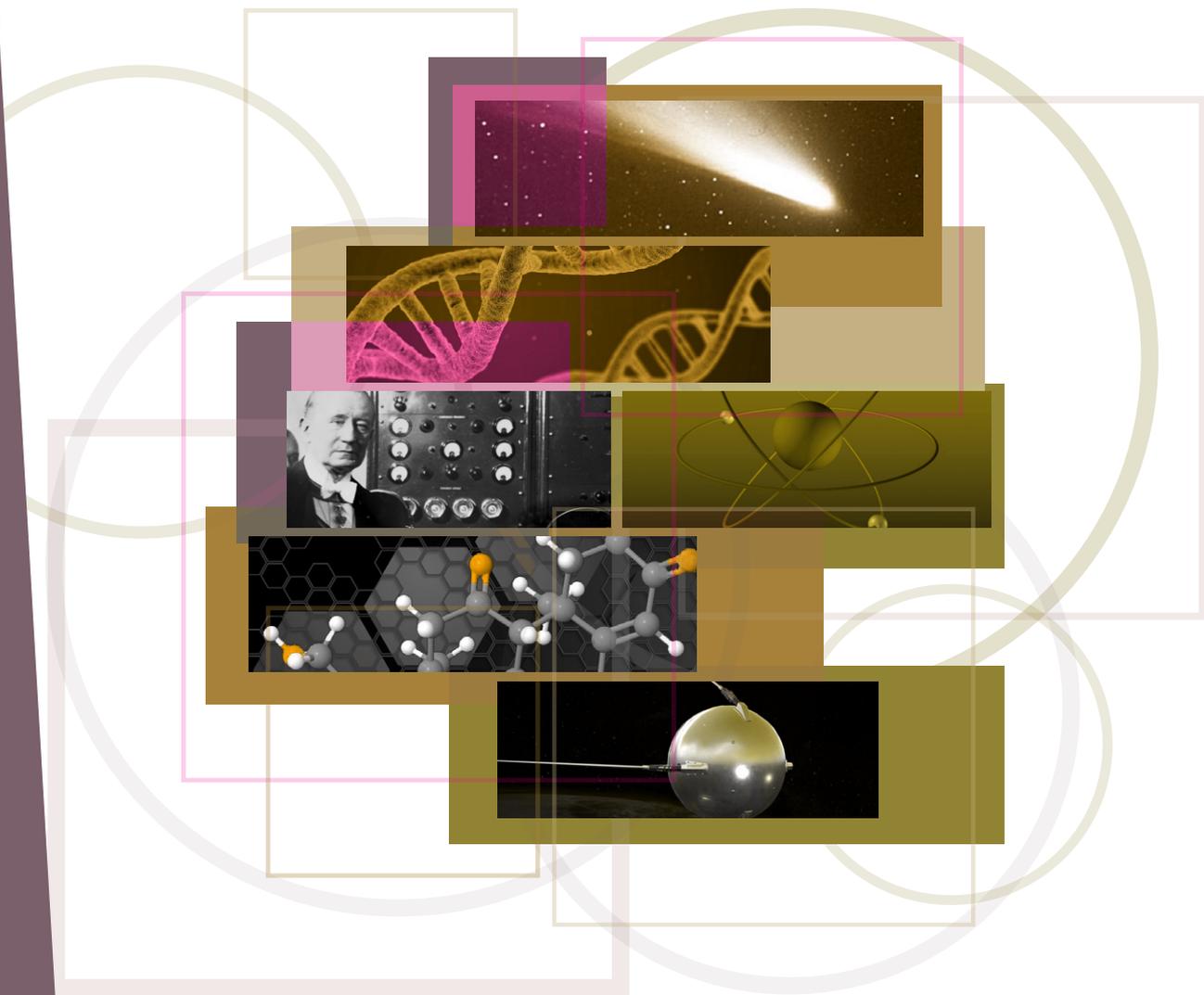




The Pontifical Academy of Sciences

Plenary Session on

TRANSFORMATIVE ROLES OF SCIENCE IN SOCIETY: FROM EMERGING BASIC SCIENCE TOWARD SOLUTIONS FOR PEOPLE'S WELLBEING



12-14 November 2018 | Casina Pio IV | Vatican City



“Very briefly, I would say that it falls to scientists, who work free of political, economic or ideological interests, to develop a cultural model which can face the crisis of climatic change and its social consequences, so that the vast potential of productivity will not be reserved only for the few. Just as the scientific community, through interdisciplinary dialogue, has been able to research and demonstrate our planet’s crisis, so too today that same community is called to offer a leadership that provides general and specific solutions for issues which your plenary meeting will confront: water, renewable forms of energy and food security. It has now become essential to create, with your cooperation, a normative system that includes inviolable limits and ensures the protection of ecosystems, before the new forms of power deriving from the techno-economic model causes irreversible harm not only to the environment, but also to our societies, to democracy, to justice and freedom”.

