

THE PONTIFICAL ACADEMY OF SCIENCES

Plenary Session on

The Scientific Legacy of the 20th Century

28 October-1 November 2010 • Casina Pio IV



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VATICAN CITY 2010



Certainly the Church acknowledges that “with the help of science and technology..., man has extended his mastery over almost the whole of nature”, and thus “he now produces by his own enterprise benefits once looked for from heavenly powers” (*Gaudium et Spes*, 33). At the same time, Christianity does not posit an inevitable conflict between supernatural faith and scientific progress. The very starting-point of Biblical revelation is the affirmation that God created human beings, endowed them with reason, and set them over all the creatures of the earth. In this way, man has become the steward of creation and God’s “helper”. If we think, for example, of how modern science, by predicting natural phenomena, has contributed to the protection of the environment, the progress of developing nations, the fight against epidemics, and an increase in life expectancy, it becomes clear that there is no conflict between God’s providence and human enterprise. Indeed, we could say that the work of predicting, controlling and governing nature, which science today renders more practicable than in the past, is itself a part of the Creator’s plan.

Science, however, while giving generously, gives only what it is meant to give. Man cannot place in science and technology so radical and unconditional a trust as to believe that scientific and technological progress can explain everything and completely fulfil all his existential and spiritual needs. Science cannot replace philosophy and revelation by giving an exhaustive answer to man’s most radical questions: questions about the meaning of living and dying, about ultimate values, and about the nature of progress itself.

Address of His Holiness Benedict XVI to the Members of the Pontifical Academy of Sciences, 6 November 2006.

The Scientific Legacy of the 20th Century

PROLOGUE

The 20th century was an important century for the sciences. In physics, revolutionary theoretical and experimental breakthroughs happened, modern biology began its triumphal march. And what is true for physics and biology is also true for other neighbouring disciplines like astrophysics, chemistry, earth and environmental sciences and the neurosciences. At the same time, more attention was paid to epistemological issues, which were discussed and solved in cooperation with the sciences and philosophy of science. This is reason enough to evaluate the entire development and to picture how this development finds its demanding continuation in modern scientific research.

All PAS members have contributed to the remarkable progress of scientific knowledge in the past century. Personal testimonies from these actors represent valuable documents for the history of science and for future generations. We thus encourage all PAS members to attend the Plenum and to comment on the progress and on still open questions in their special fields of scientific competence. Contributions can represent a general overview of research strategies, of the acquired new scientific knowledge, of its applications and of the expected future impact on the world view and welfare of human societies and on the sustainability of our natural environment. Of course, inclusion of personal recollections, including anecdotes, can render these reviews more lively.

Werner Arber and Jürgen Mittelstrass



The Scientific Legacy of the 20th Century

PROGRAMME

Wednesday, 27 October 2010

13:00 **Lunch and Council Meeting**

Thursday, 28 October 2010

Welcome, Commemorations and Self-Presentations

- 9:00 *Welcome*
H.E. Msgr. Marcelo Sánchez Sorondo, Chancellor of the Pontifical Academy of Sciences
- 9:15 *Commemorations*
Nicola Cabibbo (M.G.K. Menon), **Aage Bohr** (A. Zichichi), **Héctor Croxatto** (R. Vicuña), **Paul Germain** (N. Le Douarin), **Crodowaldo Pavan** (W. Arber)
- 10:15 *Self-Presentation of New Members*
Edward M. De Robertis, **Gerhard Ertl**
- 11:15 Coffee Break
- 11:30 **Papal Audience**
- 13:30 Lunch at the Casina Pio IV

Introduction

- 15:00 **Prof. Jürgen Mittelstrass**
Philosophical Foundations of Science in the 20th Century

Session I: ASTROPHYSICS Chair: J. Mittelstrass

- 15:30 **Prof. Wolf J. Singer**
The Explanatory Gap in Neuroscience
- 16:00 Discussion
- 16:30 Coffee Break
- 17:00 **Prof. Govind Swarup**
Great Discoveries Made by Radio Astronomers During the Last Six Decades and Key Questions Today
- 17:30 Discussion
- 18:00 Departure from the Casina Pio IV by bus to attend the concert at Palazzo Boncompagni Ludovisi
- 18:30 Concert followed by dinner
- 21:30 Bus leaves Palazzo Boncompagni Ludovisi to take participants back to the Domus Sanctae Marthae

Friday, 29 October 2010

8:30 Visit to the Vatican Museums (departure by bus from Domus Sanctae Marthae)

Chair: H. Tuppy

11:30 **Yves Quéré**
Science and Language, Twin Sisters

12:00 Discussion

12:30 Lunch at the Casina Pio IV

Session II: PHYSICS

14:30 **Prof. Antonino Zichichi**
My Personal Experience on the Scientific Legacy of the 20th Century

