

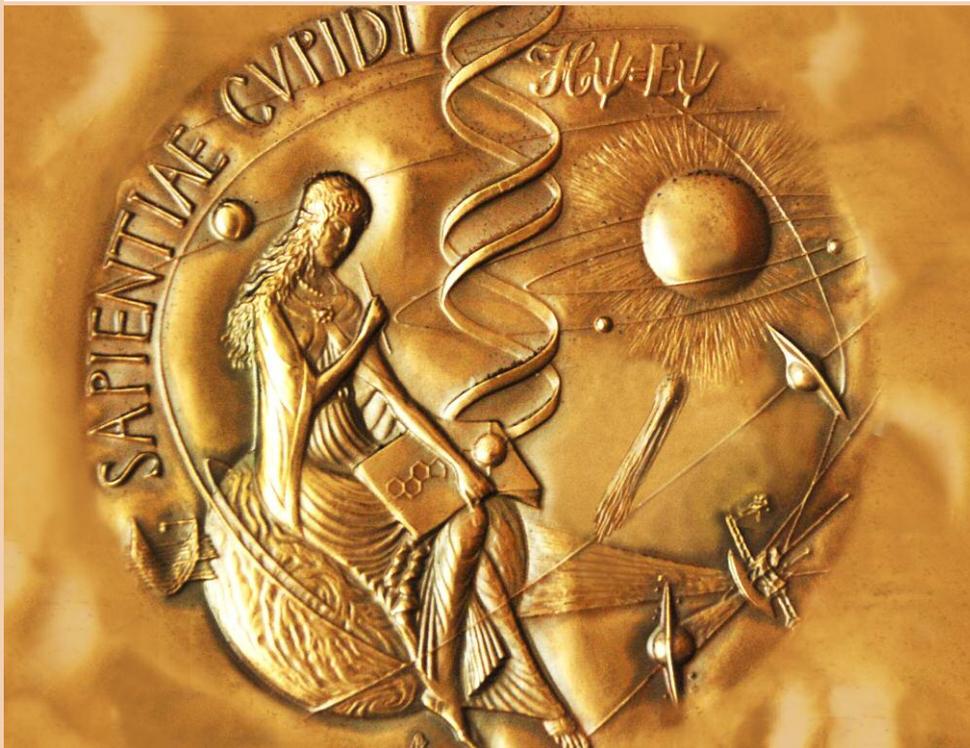


THE PONTIFICAL ACADEMY OF SCIENCES

PLENARY SESSION ON

SCIENCE *and* SUSTAINABILITY

*Impacts of Scientific Knowledge
and Technology on Human Society
and its Environment*



25-29 NOVEMBER 2016 • CASINA PIO IV • VATICAN CITY





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The climate is a common good, belonging to all and meant for all. At the global level, it is a complex system linked to many of the essential conditions for human life. A very solid scientific consensus indicates that we are presently witnessing a disturbing warming of the climatic system. In recent decades this warming has been accompanied by a constant rise in the sea level and, it would appear, by an increase of extreme weather events, even if a scientifically determinable cause cannot be assigned to each particular phenomenon. Humanity is called to recognize the need for changes of lifestyle, production and consumption, in order to combat this warming or at least the human causes which produce or aggravate it. It is true that there are other factors (such as volcanic activity, variations in the earth's orbit and axis, the solar cycle), yet a number of scientific studies indicate that most global warming in recent decades is due to the great concentration of greenhouse gases (carbon dioxide, methane, nitrogen oxides and others) released mainly as a result of human activity. As these gases build up in the atmosphere, they hamper the escape of heat produced by sunlight at the earth's surface. The problem is aggravated by a model of development based on the intensive use of fossil fuels, which is at the heart of the worldwide energy system. Another determining factor has been an increase in changed uses of the soil, principally deforestation for agricultural purposes.

