*, 37(3), pp. 514-23 (2011); Havenith, M.N., Yu, S., Biedlerlack, J., Chen, N.-H., Singer, W. and Nikolic, D., Synchrony makes neurons fire in sequence, and stimulus properties determine who is ahead, *J. Neurosci.*, 31, pp. 8570-84 (2011); Melloni, L. and Singer, W., The explanatory gap in neuroscience, *The Scientific Legacy of the 20th Century*, The Proceedings of the Plenary Session 28, Rome, Pontificiae Academia Scientiarum *Acta* 21, pp. 61-73 (2011); Ito, J., Maldonado, P., Singer, W. and Gruen, S., Saccade-related modulations of neuronal excitability support synchrony of visually elicited spikes, *Cerebr. Cortex*, 21, pp. 2482-97 (2011); Lima, B., Singer, W. and Neuenschwander, S., Gamma responses correlate with temporal expectation in monkey primary visual cortex, *J. Neurosci.*, 31, pp. 15919-31 (2011); *Neurosciences and the Human Person*, Proceedings of the Working Group 8-10 November 2012, A. Battro, S. Dehaene and W. Singer (eds), *Scripta Varia* 121, Vatican City (2013).

Govind Swarup



Date of Birth 1929
Place Thakurdwara, I.P. (India)
Nomination 18 February 2008
Field Astrophysics
Title Professor

Most important awards, prizes and academies *Membership of Professional Societies:* Royal Society, London; Indian National Science Academy; Indian Academy of Sciences; National Academy of Sciences, Allahabad, India; Third World Academy of Sciences; Indian Geophysical Union; Maharashtra Academy of Sciences; International Academy of Astronautics; Pontifical Academy of Sciences; Royal Astronomical Society, London; Astronomical Society of India (President 1975-77); International Astronomical Union (IAU) (President, Commission 40 on Radio Astronomy, 1979-82); Executive Committee, Inter Union Commission for Frequency Allocation (IUCAF till 1995); IAU Working Group for Future Large Scale Facilities (1994-2000); Chairman, Indian National Committee for International Union of Radio Science (URSI) (1986-88 & 1995-97); Editorial Board, Indian Journal of Radio & Space Physics; Editorial Board (1990-2000), National Academy of Sciences, India (1997-2000); Indian Physics Association; Indian Physical Society; Institution of Electronics & Telecommunication Engineers; Post-detection Sub-Committee of SETI of International Astronautical Federation (Chairman, 1994-98); Chairman, URSI Committee for Developing Countries (1996-2002); URSI Standing Committee for Future General Assemblies (1999-2002). *Awards:* 1973 Padma Shri; 1972 S.S. Bhatnagar Award, Council of Scientific & Industrial Research, India; 1974 Jawaharlal Nehru Fellowship for 2 years; 1984 P.C. Mahalanobis Medal, Indian National Science Academy; 1986 Biren Roy Trust Medal, Indian Physical Society, Calcutta; 1987 Dr. Vainu Bappu Memorial Award, Indian National Science Academy; 1987 Tskolovsky Medal, Federation of Cosmonautics, USSR; 1987 Meghnad Saha Medal, National Academy of Sciences, India; 1988 The Third World Academy of Sciences Award in Physics; 1990 John Howard

Delinger Gold Medal, International Union of Radio Sciences; 1990 R.D. Birla Award in Physics, Indian Physics Association; 1991 FIE Foundation Award for Eminence in Science & Technology, Ichhalkaranji, India; 1993 Gujar Mal Modi Science Award, Modi Foundation, India; 1993 The C.V. Raman Medal, Indian National Science Academy; 1994 Sir Devaprasad Sarbadhikari Medal, Calcutta University; 1995 M.P. Birla Award, Birla Institute of Astronomy and Planetarium Sciences, Calcutta; 1999 12th Khwarizmi International Award, Iran; 2001 H.K. Firodia Award; 2006 Herschel Medal of the Royal Astronomical Society; 2007 Grote Reber Medal.

Summary of scientific research During 1953-65 Prof. Swarup made the discovery of 'Type U' solar radio bursts; developed a gyro-radiation model for explaining the microwave solar emission and made studies of the radio emission from the Quiet Sun. In 1959 he developed a round trip transmission technique for phase measurements, which has been used in almost all the radio interferometers in the world. In 1962 he found the first example of a steep spectrum 'bridge' of radio emission between the two radio lobes of the powerful radio galaxy, Cyg-A, using the Stanford Compound Interferometer; such bridges allow estimates of the age of a radio galaxy. During 1963-70, he constructed a 530 m long and 30 m wide parabolic-cylindrical radio telescope of a unique and innovative design at Ooty in South India, which was placed on a suitably inclined hill so as to make its long axis of rotation parallel to that of the earth, enabling it to track celestial radio sources in hour angle for 9.5 hrs. Using the method of lunar occultation, it provided for the first time high-resolution angular data (1 to 10 arc sec) for more than 1,000 weak radio sources, which provided an independent evidence for the Big Bang model. Ooty Occultation observations of the galactic centre source, Sgr-A, yielded the first 2-dimensional separation of its thermal and non-thermal emission. During the 1980s, Swarup studied characteristics of jets, cores and hot spots of quasars based on polarization observations. During 1984-96, he conceived and directed the design and construction of the Giant Metrewave Radio Telescope (GMRT), consisting of 30 fully steerable parabolic dishes of 45m diameter that are located in a Y-shape array of about 25 km in extent in Western India. A novel concept developed by him made it possible to construct such large antennas very economically. GMRT is a highly versatile instrument. It is the world's largest radio telescope operating in the frequency range of about 130-1430 MHz. At present he is making observations with the GMRT of the emission and absorption of atomic hydrogen from objects in the early Universe. Recently, along with S.K. Sirothia, he

has investigated deficiency of radio sources at 327 MHz towards the prominent cold spot of the cosmic microwave background radiation. To summarize, during the last 40 years he has made important contributions in areas such as solar radio emission, interplanetary scintillations, pulsars, radio galaxies, quasars and cosmology.

Main publications *Books:* *Quasars*, IAU Symposium 119, G. Swarup and V.K. Kapahi (eds), Reidel Publications, Dordrecht, July 1986; *History of Oriental Astronomy*, IAU Colloquium 91, G. Swarup, A.K. Bag and K.S. Shukla (eds), Cambridge University Press (1987); *Asia-Pacific Astronomy*, 6th Asian-Pacific Regional Meeting on Astronomy of IAU, V.K. Kapahi, N.K. Dadhich, G. Swarup and J.V. Narlikar (eds), Indian Academy of Sciences, Bangalore, 1995; *The Universe at Low Radio Frequencies*, IAU Symposium No. 199, A.P. Rao, G. Swarup & Gopal Krishna (eds), Astronomical Society of the Pacific, 2003. *Articles:* Swarup, G. and Parthasarathy, R., Solar brightness distribution at a wavelength of 60 cm – Part-I: The quiet Sun, *Austr. J. Phys.*, 1955, 8, 487-97; Swarup, G. and Parthasarathy, R., Solar brightness distribution at a wavelength of 60 cm – Part-II: Localised radio bright regions, *Austr. J. Phys.*, 1958, 11, 338-49; Maxwell, A. and Swarup, G., A new spectral characteristic in solar radio emission, *Nature*, 1958, 181, 36-8; Bra-cowell, R.N., Swarup, G., and Seeger, C.L., Future large radio telescope, *Nature*, 1962, 193, 412-6; Swarup, G., *et al.*, The structure of Cygnus A, *Astrophys. J.*, 1963, 138, 305-9; Swarup, G., *et al.*, Radio observations of the quiet Sun at 49 cm, *Nature*, 1966, 212, 910-1; Swarup, G., A large cylindrical telescope at Ootacamund for radio astronomy observations, *Proc. Symp. on Antenna, Radio & Telecom. Res.*, CSIR, New Delhi, 1968 (Supplement 1, pp. 1-4); Swarup, G. and Kapahi, V.K., A simple image forming technique suitable for multifrequency observations of solar radio bursts, *Solar Physics*, 1970, 14, 404-13; Swarup, G., *et al.*, Large Steerable Radio Telescope at Ootacamund, India, *Nature Physical Science*, 1971, 230, 185-8; Swarup, G., *et al.*, Lunar occultation observations of 25 radio sources made with the Ooty Radio Telescope: List 1, *Astrophysical Letters*, 1971, 9, 53-9; Gopal-Krishna, Swarup, G., *et al.*, Occultation of Sgr A, *Nature*, 1972, 239, 91-3; Joshi, M.N., Kapahi, V.K., Gopal-Krishna, Sarma, N.V.G., and Swarup, G., Occultation of 50 radio sources at 327 MHz, *Astronomical Journal*, 1973, 78, 1023-9; Kapahi, V.G., Damle, S.H., Balasubramanian, V. and Swarup, G., An electrically steerable array of 968 Dipoles for the Ooty Radio Telescope, *Journal of the Inst. Electron. and Telecom. Engrs.*, 1975, 21, 117-22; Gopal-Krishna and Swarup, G., The radio source Sagittarius A,

Astrophysical Letters, 1976, 17, 45-7; Swarup, G., Theory and application of interplanetary scintillations, *J. Scient. Ind. Res.*, 1977, 36, 569-79; Swarup, G., Proposal for an International Institute for Space Sciences and Electronics and for a Giant Equatorial Radio Telescope as a collaborative efforts of the developing countries, *Bull. Astron. Soc. India*, 1981, 9, 269-77; Swarup, G., *et al.*, Optical identification-flux density relationship for radio galaxies, *Astron. Astrophys.* 1982, 107, 190-6; Swarup, G., *et al.*, On evolutionary models of radio sources, *Proc. of the Vatican Study Week on Cosmology and Fundamental Physics*, Ed. H.A. Bruck, G.V. Coyne and M.S. Longair, Specola Vaticana, 1982, 383-90; Swarup, G., Sinha R.P. and Hill-drup, J., Hot spots and radio lobes of quasars, *Mon. Not. R. Astr. Soc.*, 1984, 208, 813-43; Swarup, G., The Ooty Synthesis Radio Telescope: first results, *J. Astr. Astrophys.*, 1984, 5, 139-48; Swarup, G., *et al.*, Giant Equatorial Radio Telescope, *Astrophys. and Space Science*, 1984, 99, 403-7; Saikia, D.J., Swarup, G. and Kodali, P.D., Polarization properties of steep-spectrum radio cores, *Mon. Not. R. Astr. Soc.*, 1985, 216, 385-94; Swarup, G., *et al.*, Absorption lines and the radio structure of quasars, *Mon. Not. R. Astr. Soc.*, 1986, 220, 1-18; Swarup, G. and Subrahmanyan, R., Search for proto-clusters at metre wavelengths, *Observational Cosmology*, ed. A. Hewitt, *et al.*, Reidel Publications, Dordrecht, 1987, 441-4; Joshi, M.N., Swarup, G., *et al.*, A new electronically steerable 1056 dipole array at 327 MHz for the Ooty Radio Telescope, *Bull. Astron. Soc. India*, 1988, 16, 111-21; Sukumar, S., Velusamy, T., Rao, A.P., Swarup, G., *et al.*, Ooty Synthesis Telescope: design and performance, *Bull. Astron. Soc. India*, 1988, 16, 93-110; Swarup, G., Evolution of radio galaxies & quasars in *Essays on Particles and Fields* (eds B.V. Sreekantan & R.R. Daniel), *Festschrift Volume on Prof. M.G.K. Menon*, Indian Academy of Sciences, Bangalore, 1989, 149-66; Subrahmanian, K. and Swarup, G., The gaseous halos of evolving galaxies: a probe using the linear sizes of radio sources, *Mon. Not. R. Astr. Soc.*, 1990, 247, 956-62; Djorgovski, S., Meylan, G., Klemola, A., Thompson, D.J., Weir, W.N., Swarup, G., *et al.*, A Search for the optical/IR counterpart of the probable Einstein ring source 1830-211, *Mon. Not. R. Astr. Soc.* 1992, 257, 240-4; Subramanian, K. and Swarup, G., A cluster of protogalaxies at redshift 3.4, *Nature*, 1992, 359, 512-4; Swarup, G., Giant Metrewave Radio Telescope – Its possible use for SETI, *Acta Astronautica*, 1992, 26, 239-42; Swarup, G., Radio Astronomy and the Developing Countries. *In the Vanishing universe, Proc. IAU/ICSU/UNESCO Meeting Adverse Environmental Impacts on Astronomy* (ed. D. McNally), Cambridge University Press, 1993, 109-13;

Swarup, G., Experimental astronomy in India, *Proc. IUCAA Dedication Seminar*, 29-30 Dec. 1992, IUCAA (1997), New International Publication, 1997, 163-73; Sawant, H.S., Ludke, E., Subramanian, K.R., Fernandes, F.C.R., Cecatto, J.R., Rosa, R.R., Sobral, J.H.A., Swarup, G., *et al.*, High resolution decimetric solar radioheliograph, *NASA Workshop*, ASP Conference Series, 2000, 206, 347-50; Swarup G., Sarkar, A., Observations of Associated HI Absorption in Radio Galaxies and Quasars using GMRT, *Bull. Astr. Soc. India*, 2002, 30, 743-6; Swarup G., Search for HI Reionization Epoch in the Early Universe, *Bull. Astr. Soc. India*, 2003, 31, 451-2; Poonam Chandra, Swarup, G., Kulkarni, V.K., Kantharia, N.K., Associated HI observations in the $Z=3.4$ radio galaxy B2 0902+343 observed with the GMRT, *J. Astrophys. Astr.*, 25, 57-65, 2004; Swarup, G., From Potts Hill (Australia) to Pune (India): The journey of a radio astronomer, *J. Astronomical History and Heritage*, 9(1), 21-33, 2006; Swarup, G., The Puzzles of the universe and the giant metrewave radio telescope, *The Republic of Science Golden Jubilee Vignettes*, ed. Ranjit Nair, published by Scientia, an Imprint of the Centre for Philosophy and Foundations of Science, 36 Panchshila Park, New Delhi, 110017, 1-13, 2007; Swarup, G., Wind drag factors for low solidity wire-meshes for parabolic dish antennas, *Proc. Fourth National Conference on WIND Engineering*, NCWE-2007, held at Structural Engineering Research Centre, Chennai, 30 Oct.-1 Nov. 2007, eds N. Lakshmanan, Arunachalam, S., Gomathinayagam, Allied Publishers, New Delhi, 129-36, 2007; Swarup, G., Reminiscences Regarding Professor W.N. Christiansen, *Journal of Astronomical History and Heritage*, 11(3), 194-202, 2008; Sirothia, S.K., Swarup, G., Shukla, H., Observations at 325 MHz of the WMAP cold spot, *The Low-Frequency Radio Universe*, eds D.J. Saikia, Dave Green, Y. Gupta and Tiziana Venturi ASP Conference Series, vol. LFRU, 51-4, 2009; Swarup, G., Scientific Quest into the Evolution of Life in the Universe, *Scientific Insights into the Evolution of the Universe and of Life*, Oct. 31-Nov. 5, 2008, eds W. Arber, N. Cabibbo and M. Sanchez Sorondo, Pontifical Academy of Sciences, Vatican City, 45-56, 2009; Swarup, G., Growth and Development of Radio Astronomy in India, *Astronomy in India: a Historical Perspective*, ed. T. Padmanabhan, Springer Pub., New York, 129-78, 2010.

Walter E. Thirring



Date of Birth 29 April 1927

Place Vienna (Austria)

Nomination 9 June 1986

Field Physics

Title Professor

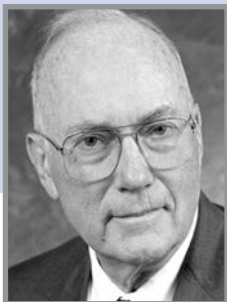
Most important awards, prizes and academies *Awards:* Max Planck Medal; Eötvös Medal (1969); Schrödinger Prize of the ÖAW; Prize of the City of Vienna; Henri Poincaré Prize 2000 of the IAMP. *Academies:* Effective Member, Austrian Academy of Science (1973-); Honorary Member, Eötvös Physics Society; Leopoldina, DDR-Academy of Sciences (1975); Pontifical Academy of Sciences (1986); Honorary Member, Hungarian Academy of Sciences. *Honorary Degrees:* Comenius University.

Summary of scientific research In my scientific activity I have tried to achieve in the various branches of theoretical physics both intuitive simplicity and mathematical rigor. Although this goal cannot be reached every where there are instances where some non-trivial general principles can be deduced from fundamental laws. This applies in particular to our work (with E. Lieb) on the stability of matter and my studies on the thermodynamic behaviour of gravitating systems. I was also fascinated by the geometrical aspects of Einstein's theory of gravity and wanted to find out why and how it is that just this force determines the geometrical structure of the world. One can actually understand that it is the universal nature of gravity which causes its influence on geometry. However, the instances where a more general understanding can be achieved are rare in the life of a scientist and most of it is struggle with details which appear to be not so important once a full understanding is gained.

Main publications Thirring, W.E., On the Divergence of Perturbation Theory for Quantized Fields, *Helv. Phys. Acta*, 26, p. 33 (1953); Thirring, W.E., Zur freien Weglänge von Neutrinos (with Houtermans, F.G.), *Helv. Phys. Acta*, 27, p. 81 (1954); Thirring, W.E., Use of Causality Conditions in Quantum Theory (with Gell-Mann, M. and Goldberger, M.), *Phys. Rev.*, 95,

p. 1612 (1954); Abstract *ibid.* p. 654; Thirring, W.E., A Soluble Relativistic Field Theory, *Ann. of Phys.*, 3, p. 91 (1958); Thirring, W.E., Lorentz-invariante Gravitationstheorien, *Fortschritte d. Physik*, Bd., (VII) 2, p. 79 (1959); Thirring, W.E., Three-Field Theory of Strong Interactions, *Nucl. Phys.*, 14, p. 565 (1959/60); Thirring, W.E., Triplet Model of Elementary Particles, *Acta Phys.*, Suppl. III (1966); Thirring, W.E., On the Mathematical Structure of the BCS-Model (with Wehrl, A.), *Commun. Math. Phys.*, 4, p. 303 (1967); Thirring, W.E., Systems with Negative Specific Heat, *Z. f. Phys.*, 235, p. 339 (1970); Thirring, W.E., Bound for the Kinetic Energy of Fermions Which Proves the Stability of Matter (with Lieb, E.H.), *Phys. Rev. Lett.*, 35, p. 687 (1975). *Books*: *A Course in Mathematical Physics*: vol. 1, *Classical Dynamical Systems*, Springer (New York, Wien, 1978); vol. 2, *Classical Field Theory*, Springer (New York, Wien, 1979, 1986); vol. 3, *Quantum Mechanics of Atoms and Molecules*, Springer (New York, Wien, 1981); vol. 4, *Quantum Mechanics of Large Systems*, Springer (New York, Wien, 1983); *On Science and Religion*, Kosmische Impressionen. Gottes Spuren in den Naturgesetzen, Molden (Wien, 2004); Thirring, W.E., *Cosmic Impressions, Traces of God in the Laws of Nature*, May 2007, pp. 208; Thirring, W.E., The Emergence of Order, the Scientific Legacy of the 20th Century, Proceedings of the Plenary Session 28 October-1 November 2010, *Acta 21* (Vatican City, 2011).

Charles Hard Townes



Date of Birth 28 July 1915

Place Greenville, SC (USA)

Nomination 26 January 1983

Field Physics

Title Professor, Nobel laureate in Physics, 1964

Most important awards, prizes and academies *Awards:* Nobel Prize in Physics (1964); Comstock Prize; John J. Carty Medal of the National Academy of Sciences; Rumford Premium of the American Academy of Arts and Sciences; Thomas Young Medal and Prize of the British Physical Society; Medal of Honor of the Institute of Electrical and Electronic Engineers; Mees Medal and Ives Medal of the Optical Society of America; Niels Bohr International Gold Medal; Plyler Prize of the American Physical Society; 2000 Founders' Award of the Nat. Academy of Engineering; Lomonosov Prize of the Russian Academy of Sciences (2001); William Exner Award of Austria; Rabindranath Tagore Birth Centenary; Plaque of the Asiatic Society; Karl Schwarzschild Medal of the Astronomische Gesellschaft; Telluride Tech Festival Award of Technology (2003); Templeton Prize for 'Progress Toward Research or Discoveries about Spiritual Realities' (2005); LeConte Medallion; Along with associate Raj Reddy, Prof. Townes was awarded the Vannevar Bush Award for Lifetime Contributions and Statesmanship to Science (2006). *Academies:* National Inventors' Hall of Fame of the USA; National Academy of Sciences; Institute for Electrical and Electronic Engineers, American Physical Society; Pontifical Academy of Sciences; Royal Society of London; American Philosophical Society; American Academy of Arts and Sciences; Optical Society of America; Indian National Science Academy; Russian Academy of Sciences.

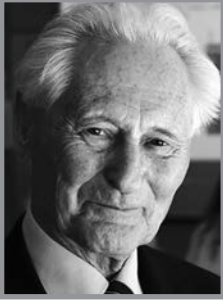
Summary of scientific research Townes' principal scientific work has been in microwave spectroscopy, molecular and nuclear structure, quantum electronics, radio astronomy, and infrared astronomy. He was one of the initiators of high resolution microwave spectroscopy and its use in detailed examination of molecular structure and nuclear moments. He and B.P. Dailey

developed an explanation of molecular hyperfine effects which allows evaluation of molecular bonding structures and of nuclear quadrupole moments. This in turn led to a systematic study of nuclear quadrupole moments and their dependence on nuclear structure. Townes initiated the field of quantum electronics, building the first maser at Columbia University. He has the fundamental patent on masers and, with A.L. Schawlow, the basic patent on lasers. This led to work on precise time and distance measurements. His subsequent work in this field included various aspects of non-linear optics, Raman scattering and self-trapping, and the use of lasers for scientific experimentation. Townes' work in radio astronomy was begun in the mid 40s with a theory of free-free emission, included the first application of maser amplifiers to radio astronomy in the 1950s, and the first discovery of complex molecules in interstellar space in the late 1960s. During the following decade, he continued active work on molecular astronomy and the interstellar medium. Since the late 1970s Townes has been occupied primarily with infrared astronomy. Much of this work has involved the invention and construction of sensitive infrared instruments both for very high spectral resolution and for high angular resolution. He has done extensive work on the interstellar medium, dense molecular clouds, and the galactic center. He is presently engaged in observing stars with a mid-infrared spatial interferometer. This instrument has located the formation of dust around stars, discovered that episodic emission of material by stars is common, provided accurate measurements of sizes of older stars, and measured the periodic expansion and contraction of Mira-type stars.

Main publications Townes, C.H., The Ammonia Spectrum and Line Shapes Near 1.25 cm Wave-Length, *Phys. Rev.*, 70, p. 665 (1946); Townes, C.H., Interpretation of Radio Radiation from the Milky Way, *Astrophys. J.*, 105, p. 235 (1946); Townes, C.H. *et al.*, Determination of Electronic Structure of Molecules from Nuclear Quadrupole Effects, *J. Chem. Phys.*, 17, p. 782 (1949); Townes, C.H. *et al.*, Nuclear Quadrupole Moments and Nuclear Shell Structure, *Phys. Rev.*, 76, p. 1415 (1949); Townes, C.H. *et al.*, The Effects of Electronic Paramagnetism on Nuclear Magnetic Resonance Frequencies in Metals, *Phys. Rev.*, 77, p. 852 (1950); Townes, C.H. *et al.*, The Maser: New Type of Microwave Amplifier, Frequency Standard, and Spectrometer, *Phys. Rev.*, 99, p. 1264 (1955); Townes, C.H., *Microwave Spectroscopy*, McGraw-Hill (New York, 1955); Townes, C.H. *et al.*, Fluctuations in Amplification of Quanta with Application to Amplifiers, *J. Phys. Soc. Japan*, 12, p. 686 (1957); also p. 517 Collection of Papers Dedicated to Masao Kotani (Tokyo, 1967); Townes, C.H. *et al.*, Infrared and Optical Masers, *Phys. Rev.*, 112, p. 1940 (1958); Townes, C.H. *et al.*, Limits

on Electromagnetic Amplification Due to Complementarity, p. 233, *Quantum Electronics* (C.H. Townes, ed.), Columbia Univ. Press (1960); Townes, C.H. *et al.*, Coherently Driven Molecular Vibrations and Light Modulation, *Phys. Rev. Letters*, 11, p. 160 (1963); Townes, C.H. *et al.*, Simulated Brillouin Scattering and Coherent Generation of Intense Waves, *Phys. Rev. Letters*, 12, p. 592 (1964); Townes, C.H. *et al.*, Detection of NH_3 Molecules in the Interstellar Medium by Their Microwave Emission, *Phys. Rev. Letters*, 21, p. 1701 (1968); Townes, C.H. *et al.*, Detection of Water in Interstellar Regions by Its Microwave Radiation, *Nature*, 221, p. 626 (1969); Townes, C.H. *et al.*, Observations of the Motion and Distribution of the Ionized Gas in the Central Parsec of the Galaxy, *Ap. J. Lett.*, 227 (1979); Townes, C.H. *et al.*, New Evidence on the Mass Distribution in the Galactic Center, *Nature*, 315, p. 767 (1985); Townes, C.H. *et al.*, The Nucleus of our Galaxy, *Rep. Prog. Phys.*, 57, p. 417 (1994); Townes, C.H. *et al.*, Characteristics of Dust Shells around 13 Late-Type Stars, *Astrom. J.*, 107, 4, p. 1469 (1994); Townes, C.H. *et al.*, Non-uniform dust outflow observed around infrared object NML Cygni, *ApJ*, 48, p. 420 (1997); Townes, C.H. *et al.*, Logic and Uncertainties in Science and Religion, *Scripta Varia* 99 (Vatican City, 2001), pp. 296-309; Townes, C.H., The Berkeley Infrared Spatial Interferometer: A Heterodyne Stellar Interferometer for the Mid-Infrared, *Ap. J.*, 537, pp. 998-1012 (2000); Townes, C.H., Interferometry on Mira in the Mid-Infrared: Cyclic Variability of the Continuum Diameter and the Effect of Spectral Lines on Apparent Size, *ApJ*, 588, pp. 1064-71 (2003); N. Short, W. Fitelson, D. Hale, and C.H. Townes, Low Altitude Atmospheric Turbulence Characteristics at Mt. Wilson Observatory, *Proceedings of SPIE*, V488, 803 (2003); J. Weiner, D. Hale, C.H. Townes, The Variability of Late-Type Stars Diameters Measured Using Mid-Infrared Interferometry, *Interferometry for Optical Astronomy II*, Conferences, August 22-28, 2002, Waikolea, Hawaii, *Proceedings of SPIE*, Vol 4838. 172-180, 2003; J. Weiner, D.D.S. Hale, and C.H. Townes, Asymptotic Giant Branch and Supergiant Stellar Diameters in the Mid-Infrared, *ApJ*, Vol. 589, 976 (2003); S. Tevosjan, J. Weiner, K.S. Abdeli, D.D.S. Hale, C.H. Townes, Mid-Infrared Interferometry on Dust Shells around 4 Late Type Stars, *ApJ*, Vol 611, 466 (2004); J. Weiner, K. Tatebe, D.D.S. Hale, C.H. Townes, J. Monnier, M. Ireland, P. Tuthill, R. Cohen, R.K. Barry, J. Rajagopol, W.C. Danchi, The Asymmetrical Dust Environment of IK Tau, *ApJ*, 636-1067 (2006); K. Tatebe, A.A. Chandler, D.D.S. Hale, and C.H. Townes, Characterisation of Dust Shell Dynamics and Asymmetry for 6 Mira-Type Stars, *ApJ*, 652, 666 (2006); K. Tatebe, D.D.S. Hale, E.H. Wishnow, and C.H. Townes, Observation of a Burst of High-Velocity Dust from - Hercules, *ApJ Letters*, April, 2007.

Hans Tuppy



Date of Birth 22 July 1924

Place Vienna (Austria)

Nomination 10 April 1970

Field Biochemistry

Title Professor Emeritus

Most important awards, prizes and academies *Academies*: Deutsche Akademie der Naturforscher 'Leopoldina'; Österreichische Akademie der Wissenschaften; Pontifical Academy of Sciences. *Honorary Degrees*: University of Veterinary Medicine and the University of Agriculture, Vienna; Österreichisches Ehrenzeichen für Wissenschaft und Kunst.