15:00 Discussion

15:30 **Prof. Walter E. Thirring**
Emergence of Order by Chance

16:00 Discussion

16:30 Coffee Break

17:00 **Prof. Charles H. Townes**
The Laser and How it Happened

17:30 Discussion

18:00 Closed Session for Academicians

19:30 Dinner at the Casina Pio IV



Saturday, 30 October 2010

9:00 *Commemorations*

Stanley L. Jaki (J.-M. Maldamé), **Marcos Moshinsky** (W.E. Thirring), **Marshall W. Nirenberg** (M. Sela), **George E. Palade** (C. De Duve), **Robert J. White** (A. Szczeklik)

Session IV: EARTH AND ENVIRONMENT SCIENCES

Chair: A.M. Battro

10:00 **Prof. Ignacio Rodríguez-Iturbe**

Hydrologic Drivers of Biodiversity: The Impact of Climate Change

10:30 Discussion

11:00 Coffee Break

11:30 **Prof. Jean-Michel Maldamé**

La place de l'humanité dans le monde des vivants: nouvelles perspectives

11:50 Discussion

12:10 **Prof. Enrico Berti**

The Discovery of DNA as a Contribution to Understand the Aristotelian Theory of Generation

12:30 Discussion

12:50 Lunch at the Casina Pio IV

Session V: CELL AND MOLECULAR BIOLOGY

Chair: N.M. Le Douarin

15:00 **Prof. Christian de Duve**

The Evolutionary Lottery

15:30 Discussion

16:00 **Prof. Michael Sela**

Therapeutic Vaccines Against Cancer and Autoimmune Diseases

16:30 Discussion

17:00 Coffee Break

17:30 **Prof. Rafael Vicuña**

The Evolving Concept of the Gene

18:00 Discussion

18:30 **Prof. Werner Arber**

Molecular Darwinism and its Relevance for Translational Genetic Research

19:00 Discussion

19:30 Dinner at the Casina Pio IV



Sunday, 31 October 2010

- 9:00 Departure from Domus Sanctae Marthae to visit the Papal Villa at Castel Gandolfo
- 10:00 Visit to the Papal Villa
- 11:00 Presentation of the Pius XI Medal (**Prof. Patrick Mehlen**)
- 13:00 Lunch at the Papal Villa
- 15:00 Departure from Castel Gandolfo and return to the Domus Sanctae Marthae
- 17:30 Holy Mass at the Casina Pio IV
- 19:00 Dinner at the Casina Pio IV

Monday, 1 November 2010

Chair: R. Vicuña

- 9:00 **Prof. Edward M. De Robertis**
Merging of Evolution and Development
- 9:30 Discussion
- 10:00 **Prof. Nicole M. Le Douarin**
New Developments in Stem Cell Biotechnology
- 10:30 Discussion
- 11:00 Coffee Break
- 11:30 **Prof. Takashi Gojobori**
Genomic Exploration of the RNA Continent
- 11:50 Discussion
- 12:10 **Prof. Peter H. Raven**
Transgenic Crops and the Future of Agriculture (tentative title)
- 12:30 Discussion
- 12:50 Lunch at the Casina Pio IV
- 15:00 **Prof. Ingo Potrykus**
Genetic Engineering of Plants
- 15:30 Discussion

Session VI: NEUROSCIENCE AND IMMUNOLOGY

Chair: M. Sela

- 16:00 **Prof. Andrzej Szczeklik**
Discovery of the Defensive System of Endothelium, the Lining of Arterial Wall
- 16:20 Discussion
- 16:40 **Prof. Aaron J. Ciechanover**
Discovery of the System That Destroys Body Proteins
- 17:00 Discussion
- 17:20 Coffee Break

End of Conference

- 17:50 **Prof. Werner Arber** *Conclusions*
- 18:30 Dinner at the Casina Pio IV

The Scientific Legacy of the 20th Century

LIST OF PARTICIPANTS



Prof. Werner Arber
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Prof. Nicole M. Le Douarin
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Nogent-sur-Marne (France)



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Constance (Germany)



Prof. Aaron J. Ciechanover
Technion, Israel Institute of Technology
The Rappaport Faculty of Medicine and Research In-
stitute, Vascular and Cancer Biology Research Center
Haifa (Israel)



Prof. Rudolf Muradian
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Instituto de Física
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Prof. Stanislas Dehaene
Inserm-CEA, Cognitive Neuroimaging Unit
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Prof. Ingo Potrykus
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Prof. Yves Quéré
Professor and Co-Chair
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Tata Institute of Fundamental Research, Pune
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MEMORANDUM