Pope Francis, Encyclical *Laudato si'* §23

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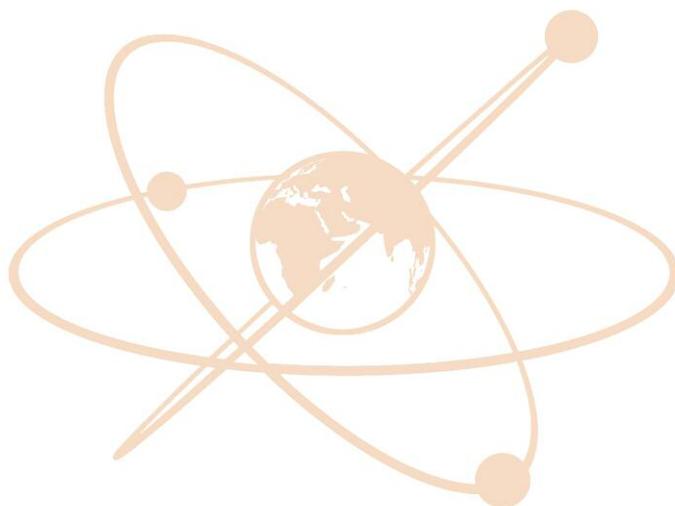


Introduction

We invite all members of the PAS to reflect on which already available or expected scientific advances may impact on the sustainable development of human societies and their environments. Please consider both positive and negative impacts. Some such impacts may become effective in the short term. But it is also important to keep in mind that sustainable development should hopefully contribute to life on Earth at the very long term, to maintain a relatively stable equilibrium of the human

civilization in the steadily but slowly evolving world around us on our planet Earth.

At this Plenary Session we expect to receive specific inputs ideally from all scientific disciplines. We therefore invite all PAS Academicians to present their relevant contributions to the 2016 Plenary Session. Contributions can be either 20 or 10 minutes long, so that we will have sufficient time for discussions and for drawing conclusions.



Friday 25 November 2016

OPENING SESSION • Chair: Werner Arber	
9:00	Werner Arber , <i>Word of Welcome</i> H.E. Msgr. Marcelo Sánchez Sorondo , <i>Presentation of the Plenary Session</i>
9:10	<i>Long Term Responsibility</i> Jürgen Mittelstraß
9:30	<i>The Project for Mankind for a Sustainable Development of the World</i> Antonino Zichichi
9:50	Discussion
10:10	Coffee break
NEUROSCIENCES AND SCIENTIFIC EDUCATION SESSION • Chair: Werner Arber	
10:40	<i>Building a Bridge from Neuroscience to Education</i> Stanislas Dehaene
11:00	Discussion
11:20	<i>Educating for Sustainable Development: A Crucial Role for Science Academies</i> Pierre Léna
11:30	Discussion
SPECIAL SESSION <i>Cosmology on the Occasion of the 50th Anniversary of Msgr. Georges Lemaître's Death</i> (M.J. Rees) • Chair: Pierre Léna	
11:50	<i>The Future of Space Exploration and Technology</i> Martin J. Rees
12:00	Discussion
12:20	<i>Exploiting Solar System Resources: Opportunities and Issues</i> Guy Consolmagno
12:30	Discussion
12:40	Lunch at the Casina Pio IV
14:50	<i>The Origin of the Universe</i> Stephen W. Hawking
15:10	<i>The State of Understanding of the Nature and Evolution of the Observable Universe</i> James P. Peebles
15:30	Discussion
15:45	<i>The Quantum Universe</i> Robbert Dijkgraaf
16:05	Discussion
16:20	<i>What We Learn When We Learn that the Universe is Accelerating</i> Saul Perlmutter
16:40	Discussion
16:55	Coffee break



17:25	<i>Thousands of New Worlds</i> Lisa Kaltenegger
17:45	Discussion
18:00	<i>The Figure and Legacy of Msgr. Lemaître</i> Thomas Hertog
18:20	Discussion
18:35	<i>Role of Space Technology for enabling inter-generational equity of natural capital and disaster resilience: Corollaries of Indian Space Program</i> Krishnaswamy Kasturirangan
18:55	Discussion
19:10	<i>Scaling in Particle Physics and Cosmology</i> Rudolf Muradyan
19:25	Discussion
19:35	Dinner at the Casina Pio IV

Saturday 26 November 2016

CHEMISTRY SESSION • Chair: Carlo Rubbia	
9:00	<i>Atmospheric Chemistry and Sustainability</i> Mario J. Molina
9:20	Discussion
9:40	<i>Novel Strategies for Energy Devices Based on Advanced Materials</i> Chintamani N.R. Rao
10:00	Discussion
10:20	Coffee break
BIOLOGY SESSION • Chair: Carlo Rubbia	
10:30	<i>Sustainable Cohabitation of Living Organisms</i> Werner Arber
10:50	Discussion
11:10	<i>New Development in Genome Engineering: Scientific and Ethical Aspects</i> Nicole Le Douarin
11:30	Discussion
11:40	<i>New Knowledge on the Causes of Human Congenital Malformations and its Impact on Society</i> Edward M. De Robertis
12:00	Discussion
12:20	<i>The Challenges of Complexity in the Life Sciences and Society</i> Wolf J. Singer
12:30	Discussion
12:50	Lunch at the Casina Pio IV