Summary of scientific research Investigations on the structure and function of biologically and biomedically important peptides and proteins (insulin, relaxin, oxytocin, cytochrome, interferon), mitochondria, blood-group antigens of the ABO and Lewis systems, and neuraminic acid derivatives.

Main publications Sanger, F. and Tuppy, H., The Amino-acid Sequence in the Phenylalanyl Chain of Insulin, *Biochem. J.*, 49, pp. 463-81 (1951); Tuppy, H., The Amino-acid Sequence in Oxytocin, *Biochem. Biophys. Acta*, 11, p. 449 (1953); Tuppy, H. and Wintersberger, E., Reinigung und Eigenschaften der Serum-Oxytocinase, *Monatshfte f. Chemie*, 91, p. 1001 (1960); Margoliash, E., Smith, E.L., Kreil, G. and Tuppy, H., The Complete Amino-acid Sequence of the Horse Heart Cytochrome C, *Nature*, 192, p. 1125 (1961); Schatz, G., Haslbrunner, E. and Tuppy, H., Deoxyribonucleic Acid Associated with Yeast Mitochondria, *Biochem. Biophys. Res. Comm.*, 15, p. 127 (1964); Wintersberger, E. and Tuppy, H., DNA-Abhängige RNA-Synthese in isolierten Hefe-Mitochondrien, *Biochem. Z.*, 341, p. 399 (1965); Meindl, P. and Tuppy, H., Über 2-Deoxy-2, 3-Dehydrosialinsäuren, *Monatshfte f. Chemie*, 100, p. 1295 (1969), *Z. Physiol. Chem.*, 350, p. 1088 (1969); Schenkel-Brunner, H. and Tuppy, H., Enzymatic Conversion of Human O into A Erythrocytes and of B into AB Erythrocytes, *Nature*, 233, p. 1272 (1969); Meindl, P., Bodo, G., Palese, P., Shulman, J. and Tuppy, H., Inhibition of Neuraminidase Activity by Derivatives of 2-deoxy-2, 3-dehydro-

N-acetylneuraminic Acid, *Virology*, 58, p. 457 (1974); Meindl, P., Bono, G. and Tuppy, H., Synthetische niedermolekulare Induktoren von Interferon, *Arzneimittelforschung*, 26, p. 303 (1976); Prohaska, R., Schenkel-Brunner, H. and Tuppy, H., Enzymatic Synthesis of Blood-group Lewis-Specific Glycolipids, *Eur. J. Biochem.*, 84, p. 161 (1978).

Rafael Vicuña



Date of Birth 12 September 1949

Place Santiago (Chile)

Nomination 11 October 2000

Field Biochemistry

Title Professor

Most important awards, prizes and academies *Honours:* Fulbright Foundation, travel fellowship (1974, 1978); Albert Einstein College of Medicine, NY, fellowship for Ph.D. studies (1974-78); International Union of Biochemistry, travel fellowship (1979); John Simon Guggenheim Memorial Foundation fellowship (1986); officially invited by the Chinese Government (mainland) to visit academic institutions (1989) and by the DFG to visit academic institutions in Germany (1998). *Academies:* Chilean Society of Biology (1973); Chilean Society of Biochemistry and Molecular Biology (1973, President 1997-99); American Society for Microbiology (1974); Association for Politics and the Life Sciences, USA (1987); Technical Association of the Pulp and Paper Industry, TAPPI, USA (1988-2000); Third World Academy of Sciences (1993); Chilean Society of Microbiology (1996); International Academy of Wood Science (1996); Latin American Academy of Sciences (1999); Chilean Academy of Sciences (1999, Vice-President 2001-03); Pontifical Academy of Sciences (2000).

Summary of scientific research Major accomplishments in the field of biochemistry of nucleic acids: the identification and characterization of two protein factors that selectively inhibit viral DNA from *φX174* phage from using the replication machinery of other single stranded DNA phages; the isolation and thorough characterization of plasmids and the restriction-modification system of the extremely thermophilic bacterium *Thermus thermophilus*; the purification and characterization of DNA polymerase from *T. thermophilus*, an enzyme that is widely used today in PCR experiments. On the other hand, some achievements in the field of microbial degradation of lignin are: the isolation, identification and characterization of natural bacterial strains able to metabolize lignin model compounds; the elucidation of metabolic pathways involving

novel catabolic intermediates; the discovery of the new enzyme benzaldehyde lyase, a proposition for its reaction mechanism and cloning and sequencing of the corresponding gene; finding that the ligninolytic system of the basidiomycete *Ceriporiopsis subvermispora* is composed of a manganese-dependent peroxidase and the copper containing phenol oxidase called laccase. Discovery of a new family of multicopper oxidases in the fungus *Phanerochaete chrysosporium*. Discovery of a transcription factor responding to copper in the same fungus. Proposition of a novel mechanism for the production of the extracellular hydrogen peroxide required as a substrate by MnP in cultures of *C. subvermispora*. Co-director of the genome project of the same fungus. Current work deals with microbial life in extremely arid environments.

Main publications R. Vicuña, J. Hurwitz, S. Wallace, M. Girard. Selective inhibition of in vitro DNA synthesis dependent on ϕ X174 compared with fd DNA. I. Protein requirements for selective inhibition. *J. Biol. Chem.* 252, 2524-33, 1977; A. Venegas, M. Motles, C. Vásquez, R. Vicuña. Conditions affecting DNA cleavage by TthI at a TthI endonuclease-dam methylase overlapping sequence. *FEBS Lett.* 130, 272-4, 1981; C. Rüttimann, M. Cotorás, J. Zaldívar, R. Vicuña. DNA polymerases from the extremely thermophilic bacterium *Thermus thermophilus* HB-8. *Eur. J. Biochem.* 149, 41-6, 1985; B. González, R. Vicuña. Benzaldehyde lyase from *Pseudomonas fluorescens* biovar I: a novel thiamine pyrophosphate-requiring enzyme. *J. Bacteriol.* 171, 2401-5, 1989; U. Urzúa, P. Kersten, R. Vicuña. Kinetics of Mn^{3+} -oxalate in reactions catalyzed by manganese peroxidase of *Ceriporiopsis subvermispora*. *Arch. Biochem. Biophys.* 360, 215-22, 1998; L. Larrondo, S. Lobos, P. Stewart, D. Cullen, R. Vicuña. Isoenzyme multiplicity and characterization of recombinant manganese peroxidases (rMnPs) from *Ceriporiopsis subvermispora* and *Phanerochaete chrysosporium*. *Appl. Environ. Microbiol.* 67, 2070-5, 2001; A. Manubens, M. Avila, P. Canessa, R. Vicuña. Differential regulation of genes encoding manganese peroxidase (MnP) in the basidiomycete *Ceriporiopsis subvermispora*. *Current Genetics* 43, 433-8, 2003; L. Larrondo, B. González, D. Cullen R. Vicuña. Characterization of a multicopper oxidase gene cluster in *Phanerochaete chrysosporium* and evidence of altered splicing of the *mco* transcripts. *Microbiology* 150, 2775-83, 2004; P. Canessa, J.M. Álvarez, R. Polanco, P. Bull, R. Vicuña. The copper-dependent ACE1 transcription factor activates the transcription of the *mco1* gene from the basidiomycete *Phanerochaete chrysosporium*. *Microbiology* 154, 491-9, 2008; A. Azúa-Bustos, C. González-Silva, R. Mancilla, L. Salas, B. Gómez-Silva, C.P. McKay, R. Vicuña. Hypolithic cyanobacteria supported only by fog in the Coastal Range of the Atacama Desert. *Microbial Ecol.* 61, 568-81, 2011.

Edward Witten



Date of Birth 26 August 1951

Place Baltimore, MD (USA)

Nomination 15 May 2006

Field Mathematical Physics

Title Professor

Most important awards, prizes and academies *Academies:* American Academy of Arts and Sciences, 1984; American Physical Society, 1984; National Academy of Sciences, 1988; Member of the Board, Americans for Peace Now, Feb. 1992-; American Philosophical Society, 1994; Royal Society, 1998; Academy of Sciences of Paris, 2000. *Honors and Awards:* MacArthur Fellowship, 1982; Einstein Medal, Einstein Society of Berne, Switzerland, 1985; Award for Physical and Mathematical Sciences, New York Academy of Sciences, 1985; Dirac Medal, International Center for Theoretical Physics, 1985; Alan T. Waterman Award, National Science Foundation, 1986; Invited Address, International Congress of Mathematicians, 1986 and 2002; Colloquium Lecturer, American Mathematical Society, 1987; Centennial Lecturer, American Mathematical Society, 1988; Fields Medal, International Union of Mathematicians, 1990; Madison Medal, Princeton University, 1992; New Jersey Pride Award, 1996; Award of the Golden Plate, American Academy of Achievement, 1997; Klein Medal, Stockholm University, 1998; Dannie Heineman Prize, American Institute of Physics, 1998; Gibbs Lecturer, American Mathematical Society, 1998; Nemmers Prize in Mathematics, Northwestern University, 2000; Clay Research Award, Clay Mathematics Institute, 2001; Shalom Award, Americans for Peace Now, 2002; National Medal of Science, 2003; Premio Pitagora, Crotona, Italy, 2005; Harvey Prize, the Technion, Israel, 2006.

Summary of scientific research Prof. Witten's research interests are in elementary particle physics, quantum field theory, and string theory. He is known for his work on dark matter detection, the behaviour of four-dimensional gauge theories, the applications of quantum field theory to mathematics, and for a variety of contributions to string theory.

Latest publications Author of 250 scientific papers. Coauthor (with M.B. Green and J.H. Schwarz) of *Superstring Theory*, Volumes 1 and 2, Cambridge University Press; *Janus Configurations, Chern-Simons Couplings, and the theta-Angle in N=4 Super Yang-Mills Theory*, D. Gaiotto, E. Witten, Apr 2008, 66pp.; *Supersymmetric Boundary Conditions in N=4 Super Yang-Mills Theory*, D. Gaiotto, E. Witten, Apr 2008, 82pp.; *Rigid Surface Operators*, S. Gukov, E. Witten, Apr 2008, 89pp.; *Mirror Symmetry, Hitchin's Equations, and Langlands Duality*, E. Witten, Feb 2008, 15pp.; *Conformal Field Theory in Four and Six Dimensions*, E. Witten, Dec 2007, 16pp. Lectures given at Symposium on *Topology, Geometry and Quantum Field Theory (Segalfest)*, Oxford, England, U.K., 24-29 Jun 2002; *Quantum Gravity Partition Functions in Three Dimensions*, A. Maloney, E. Witten, Dec 2007, 71pp.; *Geometric endoscopy and mirror symmetry*, E. Frenkel, E. Witten, Oct 2007, 130pp.; *Gauge theory and wild ramification*, E. Witten, Oct 2007, 63pp.; *Surface operators in gauge theory*, E. Witten, 2007, 6pp, *Fortsch. Phys.* 55:545-550,2007; *Three-Dimensional Gravity Revisited*, E. Witten, June 2007, 82pp.; *Gauge Theory, Ramification, and the Geometric Langlands Program*, S. Gukov, E. Witten, Dec 2006, 159pp.; *Axions in String Theory*, P. Svrcek, E. Witten, 62pp. *JHEP* 0606:051,2006; *Electric-Magnetic Duality and the Geometric Langlands Program*, A. Kapustin, E. Witten, Apr 2006, 225pp.; *New instanton effects in string theory*, C. Beasley, E. Witten, 50pp. *JHEP* 0602:060,2006; *Two-dimensional models with (0,2) supersymmetry: Perturbative aspects*, E. Witten, Apr 2005, 59pp.; *Non-Abelian localization for Chern-Simons theory*, C. Beasley, E. Witten, 133pp. *J. Diff. Geom.* 70:183-23,2005; *The Hitchin functionals and the topological B-model at one loop*, V. Pestun, E. Witten, 33pp. *Lett. Math. Phys.* 74:21-51,2005; *Direct proof of tree-level recursion relation in Yang-Mills theory*, R. Britto, F. Cachazo, B. Feng, E. Witten, Jan 2005, 8pp. *Phys. Rev. Lett.* 94:181602,2005; *Gauge theory amplitudes in twistor space and holomorphic anomaly*, F. Cachazo, P. Svrcek, E. Witten, Sep 2004, 8pp. *JHEP* 0410:077,2004; *New instanton effects in supersymmetric QCD*, C. Beasley, E. Witten, 43pp. *JHEP* 0501:056,2005; *Supersymmetry and other scenarios*, E. Witten, 2004, 6pp. *Int. J. Mod. Phys.*A19:1259-1264,2004; *Twistor space structure of one-loop amplitudes in gauge theory*, F. Cachazo, P. Svrcek, E. Witten, June 2004, 42pp. *JHEP*0410:074,2004; *Conformal super-gravity in twistor-string theory*, N. Berkovits, E. Witten, 43pp. *JHEP* 0408:009,2004; *Parity invariance for strings in twistor space*, E. Witten, Mar 2004, 17pp. *Adv. Theor. Math. Phys.* 8:779-796,2004; *MHV vertices and tree amplitudes in gauge theory*,

F. Cachazo, P. Svrcek, E. Witten, Mar 2004, 27pp. *JHEP* 0409:006,2004; Yangian symmetry in $D = 4$ superconformal Yang-Mills theory, L. Dolan, C.R. Nappi, E. Witten, Jan 2004, 16pp. *Cincinnati 2003, Quantum theory and symmetries* 300-15; The past and future of string theory, E. Witten, Jan 2002, Cambridge 2002, *The future of theoretical physics and cosmology* 455-62; Perturbative gauge theory as a string theory in twistor space, E. Witten, Dec 2003, 97pp. *Commun. Math. Phys.* 252:189-258,2004; A Relation between approaches to integrability in superconformal Yang-Mills theory, L. Dolan, C.R. Nappi, E. Witten, Aug 2003, 19pp. *JHEP* 0310:017,2003; $SL(2, \mathbb{Z})$ action on three-dimensional conformal field theories with Abelian symmetry, E. Witten, Jul 2003, 23pp. In Shifman, M. (ed.) *et al.: From fields to strings*, vol. 2 1173-1200; Residues and world sheet instantons, C. Beasley, E. Witten, 48pp. *JHEP* 0310:065,2003; Proton decay in intersecting D-brane models, I.R. Klebanov, E. Witten. PUPT-2080, Apr 2003, 21pp. *Nucl. Phys. B* 664:3-20,2003; Chiral rings and phases of supersymmetric gauge theories, F. Cachazo, N. Seiberg, E. Witten, Mar 2003, 55pp. *JHEP* 0304:018,2003; Phases of $N=1$ supersymmetric gauge theories and matrices, F. Cachazo, N. Seiberg, E. Witten, Dec 2002, 68pp. *JHEP* 0302:042,2003; Unification scale, proton decay, and manifolds of $G(2)$ holonomy, T. Friedmann, E. Witten, Nov 2002, 39pp. *Adv. Theor. Math. Phys.* 7:577-617,2003; Chiral rings and anomalies in supersymmetric gauge theory, F. Cachazo, M.R. Douglas, N. Seiberg, E. Witten, 67pp. *JHEP* 0212:071,2002; Noncommutative Yang-Mills theory and string theory, E. Witten, 1999, *Surveys Diff. Geom.* 7:685-696, 1999. Also in Cambridge 1999, *Surveys in differential geometry* 685-96; String theory, E. Witten, 6pp. *Proceedings of APS/DPF/DPB Summer Study on the Future of Particle Physics* (Snowmass 2001), Snowmass, Colorado, 30 Jun-21 Jul 2001, pp 337; Quest for unification, E. Witten, Jul 2002, 9pp. Hamburg 2002, *Supersymmetry and unification of fundamental interactions*, vol. 1 604-10; M theory and quantum mechanics, E. Witten, 1998, *Nucl. Phys. Proc. Suppl.* 62:463-466,1998. Also in Philadelphia 1997, *Supersymmetries in physics* 463-6; Hunting the Higgs, G. Kane, E. Witten, 2002, *New Sci.* 173N2336:28-32,2002; The mass question, E. Witten, 2002, *Nature* 415:969-971,2002; A Note on fluxes and superpotentials in M theory compactifications on manifolds of $G(2)$ holonomy, Chris Beasley, E. Witten, 16pp. *JHEP* 0207:046,2002; A Gravity dual of the chiral anomaly, I.R. Klebanov, P. Ouyang, E. Witten, 15pp. *Phys. Rev. D* 65:105007,2002; Deconstruction, $G(2)$ holonomy, and doublet triplet splitting, E. Witten, Oct 2001,

20pp. Hamburg 2002, *Supersymmetry and unification of fundamental interactions*, vol. 1 472-91; *Multitrace operators, boundary conditions, and AdS/CFT correspondence*, E. Witten, Dec 2001, 12pp.; Reflections on the fate of space-time, E. Witten, 2001, in Callender, C. (ed.): *Physics meets philosophy at the Planck scale*, 125-37. *Phys. Today* 49N4:24-30,1996; *Chiral fermions from manifolds of $G(2)$ holonomy*, B. Acharya, E. Witten, 26pp.; Conformal operators for partially massless states, L. Dolan, C.R. Nappi, E. Witten, Sep 2001, 13pp. *JHEP* 0110:016,2001; *Anomaly cancellation on $G(2)$ manifolds*, E. Witten, Aug 2001, 15pp.; *M theory dynamics on a manifold of $G(2)$ holonomy*, M. Atiyah, E. Witten, Jun 2001, 104pp.; *Adv. Theor. Math. Phys.* 6:1-106,2003; Quantum gravity in de Sitter space, E. Witten, June 2001, 19pp. Prepared for *International School of Subnuclear Physics: 39th Course: New Fields and Strings in Subnuclear Physics*, Erice, Italy, 29 Aug-7 Sep 2001; Anomaly analysis of brane-anti-brane systems, J.H. Schwarz, E. Witten, 28pp. *JHEP* 0103:032,2001; Quantum Yang-Mills theory, A.M. Jaffe, E. Witten, 2000, 15pp. *Clay Mathematics Institute Millennium Prize problem*; BPS Bound states of D0-D6 and D0-D8 systems in a B field, E. Witten, Dec 2000, 16pp. *JHEP* 0204:012,2002; The Hagedorn transition in noncommutative open string theory, S.S. Gubser, S. Gukov, I.R. Klebanov, M. Rangamani, E. Witten, 22pp. *J. Math. Phys.* 42:2749-2764,2001; Overview of K theory applied to strings, E. Witten, Jul 2000, 17pp. *Int. J. Mod. Phys. A* 16:693-706,2001. Also in Ann Arbor 2000, Strings 53-66; Lepton number and neutrino masses, E. Witten, Jun 2000, 5pp. *Nucl. Phys. Proc. Suppl.* 91:3-8,2001. Also in Sudbury 2000, Neutrino physics and astrophysics 3-8; Noncommutative tachyons and string field theory, E. Witten, June 2000, 13pp.; Supersymmetric index in four-dimensional gauge theories, E. Witten, May 2000, 66pp. *Adv. Theor. Math. Phys.* 5:841-907,2002; Two two-dimensional supergravity theories from Calabi-Yau four folds, S.J. Gates, Jr., S. Gukov, E. Witten, 46pp. *Nucl. Phys. B* 584:109-148,2000; A Derivation of K theory from M theory, D.-E. Diaconescu, G.W. Moore, E. Witten, IASSNS-HEP-00-38, May 2000. 17pp.

Shinya Yamanaka



Date of Birth 4 September 1962

Place Higashiōsaka, Osaka, Japan

Nomination 23 January 2013

Field Stem cell biology

Title Professor of Anatomy; Director of the Center for iPS Cell Research and Applications; Nobel Laureate in Physiology or Medicine, 2012

Most important awards, prizes and academies *Awards and prizes:* NAIST Award, Nara Institute of Science and Technology, Japan (2003); Gold Medal, Tokyo Techno Forum 21, Japan (2004); JSPS Prize, Japan Society for the Promotion of Science (2007); Nikkei BP Technology Award, Nikkei Business Publications, Inc., Japan (2007); 25th Osaka Science Prize, Japan (2007); Meyenburg Cancer Research Award, Germany (2007); Robert-Koch Preis, Germany (2008); Nikkei BP Golden Award, Nikkei Business Publications, Inc., Japan (2008); The Special Prize for Science and Technology, the Minister of Education, Culture, Sports, Science and Technology, Japan (2008); Selected as one of the “TIME 100”, Time magazine’s most influential people in the world (2008); Medals of Honor from the Japanese Government (“Shiju Hoshō”, Medals with Purple Ribbon), Japan (2008); Meira and Shaul G. Massry Prize (2008); Lifetime Scientific Achievement Award, American Skin Association (2008); Lewis S. Rosenstiel Award for Distinguished Work in Basic Medical Science (2009); Canada Gairdner International Award, The Gairdner Foundation, Canada (2009); Nikkei BP Technology Award, Nikkei Business Publications, Inc., Japan (2009); Albert Lasker Basic Medical Research Award, USA (2009); March of Dimes Prize in Developmental Biology (2010); Mayor of Osaka Special Award, Japan (2010); 100th Imperial Prize and Japan Academy Prize, The Japan Academy, Japan (2010); Kyoto Medal of Honor, Japan (2010); Person of Cultural Merit, Japan (2010); Medical Award of the Japan Medical Association, Japan (2010); 26th annual Kyoto Prize in Advanced Technology, Japan (2010); Balzan Prize for Stem Cells, Italy (2010); BBVA Foundation Frontiers of Knowledge Award in the Biomedicine category, Spain (2010); Warren Triennial Prize of Massachusetts General Hospital (MGH) (2011); King Faisal International Prize for Science (Medicine), Saudi Arabia

(2011); Wolf Prize in Medicine, Israel (2011); ISSCR McEwen Centre Award for Innovation (2011); Millennium Technology Award (2012); Nobel Prize, Physiology or Medicine (2012). *Academies*: National Academy of Sciences, Foreign Associate; International Society for Stem Cell Research, Board of Directors; The Japanese Pharmacological Society; The Japanese Society for Regenerative Medicine; The Molecular Biology Society of Japan; The RNA Society of Japan; The Japanese Orthopaedic Association.

Summary of scientific research Dr. Yamanaka's current research focuses on ways to generate cells resembling embryonic stem cells by reprogramming somatic, or skin, cells. He seeks to understand the molecular mechanisms that underlie pluripotency and the rapid proliferation of embryonic stem cells – they can become any type of cell in the body – and to identify the factors that induce reprogramming. Pluripotent stem cells can be generated from adult mouse-tail tip fibroblasts and adult human fibroblasts by the retrovirus-mediated transfection of four transcription factors, Oct3/4, Sox2, c-Myc, and Klf4. Professor Yamanaka has designated these cells as induced pluripotent stem (iPS) cells. Mouse iPS cells are indistinguishable from embryonic stem cells in morphology, proliferation, gene expression and teratoma formation. When transplanted into blastocysts, mouse iPS cells derived from mouse embryonic fibroblasts can give rise to adult chimeras, which are competent for germline transmission. These results are proof-of-principle that pluripotent stem cells can be generated from somatic cells by the combination of a small number of factors. Professor Yamanaka demonstrated that not a single "master" transcription factor, but rather a combination of factors, are important for reprogramming of cell fate from one somatic lineage back to a pluripotent state. However, the molecular mechanism of its process remains unclear. Improving our understanding of this mechanism is essential to determine the best induction protocols for each downstream application of iPS cell technology, such as disease modeling, drug screening and cell therapy.

Latest publications Shinya Yamanaka, MD, PhD – Fujishiro SH, Nakano K, Mizukami Y, Azami T, Arai Y, Matsunari H, Ishino R, Nishimura T, Watanabe M, Abe T, Furukawa Y, Umeyama K, Yamanaka S, Ema M, Nagashima H, Hanazono Y. Generation of Naive-like Porcine Induced Pluripotent Stem Cells Capable of Contributing to Embryonic and Fetal Development. *Stem Cells Dev.* 2012 Aug 13; Shinya Yamanaka, MD, PhD – Blanpain C, Daley GQ, Hochedlinger K, Passegue E, Rossant J, Yamanaka S. (2012) Stem cells assessed. *Nat Rev Mol Cell Biol* 13: 471-6; Shinya Yamanaka, MD, PhD – Tanaka T, Takahashi K, Yamane M, Tomida S, Nakamura S, Oshima K, Niwa

A, Nishikomori R, Kambe N, Hara H, Mitsuyama M, Morone N, Heuser JE, Yamamoto T, Watanabe A, Sato-Otsubo A, Ogawa S, Asaka I, Heike T, Yamanaka S, Nakahata T, Saito MK. Induced pluripotent stem cells from CIN-CA syndrome patients as a model for dissecting somatic mosaicism and drug discovery. *Blood*. 2012 Aug 9; 120(6):1299-308; Shinya Yamanaka, MD, PhD – Isobe H, Shoji M, Yamanaka S, Umena Y, Kawakami K, Kamiya N, Shen JR, Yamaguchi K. (2012) Theoretical illumination of water-inserted structures of the CaMn₄O₅ cluster in the S₂ and S₃ states of oxygen-evolving complex of photosystem II: full geometry optimizations by B3LYP hybrid density functional. *Dalton Trans* 41: 13727-40; Shinya Yamanaka, MD, PhD – Kobayashi Y, Okada Y, Itakura G, Iwai H, Nishimura S, Yasuda A, Nori S, Hikishima K, Konomi T, Fujiyoshi K, Tsuji O, Toyama Y, Yamanaka S, Nakamura M, Okano H. (2012) Pre-Evaluated Safe Human iPSC-Derived Neural Stem Cells Promote Functional Recovery after Spinal Cord Injury in Common Marmoset without Tumorigenicity. *PLoS One* 7: e52787; Shinya Yamanaka, MD, PhD – Okita K, Yamakawa T, Matsumura Y, Sato Y, Amano N, Watanabe A, Goshima N, Yamanaka S. (2012) An Efficient Non-viral Method to Generate Integration-Free Human iPS Cells from Cord Blood and Peripheral Blood Cells. *Stem Cells*; Shinya Yamanaka, MD, PhD – Tanaka K, Isobe H, Yamanaka S, Yamaguchi K. (2012) Similarities of artificial photosystems by ruthenium oxo complexes and native water splitting systems. *Proc Natl Acad Sci U S A* 109: 15600-5; Shinya Yamanaka, MD, PhD – Yamana R, Iwasaki M, Wakabayashi M, Nakagawa M, Yamanaka S, Ishihama Y. (2012) Rapid and Deep Profiling of Human Induced Pluripotent Stem Cell Proteome by One-shot NanoLC-MS/MS Analysis with Meter-scale Monolithic Silica Columns. *J Proteome Res*; Shinya Yamanaka, MD, PhD – Yamana R, Iwasaki M, Wakabayashi M, Nakagawa M, Yamanaka S, Ishihama Y. (2013) Rapid and Deep Profiling of Human Induced Pluripotent Stem Cell Proteome by One-shot NanoLC-MS/MS Analysis with Meter-scale Monolithic Silica Columns. *J Proteome Res* 12: 214-21; Shinya Yamanaka, MD, PhD – Yamanaka S. Induced pluripotent stem cells: past, present, and future. *Cell Stem Cell*. 2012 Jun 14; 10(6):678-84.

Chen Ning Yang



Date of Birth 22 September 1922

Place Anhui (PRC)

Nomination 10 February 1997

Field Physics

Title Professor, Nobel laureate in Physics, 1957

Most important awards, prizes and academies *Awards:* Nobel Prize in Physics (1957); US National Medal of Science (1986); King Faisal International Prize (2001). *Academies:* US National Academy of Science; Russian Academy of Sciences; National Academy of the PRC; Academia Sinica; Royal Society of London.