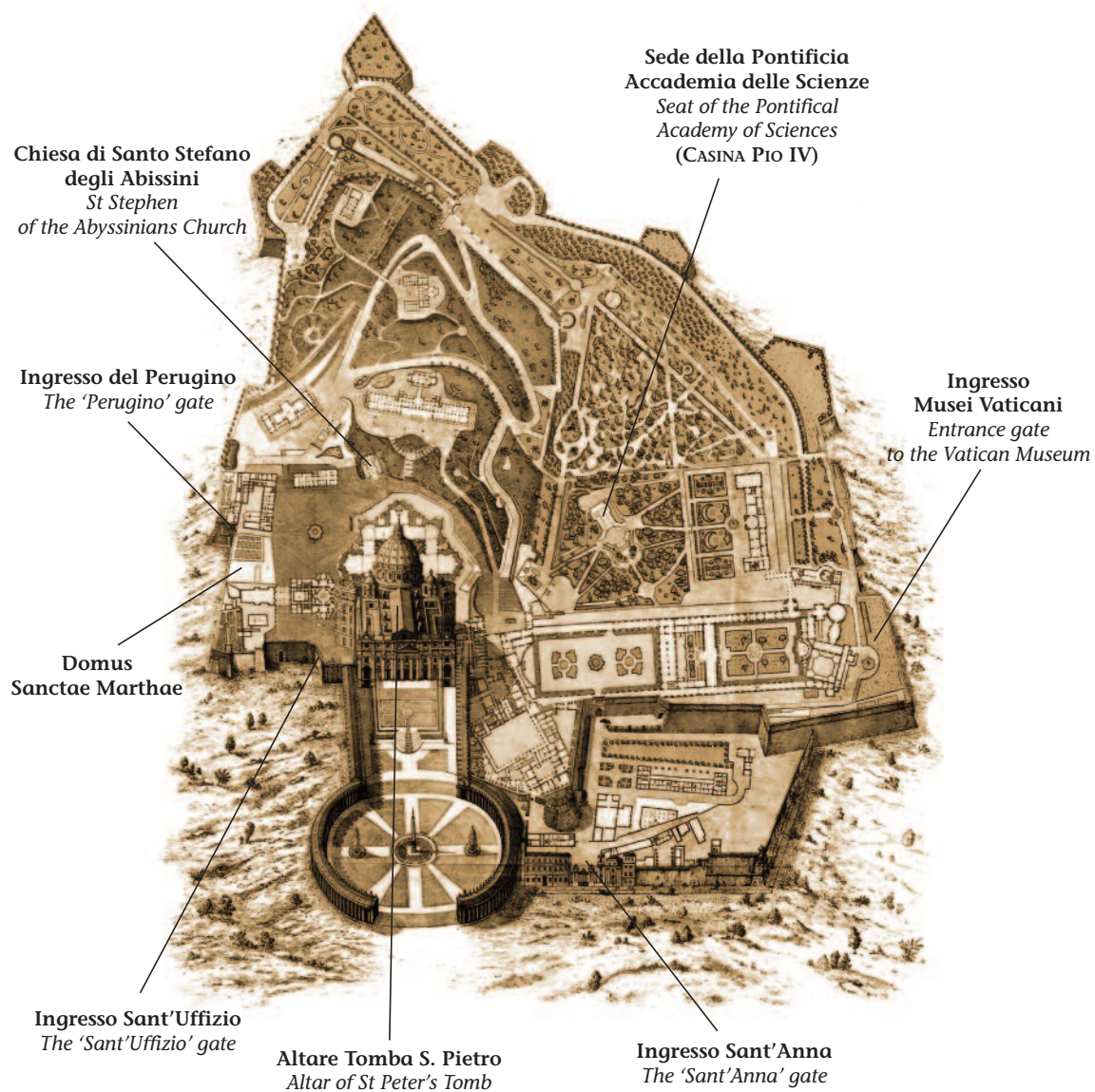
- 1)** Every day a bus will leave the Domus Sanctae Marthae at 8:45 for the Academy fifteen minutes before the beginning of the session. A bus will depart from the Academy after dinner at the end of afternoon session to take participants back to the Domus Sanctae Marthae. Lunch and dinner for the participants will be served at the Academy from 28 October to 1 November 2010 except dinner on Thursday 28 October (offered by Prince Boncompagni Ludovisi after the Concert) and lunch on Sunday 31 October, to be served after the visit to the Papal Villa at Castel Gandolfo.
- 2)** Every day, except Sunday, Holy Mass will be held at 7:00 at the Domus Sanctae Marthae for those who would like to attend.
- 3)** On Thursday 28 October a bus will take the participants from the Casina Pio IV at the end of the Session (h.18) to the concert and dinner at the Residence of Prince Boncompagni Ludovisi.
- 4)** On Sunday 31 October, for those wishing to attend, a bus will leave the Domus Sanctae Marthae at 9:00 a.m. to take participants to the Vatican Gardens at Castelgandolfo, summer residence of His Holiness for a visit followed by lunch.
- 5)** Information on the Celebration of the Holy Mass of 31 October will be communicated later.

Note

Please give your **form for the refunding of expenses** to the secretariat at least one day before your departure so that you can be refunded immediately.







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