15:10	<i>My Sixty-Six Years of Medical Research</i> Michael Sela
15:20	Discussion
15:40	<i>Impacts of Microbial Studies on Human Society and its Environment</i> Takashi Gojobori
16:00	Discussion
16:20	<i>Plastics in the Ocean: A Current Perspective on Their Biodegradation</i> Rafael Vicuña
16:30	Discussion
16:50	Coffee break
17:20	General discussion
HUMAN SCIENCES SESSION • Chair: Nicole Le Douarin	
17:40	<i>Presentation on the Current Status of Organ Donation and Transplantation Around World – With the Dilemma of Organ Trafficking and Transplant Tourism</i> Francis L. Delmonico
18:00	Discussion
18:20	<i>The Advancements in the Fight Against Cancer</i> Salvador Moncada
18:40	Discussion
19:00	<i>The New Alliance Between Science, Policy and Religion in the Pursuit of Sustainability</i> Veerabhadran Ramanathan
19:20	Discussion
19:40	Dinner at the Casina Pio IV

Sunday 27 November 2016

10:00	Council Meeting
13:00	Lunch at the Casina Pio IV
15:00	Closed Session <i>Past and Future PAS Activities</i>
17:00	Coffee Break
17:30	<i>Award Ceremony of the Pius XI Medal to</i> Mariano Sigman
18:30	Holy Mass
19:30	Dinner at the Casina Pio IV



Monday 28 November 2016

SELF-PRESENTATIONS AND COMMEMORATIONS • <i>Chair: Werner Arber</i>	
8:30	<i>Self-Presentations</i> Francis L. Delmonico, Cédric Villani, Salvador E. Moncada, Hans Joachim Schellnhuber
9:10	<i>Commemorations</i> Czesław Olech: Mathematics → Juan Maldacena Walter Thirring: Physics → Carlo Rubbia Alexander Rich: Biophysics → Werner Arber Charles Townes: Physics → William Phillips Georges M.M. Cottier: Philosophy → Jean-Michel Maldamé Ahmed Zewail: Chemistry/Physics → Theodor W. Hänsch Raymond Hide: Geophysics → Martin J. Rees Mambillikalathil G.K. Menon: Physics → Chintamani N.R. Rao
10:00	Coffee break
10:45	<i>Audience with Pope Francis, Hall of the Consistory, Apostolic Palace</i>
11:45	<i>Presentation of the Proceedings of the International Colloquium of April 2013 entitled "Sur le chemin de l'Humanité. Via humanitatis. Les grandes étapes de l'évolution morphologique et culturelle de l'Homme. Émergence de l'être humain", co-edited by the Pontifical Academy of Sciences and by CNRS Editions. Interventions by the President Werner Arber and Professor Henry de Lumley</i>
13:00	Lunch at the Casina Pio IV
SPECIAL SESSION • <i>Energy (T.W. Hänsch) • Chair: Theodor Hänsch</i>	
14:30	<i>Introduction</i> Theodor Hänsch
14:45	<i>Energy in Perspective</i> Stephen Chu
15:15	Discussion
15:30	Coffee break
15:45	<i>The Future of Energy</i> Carlo Rubbia
16:05	Discussion
16:20	<i>Solar Cells and Solar Energy</i> Klaus von Klitzing
16:30	Discussion
16:40	<i>What to Expect from Nuclear Fusion Energy</i> Sibylle Günter
17:00	Discussion
17:15	<i>New Prospects for Electrical Batteries</i> Yi Cui
17:35	Discussion



17:50	<i>Sustainable Thorium Energy for the World</i> Jean-Pierre Charles Revol
18:10	Discussion
18:25	<i>Efficient Use of Electrical Power in the Context of Sustainability</i> William Phillips
18:35	Discussion
18:45	General Discussion
19:40	Dinner at the Casina Pio IV