Summary of scientific research Yang's work in theoretical physics extends over several areas. In elementary particle theory he introduced in the early 1950s effective use of the concept of symmetry in analyzing phenomena related to the new particles. This line of research included the work he did in 1957 with T.D. Lee on parity non-conservation which won them the Nobel Prize. A few years before that in 1954 working with R.L. Mills, Yang greatly extended the use of symmetry by proposing a non-Abelian gauge theory. This theory, some 20 years later, was recognized as being of fundamental importance and is the foundation on which the present theory of elementary particles is built. Yang is also active in statistical mechanics in which he clarified with T.D. Lee the theory of phase transitions. His later work in the 1960s in this field led to the famous Yang-Baxter equation.

Main publications Yang, C.N., Field Theory. Most Important Paper being the one with R.L. Mills, *Phys. Rev.* 96, p. 191 (1954), (establishing the Yang-Mills theory); Yang, C.N., High Energy Phenomenology. Most Important Paper being the one with T.D. Lee, *Phys. Rev.* 104, p. 254 (1956), (proposing non-conservation of parity in weak interactions); Yang, C.N., Statistical Mechanics. Most Important Paper being *Phys. Rev. Letters* 19, p. 1312 (1967), (giving the Yang-Baxter equation); Yang, C.N., Condensed Matter Theory. Most important paper being *Rev. Mods. Physics* 34, p. 694 (1962), (on the concept of ODLRO). Over 250 papers in scientific journals; Selected Papers with Commentary, published by Freeman Co. in 1983.

Ahmed H. Zewail



Date of Birth 26 February 1946

Place Damanhour (Egypt)

Nomination 3 September 1999

Field Physics and Chemistry

Title Professor, Nobel laureate in Physics, 1999

Most important awards, prizes and academies *Awards:* King Faisal International Prize in Science (1989); First Linus Pauling Chair, Caltech (1990); Wolf Prize in Chemistry (1993); Robert A. Welch Award in Chemistry (1997); Benjamin Franklin Medal, The Franklin Institute, USA (1998); Egypt Postage Stamps, with Portrait (1998); 'The Fourth Pyramid' (1999); Nobel Prize in Chemistry (1999); Order of the Grand Collar of the Nile, Highest Honor of Egypt, conferred by President Mubarak (1999); Ahmed Zewail Fellowships, University of Pennsylvania, USA (2000-); Ahmed Zewail Prize, American University in Cairo (2001-); Postage Stamp, issued by the country of Ghana (2002); Albert Einstein World Award (2006). *Academies:* Ahmed Zewail Center for FemtoScience & Technology, Korea (2002); Fellow, American Physical Society (1982); National Academy of Sciences, USA (1989); Third World Academy of Sciences, Italy (1989); St Catherine's College, Fellow, Oxford, UK (1991); Sigma Xi Society (1992); American Academy of Arts and Sciences (1993); Académie Européenne des Sciences, des Arts et des Lettres, France (1994); American Philosophical Society (1998); Pontifical Academy of Sciences (1999); American Academy of Achievement (1999); Royal Danish Academy of Sciences & Letters (2000); Fellow, American Association for the Advancement of Science, AAAS (2000); Honorary Fellow, Chemical Society of India (2001); Indian Academy of Sciences, Bangalore, India (2001); Foreign Member, Royal Society of London, UK (2001); Honorary Fellow, Sydney Sussex College, Cambridge, UK (2002); Foreign Fellow, Indian National Science Academy, New Delhi, India (2002); Honorary Foreign Member, Korean Academy of Science and Technology (2002); Honorary Fellow, African Academy of Sciences, Nairobi, Kenya (2002); Honorary Fellow, Royal Society of Chemistry, UK (2003); Foreign Member, Russian Academy of Sciences (2003); Forei-

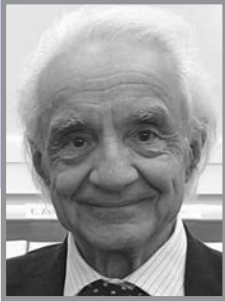
gn Member, Royal Swedish Academy of Sciences, Stockholm (2003); Foreign Member, Royal Academy of Belgium, Brussels (2003).

Summary of scientific research Current research is devoted to dynamical chemistry and biology, with a focus on the physics of elementary processes in complex systems. In the Laboratory for Molecular Sciences (LMS) Center, collaborative multidisciplinary research has been established to address the role of complexity in the primary function of real systems including enzyme catalysis, protein-RNA transcription, electron transport in DNA, and the role of water in protein and DNA recognitions. A major research frontier at LMS is the new development of ultrafast diffraction techniques that make possible the imaging of transient structures in space and time with atomic-scale resolution. A significant effort is also devoted to giving public lectures to enhance awareness of the value of knowledge gained from fundamental research, and helping the population of developing countries through the promotion of science and technology for the betterment of society.

Main publications *Physics & Chemistry – Ultrafast Electron Diffraction*: Thee, H., Lobastov, V., Gomez, U., Goodson, B., Srinivasan, R., Ruan, C.-Y. and Zewail, A.H., Direct Imaging of Transient Molecular Structures with Ultrafast Diffraction, *Science*, 291, p. 385 (2001); Thee, H., Cao, J. and Zewail, A.H., Ultrafast Electron Diffraction of Transient $\text{Fe}(\text{CO})_4$: Determination of Molecular Structure and Reaction Pathway, *Angew. Chem., Int. Ed. Engl.*, 40/8, p. 1532 (2001); Ruan, C.-Y., Lobastov, V.A., Srinivasan, R., Goodson, B.M., Thee, H. and Zewail, A.H., Ultrafast Diffraction and Structural Dynamics – The Nature of Complex Molecules Far from Equilibrium, *Proc. Natl. Acad. Sci.*, 98, p. 7117 (2001); Lobostov, V.A., Srinivasan, R., Goodson, B.M., Ruan, C.-Y., Feenstra, J.S. and Zewail, A.H., Ultrafast Diffraction of Transient Molecular Structures in Radiationless Transitions, *J. Phys. Chem. A*, 105, p. 11159 (2001); Zewail, A.H., The Uncertainty Paradox – The Fog That Was Not, *Nature*, 412, p. 279 (2001); Thee, H., Goodson, B.M., Srinivasan, R., Lobastov, V.A. and Zewail, A.H., Ultrafast Electron Diffraction and Structural Dynamics: Transient Intermediates in the Elimination Reaction of $\text{C}_2\text{F}_4\text{I}_2$, *J. Phys. Chem. A*, 106, p. 4087 (2002); Goodson, B.M., Ruan, C.-Y., Lobastov, V.A., Srinivasan, R. and Zewail, A.H., Complex Landscapes of Molecular Structures Imaged by Ultrafast Electron Diffraction: Thermal and Light-Mediated Reactions, *Chem. Phys. Lett.* (2003); Srinivasan, R., Lobastov, V.A., Ruan, C.-Y. and Zewail, A.H., Ultrafast Electron Diffraction, (UED) A New Development for the 4D Determination of Transient Molecular Structures, Review Article, *Helvetica Chimica Acta*, June Special Issue, 1 (2003). *Biology – Protein and DNA Ultrafast Dynamics*: Wan, C., Fiebig, T.,

Schiemann, O., Barton, J.K. and Zewail, A.H., Femtosecond Direct Observation of Charge Transfer between Bases in DNA, *Proc. Natl. Acad. Sci.*, 97, p. 14052 (2000); Qu, X., Wan, C., Becker, H.-C., Zhong, D. and Zewail, A.H., The Anti-cancer Drug-DNA Complex: Femtosecond Primary Dynamics for Anthracycline Antibiotics Function, *Proc. Natl. Acad. Sci.*, 98, p. 14212 (2001); Pal, S.K., Peon, J. and Zewail, A.H., Ultrafast Surface Hydration Dynamics and Expression of Protein Functionality: α -Chymotrypsin, *Proc. Natl. Acad. Sci.*, 99, p. 15297 (2002); Pal, S.K., Peon, J. and Zewail, A.H., Hydration at the Surface of the Protein Monellin: Dynamics with Femtosecond Resolution, *Proc. Natl. Acad. Sci.*, 99, p. 10964 (2002); Fiebig, T., Wan, C. and Zewail, A.H., Femtosecond Charge Transfer Dynamics of a Modified DNA Base: 2-Aminopurine in Complexes with Nucleotides, *J. Phys. Chem.*, 3, pp. 781-8 (2002); Yu, H.-Z., Baskin, J.S. and Zewail, A.H., Ultrafast Dynamics of Porphyrins in the Condensed Phase. II. Zinc Tetraphenylporphyrin, *J. Phys. Chem. A*, 106, p. 9845 (2002); Pal, S.K., Peon, J., Bagchi, B. and Zewail, A.H. (feature article), Biological Water: Femtosecond Dynamics of Macromolecular Hydration, *J. Phys. Chem. B*, 106, p. 12376 (2002). *World Affairs – Science, Public Education & Aiding the Third World*: Zewail, A.H., The New World Dis-Order – Can Science Aid the Have-Nots?, Proceedings of the Jubilee Plenary Session of the Pontifical Academy of Sciences, *Science and the Future of Mankind*, 99 (2000); Zewail, A.H., Science for the Have-Nots, *Nature*, 410, p. 741 (2001); Zewail, A.H., Dialogue of Civilizations: Making History Through New World Vision, *SSQ2/Journal*, Routledge Press (Paris, France, 2002), adapted from a public address at UNESCO, April 20, 2002; Zewail, A.H., *Dilemma of Science in the Developing World: Personal Reflections*, Third World Academy of Sciences Publication, 2003, based on Keynote Speech at the General Assembly of TWAS, New Delhi, October 22, 2002; Zewail, A.H., *Voyage Through Time – Walks of Life to the Nobel Prize*, American University Press (2002), two new editions and 17 translations into other languages; Zewail, A.H., Femtochemistry – Atomic-Scale Dynamics of the Chemical Bond using Ultrafast Lasers (Nobel Paper), *Angewandte Chemie*, Invited, International Edition, 39, pp. 2586-2631 (2000), German Edition, 112, pp. 2688-2738 (2000) Nobel Paper; A.H. Zewail, *Asr Al Álm* (Arabic), Dar Al Shorouk, Beirut-Cairo, 2005; appeared in the 7th edition since publication in June 2005; A.H. Zewail, *Al Zaman* (Time) Book Series, *Zewail Lectures* (Arabic), Dar Al Shorouk, Cairo, 2007; A.H. Zewail, *Hewar Al Hadarat* (Dialogue of Civilizations) Book Series, *Zewail Lectures* (Arabic), Dar Al Shorouk, Cairo, 2007; *Physical Biology: From Atoms to Medicine*, ed. A.H. Zewail, Imperial College Press, London, 2008.

Antonino Zichichi



Date of Birth 15 October 1929

Place Trapani (Italy)

Nomination 12 June 2000

Field Physics

Title Professor

Zichichi

Most important awards, prizes and academies Many honours and awards have been conferred upon Antonino Zichichi for his outstanding discoveries and inventions and for his contributions to the promotion of Science and Scientific Culture in Italy and abroad. He is the recipient of over 60 prizes and honorary awards among which: *Doctor Honoris Causa* in the Universities of Beijing, Buenos Aires, Malta, Bucharest, Arizona. *Academies*: Academy of Sciences of the Ukrainian Republic; Academy of Sciences of Georgia; Bologna Academy of Sciences; Pontifical Academy of Sciences. *Honours*: Order of Merit of the Republic of Poland; Order of Merit of the Federal Republic of Germany; Order of Merit of the Italian Republic; Gold Medal for Science and Culture of the President of the Italian Republic. For his discovery of Nuclear Antimatter the Italian Physical Society awarded him, in 2001, the Enrico Fermi Prize, established to celebrate the centennial anniversary of the birth of the great Italian physicist. He founded and directs the Ettore Majorana Centre for Scientific Culture, the first example of the University for the Third Millennium, making Erice famous worldwide. He is past President of the INFN (Italian National Institute for Nuclear Physics), of the EPS (European Physical Society) and of the NATO Science Committee for Disarmament Technology (nuclear, chemical, bacteriological and conventional).

Summary of scientific research Antonino Zichichi is the author of studies and research into the structure of the elementary building blocks and of the fundamental forces of Nature. He has published over 500 scientific papers, some of which have opened new avenues in Subnuclear Physics at High Energies, and has to his credit: the discovery of Nuclear Antimatter [1]; the conjecture of the existence of a Third Lepton [2] and the invention of new technologies [3-4] which led to the discovery of the Third Family in the struc-

ture of the fundamental particles [5]; the first direct measurements of the mixing angles in pseudoscalar [6] and vector mesons [7] [8]; the discovery of the 'time-like' electromagnetic structure of the proton [9]; the discovery – in the forces which act between quarks and gluons – of the Effective Energy [10]; the proof that, despite its complex structure, it is impossible to break the proton [11], the ultimate heavy building-block of the Universe; the phenomenological discovery of the EGM effect which lowers by three orders of magnitude the supersymmetry breaking threshold energy [12]. At the present time he is engaged in a series of new experiments [13]; at CERN (Geneva), he directs the LAA project [14] and the TOF project of the ALICE experiment for LHC; at DESY (Hamburg), he takes part in the HERA ZEUS experiment; at Gran Sasso, he directs the LVD experiment.

Main publications [1] Massam, T., Muller, Th., Righini, B., Schneegans, M. and Zichichi, A., Experimental Observation of Antideuteron Production, *Nuovo Cimento*, 39, p. 10 (1965); [2] Zichichi, A. *et al.*, A Proposal to Search for Leptonic Quarks and Heavy Leptons Produced by ADONE, *INFN/AE-67/3*, 20 March 1967; Zichichi, A. *et al.*, Limits on the Electromagnetic Production of Heavy Leptons, *Lettere al Nuovo Cimento*, 4, p. 1156 (1970); Zichichi, A. *et al.*, Limits on the Mass of Heavy Leptons, *Nuovo Cimento*, 17A, p. 383 (1973); [3] Massam, T., Muller, Th. and Zichichi, A., A Telescope to Identify Electrons in the Presence of Pion Background, *CERN Report 63-25*, 27 June 1963 and *Nuovo Cimento*, 39, p. 464 (1965); Zichichi, A. *et al.*, Un Grand Détecteur E.M. à Haute Réjection des Pions, *Revue de Physique Appliquée*, 4, p. 108 (1969); Zichichi, A. *et al.*, A Large Electromagnetic Shower Detector with High Rejection Power Against Pions, *Nuclear Instruments and Methods*, 101, p. 433 (1972); [4] Zichichi, A. *et al.*, Range Measurements for Muons in the GeV Region, *CERN Report 64-31*, 24 June 1964 and *Nuovo Cimento*, 35, p. 759 (1965); [5] Wu, C.S., Lee, T.D., Cabibbo, N., Weisskopf, V.F., Ting, S.C.C., Villi, C., Conversi, M., Petermann, A., Wiik, B.H. and Wolf, G., *The Origin of the Third Family* (C.S. Wu, ed.), a joint publication by University and Academy of Sciences of Bologna, INFN, SIF (1997), World Scientific (1998); [6] Zichichi, A. *et al.*, Evidence for a New Decay Mode of the X^0 -Meson: $X^0 \rightarrow 2\gamma$, *Nuovo Cimento*, 58A, p. 289 (1968); [7] Zichichi, A. *et al.*, Observation of the Rare Decay Mode of the ϕ -Meson: $\phi \rightarrow e^+e^-$, *Nuovo Cimento*, 56A, p. 1173 (1968); Zichichi, A. *et al.*, The Decay Mode $\omega \rightarrow e^+e^-$ and a Direct Determination of the ω - ϕ Mixing Angle, *Nuovo Cimento*, 57A, p. 404 (1968); Zichichi, A. *et al.*, Evidence for the New Decay Mode $\phi \rightarrow \eta\gamma$, *Proceedings of the International Conference on Meson Resonances and Related Electromagnetic Phenomena*,

Bologna, Italy, 14-16 April 1971 (Editrice Compositori, Bologna, 1972), p. 265; [8] Zichichi, A., An Apparatus of the NBC Type and the Physics Results Obtained, *Annals of Physics*, 66, p. 405 (1971); [9] Conversi, M., Massam, T., Muller, Th. and Zichichi, A., Search for the Time-Like Structure of the Proton, *Phys. Lett.*, 5, p. 195 (1963); Conversi, M., Massam, T., Muller, Th. and Zichichi, A., The Leptonic Annihilation Modes of the Proton-Antiproton System at 6.8 (GeV/c)² Timelike Four-Momentum Transfer, *Nuovo Cimento*, 40, p. 690 (1965); [10] Zichichi, A. *et al.*, Evidence of the Same Multiparticle Production Mechanism in p-p Collisions as in e⁺e⁻ Annihilation, *Physics Letters*, 92B, p. 67 (1980); [11] Massam, T. and Zichichi, A., *Quark Search at the ISR*, CERN (pre-print), Geneva, Switzerland, June 1968; Zichichi, A. *et al.*, Search for Fractionally Charged Particles Produced in Proton-Proton Collisions at the Highest ISR Energy, *Nuovo Cimento*, 40A, p. 41 (1977); Zichichi, A. *et al.*, Search for Quarks in Proton-Proton Interactions at $\sqrt{s} = 52.5$ GeV, *Nuovo Cimento*, 45A, p. 171 (1978); Zichichi, A. *et al.*, A Search for Quarks in the CERN SPS Neutrino Beam, *Nuovo Cimento*, 45A, p. 281 (1978); [12] Anselmo, F., Cifarelli, L., Peterman, A. and Zichichi, A., The Simultaneous Evolution of Masses and Couplings: Consequence on Supersymmetry Spectra and Thresholds, *Nuovo Cimento*, 105 A, p. 1179, (1992); [13] John Bell and the Ten Challenges of Subnuclear Physics, Presented at the symposium Quantum [Un]Speakables, Erwin Schrödinger Institute, Vienna, 10 November 2000; [14] Zichichi, A. *et al.*, The Main Achievements of the LAA Project, Report No. 7, CERN/LAA/91-1, 1 March 1991. Books: *L'Infinito*, Rizzoli-Bur (1988 1st ed., 1994 7th ed.), Pratiche Editrice, 6 ed. (1998-2001), and NET (2005); *Scienza ed Emergenze Planetarie*, Rizzoli (1993 1st ed., 1994 3rd ed.), Supersaggi Rizzoli (1996 1st ed., 1999 7th ed., 2005 23rd ed.); *Creativity in Science* (1st ed. 1996, World Scientific, 1999; translated into Russian and published by YPCC, Moscow 2001); *Subnuclear Physics – The first fifty years*, O. Barnabei, P. Pupillo and F. Roversi Monaco eds, a joint publication by the University and the Academy of Sciences of Bologna, Italy (1998); 20th Century Physics Series, Vol. 24, World Scientific (2000-2001); *Perché io credo in Colui che ha fatto il mondo*, il Saggiatore, 23 editions (1999-2005); *L'irresistibile fascino del Tempo*, il Saggiatore, 5 editions (2000), and NET, 3 editions (2004-2005); *Galilei, divin uomo*, il Saggiatore (2001-2005); *Il vero e il falso*, il Saggiatore, 4 editions (2003-2005); *Galilei. Dall'Ipse Dixit al processo di oggi. 100 risposte*, il Saggiatore (2004); *Tra Fede e Scienza. Da Giovanni Paolo II a Benedetto XVI*, il Saggiatore (2005).

DECEASED ACADEMICIANS*

ABDERHALDEN Emil (28-10-1936), Professor of Physiology, University of Zurich, Switzerland.

9-3-1877, † 5-8-1950

ABRAGAM Anatole (12-5-1981), Honorary Professor of Physics, Collège de France, Paris, France.

15-12-1914, † 8-6-2011

ALBAREDA Card. **Anselmo Maria**, O.S.B. (5-10-1962), Prefect, Apostolic Vatican Library, Vatican City; Academician 'Perdurante Munere' from 28-10-1936 to 19-3-1962, (Honorary Academician).

16-2-1892, † 20-7-1966

ALBAREDA HERRERA Rev. **José Maria** (29-5-1948), Rector, Catholic University of Pamplona and Director, Instituto Español de Edafología y Fisiología vegetal, University of Madrid, Spain.

15-4-1902, † 27-3-1966

de ALMEIDA Antonio (3-5-1961), Professor of Anthropology, University of Lisbon, Portugal.

21-8-1900, † 17-11-1984

AMALDI Ugo (28-10-1936), Professor of Algebraic and Infinitesimal Mathematical Analysis, University of Rome, Italy.

18-4-1875, † 11-11-1957

ANFINSEN Christian Boehmer (12-5-1981), Professor of Biology, Johns Hopkins University, Baltimore, MD, USA. Nobel laureate in Chemistry, 1972.

26-3-1916, † 14-5-1995

APPLETON Sir **Edward Victor** (29-5-1948), Vice-Chancellor and Principal, University of Edinburgh, UK. Nobel laureate in Physics, 1947.

6-9-1892, † 21-4-1965

ARMELLINI Giuseppe (28-10-1936), Professor of Astronomy, University of Rome and Director, Astronomy Observatory, Rome, Italy.

24-10-1887, † 16-7-1958

BARROIS Charles Eugène (28-10-1936), Professor of Geology, University of Lille, France.

21-4-1851, † 8-11-1939

*The date in brackets is the date of appointment to the Academy.

BERGSTRÖM Sune (14-12-1985), Professor of Human Biology and Medical Sciences, Karolinska Institutet, Stockholm, Sweden. Nobel laureate in Physiology or Medicine 1982.

10-1-1916, † 15-8-2004

BEST Charles Herbert (5-4-1955), Director, C.H. Best Institute, Toronto, Canada.

27-2-1899, † 31-3-1978

BIANCHI Emilio (28-10-1936), Professor of Astronomy and Geodesic Science, University of Milan and Director, Astronomy Observatory, Milan, Italy.

26-9-1875, † 11-9-1941

BIRKHOFF George David (28-10-1936), Professor of Mathematics, University of Harvard, Cambridge, MA, USA.

21-3-1884, † 12-11-1944

BISLETI Card. Gaetano (28-10-1936), Prefect, Holy Congregation for Seminaries and Educational Institutions, Vatican City (Honorary Academician).

21-3-1856, † 30-8-1937

BJERKNES Vilhelm Frimann Koren (28-10-1936), Professor of Mechanics and Mathematical Physics, University of Oslo, Norway.

14-3-1862, † 7-4-1951

BLANC-LAPIERRE André Joseph (17-4-1978), Professor of Physics, University of Paris-Sud Orsay and Former President, Académie des sciences, Paris, France.

7-7-1915, † 14-12-2001

BOHR Aage (17-4-1978), Director of the Niels Bohr Institute, Copenhagen, Denmark. Nobel laureate in Physics 1975.

19-6-1922, † 8-9-2009

BOHR Niels (28-10-1936), Professor of Physics, University of Copenhagen, Denmark. Nobel laureate in Physics 1922.

7-10-1885, † 18-11-1962

BOLDRINI Marcello (28-10-1936), Professor of Statistics, University of Rome, Italy.

9-2-1890, † 5-3-1969

BONINO Giovanni Battista (23-5-1942), Professor of Chemical Physics, University of Bologna, Italy.

3-5-1899, † 11-12-1985

BORSUK Karol (14-1-1982), Director of the Mathematical Department, University of Warsaw, Poland.

8-5-1905, † 24-1-1982

BOTTAZZI Filippo (28-10-1936), Professor of Physiology, University of Naples, Italy.

23-12-1867, † 19-9-1941

BOYLE Rev. **Leonard E.**, O.P. (24-5-1984), Prefect, Apostolic Vatican Library, Vatican City, until 23-5-1997; Academician 'Perdurante Munere'.

13-11-1923, † 25-10-1999

BRANLY Edouard (28-10-1936), Professor of Physics, Ecole Supérieure des Sciences de l'Institut Catholique, Paris, France.

23-10-1844, † 24-3-1940

de BROGLIE Louis (5-4-1955), Honorary Professor of Physics, Faculté des Sciences de Paris, France; Honorary Perpetual Secretary, Académie des sciences, Paris, France.

15-8-1892, † 19-3-1987

BRÜCK Hermann Alexander (5-4-1955), Professor of Astronomy, University of Edinburgh, UK.

15-8-1905, † 4-3-2000

BULLEN Keith Edward (22-4-1968), Professor of Applied Mathematics, University of Sydney, Australia.

29-6-1906, † 23-9-1976

BUYTENDIJK Frederik Jacobus Johannes (28-10-1936), Professor of Physiology, University of Utrecht, Netherlands.

29-4-1887, † 21-10-1974

CABIBBO Nicola (9-6-1986), Former President of the Pontifical Academy of Sciences. Professor of Theoretical Physics, University of Rome 'La Sapienza', Italy.

10-4-1935, † 16-8-2010

CARATHEODORY Constantin (28-10-1936), Professor of Mathematics, University of Munich, Germany.

13-9-1873, † 2-2-1950

CARDOSO FONTES Antonio (1-9-1941), Director, Instituto Oswaldo Cruz, Rio de Janeiro, Brazil.

6-10-1879, † 28-3-1943

CARREL Alexis (28-10-1936), Professor of Biology, Rockefeller Institute for Medical Research, New York, NY, USA. Nobel laureate in Physiology or Medicine, 1912.

28-6-1873, † 5-10-1944

CASTELLANI Sir **Aldo** (28-10-1936), Professor of Tropical and Subtropical Medicine, London School of Tropical Medicine, London, UK.

8-9-1877, † 3-10-1971

CHADWICK Sir **James** (3-5-1961), Professor of Physics, University of Cambridge, UK. Nobel laureate in Physics, 1935.

20-10-1891, † 24-7-1974

CHAGAS **Carlos** (11-8-1961), Former President of the Pontifical Academy of Sciences. Professor of Biology and Biophysics, Universidade Federal do Rio de Janeiro, Brazil.

12-9-1910, † 16-2-2000

CHANG **Te-Tzu** (17-3-1997), Professor of Agriculture (Crop Science), Academia Sinica, Taipei, Taiwan, Rep. of China.

3-4-1927, † 24-3-2006

CHAUDRON **Georges** (10-4-1970), Professor of Applied Chemistry and Director Emeritus, Ecole Nationale Supérieure, Paris, France.

29-4-1891, † 14-3-1976

CHIGI ALBANI DELLA ROVERE Prince Don **Ludovico** (28-10-1936), Grand Master of the Sovereign Military Order of Malta, Rome, Italy (Honorary Academician).

10-7-1866, † 14-11-1951

CICOGNANI Card. **Amleto Giovanni** (24-10-1961), Secretary of State to His Holiness Pope Paul VI, Vatican City (Honorary Academician).

24-2-1883, † 17-12-1973

COLOMBO **Bernardo Maria** (18 September 1992), Professor of Demography, University of Padua, Italy.

24-2-1919, † 26-4-2012

COLOMBO **Giuseppe** (17-4-1978), Professor of Mechanics, University of Padua, Italy.

2-10-1920, † 21-2-1984

COLONNETTI **Gustavo** (28-10-1936), Professor of Construction Science and Analytical and Graphical Mechanics, Istituto Superiore di Ingegneria, Turin, Italy.

11-8-1886, † 20-3-1968

CONWAY **Arthur William** (18-1-1939), Chairman of the Board of Theoretical Physics, Dublin Institute of Advanced Studies, Dublin, Ireland.

2-10-1875, † 11-7-1950

CONWAY **Edward Joseph** (11-8-1961), Professor of Biochemistry and Pharmacology, University of Dublin, Ireland.

3-7-1894, † 20-12-1968

CREUTZFELDT **Otto Detlev** (4-10-1990), Professor of Neurobiology, Max-Planck-Institut for Biophysical Chemistry, Göttingen, Germany.

1-4-1927, † 23-1-1992

CROCCO Gaetano Arturo (28-10-1936), Professor of General Aeronautics, University of Rome, Italy.

26-10-1877, † 19-1-1968

CROMBIE Alistair Cameron (16-10-1994), Professor of History and Philosophy of Science, University of Oxford, UK.

4-11-1915, † 9-2-1996

CROXATTO REZZIO Héctor (2-12-1975), Professor, Pontificia Universidad Católica de Chile and President, Academia de Ciencias LatinoAmericanas, Santiago, Chile.

28-7-1908, † 28-9-2010

CRUZ-COKE Eduardo (29-5-1948), Professor of Physiological Chemistry, School of Medicine, University of Santiago de Chile, Chile.

1899, † 18-3-1974

CUENOT Lucien (28-10-1936), Professor of Zoology, University of Nancy, France.

21-10-1866, † 7-1-1951

DAINELLI Giotto (5-4-1940), Professor Emeritus of Geology and Physical Geography, University of Florence, Italy.

19-5-1878, † 16-12-1968

DAL PIAZ Giorgio (28-10-1936), Professor of Geology, University of Padua, Italy.

29-3-1872, † 20-4-1962

DALLAPORTA Nicola (5-10-1989), Professor of Astronomy, University of Padua, Italy (Honorary Academician).

28-10-1910, † 23-10-2003

DARDOZZI Renato (1-7-1997), Professor of Philosophy and Theology, Former Chancellor, Vatican City (Honorary Academician).

5-4-1922, † 3-6-2003

DE BLASI Dante (23-5-1942), Professor of Hygiene, University of Rome, Italy.

25-10-1873, † 10-7-1956

DE CASTRO Aloysio (29-5-1948), Director, School of Medicine, University of Rio de Janeiro, Brazil.

1881, † 7-10-1959

DE FILIPPI Filippo (28-10-1936), Member, National Geography Committee, National Research Council, Rome, Italy.

6-4-1869, † 23-9-1938

DE GIORGI Ennio (12-5-1981), Professor of Mathematical Analysis, Scuola Normale Superiore, Pisa, Italy.

8-2-1928, † 25-10-1996

DE SANCTIS Pietro (28-10-1936), Former Secretary, Pontificia Academia Novorum Lynceorum, Vatican City (Honorary Academician).

3-2-1867, † 15-1-1957

DEBYE Pieter Josef William (28-10-1936), Chairman, Department of Chemistry, Cornell University, Ithaca, NY, USA. Nobel laureate in Chemistry, 1936.

24-3-1884, † 2-11-1966

DIRAC Paul Adrian Maurice (11-8-1961), Professor of Mathematics, State University of Florida at Tallahassee, USA. Nobel laureate in Physics, 1933.

8-8-1902, † 20-10-1984

DÖBEREINER Johanna (17-4-1978), Professor of Soil Microbiology, Centro Nacional de Pesquisa de Agrobiologia (CNPAB), Seropédica, Brazil.

28-11-1924, † 5-10-2000

DOISY Edward Adelbert (29-5-1948), Professor of Biochemistry, St. Louis University, MO, USA. Nobel laureate in Physiology or Medicine, 1943.

13-11-1893, † 23-10-1986

de DUVE Christian (10-4-1970), Professor of Biochemistry, Christian de Duve Institute of Cellular Pathology, Brussels, Belgium; Nobel Prize in Physiology or Medicine, 1974.

3-10-1917, † 4-5-2013

ECCLES Sir John Carew (8 April 1961), Professor of Neurophysiology, State University of New York at Buffalo, NY, USA. Nobel laureate in Physiology or Medicine, 1963.

27-1-1903, † 2-5-1997

FAUVEL Pierre (28-10-1936), Professor of Zoology, Université Catholique de l'Ouest, Angers, France.

8-10-1866, † 12-12-1958

FEIGL Fritz (10-4-1970), Director Emeritus of the Microchemical Laboratory of the Ministry of Agriculture, Rio de Janeiro, Brazil.

15-5-1981, † 26-1-1971

FISHER Sir Ronald Aylmer (3-5-1961), Professor of Genetics, University of Cambridge and Honorary Member, Division of Mathematical Statistics, Commonwealth Scientific and Industrial Research Organization at Adelaide University (C.S.I.R.O.), Adelaide, Australia.

17-2-1890, † 29-7-1962

FLEMING Sir **Alexander** (7-3-1946), Professor of Bacteriology, University of London, UK. Nobel laureate in Physiology or Medicine, 1945.

6-8-1881, † 11-3-1955

FUKUI Kenichi (14-12-1985), Professor of Chemistry, Institute for Fundamental Chemistry, Kyoto, Japan. Nobel laureate in Chemistry, 1981.

4-10-1918, † 9-1-1998

GALEAZZI-LISI Riccardo (3-12-1949), Pontifical Physician, Vatican City (Honorary Academician).

1891, † 16-11-1968

GARCIA OTERO Julio César (5-4-1955), Professor of Medical Pathology, University of Montevideo, Uruguay.

24-9-1895, † 28-4-1966

GARCIA SIÑERIZ José (23-5-1942), Vicepresident, Consejo Superior de Investigaciones Científicas, Madrid, Spain.

11-5-1886, † 18-1-1974

GARNHAM Percy Cyril Claude (4-10-1970), Professor of Medical Protozoology, Imperial College, Silkwood Park, UK.

15-1-1901, † 25-12-1994

GATTERER Rev. Fr. **Alois**, S.J. (28-10-1936), Prefect, Astrophysical Laboratory, Vatican Observatory, Vatican City; Academician 'Perdurante Munere'.

28-1-1866, † 17-2-1953

GEMELLI Rev. Fr. **Agostino**, O.F.M. (28-10-1936), Professor of Applied Psychology, Università Cattolica del Sacro Cuore, Milan, Italy.

18-1-1878, † 15-7-1959

GENTNER Wolfgang (10-4-1970), Professor of Physics, Max-Planck-Institut, Heidelberg, Germany.

23-7-1906, † 4-9-1980

GERMAIN Paul (9-6-1986), Professor of Mechanics, Université Pierre et Marie Curie and Ecole Polytechnique, Secrétaire Perpétuel Honoraire of the Académie des sciences, Paris, France.

28-8-1920, † 26-2-2009

GHERZI Rev. P. **Ernesto**, S.J. (28-10-1936), Director, Meteorological and Seismological Observatory, Zi-ka-wei, Shanghai, China; Director of Research, Geophysical Observatory, Collège Jean de Brébeuf, Montréal, Canada.

8-8-1886, † 6-12-1973

GHIGI Alessandro (28-10-1936), Professor of General Zoology, University of Bologna, Italy.

9-2-1875, † 20-11-1970

GIACOMELLO Giordano (3-5-1961), Professor of Pharmaceutical Chemistry and Director, Istituto di Chimica farmaceutica e tossicologica, University of Rome, Italy.

26-7-1910, † 23-6-1968

GILSON Gustave (28-10-1936), Professor of Zoology, Université Catholique, Louvain, Belgium.

17-7-1859, † 1-1-1945

GIORDANI Francesco (28-10-1936), President, National Research Council, Rome, Italy; Professor of General Chemistry, University of Naples, Italy.

5-7-1896, † 24-1-1961

GIORGI Giovanni (28-10-1936), Professor of Electrical Communications, University of Rome, Italy.

27-11-1871, † 19-8-1950

GIUSTI Rev. Fr. **Martino** (4-1-1956), Prefect, Vatican Secret Archive, Vatican City, until 25-6-1983; Academician 'Perdurante Munere'.

15-10-1905, † 1-12-1987

GODLEWSKI Emil (28-10-1936), Professor of Embryology and Biology, University of Cracow, Poland.

15-8-1875, † 25-4-1944

GOLA Giuseppe (28-10-1936), Professor of Botany, University of Padua, Italy.

26-2-1877, † 25-7-1956.

GREGOIRE Rev. Fr. **Victor** (28-10-1936), Professor of Botany, Université Catholique, Louvain, Belgium.

5-12-1870, † 12-12-1938

GUIDI Camillo (28-10-1936), Professor of Construction Science and Theory of Bridges, Istituto Superiore di Ingegneria, Turin, Italy.

24-7-1853, † 30-10-1941

GUTHNICK Paul (28-10-1936), Professor of Astronomy and Director, University of Sternwarte, Berlin-Neubabelsberg, Germany.

12-1-1879, † 6-9-1947

HAHN Otto (5-4-1955), Professor of Chemistry and Honorary President, Max-Planck-Gesellschaft zur Förderung der Wissenschaften, Göttingen, Germany. Nobel laureate in Chemistry, 1944.

8-3-1879, † 28-7-1968

HEISENBERG Werner Carl (5-4-1955), Professor of Theoretical Physics and Director, Max-Planck-Institut für Physik und Astrophysik, Munich, Germany. Nobel laureate in Physics, 1932.

5-12-1901, † 1-2-1976

HEISKANEN Veikko Aleksanteri (24-9-1964), Former Director, Department of Geodetic Science, Photogrammetry and Mapping, Ohio State University, Columbus, OH, USA; Director, Finnish Geodetic Institute, Helsinki, Finland. 23-7-1895, † 23-10-1971

HERZBERG Gerhard (24-9-1964), Distinguished Research Scientist, National Research Council Canada, Ottawa, Canada. Nobel laureate in Chemistry, 1971.

25-12-1904, † 3-3-1999

HESS Victor Francis (3-5-1961), Professor of Physics, Fordham University, New York, NY, USA. Nobel laureate in Physics, 1936.

24-6-1883, † 17-12-1964

HESS Walter Rudolf (5-4-1955), Former Professor of Physiology, University of Zurich, Switzerland. Nobel laureate in Physiology or Medicine, 1949.

17-3-1881, † 12-8-1973

de HEVESY George Charles (3-5-1961), Professor of Biochemistry, University of Stockholm, Sweden. Nobel laureate in Chemistry, 1943.

1-8-1885, † 12-8-1966

HEYMANS Corneille Jean François (23-5-1942), Professor of Pharmacology, University of Gand, Belgium. Nobel laureate in Physiology or Medicine, 1938.

28-3-1892, † 20-7-1968

HINSHELWOOD Sir Cyril Norman (3-5-1961), Professor of Chemistry, University of Oxford, UK. Nobel laureate in Chemistry, 1956.

19-6-1897, † 12-10-1967

HODGKIN Alan Lloyd (22-4-1968), Professor of Physiology, University of Cambridge, UK.

5-2-1914, † 20-12-1998

HÖRSTADIUS Sven (11-8-1961), Professor of Zoology, University of Uppsala, Sweden.

18-2-1898, † 16-6-1996

HOUSSAY Bernardo Alberto (28-10-1936), Professor of Physiology, University of Buenos Aires, Argentina. Nobel laureate in Physiology or Medicine, 1947.

10-4-1887, † 21-9-1971

HURTADO Alberto (11-8-1961), Professor of Medicine, Instituto de Investigación de la Altura, Lima, Peru.

29-8-1901, † 1-11-1983

JAKI Rev. Fr. **Stanley L.**, O.S.B. (5-9-1990), Distinguished Professor of Physics, Seton Hall University, New Jersey, USA.

17-8-1924, † 7-4-2009

JANSSEN Paul Adriaan Jan (25-6-1990), Professor of Pharmacology and Chairman, Janssen Research Foundation, Beerse, Belgium.

12-9-1926, † 11-11-2003

JOACHIMOGLU Georges (10-4-1970), Professor of Pharmacology, University of Athens, Greece.

28-12-1887, † 28-11-1979

JULIA Gaston Maurice (5-4-1955), Professor of Mathematical Analysis, Sorbonne, Paris, France.

3-2-1893, † 19-3-1978

JUNKES Rev. Fr. **Joseph**, S.J. (31-3-1953), Prefect, Astrophysical Laboratory, Vatican Observatory, Vatican City; Academician 'Perdurante Munere'.

28-9-1900, † 28-4-1984

von KARMAN Theodore (5-4-1955), Director, Guggenheim Aeronautical Laboratory, California Institute of Technology, Pasadena, CA, USA.

11-5-1881, † 7-5-1963

KEESOM Wilhelmus Hendrikus (28-10-1936), Professor of Physics, University of Leiden, Netherlands.

21-6-1876, † 3-3-1956

KHORANA Har Gobind (17 April 1978), Professor of Biochemistry, Massachusetts Institute of Technology, Cambridge, MA, USA. Nobel laureate in Physiology or Medicine, 1968.

9-1-1922, † 9-11-2011

LANGFELD Herbert Sidney (29-5-1948), Professor of Psychology and Director, Psychological Laboratory, University of Princeton, NJ, USA.

24-7-1879, † 25-2-1958

von LAUE Max Theodor Felix (5-4-1955), Professor of Theoretical Physics and Director, Fritz-Institut, Max-Planck-Gesellschaft, Berlin-Dahlem, Germany. Nobel laureate in Physics, 1914.

9-10-1879, † 24-4-1960

LECOMTE Jean (24-9-1964), First Senior Researcher, Centre National de la Recherche scientifique, Paris, France.

5-8-1898, † 28-3-1979

LEDERBERG Joshua (4-3-1996), Professor of Molecular Genetics, Rockefeller University, New York, NY, USA. Nobel laureate in Physiology or Medicine, 1958.

23-5-1925, † 2-2-2008

LEJEUNE Jérôme Jean Louis Marie (24-6-1974), Professor of Human Genetics, Institut de Progenèse, Paris, France.

13-6-1926, † 3-4-1994

LELOIR Luis Federico (22-4-1968), Professor of Biochemistry, Instituto de Investigaciones Bioquímicas 'Fundación Campomar', Buenos Aires, Argentina. Nobel laureate in Chemistry, 1970.

6-9-1906, † 2-12-1987

LEMAÎTRE Rev. Msgr. **Georges** (28-10-1936), Professor of Mechanics and Mathematical Methodology, Université Catholique, Louvain, Belgium.

17-7-1894, † 20-6-1966

LÉPINE Pierre Raphaël (24-9-1964), Professor of Biology and Cytology, Institut Pasteur, Paris, France.

15-8-1901, † 30-3-1989

LEPRI Giuseppe (28-10-1936), Professor of Zoology, University of Rome, and Director, Museo Civico di Zoologia, Rome, Italy.

2-6-1870, † 30-4-1952

LEPRINCE-RINGUET Louis (11-8-1961), Professor of Elementary Particle Physics, Ecole Polytechnique, Paris, France.

27-3-1901, † 23-12-2000

LEVI-CIVITA Tullio (28-10-1936), Professor of Rational Mechanics, University of Rome, Italy.

29-3-1873, † 29-12-1941

LEVI-MONTALCINI Rita (24-6-1974), Professor of Neurobiology, Former Director of the Italian Research Council's Laboratory of Cell Biology, Rome, Italy. Nobel Laureate in Physiology or Medicine, 1986.

22-4-1909, † 30-12-2012

LICHNEROWICZ André (12-5-1981), Professor of Mathematical Physics, Collège de France, Paris, France.

21-1-1915, † 11-12-1998

LILEY Albert William (17-4-1978), Professor of Prenatal Physiology, University of Auckland, Australia.

12-3-1929, † 15-6-1983

LIONS Jacques-Louis (4-10-1990), Former President, Academy of Sciences and Professor of Mechanical Sciences, Collège de France and Ecole Polytechnique, Paris, France.

2-5-1928, † 17-5-2001

ŁOJASIEWICZ Stanisław (27-1-1983), Professor of Mathematics, Jagiellonian University, Cracow, Poland.

9-10-1926, † 13-11-2002

LOMBARDI Luigi (28-10-1936), Professor of Electrotechnology, University of Rome, Italy.

21-8-1867, † 7-2-1958

LORA TAMAYO Manuel (24-9-1964), Professor of Organic Chemistry, Centro de Química Orgánica 'Manuel Lora Tamayo', Madrid, Spain.

26-1-1904, † 22-8-2002

LUIGIONI Paolo (28-10-1936), Curator, Museo Civico di Zoologia, Rome, Italy.

9-2-1873, † 6-5-1937

LYNEN Feodor (17-4-1978), Director, Max-Planck-Institut für Biochemie, Martinsried, Germany. Nobel laureate in Physiology or Medicine, 1964.

6-4-1911, † 6-8-1979

MAGLIONE Card. **Luigi** (15-6-1939), Secretary of State to His Holiness Pope Pius XII, Vatican City (Honorary Academician).

2-3-1877, † 22-8-1944

MARCHETTI SELVAGGIANI Card. **Francesco** (28-10-1936), Vicar General of His Holiness Pope Pius XII, Vatican City (Honorary Academician).

19-10-1871, † 13-1-1951

MARCONI Guglielmo (28-10-1936), Professor of Electromagnetic Waves, University of Rome, Italy. Nobel laureate in Physics, 1909.

25-4-1874, † 20-7-1937

MARINI-BETTÓLO Giovanni Battista (22-4-1968), Professor of Chemistry, University of Rome, Italy.

27-6-1915, † 22-7-1996

MAROTTA Domenico (3-5-1961), Professor of General Chemistry, University of Rome, Italy.

28-7-1886, † 20-3-1974

MARTINI Card. **Carlo Maria** (13-11-2000), Honorary Professor of Holy Scripture and Theology.

15-2-1927, † 31-8-2012

McCONNELL Rev. Msgr. **James Robert** (25-6-1990), Professor of Theoretical Physics, Dublin Institute for Advanced Studies, Dublin, Ireland.

25-2-1915, † 13-2-1999

MENDES CORRÊA António Augusto Esteves (28-10-1936), Professor of Anthropology, University of Porto, Portugal.

4-4-1888, † 7-1-1960

MERCATI Rev. Msgr. **Angelo** (28-10-1936), Prefect, Vatican Secret Archive, Vatican City; Academician 'Perdurante Munere'.

6-10-1870, † 3-10-1955

METZLER Josef, O.M.I. Prefect, Secret Vatican Archive from 24-5-1984 to 27-7-1996 ('Perdurante Munere').

7-2-1921, † 12-1-2010

MICHOTTE van den BERCK Baron Albert Edouard (28-10-1936), Professor of Experimental Psychology, Université Catholique, Louvain, Belgium.

13-10-1881, † 2-6-1965

MILLIKAN Robert Andrews (28-10-1936), Director, Norman Bridge Laboratory of Physics, California Institute of Technology, Pasadena, CA, USA. Nobel laureate in Physics, 1923.

22-3-1868, † 19-12-1953

MIZUSHIMA Sanichiro (11-8-1961), Professor of Physical Chemistry, Tokyo, Japan.

21-3-1899, † 3-8-1983

MORGAN Thomas Hunt (28-10-1936), Chairman, Division of Biology and Director, William G. Kerckhoff Laboratory of the Biological Sciences, California Institute of Technology, Pasadena, CA, USA. Nobel laureate in Physiology or Medicine, 1933.

25-9-1866, † 4-12-1945

MORGAN William Wilson (24-9-1964), Professor of Astronomy, University of Chicago, IL, USA.

3-1-1906, † 21-6-1994

MORUZZI Giuseppe (17-4-1978), Professor of Biology, University of Pisa, Italy.

30-7-1910, † 11-3-1986

MOSHINSKY Marcos (9-6-1986), President, Mexican Society of Physics and Professor, National Autonomous University of Mexico.

20-4-1921, † 1-4-2009

MÖBBAUER Rudolf Ludwig (10-4-1970), Professor of Physics, Technical University of Munich, Germany. Nobel laureate in Physics, 1961.

31-1-1929, † 14-9-2011

MURRAY Joseph Edward (30-5-1996), Plastic surgeon, reconstructive surgeon, transplantation. Professor of Surgery Emeritus, Harvard Medical School. Nobel laureate in Physiology or Medicine, 1991.

1-4-1919, † 26-11-2012

NIEHANS Paul (5-4-1955), Director, Endocrinology Clinic, Clarens, Switzerland.

21-11-1882, † 1-9-1971

NIRENBERG Marshall Warren (24-6-1974), National Heart Institute, Nobel laureate in Physiology or Medicine 1968.

10-4-1927, † 15-1-2010

NOBILE Umberto (28-10-1936), Professor of Aeronautical Construction, University of Naples, Italy.

21-1-1885, † 30-7-1978

NOYONS Adriaan Karel Marie (28-10-1936), Professor of Physiology, University of Utrecht, Netherlands.

7-1-1878, † 1-6-1941

OCHOA Severo (24-6-1974), Professor of Biology, Universidad Autónoma, Madrid, Spain. Nobel laureate in Physiology or Medicine, 1959.

24-9-1905, † 1-11-1993

O'CONNELL Rev. Fr. **Daniel Joseph Kelly**, S.J. (24-9-1964), Director, Vatican Observatory, Vatican City.

25-7-1896, † 15-10-1982

ODA Minoru (18-9-1992), Professor of Astrophysics, Tokyo University of Information Sciences, Japan.

24-2-1923, † 1-3-2001

ODHIAMBO Thomas Risley (12-5-1981), Professor of Insect Physiology and Honorary President, African Academy of Sciences, Nairobi, Kenya.

4-2-1931, † 27-5-2003

OORT Jan Hendrik (18-8-1961), Professor of Astronomy, Sterrewacht, University of Leiden, Belgium.

28-4-1900, † 5-11-1992

PACELLI Card. **Eugenio** (28-10-1936), Secretary of State to His Holiness Pope Pius XI, Vatican City (Honorary Academician). Elected Supreme Pontiff as Pius XII on 2 March 1939.

2-3-1876, † 9-10-1958

PALADE George Emil (2-12-1975), Chairman of the Department of Cell Biology at Yale University, Nobel laureate in Physiology or Medicine 1974.

19-11-1912, † 7-10-2008

PANETTI Modesto (28-10-1936), Professor of Mechanics Applied to Machines and Aeronautical Construction, Polytechnic of Turin, Italy.

9-2-1875, † 29-3-1957

PARRAVANO Nicola (28-10-1936), Professor of General Chemistry, University of Rome, Italy.

21-7-1883, † 10-8-1938

PASCHINI Rev. Msgr. **Pio** (13-8-1957), Perpetual Rector Magnificus Honoris Causa, Pontifical Lateran University, Vatican City (Honorary Academician).
2-3-1878, † 14-12-1962

PAVAN Crodowaldo (17-4-1978), Dean of the Biology Institute at the State University of Campinas, Brazil.
1-12-1919, † 9-4-2009

PENSA Antonio (28-10-1936), Professor of Human Anatomy and Histology, University of Pavia, Italy.
15-9-1874, † 17-8-1970

PERUTZ Max Ferdinand (12-5-1981), Professor of Cellular and Molecular Biology, Medical Research Council Laboratory of Molecular Biology, Cambridge, UK.
19-5-1914, † 6-2-2002

PETRISCH Ernst Felix (28-10-1936), Professor of Telecommunications Engineering, Technischen Hochschule, Vienna, Austria.
21-5-1878, † 18-12-1951

PICARD Emile (28-10-1936), Perpetual Secretary, Académie des sciences de l'Institut de France, Paris, France.
24-7-1856, † 11-12-1941

PICONE Mauro (10-4-1970), Professor of Mathematical Analysis, University of Rome, Italy.
2-5-1885, † 11-4-1977

PIERANTONI Umberto (5-4-1940), Professor of Zoology, University of Naples, Italy.
25-9-1876, † 16-11-1959

PIETRANGELI Carlo (5-10-1989), Professor of Archaeology and Director, Vatican Museums, Vatican City (Honorary Academician).
20-10-1912, † 23-6-1995

PISTOLESI Enrico (28-10-1936), Professor of Mechanics Applied to Machines and Aeronautical Construction, University of Pisa, Italy.
2-12-1889, † 29-2-1968

PIZZARDO Card. **Giuseppe** (15-6-1939), Prefect, Holy Congregation for Seminaries and Educational Institutions, Vatican City (Honorary Academician).
13-7-1877, † 1-8-1970

PLANCK Max (28-10-1936), Professor of Theoretical Physics, University of Berlin, Germany. Nobel laureate in Physics, 1918.
23-4-1885, † 4-10-1947

PONNAMPERUMA Cyril Andrew (16-10-1994), Professor of Chemistry, University of Maryland, College Park, USA.

16-10-1923, † 20-12-1994

PORTER Baron George (24-6-1974), Professor of Chemistry, Royal Institution of Great Britain, London, UK.

6-12-1920, † 31-8-2002

PRELOG Vladimir (14-12-1985), Professor of Organic Chemistry, Swiss Federal Institute of Technology, Zurich, Switzerland. Nobel laureate in Chemistry, 1975.

23-7-1906, † 7-1-1998

PULLMAN Bernard (12-5-1981), Professor of Quantum Biochemistry and Biophysics, Institut de Biologie Physico-Chimique, Paris, France.

19-3-1919, † 9-6-1996

PUPPI Giampietro (17-4-1978), Professor of Physics, University of Bologna, Italy.

20-11-1917, † 25-12-2006

QUAGLIARIELLO Gaetano (23-5-1942), Professor of Biological Chemistry, University of Naples, Italy.

19-12-1883, † 2-6-1957

RAES Rev. Fr. **Alfons**, S.J. (23-3-1962), Prefect, Apostolic Vatican Library, Vatican City; Academician 'Perdurante Munere'.

14-8-1896, † 25-6-1983

RAMAN Sir **Chandrasekhara Venkata** (11-8-1961), Director, Raman Research Institute, Bangalore, India. Nobel laureate in Physics, 1930.

7-11-1888, † 21-11-1970

RANZI Silvio (12-5-1981), Professor of Zoology, University of Milan, Italy (Honorary Academician).

16-10-1902, † 16-4-1996

RASETTI Franco (28-10-1936), Professor of Physics, Johns Hopkins University, Baltimore, MD, USA.

10-8-1901, † 5-12-2001

ROCHE Marcel (10-4-1970), Professor of Biomedicine and Sociology of Science, Instituto Venezolano de Investigaciones Científicas, Caracas, Venezuela.

15-8-1920, † 3-5-2003

RONDONI Pietro (28-10-1936), Professor of General and Experimental Pathology, University of Milan, Italy.

2-10-1882, † 4-11-1956

di ROVASENDA Rev. Fr. **Carlo Enrico**, O.P. (13-11-1986), Professor of Philosophy and Theology. Former Director of the Chancellery, Vatican City (Honorary Academician).

17-6-1906, † 15-12-2007

RUNCORN Stanley Keith (12-9-1981), Professor of Physics, Imperial College of Science, London, UK.

19-11-1922, † 5-12-1995

RUTHERFORD of NELSON Lord **Ernest** (28-10-1936), Professor of Experimental Physics, University of Cambridge, UK. Nobel laureate in Chemistry, 1908.

30-8-1871, † 19-10-1937

RUZICKA Leopold (5-12-1942), Professor of Organic Chemistry, Polytechnique de Zürich, Zurich, Switzerland. Nobel laureate in Chemistry, 1939.

13-9-1887, † 26-9-1976

RYLE Martin (2-12-1975), Professor of Radioastronomy, University of Cambridge, UK. Nobel laureate in Physics, 1974.

27-9-1918, † 14-10-1984

SALAM Abdus (12-5-1981), Professor of Physics, International Centre for Theoretical Physics, Trieste, Italy. Nobel laureate in Physics, 1979.

29-1-1926, † 21-11-1996

SALVIUCCI Pietro (18-11-1982), Former Chancellor, Pontifical Academy of Sciences, Vatican City (Honorary Academician).

18-10-1899, † 29-1-1984

SANDOVAL VALLARTA Manuel (11-8-1961), Professor of Theoretical Physics, University of Mexico City, Mexico.

11-2-1899, † 1-5-1977

SCHMIDT Rev. Fr. **Wilhelm**, S.V.D. (28-10-1936), Scientific Director, Pontificio Museo Missionario Etnologico del Laterano, Vatican City; Academician 'Perdurante Munere'.

16-2-1868, † 10-2-1954

SCHRÖDINGER Erwin (28-10-1936), Professor of Theoretical Physics, University of Vienna, Austria. Nobel laureate in Physics, 1933.

12-8-1887, † 4-1-1961

SCHULIEN Rev. Fr. **Michael**, S.V.D. (10-2-1954), Scientific Director, Pontificio Museo Missionario Etnologico del Laterano, Vatican City; Academician 'Perdurante Munere'.

21-5-1888, † 4-4-1968

SEGRE Beniamino (2-12-1975), Professor of Mathematical Analysis, University of Rome, Italy.

16-2-1903, † 2-10-1977

SEVERI Francesco (5-4-1940), President, Istituto Nazionale di Alta Matematica and Professor of Higher Geometry, University of Rome, Italy.

13-4-1879, † 8-12-1961

SHERRINGTON Charles Scott (28-10-1936), Professor of Physiology, University of Oxford, UK. Nobel laureate in Physiology or Medicine, 1932.

29-11-1858, † 4-3-1952

SIDDIQUI Salimuzzaman (24-9-1964), Professor of Organic Chemistry, University of Karachi, Pakistan.