Tuesday 29 November 2016

PHYSICS SESSION • Chair: William Phillips	
09:00	<i>New Photonic Ways to Control Local Infections in Young Kids – Avoiding the Antibiotic Catastrophe</i> Vanderlei S. Bagnato
09:10	Discussion
09:30	<i>Down the Carbon Staircase!</i> Hans Joachim Schellnhuber
09:50	Discussion
10:10	Coffee Break
SPECIAL SESSION <i>Food & Nutrition – The Role of Biotechnology in Agriculture</i> (Joachim von Braun and Ingo Potrykus) • Chair: William Phillips	
10:40	<i>Welcome and Introduction</i> Ingo Potrykus
11:10	<i>The Need for Sustained Improvements</i> Joachim von Braun
11:25	Discussion
11:35	<i>Increasing Crop Yield Potential: A Role for Genetic Modification?</i> Peter Beyer
11:50	Discussion
12:00	Lunch at the Casina Pio IV
13:30	<i>Reducing Mineral and Vitamin Deficiencies Through Biofortification: Progress Under HarvestPlus</i> Howarth Bouis
13:45	Discussion
13:55	<i>Effects on Biodiversity</i> Peter Raven
14:10	Discussion
14:20	<i>Sustained Soil Management – “No Till” – Agriculture</i> Mariano M. Bosch
14:35	Discussion



14:45	<i>Socio-Economic Impacts Pro Poor</i> Matin Qaim
15:00	Discussion
15:10	<i>The Role of the Public Sector – “New Technologies”</i> Marc van Montagu
15:25	Discussion
15:35	<i>The Role of Plant Biotechnology in Human Health. Public Sector Constraints: The Golden Rice Experience</i> Adrian Dubock
15:50	Discussion
16:00	Coffee Break
16:30	<i>The Devastating Effect of Regulation and the Nobel Laureate Campaign in favor of GMOs</i> Richard J. Roberts
16:45	Discussion
16:55	<i>Summary</i> Joachim von Braun
CLOSING SESSION • Chair: ...	
17:40	<i>General Discussion and Final Statement</i>
19:40	Dinner at the Casina Pio IV



List of Participants



Prof. Werner Arber
President of the Pontifical Academy of Sciences;
Biozentrum, Department of Microbiology
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Prof. Stanislas Dehaene
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CEA/SAC/DSV/DRM/NeuroSpin
Gif sur Yvette (France)



Prof. Vanderlei Salvador Bagnato
University of Sao Paulo
Department IFSC – Physics
(Brazil)



Prof. Francis L. Delmonico
New England Organ Bank
Chief Medical Officer
Waltham, Massachusetts
(USA)



Prof. Peter Beyer
University of Freiburg
Dept of Cell Biology
(Germany)



Prof. Robbert Dijkgraaf
Director and Leon Levy Professor at the
Institute for Advanced Study in Princeton,
New Jersey (USA)



Prof. Mariano Miguel Bosch
Vicepresidente de INTA, Instituto Nacional
de Tecnología Agropecuaria
Buenos Aires (Argentina)



Dr. Adrian Dubock
Golden Rice Project Manager,
Agricultural Consultancy for Development
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IFPRI, International Food Policy
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Washington, DC
(USA)



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Bank of Japan,
National Institute of Genetics
Mishima (Japan)



Prof. Joachim von Braun
Director, Center for Development
Research (ZEF), University of Bonn
Bonn (Germany)



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Max Planck Institute for Plasma Physics,
Garching (Germany)



Prof. Stephen Chu
Physics and Molecular & Cellular Physiology,
Stanford University,
Department of Physics
Stanford, CA (USA)



Prof. Theodor W. Hänsch
Max-Planck-Institut für Quantenoptik
Garching (Germany)



Brother Guy Joseph Consolmagno SJ
Director of the Vatican Observatory
(Vatican City)



Prof. Stephen W. Hawking
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Cambridge (UK)



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Prof. Thomas Hertog
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Howard Hughes Medical Institute
Los Angeles, CA (USA)



Prof. Lisa Kaltenecker
Cornell University,
Ithaca, NY (USA)





Prof. Klaus von Klitzing
Max-Planck-Institute
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Stuttgart (Germany)



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National Institute of Standards
and Technology
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Prof. Ingo Potrykus
Golden Rice Board and Network
(Switzerland)



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Taipei, Taiwan (ROC)



Prof. Martin Qaim
Professor of International Food Economics
and Rural Development,
Georg-August-University of Goettingen
(Germany)



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Constance (Germany)



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Bangalore (India)



Prof. Mario J. Molina
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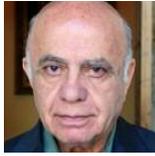
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University of Manchester,
Manchester (UK)



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Institute of Astronomy,
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Prof. Rudolf Muradyan
Armenian National Academy of Sciences,
Yerevan (Republic of Armenia)



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Scientific Associate at Museo Storico
della Fisica e Centro Studi
e Ricerche Enrico Fermi,
Roma (Italy)



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Princeton NJ (USA)



Prof. Richard J. Roberts
New England Biolabs,
Ipswich, MA (USA)



Prof. Saul Perlmutter
Franklin W. and Karen Weber Dabby Professor,
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Department of Physics,
Berkeley CA (USA)



Prof. Carlo Rubbia
European Organization for Particle Physics
(CERN)
Geneva (Switzerland)





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(Vatican City)



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Potsdam Institute for Climate Impact
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Potsdam (Germany)



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Ghent (Belgium)



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Departamento de Genética Molecular y
Microbiología, Santiago (Chile)



Prof. Mariano Sigman
Universidad Torcuato Di Tella,
Laboratorio de Neurociencia,
Buenos Aires (Argentina)



Prof. Cédric Villani
Institut Henri Poincaré (UPMC/CNRS),
Paris (France)



Prof. Wolf J. Singer
Max-Planck-Institute for Brain Research,
Frankfurt am Main (Germany)



Prof. Antonino Zichichi
Università degli Studi di Bologna
Dipartimento di Fisica
Bologna (Italy)

OBSERVER

Anna A. Hlaváčová | Institute of Social and Psychological Sciences, Slovak Academy of Sciences, Bratislava, Slovak Republic



Biographies

Peter Beyer is a Professor in Cell Biology at the Albert-Ludwigs Universität Freiburg, Germany. He heads a research team doing research on the biochemistry, molecular biology and regulation of the plant prenllipid metabolism with an emphasis on the biosynthesis of carotenoids. Besides doing basic-science oriented work, there is a strong focus on the application of the findings in plant pathway engineering to improve the nutritional value of crop plants. P.B. is, jointly with Prof. I. Potrykus, co-inventor of Golden Rice and shares the mission to make the technology freely available to resource-poor farmers world-wide.

Mariano Miguel Bosch graduated in Agronomy from the National University of Buenos Aires (UBA) in 1968. He worked in the administration and management of different agricultural enterprises in the province of Buenos Aires and Formosa. From 1999 to 2009 he served as a member of the INTA Board of Directors, representing the Asociación Argentina de Consorcios Regionales de Experimentación Agrícola (Aacrea). He was also the coordinator and technical advisor of CREA. Since December 2015 he has been Vice-President of INTA.

Howarth Bouis As director of HarvestPlus, Dr. Howarth Bouis coordinates an interdisciplinary, global effort to breed and disseminate micronutrient-rich staple food crops to reduce mineral and vitamin deficiencies among malnourished populations in developing countries. HarvestPlus is a joint program of the International Food Policy Research Institute (IFPRI) (Washington, D.C.) and the International Center for Tropical Agriculture (CIAT) (Cali, Colombia). Dr. Bouis received his B.A. in economics from Stanford University and his M.A. and Ph.D. from Stanford University's Food Research Institute. Since 1993, he has sought to promote biofortification within the CGIAR, among national agricultural research centers, and in the human nutrition community. His past research at IFPRI (which he joined in 1982 as post-doctoral fellow) focused on understanding how economic factors affect food demand and nutrition outcomes, particularly in Asia. During 1972-75, Bouis worked as a volunteer in the Philippines with Volunteers in Asia.

Steven Chu is known for his research at Bell Labs and Stanford University regarding the cooling and trapping of atoms with laser light, which won him the Nobel Prize in Physics in 1997, along with his scientific colleagues Claude Cohen-Tannoudji and William Daniel Phillips. Chu served as the 12th United States Secretary of Energy from 2009 to 2013. He resigned in 2013 and returned to Stanford as Professor of Physics and Professor of Molecular & Cellular Physiology. Chu is a vocal advocate for more research into renewable energy and nuclear power. He has conceived of a global "glucose economy", a form of a low-carbon economy, in which glucose from tropical plants is shipped around like oil is today.

Yi Cui is a Professor of Materials Science at Stanford University. He obtained his BS from the University of Science and Technology of China (1998) and Ph.D in Chemistry from Harvard University (2002). He was a Miller Postdoctoral Fellow at the University of California, Berkeley (2002-2005). He joined in Stanford as an Assistant Professor in 2005 and was promoted as a tenured Associate Professor in 2010 and a full Professor in 2016. His current research is on materials for energy and environment. He is an Associate Editor of Nano Letters. He is a Co-Director of Bay Area Photovoltaics Consortium and a Co-Director of Battery 500 Consortium.