19-10-1897, † 14-4-1994

SIEGBAHN Kai M.B. (14-12-1985), Professor of Physics, University of Uppsala, Sweden. Nobel laureate in Physics, 1981.

20-4-1918, † 20-7-2007

SIERPINSKI Wacław Franciszek (22-4-1968), Professor of Mathematics, University of Warsaw, Poland.

14-3-1882, † 21-10-1969

SILVESTRI Filippo (28-10-1936), Professor of General Zoology and Agricultural Science, Istituto Superiore Agrario and Director, Zoology Laboratory, Naples, Italy.

22-6-1873, † 2-6-1949

SOMIGLIANA Carlo (18-1-1939), Professor of Mathematical Physics, University of Turin, Italy.

20-9-1860, † 20-6-1955

SOUTHWOOD (Thomas) Richard Edmund (18-9-1992), Professor of Zoology, University of Oxford, UK.

20-6-1931, † 26-10-2005

SPERI SPERTI George (28-10-1936), Professor of Physics, St Thomas Institute, Cincinnati, OH, USA.

17-1-1900, † 29-4-1991

SPERRY Roger Wolcott (17-4-1978), Professor of Psychobiology, California Institute of Technology, Pasadena, USA. Nobel laureate in Physiology or Medicine, 1981.

20-8-1913, † 17-4-1994

STEIN Rev. Fr. **Johan Willem Jakob Antoon**, S.J. (28-10-1936), Director, Vatican Observatory, Vatican City; Academician 'Perdurante Munere'.

27-2-1871, † 27-12-1951

STICKLER Card. **Alfons Maria**, S.D.B., Prefect, Apostolic Vatican Library from 25-3-1971 to 8-9-1983; Academician 'Perdurante Munere'.

23-10-1910, † 12-12-2007

STONELEY Robert (10-4-1970), Professor of Theoretical Geophysics, University of Cambridge, UK.

14-5-1894, † 2-2-1976

STRÖMGREN Bengt (2-12-1975), Professor Emeritus of Astronomy and Director, NORDITA, Copenhagen, Denmark.

21-1-1908, † 4-7-1987

SZCZEKLIK Andrzej (16-10-1994), Professor of Cardiopulmonary Diseases, Jagiellonian University School of Medicine, Krakow, Poland.

29-7-1938, † 3-2-2012

SZENT-GYÖRGYI Albert (10-4-1970), Professor of Biochemistry, National Foundation for Cancer Research, Woods Hole, MA, USA. Nobel laureate in Physiology or Medicine, 1937.

16-8-1893, † 22-10-1986

SZENTAGOTHAJ János (12-5-1981), Professor of Anatomy, Semmelweis University, Budapest, Hungary.

31-10-1912, † 8-9-1994

TARDINI Card. **Domenico** (19-3-1960), Secretary of State to His Holiness Pope John XXIII, Vatican City (Honorary Academician).

29-2-1888, † 30-7-1961

TAYLOR Sir **Hugh Stott** (28-10-1936), Professor of Chemistry, University of Princeton, NJ, USA.

6-2-1890, † 17-4-1974

TISELIUS Arne Wilhelm Kaurin (5-4-1955), Professor of Biochemistry, University of Uppsala, Sweden. Nobel laureate in Chemistry, 1948.

10-8-1901, † 29-10-1971

TISSERANT Card. **Eugène** (19-3-1960), Librarian and Archivist of the Holy See and Dean of the College of Cardinals (Honorary Academician).

24-3-1884, † 21-2-1972

TONELLI Leonida (23-5-1942), Professor of Mathematical Analysis, University of Pisa, Italy.

19-4-1885, † 11-3-1946

TONIOLO Antonio Renato (28-10-1936), Professor of General Geography, University of Bologna, Italy.

7-4-1881, † 9-5-1955

TREANOR Rev. Fr. **Patrick**, S.J. (11-9-1970), Director, Vatican Observatory, Vatican City; Academician 'Perdurante Munere'.

15-3-1920, † 18-2-1978

TSCHERMAK-SEYSENEGG Armin (28-10-1936), Professor of Physiology, Philosophisch-Theologische Hochschule, Regensburg, Germany.

21-9-1870, † 9-10-1952

UBBELOHDE Alfred René (22-4-1968), Professor of Thermodynamics, Imperial College, London, UK.

14-12-1907, † 7-1-1988

UMEZAWA Hamao (26-9-1983), Professor of Biochemistry, Institute of Microbial Chemistry, Tokyo, Japan.

1-10-1914, † 25-12-1986

URSPRUNG Alfred (25-6-1941), Professor of Botany, University of Friebourg, Germany.

22-12-1876, † 21-4-1952

VALLAURI Giancarlo (28-10-1936), Professor of Electrotechnology, Istituto Superiore di Ingegneria, Turin, Italy.

19-10-1882, † 7-5-1957

de la VALLÉE POUSSIN Baron **Charles Jean** (28-10-1936), Professor of Mathematics, Université Catholique, Louvain, Belgium.

14-8-1866, † 2-3-1962

VALLETTA Vittorio (31-8-1956), Engineer, Turin, Italy (Honorary Academician).

28-7-1883, † 10-8-1967

VENING MEINSZ Felix Andries (24-9-1964), University Professor of Geophysics, Professor of Geodetic Science, Technische Hogeschool of Delft and Head Director, Royal Dutch Meteorological Institute, De Bilt, Utrecht, Netherlands.

30-7-1887, † 12-8-1966

VERCELLI Francesco (28-10-1936), Director, Istituto Talassografico e Osservatorio Geofisico, Trieste, Italy.

22-10-1883, † 24-11-1952

VIRTANEN Artturi Ilmari (5-4-1955), Professor of Biochemistry and President, Finnish Academy, Helsinki, Finland. Nobel laureate in Chemistry, 1945.

15-1-1895, † 11-12-1973

VOLTERRA Vito (28-10-1936), Professor of Mathematical Physics and Celestial Mechanics, University of Rome, Italy.

3-5-1860, † 11-10-1940

WEISSKOPF Victor Frederick (2-12-1975), Professor of Physics, Massachusetts Institute of Technology, Cambridge, MA, USA.

19-9-1908, † 21-4-2002

WEYL Hermann (5-4-1955), Professor of Mathematics, University of Zurich, Switzerland.

9-11-1885, † 9-12-1955

WHITE Robert Joseph (29-3-1994), Professor of Neurological Surgery, Case Western Reserve University medical school, Cleveland, OH.

21-1-1926, † 16-9-2010

WHITTAKER Sir Edmund Taylor (28-10-1936), Professor of Mathematics, University of Edinburgh, UK.

24-10-1873, † 24-4-1956

WIESNER Karel Frantisek (17-4-1978), Professor of Chemistry, University of New Brunswick, Fredericton, Canada.

25-11-1919, † 28-11-1986

YUKAWA Hideki (3-5-1961), Director, Research Institute for Fundamental Physics, Kyoto, Japan. Nobel laureate in Physics, 1949.

23-1-1907, † 8-9-1981

ZEEMAN Pieter (28-10-1936), Professor of Physics, University of Amsterdam, Netherlands. Nobel laureate in Physics, 1902.

25-5-1865, † 9-10-1943

STATISTICAL TABLES

1. LIST OF DISCIPLINES

1. Astronomy
2. Chemistry
3. Earth and Environmental Sciences
4. Life Sciences
 - 4.1. Botany
 - 4.2. Agronomy
 - 4.3. Zoology
 - 4.4. Genetics
 - 4.5. Molecular Biology
 - 4.6. Biochemistry
 - 4.7. Neuroscience
 - 4.8. Surgery
5. Mathematics
6. Applications of Science
7. Philosophy and History of Science (Epistemology); Foundations of Science
8. Physics
9. Other Disciplines

2. ACADEMICIANS IN ALPHABETICAL ORDER

	<i>Name</i>	<i>Birth</i>	<i>App.</i>	<i>Residence</i>	<i>Disc.*</i>
1	ARBER W. (Nobel)	1929	1981	SWITZERLAND	4.4
2	BAGNATO V.S.	1958	2012	BRAZIL	8
3	BALTIMORE D. (Nobel)	1938	1978	USA	4.5
4	BATTRO A.M.	1936	2002	ARGENTINA	4.7
5	BECKER G.S. (Nobel)	1930	1997	USA	9
6	BEKOE D.A.	1928	1983	GHANA	2
7	BERG P. (Nobel)	1926	1996	USA	4.6
8	BERTI E.	1935	2001	ITALY	7
9	BLOBEL G. (Nobel)	1936	2001	USA	4.5
10	BOON-FALLEUR T.	1944	2002	BELGIUM	4.5
11	VON BRAUN J.	1950	2012	GERMANY	9
12	CAFFARELLI L.A.	1948	1994	USA	5
13	CAVALLI-SFORZA L.L.	1922	1994	USA	4.4
14	CIECHANOVER A.J. (Nobel)	1947	2007	ISRAEL	4.6
15	COHEN-TANNOUJDI C. (Nobel)	1933	1999	FRANCE	8
16	COLLINS F.S.	1950	2009	USA	4.4
17	CORY S.	1942	2004	AUSTRALIA	4.5
18	COTTIER G.M.M. •	1922	1992	VATICAN CITY	9
19	CRUTZEN P.J. (Nobel)	1933	1996	GERMANY	3
20	DE ROBERTIS E.M.	1947	2009	USA	4.5
21	DEHAENE S.	1965	2008	FRANCE	4.7
22	EIGEN M. (Nobel)	1927	1981	GERMANY	2
23	ERTL G.L. (Nobel)	1936	2010	GERMANY	2
24	ESCHENMOSER A.	1925	1986	SWITZERLAND	2
25	FUNES J.G. ••	1963	2006	VATICAN CITY	1
26	GARCÍA-BELLIDO A.	1936	2003	SPAIN	4.5
27	GOJOBORI T.	1951	2007	JAPAN	4.4
28	HÄNSCH T.W. (Nobel)	1941	2006	GERMANY	8

* For a list of the disciplines these numbers refer to see previous page.

• Honorary Academician •• Academician 'Perdurante Munere'

	<i>Name</i>	<i>Birth</i>	<i>App.</i>	<i>Residence</i>	<i>Disc.</i>
29	HAWKING S.W.	1942	1986	UK	8
30	HELLER M.	1936	1990	POLAND	7
31	HIDE R.	1929	1996	UK	3
32	KAFATOS F.C.	1940	2003	GERMANY	4.5
33	KASTURIRANGAN K.	1940	2006	INDIA	8
34	KEILIS-BOROK V.I.	1921	1994	USA	3
35	VON KLITZING K. (Nobel)	1943	2007	GERMANY	8
36	LE DOUARIN N.M.	1930	1999	FRANCE	4.5
37	LEE T.-D. (Nobel)	1926	2003	USA	8
38	LEE Y.T. (Nobel)	1936	2007	CHINA (Rep. of)	2
39	LEHN J.-M. (Nobel)	1939	1996	FRANCE	2
40	LÉNA P.J.	1937	2001	FRANCE	1
41	MALDACENA J.M.	1968	2013	USA	8
42	MALDAMÉ J.-M. •	1939	1997	FRANCE	7
43	MALU F.W.K.	1936	1983	CONGO (D.R.)	6
44	MANIN Y.I.	1937	1996	GERMANY	5
45	MENON M.G.K.	1928	1981	INDIA	8
46	MINTZ B.	1921	1986	USA	4.4
47	MITTELSTRAß J.	1936	2002	GERMANY	7
48	MOLINA M.J. (Nobel)	1943	2000	USA	2
49	MURADYAN R.	1936	1994	BRAZIL	1
50	NOVIKOV S.P.	1938	1996	RUSSIA	5
51	NOYORI R. (Nobel)	1938	2002	JAPAN	2
52	OLECH C.	1931	1986	POLAND	5
53	PAGANO S. ••	1948	1997	VATICAN CITY	9
54	PASINI C. ••	1950	2007	VATICAN CITY	9
55	PHILLIPS W.D. (Nobel)	1948	2004	USA	8
56	POLANYI J.C. (Nobel)	1929	1986	CANADA	2
57	POTRYKUS I.	1933	2005	SWITZERLAND	4.4
58	PRESS F.	1924	1999	USA	3
59	QUÉRÉ Y.	1931	2003	FRANCE	8
60	RAMANATHAN V.	1944	2004	USA	3

	<i>Name</i>	<i>Birth</i>	<i>App.</i>	<i>Residence</i>	<i>Disc.</i>
61	RAO C.N.R.	1934	1990	INDIA	2
62	RAVEN P.H.	1936	1990	USA	4.1
63	REES M.J.	1942	1990	UK	1
64	RICH A.	1924	1978	USA	4.5
65	RODRÍGUEZ-ITURBE I.	1942	2007	USA	3
66	RUBBIA C. (Nobel)	1934	1985	ITALY	8
67	RUBIN V.C.	1928	1996	USA	1
68	SAGDEEV R.Z.	1932	1990	USA	8
69	SÁNCHEZ SORONDO M. ••	1942	1998	ITALY	7
70	SELA M.	1924	1975	ISRAEL	4.6
71	SINGER M.F.	1931	1986	USA	4.6
72	SINGER W.J.	1943	1992	GERMANY	4.7
73	SWARUP G.	1929	2008	INDIA	8
74	THIRRING W.E.	1927	1986	AUSTRIA	5
75	TOWNES C.H. (Nobel)	1915	1983	USA	8
76	TUPPY H.	1924	1970	AUSTRIA	4.6
77	VICUÑA R.	1949	2000	CHILE	4.6
78	WITTEN E.	1951	2006	USA	5
79	YAMANAKA S. (Nobel)	1962	2013	JAPAN	4.4
80	YANG C.N. (Nobel)	1922	1997	USA	8
81	ZEWAIL A.H. (Nobel)	1946	1999	USA	2
82	ZICHICHI A.	1929	2000	ITALY	8

3. NATION OF BIRTH AND RESIDENCE

<i>Nation</i>	<i>Birth</i>	<i>Residence</i>
ALGERIA	COHEN-TANNOUDI C. MALDAMÉ J.-M.	
ARGENTINA	BATTRO A.M. CAFFARELLI L.A. FUNES J.C. MALDACENA J.M. SÁNCHEZ SORONDO M.	BATTRO A.M.
ARMENIA	MURADYAN R.	
AUSTRALIA	CORY S.	CORY S.
AUSTRIA	THIRRING W.E. TUPPY H.	THIRRING W.E. TUPPY H.
BELGIUM	BOON-FALLEUR T.	BOON-FALLEUR T.
BRAZIL	BAGNATO V.S.	BAGNATO V.S. MURADYAN R.
CANADA		POLANYI J.C.
CHILE	VICUÑA R.	VICUÑA R.
CHINA (P.R.)	LEE T.-D. RAVEN P.H. YANG C.N.	
CHINA (Rep. of)	LEE Y.T.	LEE Y.T.
CONGO (D.R.)	MALU F.W.K.	MALU F.W.K.
EGYPT	ZEWAIL A.H.	
FRANCE	DEHAENE S. LE DOUARIN N.M. LEHN J.-M. LÉNA P.J. QUÉRÉ Y.	COHEN-TANNOUDI C. DEHAENE S. LE DOUARIN N.M. LEHN J.-M. LÉNA P.J. MALDAMÉ J.-M. QUÉRÉ Y.

<i>Nation</i>	<i>Birth</i>	<i>Residence</i>
GERMANY	BLOBEL G. VON BRAUN J. EIGEN M. ERTL G.L. HÄNSCH T.W. MITTELSTRAß J. POLANYI J.C. POTRYKUS I. SINGER W.J.	VON BRAUN J. CRUTZEN P.J. EIGEN M. ERTL G.L. HÄNSCH T.W. KAFATOS F.C. VON KLITZING K. MANIN Y.I. MITTELSTRAß J. SINGER W.J.
GHANA	BEKOE D.A.	BEKOE D.A.
GREECE	KAFATOS F.C.	
HOLLAND	CRUTZEN P.J.	
INDIA	KASTURIRANGAN K. MENON M.G.K. RAMANATHAN V. RAO C.N.R. SWARUP G.	KASTURIRANGAN K. MENON M.G.K. RAMANATHAN V. RAO C.N.R. SWARUP G.
ISRAEL	CIECHANOVER A.J.	CIECHANOVER A.J. SELA M.
ITALY	BERTI E. CAVALLI-SFORZA L.L. PAGANO S. PASINI C. RUBBIA C. ZICHICHI A.	BERTI E. RUBBIA C. SÁNCHEZ SORONDO M. ZICHICHI A.
JAPAN	GOJOBORI T. NOYORI R. YAMANAKA S.	GOJOBORI T. NOYORI R. YAMANAKA S.
MEXICO	MOLINA M.J.	



<i>Nation</i>	<i>Birth</i>	<i>Residence</i>
POLAND	HELLER M. OLECH C. SELA M. VON KLITZING K.	HELLER M. OLECH C.
RUSSIA	KEILIS-BOROK V.I. NOVIKOV S.P. SAGDEEV R.Z.	NOVIKOV S.P.
SPAIN	GARCÍA-BELLIDO A.	GARCÍA-BELLIDO A.
SWITZERLAND	ARBER W. COTTIER G.M.M. ESCHENMOSER A.	ARBER W. ESCHENMOSER A. POTRYKUS I.
UK	HAWKING S.W. HIDE R. REES M.J.	HAWKING S.W. HIDE R. REES M.J.
UKRAINE	MANIN Y.I.	
USA	BALTIMORE D. BECKER G.S. BERG P. COLLINS F.S. DE ROBERTIS E.M. MINTZ B. PHILLIPS W.D. PRESS F. RICH A. RUBIN V.C. SINGER M.F. TOWNES C.H. WITTEN E.	BALTIMORE D. BECKER G.S. BERG P. BLOBEL G. CAFFARELLI L.A. CAVALLI-SFORZA L.L. COLLINS F.S. DE ROBERTIS E.M. KEILIS-BOROK V.I. LEE T.-D. MALDACENA J.M. MINTZ B. MOLINA M.J. PHILLIPS W.D. PRESS F. RAVEN P.H. RICH A. RODRÍGUEZ-ITURBE I. RUBIN V.C.

<i>Nation</i>	<i>Birth</i>	<i>Residence</i>
USA		SAGDEEV R.Z. SINGER M.F. TOWNES C.H. YANG C.N. WITTEN E. ZEWAIL A.H.
VATICAN CITY		COTTIER G.M.M. FUNES J.C. PAGANO S. PASINI C.
VENEZUELA	RODRÍGUEZ-ITURBE I.	

4. SCIENTIFIC DISCIPLINES

1. ASTRONOMY	FUNES J.C. LÉNA P.J. MURADYAN R. REES M.J. RUBIN V.C.
2. CHEMISTRY	BEKOE D.A. EIGEN M. ERTL G.L. ESCHENMOSE A. LEE Y.T. LEHN J.-M. MOLINA M.J. NOYORI R. POLANYI J.C. RAO C.N.R. ZEWAIL A.H.
3. EARTH SCIENCES	CRUTZEN P.J. HIDE R. KEILIS-BOROK V.I. PRESS F. RAMANATHAN V. RODRÍGUEZ-ITURBE I.
4. LIFE SCIENCES	
4.1. BOTANY	RAVEN P.H.
4.2. AGRONOMY	
4.3. ZOOLOGY	
4.4. GENETICS	ARBER W. CAVALLI-SFORZA L.L. COLLINS F.S. GOJOBORI T. MINTZ B. POTRYKUS I. YAMANAKA S.

4.5. MOLECULAR BIOLOGY	BALTIMORE D. BLOBEL G. BOON-FALLEUR T. CORY S. DE ROBERTIS E.M. GARCÍA-BELLIDO A. KAFATOS F.C. LE DOUARIN N.M. RICH A.
4.6. BIOCHEMISTRY	BERG P. CIECHANOVER A.J. SELA M. SINGER M.F. TUPPY H. VICUÑA R.
4.7. NEUROSCIENCE	BATTRO A.M. DEHAENE S. SINGER W.J.
4.8. SURGERY	
5. MATHEMATICS	CAFFARELLI L.A. MANIN Y.I. NOVIKOV S.P. OLECH C. THIRRING W.E. WITTEN E.
6. APPLICATIONS OF SCIENCE	MALU F.W.K.
7. PHILOSOPHY AND HISTORY OF SCIENCE (EPISTEMOLOGY): FOUNDATIONS OF SCIENCE	BERTI E. HELLER M. MALDAMÉ J.-M. MITTELSTRAß J. SÁNCHEZ SORONDO M.



8. PHYSICS

BAGNATO V.S.
COHEN-TANNOUJDI C.
HÄNSCH T.W.
HAWKING S.W.
KASTURIRANGAN K.
VON KLITZING K.
LEE T.-D.
MALDACENA J.M.
MENON M. G.K.
PHILLIPS W.D.
QUÉRÉ Y.
RUBBIA C.
SAGDEEV R.Z.
SWARUP G.
TOWNES C.H.
YANG C.N.
ZICHICHI A.

9. OTHER DISCIPLINES

BECKER G.S.
VON BRAUN J.
COTTIER G.M.M.
PAGANO S.
PASINI C.

5. NATION OF RESIDENCE AND DISCIPLINE

<i>Nation</i>	<i>Name</i>	<i>Discipline</i>
ARGENTINA	BATTRO A.M.	LIFE SCIENCES (Neuroscience)
AUSTRALIA	CORY S.	LIFE SCIENCES (Molec. Biol.)
AUSTRIA	THIRRING W.E. TUPPY H.	MATHEMATICS LIFE SCIENCES (Biochemistry)
BELGIUM	BOON-FALLEUR T.	LIFE SCIENCES (Molec. Biol.)
BRAZIL	BAGNATO V.S. MURADYAN R.	PHYSICS ASTRONOMY
CANADA	POLANYI J.C.	CHEMISTRY
CHILE	VICUÑA R.	LIFE SCIENCES (Biochemistry)
CHINA (Rep. of)	LEE Y.T.	CHEMISTRY
CONGO (D.R.)	MALU F.W.K.	APPLICATIONS OF SCIENCE
FRANCE	COHEN-TANNOUDI C. DEHAENE S. LE DOUARIN N.M. LEHN J.-M. LÉNA P. MALDAMÉ J.-M. QUÉRÉ Y.	PHYSICS LIFE SCIENCES (Neuroscience) LIFE SCIENCES (Molec. Biol.) CHEMISTRY ASTRONOMY FOUNDATIONS OF SCIENCE PHYSICS
GERMANY	VON BRAUN J. CRUTZEN P.J. EIGEN M. ERTL G.L. HÄNSCH T.W. KAFATOS F.C. VON KLITZING K. MANIN Y.I. MITTELSTRAß J. SINGER W.J.	OTHER DISCIPLINES EARTH SCIENCES CHEMISTRY CHEMISTRY PHYSICS LIFE SCIENCES (Molec. Biol.) PHYSICS MATHEMATICS FOUNDATIONS OF SCIENCE LIFE SCIENCES (Neuroscience)
GHANA	BEKOE D.A.	CHEMISTRY



<i>Nation</i>	<i>Name</i>	<i>Discipline</i>
INDIA	KASTURIRANGAN K. MENON M.G.K. RAO C.N.R. SWARUP G.	PHYSICS PHYSICS CHEMISTRY PHYSICS
ISRAEL	CIECHANOVER A.J. SELA M.	LIFE SCIENCES (Biochemistry) LIFE SCIENCES (Biochemistry)
ITALY	BERTI E. RUBBIA C. SÁNCHEZ SORONDO M. ZICHICHI A.	FOUNDATIONS OF SCIENCE PHYSICS FOUNDATIONS OF SCIENCE PHYSICS
JAPAN	GOJOBORI T. NOYORI R. YAMANAKA S.	LIFE SCIENCES (Genetics) CHEMISTRY LIFE SCIENCES (Genetics)
POLAND	HELLER M. OLECH C.	FOUNDATIONS OF SCIENCE MATHEMATICS
RUSSIA	NOVIKOV S.P.	MATHEMATICS
SPAIN	GARCÍA-BELLIDO A.	LIFE SCIENCES (Molec. Biol.)
SWITZERLAND	ARBER W. ESCHENMOSER A. POTRYKUS I.	LIFE SCIENCES (Genetics) CHEMISTRY LIFE SCIENCES (Genetics)
UK	HAWKING S.W. HIDE R. REES M.J.	PHYSICS EARTH SCIENCES ASTRONOMY
USA	BALTIMORE D. BECKER G.S. BERG P. BLOBEL G.	LIFE SCIENCES (Molec. Biol.) OTHER DISCIPLINES LIFE SCIENCES (Biochemistry) LIFE SCIENCES (Molec. Biol.)

<i>Nation</i>	<i>Name</i>	<i>Discipline</i>
USA	CAFFARELLI L.A.	MATHEMATICS
	CAVALLI-SFORZA L.L.	LIFE SCIENCES (Genetics)
	COLLINS F.S.	LIFE SCIENCES (Genetics)
	DE ROBERTIS E.M.	LIFE SCIENCES (Molec. Biol.)
	KEILIS-BOROK V.I.	EARTH SCIENCES
	LEE T.-D.	PHYSICS
	MALDACENA J.M.	PHYSICS
	MINTZ B.	LIFE SCIENCES (Genetics)
	MOLINA M.J.	CHEMISTRY
	PHILLIPS W.D.	PHYSICS
	PRESS F.	EARTH SCIENCES
	RAMANATHAN V.	EARTH SCIENCES
	RAVEN P.H.	LIFE SCIENCES (Botany)
	RICH A.	LIFE SCIENCES (Molec. Biol.)
	RODRÍGUEZ-ITURBE I.	EARTH SCIENCES
	RUBIN V.C.	ASTRONOMY
	SAGDEEV R.Z.	PHYSICS
	SINGER M.F.	LIFE SCIENCES (Biochemistry)
	TOWNES C.H.	PHYSICS
	WITTEN E.	MATHEMATICS
YANG C.N.	PHYSICS	
ZEWAIL A.H.	CHEMISTRY	
VATICAN CITY	COTTIER G.M.M.	OTHER DISCIPLINES
	FUNES J.C.	ASTRONOMY
	PAGANO S.	OTHER DISCIPLINES
	PASINI C.	OTHER DISCIPLINES

6. CONTINENT OF RESIDENCE AND DISCIPLINE

<i>Continent</i>	<i>Name</i>	<i>Discipline</i>
AFRICA	BEKOE D.A.	CHEMISTRY
	MALU F.W.K.	APPLICATIONS OF SCIENCE
ASIA	CIECHANOVER A.J.	LIFE SCIENCES (Biochemistry)
	GOJOBORI T.	LIFE SCIENCES (Genetics)
	KASTURIRANGAN K.	PHYSICS
	LEE Y.T.	CHEMISTRY
	MENON M.G.K.	PHYSICS
	NOYORI R.	CHEMISTRY
	RAO C.N.R.	CHEMISTRY
	SELA M.	LIFE SCIENCES (Biochemistry)
	SWARUP G.	PHYSICS
YAMANAKA S.	LIFE SCIENCES (Genetics)	
EUROPE	ARBER W.	LIFE SCIENCES (Genetics)
	BERTI E.	FOUNDATIONS OF SCIENCE
	BOON-FALLEUR T.	LIFE SCIENCES (Molec. Biol.)
	VON BRAUN J.	OTHER DISCIPLINES
	COHEN-TANNOUJJI C.	PHYSICS
	COTTIER G.M.M.	OTHER DISCIPLINES
	CRUTZEN P.J.	EARTH SCIENCES
	DEHAENE S.	LIFE SCIENCES (Neuroscience)
	EIGEN M.	CHEMISTRY
	ERTL G.L.	CHEMISTRY
	ESCHENMOSE A.	CHEMISTRY
	FUNES J.C.	ASTRONOMY
	GARCÍA-BELLIDO A.	LIFE SCIENCES (Molec. Biol.)
	HÄNSCH T.W.	PHYSICS
	HAWKING S.W.	PHYSICS
	HELLER M.	FOUNDATIONS OF SCIENCE
	HIDE R.	EARTH SCIENCES
	KAFATOS F.C.	LIFE SCIENCES (Molec. Biol.)
VON KLITZING K.	PHYSICS	
LE DOUARIN N.M.	LIFE SCIENCES (Molec. Biol.)	
LEHN J.-M.	CHEMISTRY	

<i>Continent</i>	<i>Name</i>	<i>Discipline</i>
EUROPE	LÉNA P.J.	ASTRONOMY
	MALDAMÉ J.-M.	FOUNDATIONS OF SCIENCE
	MANIN Y.I.	MATHEMATICS
	MITTELSTRAß J.	FOUNDATIONS OF SCIENCE
	NOVIKOV S.P.	MATHEMATICS
	OLECH C.	MATHEMATICS
	PAGANO S.	OTHER DISCIPLINES
	PASINI C.	OTHER DISCIPLINES
	POTRYKUS I.	LIFE SCIENCES (Genetics)
	QUÉRÉ Y.	PHYSICS
	REES M.J.	ASTRONOMY
	RUBBIA C.	PHYSICS
	SÁNCHEZ SORONDO M.	FOUNDATIONS OF SCIENCE
	SINGER W.J.	LIFE SCIENCES (Neuroscience)
THIRRING W.E.	MATHEMATICS	
TUPPY H.	LIFE SCIENCES (Biochemistry)	
ZICHICHI A.	PHYSICS	
NORTH AMERICA	BALTIMORE D.	LIFE SCIENCES (Molec. Biol.)
	BECKER G.S.	OTHER DISCIPLINES
	BERG P.	LIFE SCIENCES (Biochemistry)
	BLOBEL G.	LIFE SCIENCES (Molec. Biol.)
	CAFFARELLI L.A.	MATHEMATICS
	CAVALLI-SFORZA L.L.	LIFE SCIENCES (Genetics)
	COLLINS F.S.	LIFE SCIENCES (Genetics)
	DE ROBERTIS E.M.	LIFE SCIENCES (Molec. Biol.)
	KEILIS-BOROK V.I.	EARTH SCIENCES
	LEE T.-D.	PHYSICS
	MALDACENA J.M.	PHYSICS
	MINTZ B.	LIFE SCIENCES (Genetics)
	MOLINA M.J.	CHEMISTRY
	PHILLIPS W.D.	PHYSICS
	POLANYI J.C.	CHEMISTRY
	PRESS F.	EARTH SCIENCES
	RAMANATHAN V.	EARTH SCIENCES



<i>Continent</i>	<i>Name</i>	<i>Discipline</i>
NORTH AMERICA	RAVEN P.H.	LIFE SCIENCES (Botany)
	RICH A.	LIFE SCIENCES (Molec. Biol.)
	RODRÍGUEZ-ITURBE I.	EARTH SCIENCES
	RUBIN V.C.	ASTRONOMY
	SAGDEEV R.Z.	PHYSICS
	SINGER M.F.	LIFE SCIENCES (Biochemistry)
	TOWNES C.H.	PHYSICS
	WITTEN E.	MATHEMATICS
SOUTH AMERICA	YANG C.N.	PHYSICS
	ZEWAIL A.H.	CHEMISTRY
	BAGNATO V.S.	PHYSICS
	BATTRO A.M.	LIFE SCIENCES (Neuroscience)
OCEANIA	MURADYAN R.	ASTRONOMY
	VICUÑA R.	LIFE SCIENCES (Biochemistry)
	CORY S.	LIFE SCIENCES (Molec. Biol.)

7. YEAR OF BIRTH AND DISCIPLINE

<i>Birth</i>	<i>Name</i>	<i>Discipline</i>
1915	TOWNES C.H.	PHYSICS
1921	KEILIS-BOROK V.I. MINTZ B.	EARTH SCIENCES LIFE SCIENCES (Genetics)
1922	CAVALLI-SFORZA L.L. COTTIER G.M.M. YANG C.N.	LIFE SCIENCES (Genetics) OTHER DISCIPLINES PHYSICS
1924	PRESS F. RICH A. SELA M. TUPPY H.	EARTH SCIENCES LIFE SCIENCES (Molec. Biol.) LIFE SCIENCES (Biochemistry) LIFE SCIENCES (Biochemistry)
1925	ESCHENMOSE A.	CHEMISTRY
1926	BERG P. LEE T.-D.	LIFE SCIENCES (Biochemistry) PHYSICS
1927	EIGEN M. THIRRING W.E.	CHEMISTRY MATHEMATICS
1928	BEKOE D.A. MENON M.G.K. RUBIN V.C.	CHEMISTRY PHYSICS ASTRONOMY
1929	ARBER W. HIDE R. POLANYI J.C. SWARUP G. ZICHICHI A.	LIFE SCIENCES (Genetics) EARTH SCIENCES CHEMISTRY PHYSICS PHYSICS
1930	BECKER G.S. LE DOUARIN N.M.	OTHER DISCIPLINES LIFE SCIENCES (Molec. Biol.)
1931	OLECH C. QUÉRÉ Y. SINGER M.F.	MATHEMATICS PHYSICS LIFE SCIENCES (Biochemistry)



<i>Birth</i>	<i>Name</i>	<i>Discipline</i>
1932	SAGDEEV R.Z.	PHYSICS
1933	COHEN-TANNOUDI C. CRUTZEN P.J. POTRYKUS I.	PHYSICS EARTH SCIENCES LIFE SCIENCES (Genetics)
1934	RAO C.N.R. RUBBIA C.	CHEMISTRY PHYSICS
1935	BERTI E.	FOUNDATIONS OF SCIENCE
1936	BATTRO A.M. BLOBEL G. ERTL G.L. GARCÍA-BELLIDO A. HELLER M. LEE Y.T. MALU F.W.K. MITTELSTRAß J. MURADYAN R. RAVEN P.H.	LIFE SCIENCES (Neuroscience) LIFE SCIENCES (Molec. Biol.) CHEMISTRY LIFE SCIENCES (Molec. Biol.) FOUNDATIONS OF SCIENCE CHEMISTRY APPLICATIONS OF SCIENCE FOUNDATIONS OF SCIENCE ASTRONOMY LIFE SCIENCES (Botany)
1937	LÉNA P.L. MANIN Y.I.	ASTRONOMY MATHEMATICS
1938	BALTIMORE D. NOVIKOV S.P. NOYORI R.	LIFE SCIENCES (Molec. Biol.) MATHEMATICS CHEMISTRY
1939	LEHN J.-M. MALDAMÉ J.-M.	CHEMISTRY FOUNDATIONS OF SCIENCE
1940	KAFATOS F.C. KASTURIRANGAN K.	LIFE SCIENCES (Molec. Biol.) PHYSICS
1941	HÄNSCH T.W.	PHYSICS
1942	CORY S. HAWKING S.W. REES M.J. RODRÍGUEZ-ITURBE I. SÁNCHEZ SORONDO M.	LIFE SCIENCES (Molec. Biol.) PHYSICS ASTRONOMY EARTH SCIENCES FOUNDATIONS OF SCIENCE

<i>Birth</i>	<i>Name</i>	<i>Discipline</i>
1943	VON KLITZING K. MOLINA M.J. SINGER W.J.	PHYSICS CHEMISTRY LIFE SCIENCES (Neuroscience)
1944	BOON-FALLEUR T. RAMANATHAN V.	LIFE SCIENCES (Molec. Biol.) EARTH SCIENCES
1946	ZEWAIL A.H.	CHEMISTRY
1947	CIECHANOVER A.J. DE ROBERTIS E.M.	LIFE SCIENCES (Biochemistry) LIFE SCIENCES (Molec. Biol.)
1948	CAFFARELLI L.A. PAGANO S. PHILLIPS W.D.	MATHEMATICS OTHER DISCIPLINES PHYSICS
1949	VICUÑA R.	LIFE SCIENCES (Biochemistry)
1950	VON BRAUN J. COLLINS F.S. PASINI C.	OTHER DISCIPLINES LIFE SCIENCES (Genetics) OTHER DISCIPLINES
1951	GOJOBORI T. WITTEN E.	LIFE SCIENCES (Genetics) MATHEMATICS
1958	BAGNATO V.S.	PHYSICS
1962	YAMANAKA S.	LIFE SCIENCES (Genetics)
1963	FUNES J.C.	ASTRONOMY
1965	DEHAENE S.	LIFE SCIENCES (Neuroscience)
1968	MALDACENA J.M.	PHYSICS

8. YEAR OF APPOINTMENT AND DISCIPLINE

<i>Appointment</i>	<i>Name</i>	<i>Discipline</i>
1970	TUPPY H.	LIFE SCIENCES (Biochemistry)
1975	SELA M.	LIFE SCIENCES (Biochemistry)
1978	BALTIMORE D. RICH A.	LIFE SCIENCES (Molec. Biol.) LIFE SCIENCES (Molec. Biol.)
1981	ARBER W. EIGEN M. MENON M.G.K.	LIFE SCIENCES (Genetics) CHEMISTRY PHYSICS
1983	BEKOE D.A. MALU F.W.K. TOWNES C.H.	CHEMISTRY APPLICATIONS OF SCIENCE PHYSICS
1985	RUBBIA C.	PHYSICS
1986	ESCHENMOSER A. HAWKING S.W. MINTZ B. OLECH C. POLANYI J.C. SINGER M.F. THIRRING W.E.	CHEMISTRY PHYSICS LIFE SCIENCES (Genetics) MATHEMATICS CHEMISTRY LIFE SCIENCES (Biochemistry) MATHEMATICS
1990	HELLER M. RAO C.N.R. RAVEN P.H. REES M.J. SAGDEEV R.Z.	FOUNDATIONS OF SCIENCE CHEMISTRY LIFE SCIENCES (Botany) ASTRONOMY PHYSICS
1992	COTTIER G.M.M. SINGER W.J.	OTHER DISCIPLINES LIFE SCIENCES (Neuroscience)
1994	CAFFARELLI L.A. CAVALLI-SFORZA L.L. KEILIS-BOROK V.I. MURADYAN R.	MATHEMATICS LIFE SCIENCES (Genetics) EARTH SCIENCES ASTRONOMY

<i>Appointment</i>	<i>Name</i>	<i>Discipline</i>
1996	BERG P. CRUTZEN P.J. HIDE R. LEHN J.-M. MANIN Y.I. NOVIKOV S.P. RUBIN V.C.	LIFE SCIENCES (Biochemistry) EARTH SCIENCES EARTH SCIENCES CHEMISTRY MATHEMATICS MATHEMATICS ASTRONOMY
1997	BECKER G.S. MALDAMÉ J.-M. PAGANO S. YANG C.N.	OTHER DISCIPLINES FOUNDATIONS OF SCIENCE OTHER DISCIPLINES PHYSICS
1998	SÁNCHEZ SORONDO M.	FOUNDATIONS OF SCIENCES
1999	COHEN-TANNOUJDI C. LE DOUARIN N.M. PRESS F. ZEWAIL A.H.	PHYSICS LIFE SCIENCES (Molec. Biol.) EARTH SCIENCES CHEMISTRY
2000	MOLINA M.J. VICUÑA R. ZICHICHI A.	CHEMISTRY LIFE SCIENCES (Biochemistry) PHYSICS
2001	BERTI E. BLOBEL G. LÉNA P.J.	FOUNDATIONS OF SCIENCE LIFE SCIENCES (Molec. Biol.) ASTRONOMY
2002	BATTRO A.M. BOON-FALLEUR T. NOYORI R. MITTELSTRAß J.	LIFE SCIENCES (Neuroscience) LIFE SCIENCES (Molec. Biol.) CHEMISTRY FOUNDATIONS OF SCIENCE
2003	GARCÍA-BELLIDO A. KAFATOS F.C. LEE T.-D. QUÉRÉ Y.	LIFE SCIENCES (Molec. Biol.) LIFE SCIENCES (Molec. Biol.) PHYSICS PHYSICS



<i>Appointment</i>	<i>Name</i>	<i>Discipline</i>
2004	CORY S. PHILLIPS W.D. RAMANATHAN V.	LIFE SCIENCES (Molec. Biol.) PHYSICS EARTH SCIENCES
2005	POTRYKUS I.	LIFE SCIENCES (Genetics)
2006	FUNES J.C. HÄNSCH T.W. KASTURIRANGAN K. WITTEN E.	ASTRONOMY PHYSICS PHYSICS MATHEMATICS
2007	CIECHANOVER A.J. GOJOBORI T. VON KLITZING K. LEE Y.T. PASINI C. RODRÍGUEZ-ITURBE I.	LIFE SCIENCES (Biochemistry) LIFE SCIENCES (Genetics) PHYSICS CHEMISTRY OTHER DISCIPLINES EARTH SCIENCES
2008	DEHAENE S. SWARUP G.	LIFE SCIENCES (Neuroscience) PHYSICS
2009	COLLINS F.S. DE ROBERTIS E.M.	LIFE SCIENCES (Genetics) LIFE SCIENCES (Molec. Biol.)
2010	ERTL G.L.	CHEMISTRY
2012	BAGNATO V.S. VON BRAUN J.	PHYSICS OTHER DISCIPLINES
2013	MALDACENA J.M. YAMANAKA S.	PHYSICS LIFE SCIENCES (Genetics)

9. YEAR OF APPOINTMENT AND CONTINENT OF RESIDENCE

<i>Appointment</i>	<i>Continent</i>	<i>Name</i>
1970	EUROPE	TUPPY H.
1975	ASIA	SELA M.
1978	NORTH AMERICA NORTH AMERICA	BALTIMORE D. RICH A.
1981	ASIA EUROPE EUROPE	MENON M.G.K. ARBER W. EIGEN M.
1983	AFRICA AFRICA NORTH AMERICA	BEKOE D.A. MALU F.W.K. TOWNES C.H.
1985	EUROPE	RUBBIA C.
1986	EUROPE EUROPE EUROPE EUROPE NORTH AMERICA NORTH AMERICA NORTH AMERICA	ESCHENMOSE A. HAWKING S.W. OLECH C. THIRRING W.E. MINTZ B. POLANYI J.C. SINGER M.F.
1990	ASIA EUROPE EUROPE NORTH AMERICA NORTH AMERICA	RAO C.N.R. HELLER M. REES M.J. RAVEN P.H. SAGDEEV R.Z.
1992	EUROPE EUROPE	COTTIER G.M.M. SINGER W.J.
1994	ASIA NORTH AMERICA NORTH AMERICA NORTH AMERICA	MURADYAN R. CAFFARELLI L.A. CAVALLI-SFORZA L.L. KEILIS-BOROK V.I.



<i>Appointment</i>	<i>Continent</i>	<i>Name</i>
1996	EUROPE	CRUTZEN P.J.
	EUROPE	HIDE R.
	EUROPE	LEHN J.-M.
	EUROPE	MANIN Y.I.
	EUROPE	NOVIKOV S.P.
	NORTH AMERICA	BERG P.
	NORTH AMERICA	RUBIN V.C.
1997	EUROPE	MALDAMÉ J.-M.
	EUROPE	PAGANO S.
	NORTH AMERICA	BECKER G.S.
	NORTH AMERICA	YANG C.N.
1998	EUROPE	SÁNCHEZ SORONDO M.
1999	EUROPE	COHEN-TANNOUJJI C.
	EUROPE	LE DOUARIN N.M.
	NORTH AMERICA	PRESS F.
	NORTH AMERICA	ZEWAIL A.H.
2000	EUROPE	ZICHICHI A.
	NORTH AMERICA	MOLINA M.J.
	SOUTH AMERICA	VICUÑA R.
2001	EUROPE	BERTI E.
	EUROPE	LÉNA P.J.
	NORTH AMERICA	BLOBEL G.
2002	ASIA	NOYORI R.
	EUROPE	BOON-FALLEUR T.
	EUROPE	MITTELSTRAß J.
	SOUTH AMERICA	BATTRO A.M.
2003	EUROPE	GARCÍA-BELLIDO A.
	EUROPE	KAFATOS F.C.
	EUROPE	QUÉRÉ Y.
	NORTH AMERICA	LEE T.-D.

<i>Appointment</i>	<i>Continent</i>	<i>Name</i>
2004	NORTH AMERICA NORTH AMERICA OCEANIA	PHILLIPS W.D. RAMANATHAN V. CORY S.
2005	EUROPE	POTRYKUS I.
2006	ASIA EUROPE EUROPE NORTH AMERICA	KASTURIRANGAN K. FUNES J.C. HÄNSCH T.W. WITTEN E.
2007	ASIA ASIA ASIA EUROPE EUROPE NORTH AMERICA	CIECHANOVER A.J. GOJOBORI T. LEE Y.T. VON KLITZING K. PASINI C. RODRÍGUEZ-ITURBE I.
2008	ASIA EUROPE	SWARUP G. DEHAENE S.
2009	NORTH AMERICA NORTH AMERICA	COLLINS F.S. DE ROBERTIS E.M.
2010	EUROPE	ERTL G.L.
2012	SOUTH AMERICA EUROPE	BAGNATO V.S. VON BRAUN J.
2013	NORTH AMERICA ASIA	MALDACENA J.M YAMANAKA S.

10. ACADEMICIANS APPOINTED BY EACH SUPREME PONTIFF

	<i>Pope</i>	<i>N.</i>
PIUS XI	(1936-1939)	82
PIUS XII	(1939-1958)	41
JOHN XXIII	(1958-1963)	24
PAUL VI	(1963-1978)	56
JOHN PAUL I	(1978)	1
JOHN PAUL II	(1978-2005)	106
BENEDICT XVI	(2005-2013)	17
FRANCIS	(2013-)	1
<i>Total</i>		328

Former Academicians

COYNE George V., S.J. (19-1-1933), Director, Specola Vaticana from 2-9-1978 to 4-8-2006 ('Perdurante Munere').

FARINA Card. **Raffaele**, S.D.B. (24-9-1933), Prefect, Apostolic Vatican Library from 24-5-1997 to 24-6-2007 ('Perdurante Munere').

PITTAU Archbishop **Giuseppe**, S.J. (20-10-1928), Chancellor, Pontifical Academy of Sciences from 1-7-1997 to 4-10-1998 ('Perdurante Munere').

RATZINGER Card. **Joseph** (16-4-1927), Prefect, Congregation for the Doctrine of the Faith from 13-11-2000 to 18-4-2005 ('Honorary Academician'). Elected Supreme Pontiff as Benedict XVI on 19-4-2005.

WINNERS OF THE PRIZES OF THE ACADEMY

PIUS XI and PIUS XII PRIZES 1939-1943

Year	Name	Nation	Discipline
1939	HEYMANS Corneille J.F.	Belgium	Life Sciences
1942	SHAPLEY Harlow	USA	Astronomy
1943	DE MARGERIE Emanuel	France	Earth Sciences

THE PIUS XI MEDAL 1961-2012

Year	Name	Nation	Discipline
1961	WOODWARD Robert B.	USA	Chemistry
1962	ANDERSSON Bengt E.	Sweden	Life Sciences
1963	BOHR Aage	Denmark	Physics
1964	GROS François	France	Life Sciences
1966	SANDAGE Alan R.	USA	Astronomy
1970	KANATANI Haruo	Japan	Life Sciences
1972	NÉMETHY György	Hungary	Physics
1975	HAWKING Stephen W.	UK	Astronomy
1976	LUZZATTO Lucio	Italy	Life Sciences
1978	PAES DE CARVALHO Antonio	Brazil	Life Sciences
1981	LEHN Jean-Marie	France	Chemistry
1983	’HOOFT Gerardus	Netherlands	Physics
1986	BERNAYS Elizabeth A.	Australia	Life Sciences
1988	CAFFARELLI Luis A.	Argentina	Mathematics
1992	SHAMIR Adi	Israel	Other Disciplines
1996	DAVIS Mark M.	USA	Chemistry
2000	BATES Gillian P.	UK	Life Sciences
2000	DAVIES Stephen W.	UK	Life Sciences
2002	DEHAENE Stanislas	France	Life Sciences
2002	MALDACENA Juan M.	USA	Physics
2004	SAINT-RAYMOND Laure	France	Mathematics
2006	SEN Ashoka	India	Physics
2008	LARRAÍN Juan A.	Chile	Life Sciences
2010	MEHLEN Patrick	France	Biology
2012	CHUANG Trees-Juen	Taiwan	Genomics
2012	PÖSCHL Ulrich	Austria	Chemistry

EX MOTU PROPRIO

THE PONTIFICAL ACADEMY OF SCIENCES

28th October 1936

PIUS PP. XI

Amongst the many consolations which Almighty God has seen fit to bestow on Us during the course of Our Pontificate We are pleased to acknowledge that We have seen that not a few of those who experiment with the secrets of nature change their spiritual inclinations and attitude so radically, as to appear entirely renewed in spirit.

Science, which consists in a true recognition of fact, is never opposed to the truths of the Christian faith; in fact – as everyone who examines and meditates on the history of science, is bound to admit – the Pontiffs, together with the Church, have never at any time failed to encourage the research work of learned men, also in the sphere of experimental science; this research work has, in turn, made a valid contribution to the defence of the treasure of heavenly truth entrusted to the Church.

Consequently, as was solemnly declared by the Vatican Council, 'not only can faith and reason never disagree with each other, but they rather offer each other reciprocal help, because real reason demonstrates the foundation of faith and, illuminated by the light thereof, develops the science of things divine; while faith, in turn, liberates and defends reason from errors and enriches it with considerable knowledge'.

Unhappily, in recent times, some, who formerly lived in the paternal home of their inherited religion, have, like the 'prodigal son', miserably abandoned it, though not really for the purpose of learning the truth. It has also been asserted, especially during the last century, with false deductions and daring rashness, that the methods and reasonings of human science and of Divine Revelation are contrary one to the other. But now – and it is with no little consolation that We note it – such prejudiced opinions have been so thoroughly discredited that scarcely anyone can be found, among those who worthily carry on research in the physical sciences, who still asserts and defends such an error. Nor do We wish here to pass over in silence the fact that, during the years of Our Pontificate, a number of scientists – among whom some were considered the highest in their special field and who had received the highest hon-

ours – when visiting Rome, even from various very distant lands, to attend meetings for the advancement of science, came to offer Us their deferential homage, or, rather, to offer it to that venerable Authority which, in the person, although undeserving, of the Successor of St. Peter, has been entrusted in perpetuity to this Apostolic See.

It has also happened that, among those eminent persons, some there were who, though they had not the precious gift of the Catholic Faith, did not, nevertheless, think it unbecoming to bow in reverence before this, Our Chair of Truth.

Some of these, moreover, speaking to Us in their own name as well as in the name of their colleagues, did not hesitate to state, and rightly, that all natural science prepares and consolidates the road leading to the Christian Faith; and their words filled Our fatherly heart with great happiness.

Therefore by the plenitude of Our Authority, *motu proprio*, and after careful deliberation, We constitute and declare established 'The Pontifical Academy of Sciences'.

To testify that We attribute to this Institution a dignity equal to its very high task, We ourselves appoint – and for this first time not by Our Authority alone, but of Our direct and spontaneous will – the seventy renowned scientists who will constitute the Pontifical Academy, and who will be called Pontifical Academicians.

These We have chosen with the greatest care from among those learned men who have, in their own countries, attained the highest peaks of renown.

In making Our choice, We have not only been influenced by the excellence of the research and achievements by which each of them has contributed to the advance of science, but also have taken into consideration their personal renown among scholars, as attested by the approbation and general esteem they enjoy.

Consequently, this Apostolic See hopes and expects to receive from them that help and honour of which this Senate of learned men, as it were a 'Scientific Senate', is a certain augury.

Nor should it seem excessive that this Assembly of noble disciplines should be designated by Us as, so to say, the Senate of the Apostolic See in the field of science. In fact, all honour rendered by scientists to the Divine is not only the homage due from human reason to the Supreme Truth, but also a noble expression of reverence to God the Creator.

Verily then do We desire and expect that the Pontifical Academicians, by means of this Institute of studies, which is both Ours and theirs, will give an

ever greater and higher contribution to the advance of science. We ask no more than this, since the service we expect of these servants of the truth is based on this high purpose and noble efforts.


Given in Rome, at St. Peter's, on the twenty-eighth day of October in the year 1936, the fifteenth of Our Pontificate.

PIUS PP. XI

An. et vol. XXVIII 28 Octobris 1936 (Ser. II, v. III) - Num. 13

ACTA APOSTOLICAE SEDIS

COMMENTARIUM OFFICIALE



SUMMARIVM

Acta Pii Pp. XI: Nota proprio de Pontificia Academia Scientiarum, p. 431 - Statuto, p. 427 - Elenco degli Accademici e Consiglio Accademico, pp. 447-452.

TYPIS POLYGLOTTIS VATICANIS

M - DCCC - XXXVI

<p>Directio: Palazzo Apostolico — Città del Vaticano</p> <p>Administratio: Libreria Vaticana — Città del Vaticano</p>	<p>Præsum annuæ subscriptionis: In Italia, Lib. 80 — extra Italiam, L. 44, 50 —</p> <p>Præsum unius fasciculi: In Italia, Lib. 3,50 — extra Italiam, L. 44, 4 —</p>
---	---

*Bis pro his mensis (Commentariis) prodibit ad quoscunque vel necessitas vel utilitas ad postulare videbitur. (Ex Commentariis Officialis vaticanae, die 29 Octobris 1936 editis).

STATUTES

PART I

CONSTITUTION AND PURPOSE

Art. 1 The Pontifical Academy of Sciences, founded by Pius XI of hallowed memory, is placed under the exalted and direct protection of the reigning Supreme Pontiff.

Art. 2 The purpose of the Pontifical Academy of Sciences is to promote the progress of the mathematical, physical and natural sciences and the study of related epistemological questions and issues.

Art. 3 In order to achieve its ends the Academy:

- a) holds plenary sessions of the Academicians;
- b) organises meetings to promote the progress of science and the solution of important scientific-technical problems at the root of the development of mankind;
- c) promotes scientific investigations and research which can contribute, in the appropriate spheres, to the exploration of moral, social and spiritual questions;
- d) arranges conferences and celebrations;
- e) engages in the publication of the Proceedings of its own meetings and the results of the scientific research and studies of the Academicians and other scientists.

Art. 4 With the object of promoting scientific research, the Academy every two years awards the Pius XI Medal to a young scientist of international reputation.

PART II

THE ACADEMICIANS

Art. 5 Candidates for a seat in the Academy are chosen by the Academy on the basis of their eminent original scientific studies and their acknowledged moral personality, without any form of ethnic or religious discrimination, and are appointed for life by sovereign act of the Holy Father.

In addition, *ex officio*, the Director of the Vatican Observatory; the Director of the Astrophysical Laboratory of the Vatican Observatory; the Prefect of the Vatican Library; and the Prefect of the Secret Archives of the Vatican, are

appointed 'Academicians pro tempore'. The Academicians 'pro tempore' enjoy the same rights and perform the same functions as the Pontifical Academicians. As an exception, and in a purely honorary capacity, persons who deserve the special gratitude of the Academy, by honouring it and helping it and its scientific undertakings, after being proposed by the Council of the Academy, can be appointed by the Holy Father 'Honorary Pontifical Academicians'.

Art. 6 The full complement of the Academy consists of seventy life members, chosen in such a way that as far as possible all the principal branches of the sciences and all the great geographical regions are represented.¹

PART III

THE GOVERNMENT OF THE ACADEMY

Art. 7 The Academy is governed by a President, appointed from among the Academicians by the Supreme Pontiff, *Motu Proprio*. The President is under the direct authority of the Supreme Pontiff. The President remains in office for four years and can be reappointed by the Supreme Pontiff. The President guides and directs every activity of the Academy and represents it in relations with the Holy See and every other Authority or Institution.

Art. 8 The President is assisted by the Council of the Academy, which is constituted as follows:

- a) the outgoing President for a period of four years;
- b) the former President appointed by the Holy Father President Emeritus for life;
- c) five Councillors appointed by the Holy Father, after being proposed by the President, for a period of four years, who can be reappointed.²

Art. 9 The President is assisted directly by the Director of the Chancellery,³ who is appointed by the Holy Father for a period of four years and can be reappointed.

¹ On 8 January 1986 John Paul II increased the number of Academicians for life to eighty.

² On 20 November 1995 John Paul II increased the number of Councillors to seven.