Robbert Dijkgraaf, Director and Leon Levy Professor of the Institute for Advanced Study in Princeton, is a mathematical physicist who has made significant contributions to string theory and the advancement of science education. Dijkgraaf is President of the InterAcademy Partnership, past President of the Royal Netherlands Academy of Arts and Sciences, and a distinguished public policy adviser and advocate for science and the arts.

Adrian Dubock PhD is Swiss and British, with public and private sector experience, as a farmer and a range of international agri business responsibilities. 2000: proposed and negotiated the architecture of the

Golden Rice project. Still works to bring the humanitarian not for profit vision to fruition; 2008-14: Advisory Board of the Institute of Advances Studies, Freiburg University, Germany; 2013: Recognised personally by Scientific American World View for bringing philanthropy to industry; 2015: Collected from the White House a Patents for Humanity Award, for the Golden Rice Project; 2016: Participated in a WHO/FAO consultation on micronutrient biofortification; 2106: Joined the Board of the Borlaug Training Foundation.

Sibylle Gunter studied physics at Rostock University, Germany, where she completed her PhD in 1990. After an extended research stay in the USA, she became staff member at the Max-Planck Institute for Plasma Physics (IPP) in 1996. In 2000, she was appointed Member of the Max Planck Society and director at IPP. Since 2001 she has been adjunct professor at Rostock University, since 2006 honorary professor at TU Munich. In 2011 she was made the Scientific Director of IPP. Sibylle Gunter is elected member of the National Academy of Science and Engineering of Germany (Acatech) and of the Academia Europaea.

Thomas Hertog received his undergraduate degree from the KU Leuven and his doctorate from the University of Cambridge. He joined the University of California as a research fellow in 2002 and became a fellow at CERN, Geneva, in 2005. He returned to Belgium in 2011 with the Odysseus program of the Flemish government and is currently Research Professor in the Physics Department at the KU Leuven. Hertog is an internationally renowned cosmologist and a close collaborator of Stephen Hawking. He and his colleagues of the theoretical high-energy group at the KU Leuven study string theory and how it applies to the real universe, in order to elucidate the nature of the big bang and our place in the grand scheme. Hertog has lectured at both a general and a technical level in more than 20 countries and his research has featured in distinguished media channels. He lives with his wife and their four children in Bousval, Belgium.

Lisa Kaltenegger is Associate Professor at Cornell University and Director of the Carl Sagan Institute. Her research focuses on rocky planets and super-Earths atmospheres in the habitable zone, as well as the spectral fingerprint of exoplanets that can be detected with the next generation of telescopes. Lisa Kaltenegger was named one of America's Young Innovators 2007 by Smithsonian Magazine, was selected as one of the European Commission's Role Models for Women in Science and Research and recently received the Heinz Meier Leibnitz Prize for Physics of Germany in 2012 among several other awards.

P. James E. Peebles Physicist P. James E. Peebles investigated galaxy formation and the nature of dark matter. His work provided the first cogent explanation of the primordial fireball in light of cosmic background radiation, demonstrated the covariance function of extragalactic objects, and showed that recombination is a very rapid process. He has also refocused attention on Albert Einstein's idea of a cosmological constant.

Saul Perlmutter is the Franklin W. and Karen Weber Dabby Chair holder in the Physics Department. He graduated from Harvard magna cum laude in 1981, received his PhD from UC Berkeley in 1986. He joined the UC Berkeley Physics Department in 2004. He is also an astrophysicist at Lawrence Berkeley National Laboratory and leader of the international Supernova Cosmology Project, which first announced the results indicating that the universe will last forever, with its expansion ever accelerating. In 1996, he received the American Astronomical Society's Henri Chretien Award. Professor Perlmutter, who led one of two teams that simultaneously discovered the accelerating expansion of the universe, was awarded the 2011 Nobel Prize in Physics, which he shares with two members of the rival team.

Matin Qaim is Professor of International Food Economics and Rural Development at the University of Goettingen, Germany. Before, he had research and teaching positions at the Universities of Hohenheim, Bonn, Kiel, and Berkeley. He holds a doctoral degree in agricultural economics



from the University of Bonn. His research relates to the economics of poverty, hunger, and malnutrition, and to technological and institutional change in the small farm sector of developing countries. Qaim has published widely in disciplinary and interdisciplinary journals and has received several academic prizes. He is member of different scientific and policy advisory committees.