³ On 30 January 1995 John Paul II appointed the Director of the Chancellery: 'Chancellor', 'Academician Perdurante Munere' and 'Councillor Perdurante Munere'.

PART IV
FINANCIAL RESOURCES

Art. 10 The financing of the Academy is ensured by the Administration of the Patrimony of the Apostolic See.

Art. 11 The Academy can also make use of possible gifts, legacies and income derived from its activity.

Art. 12 The President with his Council considers the expenditure necessary for the life of the Academy and approves the budgets and accounts.

PART V
GENERAL REGULATIONS

Art. 13 The present Statutes, promulgated by their publication in the *Acta Apostolicae Sedis*, replace the former Statutes published in the *Acta Apostolicae Sedis* of the year 1936, p. 427 and ff. Every modification of the present Statutes is reserved to the Supreme Pontiff, who is the sole authority competent to dissolve the Academy.

Art. 14 The present Statutes are supplemented by the Regulations drawn up and approved by the President with his Council.

Haec Statuta Paulus VI Summus Pontifex in Audientia infrascripto concessa die I mensis Aprilis, anno MCMLXXVI, approbavit et publici iuris fieri iussit.

Ioannes Card. VILLOT, *Secretarius Status*

SCIENTIFIC MEETINGS

1949-2013

<i>Title</i>	<i>Year</i>
The Biological Problem of Cancer	1949
The Problem of Microseisms	1951
The Problem of Oligo-elements in Vegetal and Animal Life	1955
The Problem of Stellar Population	1957
The Problem of Macromolecules of Biological Interest with Special Reference to Nuclear Proteins	1961
The Problem of Cosmic Radiation in Interplanetary Space	1962
The Econometric Approach to Development Planning	1963
Brain and Conscious Experience	1964
Molecular Forces	1966
Organic Matter and Soil Fertility	1968
Nuclei of Galaxies	1970
Use of Fertilizers and its Effect in Increasing Yield with Particular Attention to Quality and Economy	1972
Oriented Mutation in Man	1974
Biological and Artificial Membranes and Desalination of Water	1975
The Effect of Ionizing Radiation in Man	1975
Natural Products and the Protection of Plants	1976
The Role of Non-specific Immunity in the Prevention and Treatment of Cancer	1977
Nerve Cells, Transmitters and Behaviour	1978
Molecular Aspects of the Origin of Life	1978
Einstein Galileo	1979
The Dangers of a Nuclear War	1980
Mental Deficiency	1980
Mankind and Energy: Needs, Resources, Hopes	1980
Cosmology and Fundamental Physics	1981
Perspectives on Immunization in Parasitic Diseases	1981
The Consequences of the Use of Nuclear Weapons	1981
Recent Advances in the Evolution of Primates	1982



<i>Title</i>	<i>Year</i>
Peace and the Rights of Man	1982
The Gregorian Reform of the Calendar	1982
The Prevention of Nuclear War	1982
Modern Biological Experimentation	1982
Pattern Recognition Mechanisms	1983
Biological Implications of Optimization in Radiation Procedures	1983
Specificity in Biological Interactions	1983
Modern Biology Applied to Agriculture	1983
Chemical Events in the Atmosphere and their Impact on the Environment	1983
Effects of a Nuclear Explosion in the Atmosphere: Nuclear Winter	1984
Immunology, Epidemiology and Social Aspects of Leprosy	1984
Energy For Survival and Development	1984
Extra Corporeal Fecundation	1984
The Impact of Space Exploration on Mankind	1984
Weaponization of Space	1985
Developmental Neurobiology of Mammals	1985
The Artificial Prolongation of Life and the Determination of the Exact Moment of Death	1985
Interaction of Parasitic Diseases and Nutrition	1985
Remote Sensing and its Impact on Developing Countries	1986
Persistent Meteo-oceanographic Anomalies and Teleconnections	1986
Molecular Mechanisms of Carcinogenic and Antitumor Activity	1986
The Fiftieth Anniversary of the Academy	1986
Aspects of the Uses of Genetic Engineering	1987
A Modern Approach to the Protection of the Environment	1987
Large Scale Motions in the Universe	1987
Agriculture and the Quality of Life. New Global Trends	1988
The Principles of Design and Operation of the Brain	1988
Brain Research and the Body-mind Problem: Epistemological and Metaphysical Issues	1988
The Responsibility of Science	1988
Future Trends in Spectroscopy	1989



<i>Title</i>	<i>Year</i>
Science for Development in a Solidarity Framework	1989
The Determination of Brain Death and its Relationship to Human Death	1989
Man and his Environment. Tropical Forests and the Conservation of Species	1990
Science in the Context of Human Culture (I)	1990
Science in the Context of Human Culture (II)	1991
Resources and Population	1991
The Epoch of Galaxy Formation	1992
The Emergence of Complexity in Mathematics, Physics, Chemistry and Biology	1992
Chemical Hazards in Developing Countries	1993
The Legal and Ethical Aspects Related to the Project of Human Genome	1993
Human Genome, Alternative Energy Sources for Developing Countries, Fundamental Principles of Mathematics and Artificial Intelligence	1994
Scientific Bases and Problems of Natural Fertility Regulation	1994
Breast-feeding: Science and Society	1995
The Origin and Early Evolution of Life. Reflection on Science at the Dawn of the Third Millennium	1996
Emergence of Structure in the Universe at the Level of Galaxies	1996
Changing Concepts of Nature at the Turn of the Millennium	1998
Geosphere-biosphere Interactions and Climate	1998
Food Needs of the Developing World in the Early Twenty-first Century	1999
Science for Survival and Sustainable Development	1999
Science For Man and Man for Science	1999
Science and the Future of Mankind (Jubilee Plenary Session)	2000
The Challenges of Sciences (A Tribute to the Memory of Carlos Chagas)	2001
The Challenges for Science: Education for the Twenty-first Century	2001
The Cultural Values of Science	2002
Mind, Brain and Education	2003
The Session Commemorating the 400th Anniversary of the Foundation of the Pontifical Academy of Sciences (1603-2003)	2003



Title	Year
Stem Cell Technology and the Other Innovative Therapies	2003
Water Conflicts and Spiritual Transformation: a Dialogue	2004
Interactions between Global Change and Human Health	2004
Paths of Discovery	2004
The Signs of Death	2005
Water and the Environment	2005
Globalization and Education	2005
What Is Our Real Knowledge About the Human Being?	2006
The Signs of Death	2006
Predictability in Science: Accuracy and Limitations	2006
Scientific Insights into the Evolution of the Universe and of Life	2008
Transgenic Plants for Food Security in the Context of Development	2009
Glacier Retreat	2009
Astrobiology	2009
Nuclear Disarmament, Non-Proliferation and Development	2010
Atherosclerosis: The 21st Century Epidemic	2010
Human Neuroplasticity and Education	2010
The Scientific Legacy of the 20th Century	2010
Global Climate Change and Biodiversity	2010
Fate of Mountain Glaciers in the Anthropocene	2011
Subnuclear Physics	2011
New Developments in Stem Cell Research: induced Pluripotent Stem Cells and their Possible Applications in Medicine	2012
Neurosciences and the Human Person	2012
Complexity and Analogy in Science	2012
On the road to humanity – <i>Via Humanitatis</i> – The main stages of the morphological and cultural evolution of Man. The emergence of the human being	2013
Trafficking in Human Beings: Modern Slavery	2013
Bread and Brain, Education and Poverty	2013

PUBLICATIONS

1936-2013

ACTA

N.	<i>Acta</i>
1-16	<i>Pontificiae Academiae Scientiarum ACTA</i> . The series is available from 1937 to 1959.
017	<i>The Four-Hundredth Anniversary of the Pontifical Academy of Sciences 1603-2003</i> . Commemorative Session, 9 November 2003, Vatican City, 2004, pp. 172, ISBN 88-7761-084-0.
018	<i>Paths of Discovery</i> . Plenary Session, 5-8 November 2004, Vatican City, 2006, pp. LXVIII-299, ISBN 88-7761-088-3.
019	<i>Predictability in Science: Accuracy and Limitations</i> . Plenary Session, 3-6 November 2006, Vatican City, 2008 pp. XLII-277, ISBN 978-88-7761-094-2.
020	<i>Scientific Insights into the Evolution of the Universe and of Life</i> . Plenary Session 31 October-4 November 2008, Vatican City, 2009, pp. LXVII-622, ISBN 978-88-7761-097-3.
021	<i>The Scientific Legacy of the 20th Century</i> . Plenary Session 28 October-1 November 2010, Vatican City, 2011, pp. 376, ISBN 978-88-7761-101-7.

SCRIPTA VARIA

N.	Scripta Varia
001	<i>Index général des travaux de l'Académie Pontificale des 'Nuovi Lincei', 1847-1935, pp. 473.</i>
003	<i>Catalogo dei gasteropodi polmonati, G.S. Coen, 1945, pp. 99.</i>
004	<i>Funzioni quasi abeliane, F. Severi, 1947, pp. 327.</i>
005	<i>La sphygmographie, L. Dalla Torre, 1946, pp. ix-122.</i>
006	<i>L'anemia perniciosa, M. Torrioli, 1948, pp. vii-94.</i>
007	<i>The biological problem of cancer. Study Week, 6-13 June 1949, pp. xv-349.</i>
008	<i>La strutturazione psicologica del linguaggio studiata mediante l'analisi elettroacustica, A. Gemelli, 1950, pp. 53.</i>
009	<i>Tendenza aggressiva e accertamento precoce del sesso nel pavoncello, E. Valentini, 1951, pp. 303.</i>
010	<i>Studio fisico dell'aorta normale e patologica, V. Dal Borgo, 1952, pp. 136.</i>
011	<i>Ein Vorschlag zur empirischen Reduktion von Spektralverteilungen, J. Junkes, 1952, pp. 240.</i>
012	<i>The problem of microseisms. Study Week, 19-26 November 1951, pp. XLVII-418.</i>
013	<i>Cellule cianofile e cellule mucoidi dell'adenoipofisi, A. Casarini, N. Rossi, 1958, pp. 142.</i>
014	<i>The problem of oligoelements in vegetal and animal life. Study Week, 24 April – 2 Mai 1955, pp. XLVI-616.</i>
015	<i>Studio sulle ernie diaframmatiche, L.V. De Stefano, C. Simonetti, 1957, pp. 239.</i>
016	<i>The problem of stellar population. Study Week, 20-28 May 1957, pp. LXVII-551.</i>
017	<i>La vescica artificiale, V. Russo, F. Salviucci, P. Proietti, 1958, pp. 151.</i>
018	<i>La rivascularizzazione del miocardio, L.V. De Stefano, L.G. Frezza, 1959, pp. 142.</i>
019	<i>Elastoplasticità, saggio di interpretazione delle deformazioni plastiche come fenomeni ereditari, G. Colonnetti, 1960, pp. 110.</i>
020	<i>Funzioni quasi abeliane, F. Severi (seconda edizione ampliata), 1961, pp. 408.</i>



N.	<i>Scripta Varia</i>
021	<i>Testosterone e patologia epatica, ricerche istologiche e biochimiche</i> , M. Girolami, 1961, pp. 211.
022	<i>The problem of macromolecules of biological interest with special reference to nuclear proteins</i> . Study Week, 23-31 October 1961, pp. XLIII-479.
023	<i>Le funzioni e le varietà quasi abeliane dalla teoria del Severi ad oggi</i> , M. Rosati, 1962, pp. 196.
024	<i>La prevenzione del cancro</i> , V. Russo, S. Magalini, F. Salviucci, 1963, pp. 168.
025	<i>The problem of cosmic radiations in interplanetary space</i> . Study Week, 1-6 October 1962, pp. XLIX-575.
026	<i>Myasthenia gravis, rivista sintetica e studio patogenetico</i> , E. Malizia, M. Di Lorenzo, L. Torbidoni, 1963, pp. 196.
027a	<i>Miscellanea galileiana</i> , P. Paschini, voll. I-II, 1964, pp. xv-727.
027b	<i>Miscellanea galileiana</i> , P. Paschini, V. Ronchi, F. Soccorsi, vol. III, 1964, pp. 224.
028	<i>The econometric approach to development planning</i> , part I-II. Study Week, 7-13 October 1963, pp. XLVII-1261.
029	<i>Fisiopatologia dell'annegamento</i> , C. Manni, V. Russo, F. Salviucci, E. Scarscia, 1963, pp. 334.
030	<i>Brain and conscious experience</i> . Study Week, 28 September – 3 October 1964, pp. XLVII-885.
031	<i>Molecular forces</i> . Study Week, 18-23 April 1966, pp. LXV-754.
032	<i>Organic matter and soil fertility</i> . Study Week, 22-27 April 1968, pp. LXXII-1017.
034	<i>L'Académie Pontificale des Sciences en mémoire de son premier Président Agostino Gemelli</i> , G.B. Montini, F. Severi, A. Michotte, G.B. Marini-Bettòlo, 1970, pp. 263.
035	<i>Nuclei of galaxies</i> . Study Week, 13-18 April 1970, pp. XLIX-800.
036	<i>L'Académie Pontificale des Sciences en mémoire de son second Président Georges Lemaître</i> , C. Manneback, O. Godart, P.A.M. Dirac, G. Lemaître, A.S. Eddington, 1972, pp. 296.



N.	<i>Scripta Varia</i>
038	<i>Use of fertilizers and its effect in increasing yield with particular attention to quality and economy</i> , part I-II. Study Week, 10-16 April 1972, pp. xci-1423.
039	<i>Pontificiae Academiae Scientiarum Edita Omnia</i> , MCMXXXVI-MCMLXXI-II, pp. 360.
040	<i>Biological and artificial membranes and desalination of water</i> . Study Week, 14-19 April 1975, pp. xxxix-901.
041	<i>Natural products and the protection of plants</i> . Study Week, 18-23 October 1976, pp. xlii-846 (out of print).
042	<i>Science and the modern world</i> . Plenary Session held in March, 1976, Part I, pp. viii-78.
043	<i>The role of non-specific immunity in the prevention and treatment of cancer</i> . Study Week, 17-21 October 1977, pp. xxxv-589.
044	<i>Science and technology for developing countries</i> . A contribution to the problem by the Pontificia Academia Scientiarum. Report prepared by a special Committee of the Pontifical Academy of Sciences composed of C. Chagas (President) and G.B. Marini-Bettolo, G.P. Puppi, Father E. di Rovasenda, together with Prof. P. Bisogno (CNR) and A. Rambelli (University of Rome), 1979 pp. 53.
045	<i>Nerve cells, transmitters and behaviour</i> . Study Week, 9-14 October 1978, pp. xix-679.
046	<i>Mankind and energy: needs, resources, hopes</i> . Study Week, 10-15 November 1980, pp. xxxv-719.
047a	<i>Mental deficiency</i> . Working Group, 3-6 November 1980, pp. xvii-102.
047b	<i>Perspectives of immunization in parasitic diseases</i> . Working Group, 29 September – 2 October 1981, pp. xix-178.
048	<i>Astrophysical cosmology</i> . Proceedings on cosmology and fundamental physics. Study Week, 28 September – 2 October 1981, pp. xxxvii-600.
049	<i>Science and the modern world</i> . Plenary Session, 11-13 October 1978, Part II, pp. 148.
050	<i>Recent advances in the evolution of primates</i> . Working Group, 24-27 May 1982, pp. xvii-204 (out of print).



N.	<i>Scripta Varia</i>
051	<i>Modern biological experimentation</i> . Study Week, 18-23 October 1982, pp. xxix-260.
052	<i>Science and the modern world</i> . Plenary Session, 11-13 November 1979, Part III, pp. 213.
053	<i>I documenti del processo di Galileo Galilei</i> . S.M. Pagano, A.G. Luciani, 1984, pp. xxvii-280.
054	<i>Pattern recognition mechanisms</i> . Study Week, 25-29 April 1983, pp. xv-359.
055	<i>Specificity in biological interactions</i> . Working Group, 9-11 November 1983, pp. xxxv-318.
056	<i>Chemical events in the atmosphere and their impact on the environment</i> . Study Week, 7-11 November 1983, pp. xix-702.
057	<i>Energy for survival and development</i> . Study Week, 11-14 June 1984, pp. xxi-615.
058	<i>The impact of space exploration on mankind</i> . Study Week, 1-5 October 1984, pp. xxvii-364.
059	<i>Developmental neurobiology of mammals</i> . Working Group, 3-7 June 1985, pp. xv-484, ISBN 88-7761-000-X.
060	<i>The artificial prolongation of life and the determination of the exact moment of death</i> . Working Group, 19-21 October 1985, pp. xxvii-114, ISBN 88-7761-001-8.
061	<i>The interaction of parasitic diseases and nutrition</i> . Study Week, 22-26 October 1985, pp. xix-352, ISBN 88-7761-002-6.
062	<i>Galileo Galilei e gli orientamenti esegetici del suo tempo</i> . R. Fabris, 1986, pp. 45.
063	<i>Federico Cesi nel quarto centenario della nascita</i> . E. di Rovasenda e G.B. Marini-Bettòlo, 1986, pp. 47, ISBN 88-7761-003-4.
064	<i>Discorsi indirizzati dai Sommi Pontefici Pio XI, Pio XII, Giovanni XXIII, Paolo VI, Giovanni Paolo II alla Pontificia Accademia delle Scienze dal 1936 al 1986</i> . 1986, pp. x-200, ISBN 88-7761-004-2.
065	<i>Discours adressés par les Souverains Pontifes Pie XI, Pie XII, Jean XXIII, Paul VI, Jean-Paul II à l'Académie Pontificale des Sciences de 1936 à 1986</i> . 1986, pp. x-212, ISBN 88-7761-005-0.



N.	<i>Scripta Varia</i>
066	<i>Discourses of the Popes from Pius XI to John Paul II to the Pontifical Academy of Sciences 1936-1986.</i> 1986, pp. x-202, ISBN 88-7761-006-9.
067	<i>The activity of the Pontifical Academy of Sciences 1936-1986.</i> G.B. Marini-Bettòlo, 1986, pp. xx-245, ISBN 88-7761-019-0.
068	<i>Remote sensing and its impact on developing countries.</i> Study Week, 16-21 June 1986, pp. xxix-676, ISBN 88-7761-007-7.
069	<i>Persistent meteo-oceanographic anomalies and teleconnections.</i> Study Week, 23-27 September 1986, pp. xxi-665, ISBN 88-7761-025-5.
070	<i>Molecular mechanisms of carcinogenic and antitumor activity.</i> Working Group, 21-25 October 1986, pp. xxiii-489, ISBN 88-7761-023-9.
071	<i>L'attività della Pontificia Accademia delle Scienze 1936-1986.</i> G.B. Marini-Bettòlo, 1987, pp. xix-265, ISBN 88-7761-021-2.
072	<i>Immunology, epidemiology and social aspects of leprosy.</i> Working Group, 28 May – 1 June 1984, pp. xxiii-212, ISBN 88-7761-022-0.
073	<i>Cinquantesime de la fondation de l'Académie Pontificale des Sciences. Compte Rendu et Actes de la Session Plénière et des Célébrations,</i> 27-30 Octobre 1986, pp. xx-436, ISBN 88-7761-030-1.
074	<i>Aspects of the uses of genetic engineering.</i> Working Group, 19-23 October 1987 (unpublished).
075	<i>A modern approach to the protection of the environment.</i> Study Week, 2-7 November 1987, pp. xxiv-606, ISBN 88-7761-033-6.
076	<i>Large-scale motions in the Universe.</i> Study Week, 9-14 November 1987, pp. xx-604, ISBN 88-7761-034-4.
077	<i>Agriculture and the quality of life. New global trends.</i> Study Week, 17-22 October 1988, pp. xxv-345, ISBN 88-7761-037-9.
078	<i>The principles of design and operation of the brain.</i> Study Week, 19-24 October 1988, pp. xxiii-589, ISBN 88-7761-038-7.
079	<i>Brain research and the mind-body problem: Epistemological and meta-physical issues.</i> Round Table, 25 October 1988, pp. xv-186, ISBN 88-7761-042-5.
080	<i>The responsibility of science.</i> Plenary Session, 27-31 October 1988, pp. xix-300, ISBN 88-7761-040-9.



N.	<i>Scripta Varia</i>
081	<i>Future trends in spectroscopy</i> . Symposium, 27-28 June 1989 (coedition Pergamon Press), pp. XIX-332, ISBN 88-7761-054-9.
082	<i>Issues on international development and solidarity</i> . Study Week, 23-27 October 1989, pp. LVI-200, ISBN 88-7761-043-3.
083	<i>The determination of brain death and its relationship to human death</i> . Working Group, 10-14 December 1989, pp. XXVII-210, ISBN 88-7761-048-4.
084	<i>Man and his environment. Tropical forests and the conservation of species</i> . Study Week, 14-18 May 1990, pp. XXXII-440, ISBN 88-7761-049-2.
085	<i>Science in the context of human culture I</i> . Plenary Session, 29-31 October 1990, pp. 504, ISBN 88-7761-050-6.
086	<i>Science in the context of human culture II</i> . Symposium, 30 September – 4 October 1991, pp. 351, ISBN 88-7761-037-9.
087	<i>Resources and population</i> . Study Week, 17-22 November 1991, pp. XXIV-338, ISBN 88-7761-057-3.
088	<i>The epoch of galaxy formation</i> . Working Group, 2-4 September 1992 (unpublished).
089	<i>The emergency of complexity in mathematics, physics, chemistry and biology</i> . Plenary Session, 26-31 October 1992, pp. XX-474, ISBN 88-7761-055-7.
090	<i>Chemical hazard in developing countries</i> . Working Group, 21-23 October 1993, pp. XX-158, ISSN 0048-9697.
091	<i>The legal and ethical aspects related to the project of the human genome</i> . Working Group, 19-20 November 1993, pp. XIV-193, ISBN 84-88562-41-1.
092	<i>Human genome, alternative energy sources for developing countries, fundamental principles of mathematics and artificial intelligence</i> . Plenary Session, 25-29 October 1994, ISBN 88-7761-066-2.
093	<i>Scientific bases and problems of natural fertility regulation</i> . Working Group, 16-19 November 1994 (unpublished).
094	<i>Breast-feeding: science and society</i> . Working Group, 11-13 May 1995, pp. IV-453, ISSN 0379-5721.
095	<i>Changing concepts of nature at the turn of the millennium</i> . Plenary Session, 26-29 October 1998, pp. XXXIX-343, ISBN 88-7761-070-0.



N.	<i>Scripta Varia</i>
096	<i>Geosphere-biosphere interactions and climate</i> . Working Group, 9-13 November 1998, Cambridge University Press, 2001, pp. 302.
097	<i>Food needs of the developing world in the early twenty-first century</i> . Study Week, 27-30 January 1999, pp. 472, ISBN 88-7761-072-7.
098	<i>Science for survival and sustainable development</i> . Study Week, 12-16 March 1999, pp. 431, ISBN 88-7761-071-9.
099	<i>Science and the future of mankind. Science for man and man for science</i> . Working Group, 12-14 November 1999 and Jubilee Plenary Session, 10-13 November 2000, pp. 526, ISBN 88-7761-075-1.
100	<i>Papal addresses to the Pontifical Academy of Sciences 1917-2002 and to the Pontifical Academy of Social Sciences 1994-2002</i> . Vatican City 2003, pp. LV, 526, ISBN 88-7761-076-X.
101	<i>Discorsi dei Papi alla Pontificia Accademia delle Scienze dal 1917 al 2002 e alla Pontificia Accademia delle Scienze Sociali dal 1994 al 2002</i> . (forthcoming).
102	<i>Discours adressés par les Souverains Pontifes Pie XI, Pie XII, Jean XXIII, Paul VI, Jean-Paul II à l'Académie Pontificale des Sciences de 1936 à 2001</i> (forthcoming).
103	<i>The challenges of sciences. A tribute to the memory of Carlos Chagas</i> . Working Group, 23-24 February 2001, Vatican City, 2002, pp. 168, tables VI, ISBN 88-7761-081-6.
104	<i>The challenges of science. Education for the twenty-first century</i> . Working Group, 19-21 November 2001, Vatican City, 2002, pp. 293, tables III, ISBN 88-7761-080-8.
105	<i>The cultural values of science</i> . Plenary Session, 8-11 November 2002, Vatican City, 2002, pp. LXXI, 391, ISBN 88-7761-082-4.
106	<i>Interactions between Global Change and Human Health</i> . Working Group, 31 October – 2 November 2004, Vatican City, 2006, pp. XXVIII-421, ISBN 88-7761-085-9.
107	<i>The Educated Brain</i> . Working Group, 7-8 November 2003, Cambridge University Press, pp. XXIV-256, ISBN 978-0-521-87673-5.
108	<i>Water and the Environment</i> . Working Group, 12-14 November 2005, Vatican City, 2007, pp. XVIII-234, ISBN 978-88-7761-091-1



N.	<i>Scripta Varia</i>
109	<i>What is our Real Knowledge about the Human Being.</i> Working Group, 5-6 May 2006, Vatican City, 2007, pp. xix-186, ISBN 978-88-7761-093-5.
110	<i>The Signs of Death.</i> Working Group, 11-12 September 2006, Vatican City, 2007, pp. xciv-466, ISBN 88-7761-090-4.
111	<i>Stem Cell Technology and Other Innovative Therapies.</i> Working Group, 10-11 November 2003, Vatican City, 2007, pp. xxviii-152, ISBN 978-88-7761-092-8.
112	<i>I documenti vaticani del processo di Galileo Galilei (1611-1741).</i> New edition, Vatican City, 2009, pp. cclviii-340, ISBN 978-88-7761-096-6.
113	<i>Transgenic Plants for Food Security in the Context of Development.</i> Proceedings of a Study Week of the Pontifical Academy of Sciences. New Biotechnology vol. 27, Issue 5, November 2010, ISSN 1871-6784.
115	<i>Nuclear Disarmament, Non-Proliferation and Development.</i> Study Day 10 February 2010, Vatican City, 2010, pp. 254, ISBN 978-88-7761-100-0.
116	<i>Atherosclerosis: The 21st Century Epidemic.</i> Working Group 31 May-1 June 2010, Vatican City, 2011, pp. 199, ISBN 978-88-7761-102-4.
117	<i>Human Neuroplasticity and Education.</i> Working Group 27-28 October 2010, Vatican City, 2011, pp. 260, ISBN 978-88-7761-103-1.
118	<i>Fate of Mountain Glaciers in the Anthropocene.</i> Proceedings of the Working Group 2-4 April 2011, Vatican City, 2013, Epub ahead of print.
121	<i>Neurosciences and the Human Person: New Perspectives on Human Activities.</i> Proceedings of the Working Group 8-10 November 2012, Vatican City, 2013, Epub ahead of print.

EXTRA SERIES

N.	Extra Series
001	<i>Gregorian Reform of the Calendar</i> . Proceedings of the Vatican Conference to commemorate its 400th Anniversary, 1582-1982, pp. xxv-323.
002	<i>Einstein, Galileo</i> . Commemoration of Albert Einstein, 1979, pp. 84, ISBN 88-209-0023-8.
003	Delfini Filippi, Gabriella. <i>La Sede (della Pontificia Accademia delle Scienze)</i> . Vatican City, 1986, pp. 68.
004	Delfini Filippi, Gabriella. <i>Le Siège (de l'Académie Pontificale des Science)</i> . Vatican City, 1986, pp. 68.
005	Delfini Filippi, Gabriella. <i>The Building (of the Pontifical Academy of Sciences)</i> . Vatican City, 1986, pp. 68.
006	'Popolazione e risorse'. <i>Rapporto</i> . pp. 72, ISBN 88-343-3635-6.
007	<i>Annuaire mis à jour au 1 Juin 1999</i> , pp. 160, ISBN 88-7761-068-9.
008	<i>Pontificiae Academiae Scientiarum COMMENTATIONES</i> . The series is available from 1937 to 1959.
009	<i>Pontificiae Academiae Scientiarum RELATIONES</i> . The series is available from 1939 to 1945.
010	<i>Annuaire mis à jour au 1 Janvier 2000</i> , pp. 160, ISBN 88-7761-069-7.
011	<i>Discorsi dei Papi alla Pontificia Accademia delle Scienze (1936-1993)</i> . pp. 337, ISBN 88-7761-051-4.
012	'Population and resources', <i>A report</i> . pp. 77, ISBN 88-434-3436-4.
013	<i>Publication of the Pontifical Academy of Science</i> . pp. 20, ISBN 88-7761-067-0.
014	<i>Year Book 2001</i> . pp. 381, ISBN 88-7761-078-6.
015	Sánchez Sorondo, Marcelo. <i>Globalización y Solidaridad</i> . Vatican City 2002, pp. 46.
016	Sánchez Sorondo, Marcelo. <i>Storia e compiti della Pontificia Accademia delle Scienze</i> . Città del Vaticano, 2002, pp. 20.
016a	Sánchez Sorondo, Marcelo. <i>The Pontifical Academy of Sciences: A historical profile</i> . Vatican City 2003, pp. 24.
017	<i>Statement on the cultural values of the natural sciences</i> . Vatican City, 2003, pp. 10.