Jean-Pierre Charles Revol Education: Ingénieur, Ecole Nationale Supérieure des Arts et Métiers, France; Licence de Mathématiques, Université Paris VI, France; Ph.D., MIT Physics Department, USA. Employment: Faculty, MIT Physics Department (1984-1991); CERN Physicist (1991-2013); scientific associate, Centro Fermi (since 2014). Scientific contributions to experiments and projects: R209, CERN ISR; MARK-J, DESY PETRA (1979, discovery of the gluon); UA1, CERN SpS collider (1983, discovery of the W^\pm and Z0); ICARUS; CERN Neutrino Beam to Gran Sasso Laboratory; FEAT and TARC, CERN Proton Synchrotron; ALICE, CERN LHC (since 2000). Others: Former adviser to CERN DG; President of the international Thorium Energy Committee (iTheC)

Richard J. Roberts is the Chief Scientific Officer at New England Biolabs. Roberts received a Ph.D. in organic chemistry from the University of Sheffield, Eng., in 1968. After postdoctoral research at Harvard University, he took a post at Cold Spring Harbor Laboratory in New York in 1972. In 1992 he joined New England Biolabs, a biotechnology firm. In 1977 Roberts and a team established that the genes of the adenovirus – one of the viruses that cause the common cold – are discontinuous: the segments of DNA that code for proteins are interrupted by lengthy stretches of DNA that do not contain genetic information. Previously, based on studies of bacterial DNA, biologists

believed that genes consisted of unbroken stretches of DNA, all of which encoded protein structure.

Mariano Sigman was born in Argentina and grew up in Barcelona, Spain. He obtained a master degree in physics at the University of Buenos Aires and a PhD in neuroscience at the Rockefeller University, with Charles Gilbert, investigating how the cortex organizes to assemble the statistics of the visual world, vast cultural changes (such as reading) and dynamically multiplex several functions through addressing mechanisms and top-down control. He moved to Paris as a Human Frontiers Fellow, investigating with Stanislas Dehaene decision making, cognitive architecture and consciousness. In 2006 he founded the Integrative Neuroscience Laboratory, at the University of Buenos Aires. His lab has an empirical and theoretical approach to decision making, with special focus on the assemblage of unitary decisions into mental programs and understanding the construction of confidence and introspective judgments in the decision process. He was awarded a Human Frontiers Career Development Award, the young investigator prize of “College de France”, the IBM Scalable Data Analytics award and is a scholar of the James S. McDonnell Foundation.

Marc Van Montagu is a pioneer in plant molecular biology. He is well known (with J. Schell) as the discoverer of the Ti-plasmid and the inventor of *Agrobacterium tumefaciens* transformation technology, now used worldwide to produce genetically engineered plants. Van Montagu used this new technology to study gene regulation and to discover the molecular basis of several plant physiological processes. He has made major contributions to the identification of genes involved in plant growth, development and flowering.