N.	Extra Series
018	Cesi, Federico. <i>Il natural desiderio di sapere. The natural desire for knowledge</i> . Vatican City, 2003, pp. 159, ISBN 88-7761-083-2.
019	Sánchez Sorondo, Marcelo. <i>Cien años de Magisterio Pontificio</i> . Ciudad del Vaticano, 2003, pp. 59.
020	Sánchez Sorondo, Marcelo. <i>Globalisation, Justice, Charity</i> . Vatican City, 2004, pp. 19.
021	Sánchez Sorondo, Marcelo. <i>Globalización y Justicia Social</i> . Ciudad del Vaticano, 2004, pp. 27.
022	Sánchez Sorondo, Marcelo. <i>Los lirios del campo y los pájaros del cielo</i> . Ciudad del Vaticano, 2004, pp. 19.
023	<i>Study Document on the Use of 'Genetically Modified Plants' to Combat Hunger in the World</i> . Vatican City, 2004, pp. 30.
024	<i>Visit of the Benedict XVI to Casina Pio IV to Honour the Servant of God John Paul II (21 November 2005)</i> . Vatican City, 2005, pp. 22.
025	Statement on <i>Globalization and Education – Dichiarazione su Globalizzazione ed Educazione – Declaración sobre Globalización y Educación</i> . 16-17 November 2005, Città del Vaticano, 2006, pp. 24.
026	Statement on <i>Water and the Environment – Dichiarazione su Acqua e Ambiente</i> . 12-14 November 2005, Città del Vaticano, 2006, pp. 20.
027	Sánchez Sorondo, Marcelo. <i>Caridad y justicia para un mundo globalizado</i> . Città del Vaticano, 2006, pp. 32.
028	Joint Workshop P.A.S. and P.A.S.S. on <i>Globalization and Education</i> . 16-17 November 2005, Walter de Gruyter (Berlin-New York), 2007, pp. XXI-290.
029	<i>Secularism, Faith and Freedom. A Lecture given at the Pontifical Academy of Sciences</i> , by His Grace the Archbishop of Canterbury, Dr. Rowan Williams, Thursday, 23 November 2006, Vatican City, 2006, pp. 28.
030	Sánchez Sorondo, Marcelo. <i>Importanza e attualità del Gesù di Nazaret di Joseph Ratzinger Benedetto XVI. Conferenza dell'Ambasciata di Croazia</i> . 30 ottobre 2007. Città del Vaticano, 2007, pp. 24.
031	<i>Why the Concept of Death is Valid as a Definition of Brain Death</i> . Statement by the Pontifical Academy of Sciences and Responses to Objections, Vatican City, 2008, pp. 54



N.	Extra Series
032	Sánchez Sorondo, Marcelo. <i>The Status of the Human Being in the Age of Science</i> . Vatican City, 2008, pp. 14.
033	<i>Current Scientific Knowledge on Cosmic Evolution and Biological Evolution</i> . Address of His Holiness Benedict XVI to the Members of the Pontifical Academy of Sciences on the Occasion of their Plenary Session and Statement by the PAS, Vatican City, 2008, pp. 26.
034	Sánchez Sorondo, Marcelo. <i>La Verità della Scienza per la Giustizia e la Pace</i> . Vatican City, 2010, pp. 24.
035	Raven, Peter H. <i>Global Climate Change and Biodiversity</i> . Vatican City, 2010, pp. 37.
036	The Scientific Legacy of the 20th Century. Address of His Holiness Benedict XVI to the Members of the Pontifical Academy of Sciences on the Occasion of their Plenary Session and Statement by the PAS, Vatican City, 2010, pp. 12.
037	<i>Human Neuroplasticity and Education</i> . Statement of the Working Group on Human Neuroplasticity and Education (27-28 October 2010), Vatican City, 2010, pp. 10.
038	Sánchez Sorondo, Marcelo. <i>The Pontifical Academy of Sciences: A Historical Profile</i> . Vatican City, 2012, pp. 24.
039	<i>New Developments in Stem Cell Research</i> . Statement of the Working Group on New Developments in Stem Cell Research: Induced Pluripotent Stem Cells and Their Possible Applications in Medicine (16-17 April 2012), Vatican City, 2012, pp. 36.

DOCUMENTA

N.	Documenta
001	<i>Perspectives of immunization in parasitic diseases</i> , Working Group, 29 September – 2 October 1981. Conclusions, pp. 16.
002	<i>Allocution de Sa Sainteté Jean Paul II et discours de Carlos Chagas, Président de l'Académie, Audience Pontificale, 3 Octobre 1981</i> (Textes français et anglais), pp. 29.
003	<i>Statement of the consequences of the use of nuclear weapons</i> , 7-8 October 1981, pp. 14.
004	<i>Declaration on prevention of nuclear war</i> , 23-24 September 1982 (English, French and Italian texts), pp. 30.
005	<i>Astrophysical cosmology</i> . Study Week, 28 September – 2 October 1981. Conclusions, pp. 25.
006	<i>Discourse of His Holiness John Paul II and Address of Carlos Chagas, President of the Academy</i> . Papal Audience, 23 October 1982, pp. 15.
007	<i>Report on the International Conference on nuclear power experience</i> . L. Leprince-Ringuet, Vienna, 13-17 September 1982, pp. 11 (out of print).
008	<i>Allocution de Sa Sainteté Jean Paul II et discours de Carlos Chagas, Président de l'Académie</i> . Audience Pontificale, 12 Novembre 1983 (Textes français, italien et anglais), pp. 49 (out of print).
009	<i>Chemical events in the atmosphere and their impact on the environment</i> . Study Week, 7-11 November 1983. Conclusions, pp. 24.
010	<i>Immunology, epidemiology and social aspects of leprosy</i> . Working Group, 28 May – 1 June 1984. Conclusions, pp. 42.
011	<i>Nuclear winter: a warning</i> , 23-25 January 1984 (English, French and Italian texts), pp. 15.
012	<i>Energy for survival and development</i> . Study Week, 11-14 June 1984. Conclusions, pp. 25.
013	<i>The impact of space exploration on mankind</i> . Study Week, 1-5 October 1984. Conclusions, pp. 20.
014	<i>Biological implications of optimization in radiation procedures</i> . Working Group, 2-5 May 1983. Conclusions (English, Italian and French texts), pp. 32.



N.	Documenta
015	<i>The interaction of parasitic diseases and nutrition.</i> Study Week, 22-26 October 1985. Conclusions, pp. 14, ISBN 88-7761-026-3.
016	<i>Remote sensing and its impact on developing countries.</i> Study Week, 16-21 June 1986. Conclusions, pp. 22, ISBN 88-7761-027-1.
017	<i>Persistent meteo-oceanographic anomalies and teleconnections.</i> Study Week, 23-27 September 1986. Conclusions, pp. 21, ISBN 88-7761-024-7.
018	<i>Molecular mechanisms of carcinogenic and antitumor activity.</i> Working group, 21-25 October 1986. Conclusions, pp. 27, ISBN 88-7761-028-X.
019	<i>Celebration of the fiftieth anniversary of the restoration of the Academy (1936-1986). Inaugural address of President Carlos Chagas, 27 October 1986.</i> (English, French and Italian texts), pp. 49, ISBN 88-7761-015-8.
020	<i>Allocution de Sa Sainteté Jean Paul II et discours de Carlos Chagas Président de l'Académie.</i> Audience Pontificale, 28 Octobre 1986. (Texte français, anglais, italien), pp. 74, ISBN 88-7761-016-6.
021	<i>Historical aspects of the Pontifical Academy of Sciences.</i> 28 October 1986. G.B. Marini-Bettòlo, pp. 16, ISBN 88-7761-018-2.
022	<i>Aspetti artistici della Casina Pio IV sede della Pontificia Accademia delle Scienze.</i> 28 Ottobre 1986. Carlo Pietrangeli, pp. 16.
023	<i>A modern approach to the protection of the environment.</i> Study Week, 2-7 November 1987, pp. 24, ISBN 88-7761-032-8.
024	<i>Agriculture and the quality of life. New global trends.</i> Study Week, 17-24 October 1988. Conclusions, pp. 33, ISBN 88-7761-036-0.
025	<i>Science for development in a solidarity framework.</i> Study Week, 23-27 October 1989. Conclusions, pp. 77, ISBN 88-7761-039-5.
026	<i>Man and his environment. Tropical forests and the conservation of species.</i> Study Week, 14-18 May 1990. Conclusions, pp. 43, ISBN 88-7761-041-7.
027	<i>Chemical hazards in developing countries.</i> Working Group, 21-23 October 1993. Final Remarks, pp. 44, ISBN 88-7761-047-6.
028	<i>Breastfeeding: science and society.</i> Working Group, 11-13 May 1994. Summary Report, pp. 35, ISBN 88-7761-059-X.

COMMENTARII (Volumen I, 1961-1966)

N.	Commentarii, Vol. I, 1961-1966
001	<i>Panegyrique du Rév.me Père Agostino Gemelli, O.F.M., A.M. van den Berk, pp. 24.</i>
002	<i>Long-term observations on pathogenic fungi cultivated on artificial media for two, three, four and five decades. Permanency and variations of their characters. The 'Sterile distilled water method' of cultivation to maintain such fungi in mycological collections and prevent the development of pleomorphism, A. Castellani, pp. 12.</i>
003	<i>Nouvelles observations sur l'identification mycologique du saccharose et de l'insuline, substances non réductrices, A. Castellani, pp. 12.</i>
004	<i>Una nuova razza di fagiano dorato doppiamente recessiva, A. Chigi, pp. 4.</i>
005	<i>Modalità di comportamento aggressivo del pavoncello maschio adulto e loro analisi quantitativa, E. Valentini, pp. 124.</i>
006	<i>Sulla stereospecificità della biosintesi di alcuni triterpeni, D. Arrigoni e L. Guglielmetti, pp. 4.</i>
007	<i>Les temples d'Abou-Simbel en danger, G. Colonnetti, pp. 24.</i>
008	<i>Charles Jean de La Vallée Poussin, G. Lemaître, pp. 4.</i>
009	<i>Vers une physiologie anthropologique, F.J.J. Buytendijk, pp. 16.</i>
010	<i>Drug resistance of bacteria in relation to general biology, C.N. Hinshelwood, pp. 4.</i>
011	<i>The nature of the elementary particles, W. Heisenberg, pp. 4.</i>
012	<i>Partition phenomena in two phase polymer systems and their significance for particle separation, A. Tiselius, pp. 8.</i>
013	<i>Internal rotation in polymers, S. Mizushima, pp. 4.</i>
014	<i>Mechanism of the synthesis of ammonia on iron catalysts, H.S. Taylor, pp. 4.</i>
015	<i>Sur les peuplades non bantoues de l'Angola, A. de Almeida, pp. 24.</i>
016	<i>La vie et l'oeuvre de Francesco Severi, G. Julia, pp. 12.</i>
017	<i>Etat actuel de nos connaissances des cyclones tropicaux, E. Gherzi, pp. 20.</i>
018	<i>Researches on the central nervous system, J.C. Eccles, pp. 16.</i>
019	<i>The significance of inorganic levels in the internal medium of higher animals, E.J. Conway, pp. 16.</i>
020	<i>On fever, hunger and thirst, B.E. Andersson, pp. 28.</i>



N.	<i>Commentarii, Vol. I, 1961-1966</i>
021	<i>Historical notes to the discovery of the cosmic radiation, G. de Hevesy, pp. 4.</i>
022	<i>Bibliografia dell'Archivio Vaticano, M. Giusti, pp. 8.</i>
023	<i>History and clinical value of the ballistocardiogram – A review of clinical and experimental researches, E. Castagnetta, A. Farulla, pp. 32.</i>
024	<i>Rilievi batteriologici in corso di rinofaringite acuta – Frequenza dell'isolamento di stafilococchi patogeni del cavo nasale, E. Castagnetta, pp. 8.</i>
025	<i>Rilievi farmacologici sulle alterazioni elettrocardiografiche indotte nel coniglio dalla somministrazione di 'Stafilolisina Alfa', E. Castagnetta, pp. 8.</i>
026	<i>Rilievi elettrocardiografici nel coniglio dopo somministrazione di 'O Streptolisina', E. Castagnetta, pp. 12.</i>
027	<i>Anatomical and physiological remarks on right ventricle infarctions, E. Castagnetta, A. Farulla, G. Naro, pp. 12.</i>
028	<i>Endocardial fibroelastosis, E. Castagnetta, A. Farulla, G. Naro, pp. 26.</i>
029	<i>Observations on pathogenic fungi cultured on artificial media for 2, 3, 4 and 5 decades. Permanency and variations of certain cultural, biochemical and antigenic characters, A. Castellani, pp. 8.</i>
030	<i>The cultivation of pathogenic fungi in sterile distilled water, A. Castellani, pp. 8.</i>
031	<i>Theodor von Karman, E. Pistoiesi, pp. 8.</i>
032	<i>Actions pharmacologiques sur le seuil convulsif de l'électrochoc, C. Heymans, A.F. De Schaepdryver, Y. Piette, A.L. Delaunois, pp. 12.</i>
033	<i>Aplicaciones científicas y utilitarias de los mapas gravimétricos, J.G. Siñeriz, pp. 8.</i>
034	<i>La struttura di una nuova categoria di composti aromatici derivati del tetraazapentalene, M. Brufani, W. Fedeli, G. Giacomello, A. Vaciago, pp. 8.</i>
035	<i>On the structure of atomic nuclei, A. Bohr, pp. 20.</i>
036	<i>Su la possibilità di sottofondazione del Campanile di Pisa, G. Colonnetti, pp. 12.</i>
037	<i>The redox pump in the biological performance of osmotic work, E.J. Conway, pp. 12.</i>
038	<i>Changes in reaction pattern accompanying bacterial adaptation, C.N. Hinshelwood, pp. 4.</i>



N.	<i>Commentarii, Vol. I, 1961-1966</i>
039	<i>Prinzipien cerebraler organisation</i> , W.R. Hess, pp. 12.
040	<i>Appunti sul significato morfologico dell'apparato reticolare interno (Golgi) studiato in cellule nervose di cefalopodi</i> , P. Graziadei, pp. 16.
041	<i>The floating zone refining of iron</i> , S. Mizushima, pp. 8.
042	<i>Hormonal factors of diabetic ketosis</i> , B.A. Houssay, pp. 24.
043	<i>Natural resistance to disease</i> , G. Speri Sperti, pp. 8.
044	<i>The effect of an electric field on the critical opalescence</i> , P. Debye, pp. 4.
045	<i>Cell regulation</i> , C.N. Hinshelwood, pp. 4.
046	<i>Internal rotation and conformation of linear high polymers</i> , S. Mizushima, pp. 4.
047	<i>Campo fluido supersonico dietro onda d'urto aderente</i> , L. Broglio, pp. 28.
048	<i>Membrane barriers to the entrance of sodium ions into isolated amphibian skeletal muscle</i> , E.J. Conway, pp. 12.
049	<i>Analisi elementare continua di composti organici separati mediante cromatografia in fase vapore</i> , F. Cacace, R. Cipollini, G. Perez, pp. 12.
050	<i>Index</i> , pp. 8.

COMMENTARII (Volumen II, 1967-1972)

N.	Commentarii, Vol. II, 1967-1972
001	<i>Note on the reception at Brébeuf College in Montreal of pulses from distant Loran stations on the Atlantic Coast</i> , E. Gherzi, pp. 8.
002	<i>Contribution à la synthèse des hétérocycles au moyen des sels de nitrilium</i> , M. Lora Tamayo, pp. 20.
003	<i>Role of liver innervation on fat metabolism</i> , B.A. Houssay, E. Ashkar, E. Del Castillo, M.E. Galli, A. Roldan, C.T. Rietti, E. Urgoiti, pp. 8.
004	<i>Copper content of blood plasma</i> , G.C. de Hevesy, pp. 4.
005	<i>Milk production on protein-free feed</i> , A.L. Virtanen, pp. 4.
006	<i>The active transport of inorganic cations across the yeast cell membrane</i> , E.J. Conway, pp. 4.
007	<i>Virus et hérédité</i> , P. Lépine, pp. 8.
008	<i>Progrès dans la micromorphologie des sols</i> , J.M. Albareda Herrera, pp. 68.
009	<i>Researches on certain long-term recurring phenomena exhibited by some bacteria and fungi</i> , A. Castellani, pp. 8.
010	<i>Two peculiar pleomorphic slime organisms isolated from human lesions of most difficult classification: myxomicrobium multiplex cast, and myxogotrichum filarioides cast</i> , A. Castellani, pp. 20.
011	<i>The scientific work of Georges Lemaître</i> , P.A.M. Dirac, pp. 20.
012	<i>Dérivés hydraziniques d'indols en tant qu'inhibiteurs de la monoamineoxidase</i> , M. Lora Tamayo, pp. 16.
013	<i>The physical interpretation of quantum electrodynamics</i> , P.A.M. Dirac, pp. 12.
014	<i>Note on an explanation of crystal structures of elementary substances</i> , S. Mizushima and I. Ichishima, pp. 12.
015	<i>Absorption spectra of molecular ions</i> , G. Herzberg, pp. 8.
016	<i>Note on the reception at Montreal of a continuous wave radio transmission on 80 kHz from the Defense Research Communications Establishment in Ottawa, Canada</i> , E. Gherzi, pp. 16.
017	<i>Long-term maintenance and cultivation of the common pathogenic fungi of man in sterile distilled water</i> , A. Castellani, pp. 8.



N.	<i>Commentarii, Vol. II, 1967-1972</i>
018	<i>La protection de la nature dans la lutte contre la faim</i> , A. Ghigi, pp. 8.
019	<i>Le spectre infrarouge – Quelques-unes de ses propriétés et de ses applications</i> , J. Lecomte, pp. 24.
020	<i>An improvement of Runge's theorem on diophantine equations</i> , A. Schinzel, pp. 12.
021	<i>Production of L-asparaginase by a strain of 'Aspergillus terreus'</i> , A. Tonolo, L. Carta De Angelis, E. Zurita, pp. 4.
022	<i>Ricordo del Padre Agostino Gemelli</i> , G.B. Marini-Bettòlo, pp. 28.
023	<i>Valutazione statica e dinamica delle strutture istologiche e citologiche</i> , A. Pensa, pp. 16.
024	<i>La production de chaleur et les deux facteurs qui la composent: vitesse et rendement</i> , E. Cruz Coke, pp. 24.
025	<i>Science and the protection of the environment</i> , G.B. Marini-Bettòlo, pp. 40.
026	<i>Priorities in scientific research</i> , A. Tiselius, pp. 8.
027	<i>On the substances controlling certain reproductive phenomena in starfishes</i> , H. Kanatani, pp. 36.
028	<i>Les infections virales à évolution lente</i> , P. Lépine, pp. 8.
029	<i>Urinary kininogenase and renal hypertension</i> , H.R. Croxatto and M. San Martin, pp. 8.
030	<i>Note on the conformation of chain molecules</i> , S. Mizushima and T. Shimanouchi, pp. 4.
031	<i>Dolichol monophosphate glucose, an intermediate in glucose transfer in liver</i> , L.F. Leloir and N.H. Behrens, pp. 8.
032	<i>A meteorological forecasting puzzle</i> , E. Gherzi, pp. 8.
033	<i>Role of the hypophysis on ketonemia and fatty liver of the pancreatectomized dog</i> . B.A. Houssay, A.G. Roldan, C.T. Rietti, E.J. Del Castillo, M.E. Galli, pp. 8.
034	<i>Sir Edward Victor Appleton</i> , H.A. Brück, pp. 8.
035	<i>L'infrarouge et la météorologie</i> , J. Lecomte, pp. 8.
036	<i>Alessandro Ghigi (1875-1970)</i> , S.O. Hörstadius, pp. 4.
037	<i>Sur un virus modèle et son évolution: le virus de la rage</i> , P. Lépine, pp. 4.
038	<i>Arne Tiselius (1902-1971)</i> , G.B. Marini-Bettòlo, pp. 24.
039	<i>The solidity of the earth's inner core</i> , K.E. Bullen, pp. 16.



N.	<i>Commentarii, Vol. II, 1967-1972</i>
040	<i>Kallikrein-like enzyme in purified rat renal extracts containing renin</i> , H.R. Croxatto and G.E. Noe, pp. 24.
041	<i>A short note on atmospheric pollution and atmospheric electricity</i> , E. Gherzi, pp. 8.
042	<i>Dimeric proanthocyanidins: structure and biological activity</i> , G.B. Marini-Bettòlo and F. Delle Monache, pp. 16.
043	<i>Reexamination of conformations of some molecules</i> , S. Mizushima, T. Shimanouchi and I. Harada, pp. 20.
044	<i>Bat malaria: zoogeography and possible course of evolution</i> , P.C.C. Garnham, pp. 16.
045	<i>Aldo Castellani (1877-1971)</i> , P.C.C. Garnham, pp. 36.
046	<i>Evolutionary cosmology</i> , P.A.M. Dirac, pp. 16.
047	<i>Cell division</i> , A. Szent-Györgyi, pp. 8.
048	<i>Les techniques pour obtenir les hautes températures et leurs applications</i> , G. Chaudron, pp. 16.
049	<i>Experimental texts of the quantum theory of molecular hydrogen</i> , G. Herzberg, pp. 36.
050	<i>Inhibición de la tiroxina</i> , E. Cruz-Coke, pp. 12.
051	<i>Molecular interactions in hydrogen-bonding solvents</i> , G. Némethy, pp. 24.
052	<i>Alcune osservazioni sulle formule di quadratura approssimata</i> , M.A. Sneider Ludovici, pp. 16.
053	<i>Contribution à l'étude de l'ascendance des Bochimans Khun</i> , A. de Almeida, pp. 48.
054	<i>Synthetic metals</i> , A.R. Ubbelohde, pp. 12.
055	<i>On the problem of the origin of spiral structure</i> , J.H. Oort, pp. 8.
056	<i>Organic ionic melts. A novel class of liquids</i> , A.R. Ubbelohde, pp. 12.
057	<i>The history, the discovery and the present position of insulin</i> , C.H. Best, pp. 28.
058	<i>Recientes progresos en el estudio del curare y de los alcaloides de menispermaceae y loganiaceae</i> , G.B. Marini-Bettòlo, pp. 28.
059	<i>Productos naturales de origen vegetal de interés farmacológico en Latino-América</i> , G.B. Marini-Bettòlo, pp. 36.
060	<i>Les di- et triazolindiones comme philodienes</i> , M. Lora Tamayo, pp. 8.

COMMENTARII (Volumen III, 1973-1996)

N.	<i>Commentarii, Vol. III, 1973-1996</i>
001	<i>Le progrès de la science et l'avenir de l'humanité</i> , C. Chagas, pp. 16.
002	<i>Le message de vie</i> , J. Lejeune, pp. 15 (out of print).
003	<i>Commemorazione di Guglielmo Marconi</i> , G.B. Marini-Bettòlo, pp. 43.
004	<i>Gravitational collapse and after</i> , S.W. Hawking, pp. 6.
005	<i>Infrared and Raman spectra of 1,2-dichloroethane and its deuterium compound in the gaseous, liquid and solid states</i> , S. Mizushima, pp. 19.
006	<i>James Chadwick</i> , P.A.M. Dirac, pp. 5.
007	<i>Does the gravitational constant vary?</i> , P.A.M. Dirac, pp. 7.
008	<i>Some ethical considerations regarding the use of man and primates in scientific research</i> , P.C.C. Garnham, pp. 11.
009	<i>Réflexions sur la débilité de l'intelligence des enfants trisomiques 21</i> , J. Lejeune, pp. 12.
010	<i>Remarques sur l'énergie et sur quelques moyens proposés pour remédier à la pénurie actuelle</i> , J. Lecomte, pp. 18.
011	<i>La tache pigmentaire congénitale chez des nouveaux-nés du Timor Portugais</i> , A. de Almeida, pp. 16.
012	<i>Domenico Marotta</i> , G.B. Marini-Bettòlo, pp. 7.
013	<i>Commemorazione del Padre Giuseppe Gianfranceschi, S.J., Presidente della Pontificia Accademia delle Scienze – Nuovi Lincei</i> , E. di Rovasenda, pp. 13 (out of print).
014	<i>Heisenberg's influence on physics</i> . P.A.M. Dirac, pp. 15.
015	<i>New developments in neurobiological research</i> , R. Levi-Montalcini, pp. 23.
016	<i>A partial survey of mathematical achievements</i> , B. Segre, pp. 12.
017	<i>The kidney and its humoral action on arterial hypertension</i> , H. Croxatto, pp. 23.
018	<i>Elementary particles</i> , V.F. Weisskopf, pp. 13.
019	<i>Natural products and the protection of plants</i> . Summary of the Study Week held October 18-23, 1976, pp. 47.
020	<i>L'évolution des galaxies dans l'Univers en expansion</i> , B. Strömgren, pp. 26.
021	<i>Les relations entre la science et la foi chez Georges Lemaître</i> , O. Godart, M. Heller, pp. 12.



N.	<i>Commentarii, Vol. III, 1973-1996</i>
022	<i>P. Angelo Secchi, S.J., H.A. Brück, pp. 17.</i>
023	<i>Cultural and social background of the rapid modernization of Japan, S. Mizushima, pp. 10.</i>
024	<i>New ideas about gravitation and cosmology, P.A.M. Dirac, pp. 10.</i>
025	<i>Accordion-like vibrations of long chain molecules, S. Mizushima, pp. 5.</i>
026	<i>Organic matter in interstellar space, R.D. Brown, pp. 21.</i>
027	<i>Mathematics, science, and mathematical sciences, G. Colombo, pp. 17.</i>
028	<i>Solar photochemistry and water photolysis, J.M. Lehn, pp. 30.</i>
029	<i>Understanding elementary particles by Gauge theories, G. 'tHooft, pp. 6.</i>
030	<i>The developmental role of sleep: a new hypothesis, A. Giuditta, M.V. Ambrosini, G. Grassi Zucconi, pp. 12.</i>
031	<i>Research on pathogeny of mental retardation in trisomy 21, J. Lejeune, pp. 18, ISBN 88-7761-031-X.</i>
032	<i>Alcune note di cosmologia, N. Dallaporta, pp. 24.</i>
033	<i>From the privileged margin to an average centre, M. Heller, pp. 20.</i>
034	<i>Giornata Galileiana (16.6.1994), pp. 100, ISBN 88-7761-053-0.</i>
035	<i>Commemoration of the academicians (1992-1994), pp. 67, ISBN 88-7761-056-5.</i>

COMMENTARII (Volumen IV, 1996-)

N.	<i>Commentarii, Vol. IV, 1996-</i>
001	<i>Alla radice della compartecipazione. La società partecipativa, pp. 28, ISBN 88-7761-058-1.</i>
002	<i>Bioengineering: short term optimism and long term risk, C.B. Anfinsen, pp. 35, ISBN 88-7761-061-1.</i>
003	<i>The origin and early evolution of life. Plenary Session, 22-26 October 1996, pp. 340, ISBN 88-7761-063-8.</i>
004	<i>Reflection on science at the dawn of the third millennium. Plenary Session, 22-26 October 1996, pp. 227, ISBN 88-7761-064-6.</i>
005	<i>Round table on the problems of the origin of life. Plenary Session, 22-26 October 1996, pp. 152, ISBN 88-7761-065-4.</i>