For the biographies of the Academicians of the PAS see www.pas.va



MEMORANDUM

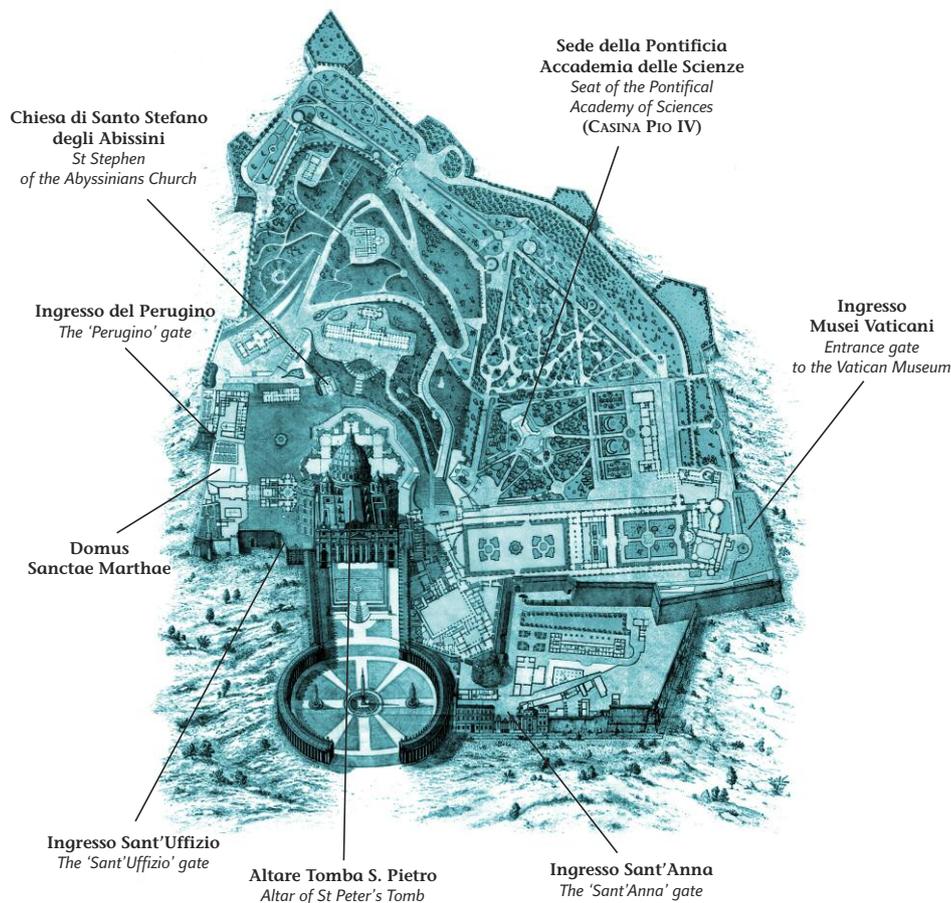
1) On 25, 26, and 29 November 2016 a bus will depart from Casa Bonus Pastor for the Academy 30 minutes before the beginning of the first session (8.30 am), and another bus will depart from the Domus Sanctae Marthae 15 minutes before the beginning of the first session (8.45 am). The same vehicles will take the Participants back to their hotels after dinner.

2) On 28 November a bus will depart from Casa Bonus Pastor for the Academy 30 minutes before the beginning of the first session (8.00 am), and another bus will depart from the Domus Sanctae Marthae 15 minutes before the beginning of the first session (8.15 am). The same vehicles will take the Participants back to their hotels after dinner.

3) On Sunday 27 November a bus will depart from Casa Bonus Pastor at 12.30 and another from the Domus Sanctae Marthae at 12.45. Holy Mass will be celebrated in the Chapel at the Casina Pio IV at 18.30. Participants will be accompanied to their hotels after dinner.

4) Lunches and dinners will be served at the Academy every day during the Plenary Session. If you are a vegetarian, please let us know as soon as possible.





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For further information please visit:
www.pas.va

MEDIA ENQUIRIES

 All journalists and media organizations wishing to apply for accreditation may request TEMPORARY accreditation through the online form of the Media Operations Section of the Holy See Press Office website:
<http://press.vatican.va/content/salastampa/en/accrediti/pubblico/accredito.html> Journalists and media organizations regularly accredited at the Holy See Press Office may send their request through the usual channels. All requests must be sent no less than 48 hours before the event.

 I giornalisti e gli operatori media che intendono partecipare devono inviare richiesta di accreditamento TEMPORANEO attraverso il modulo disponibile online nella sezione accrediti del sito della Sala Stampa della Santa Sede:
press.vatican.va/accreditamenti.
 Coloro che già dispongono di accredito ordinario valido devono inviare una richiesta di partecipazione secondo le consuete modalità. Tutte le richieste dovranno pervenire entro 48 ore dall'evento.

 Todos los periodistas y gráficos que deseen participar deben enviar una solicitud de acreditación TEMPORAL a través del módulo que está disponible online en la sección de acreditaciones de la página web de la Oficina de Prensa de la Santa Sede:
press.vatican.va/accreditamenti. Los que ya dispongan de acreditación normal válida, deben enviar una solicitud de participación según la modalidad habitual. Todas las peticiones deberán hacerse al menos 48 horas antes del evento.

FRONT COVER:

Medal designed by Master Guido Veroli in 1986 for the 50th Anniversary of Pius XI's refounding of the Pontifical Academy of Sciences and new headquarters in the Casina Pio IV. It features a female figure with symbols recalling the conquests of science in those five decades: space exploration, Schrödinger's equation, Halley's comet, Marconi's parabolic antenna, the double helix, the s orbital, the formula of steroids, etc.