**Pope Francis, Address to the Pontifical Academy of Sciences,
28 November 2016**

Introduction

The 2018 PAS plenary is guided by the ideas that

- basic sciences remain fundamental for generating a valid and evidence based model of the world
- sciences become ever more interconnected across disciplines, including the humanities
- scientists and science policy makers need to engage with society to maintain (foster) trust in science and to counter the spread of statements that are not based on scientific insights (fake news).

In the 2018 Plenary we attempt to identify emerging insights from basic science, and – where appropriate – connect new insights with visions for problem-solving strategies and related research. As Goethe said: “Knowing is not enough, you must apply; willing is not enough; you must do”.

We note that trust in science may have declined. Loss of trust in science will lead to reduced support by society and jeopardizes the transformative impact of science. Our Academy is particularly sensitive to any

such tendencies and therefore seeks the dialogue with science policy leaders at the Plenary Session 2018.

This Plenary has the following objectives:

1. To identify groundbreaking developments in the main disciplines of basic science. These shall be communicated by speakers in ways understandable by participants from different science disciplines.
2. To identify evidence based and sustainable problem-solving strategies and related research for people’s wellbeing, poverty reduction and humanity’s current problems of environmental destructions and conflicts.
3. To identify and share approaches on how to strengthen societies’ trust in science. Causes of possibly growing mistrust in science are addressed and opportunities to enhance trust in science identified, including science education and communication. In that context we shall also embrace the theme, how to foster fruitful relations between sciences and religions.

Programme

Monday, November 12th 2018

OPENING SESSION

Chair: **Joachim von Braun**

- 9:00 | **Joachim von Braun** | *Opening, Words of Welcome and Concept of the Plenary*
H.E. Msgr. Marcelo Sánchez Sorondo | *Introduction to the Plenary*

Bloc 1. Scientific assessment of a set of large global humanities issues

(population, health, ecology, and their underlying causes).

SESSION I – Population and Science Approaches

- 9:10 | *World Population Change – Future Dynamics*
Wolfgang Lutz
- 9:30 | *The Complementary Nature of Scientific Experimentation and Thought Experiments*
Werner Arber and **Marcel Weber**
- 9:50 | Discussion

SESSION II – Climate and Energy

Chair: **Edward M. De Robertis**

- 10:00 | *Energy for the Nine Billion*
Steven Chu
- 10:20 | *Energies for the Future*
Carlo Rubbia
- 10:40 | Discussion
- 10:45 | Coffee Break
- 11:15 | **Audience with Pope Francis, Consistory Hall**
- 13:30 | Lunch at the Casina Pio IV
- 14:30 | *What Must Be Sustained to Enable Sustainable Improvements in People's Well-being?*
William C. Clark
- 14:45 | *Where on Earth Are We Heading: Pliocene or Miocene?*
Hans Joachim Schellnhuber
- 15:00 | Discussion

SESSION III – Health

Chair: **Klaus von Klitzing**

- 15:25 | *The Revolution of Personalized Medicine – Bioethical Obstacles on the Road of Technological Advances*
Aaron J. Ciechanover
- 15:40 | *Organ Transplants*
Francis L. Delmonico
- 15:55 | *The Three-Dimensional Architecture of the Human Genome: Understanding the Physical Mechanisms Controlling Gene Expression*
José Nelson Onuchic
- 16:15 | *Next Generation Antibiotics*
Ada E. Yonath
- 16:30 | Discussion
- 16:50 | Coffee Break

SESSION IV – Ecology and Biosystems

Chair: **Edward M. De Robertis**

- 17:20 | *Saving Plants from Extinction: How and Why?*
Peter H. Raven
- 17:35 | *Science in a Post-Truth World: Hope for People and the Ocean*
Jane Lubchenco
- 17:50 | Discussion

Bloc 2. Frontiers in science disciplines

Science community of PAS members and guest speakers highlight science frontiers. Firstly, frontier insights are presented independently from linking them to applications or solution orientation; later and during discussions, new insights may be related to innovations with social responsibility, wellbeing of people and the planet, development of long term perspectives.

SESSION V – Physics

Chair: **Theodor W. Hänsch**

- 18:10 | *Constants of Nature and Their Applications*
Klaus von Klitzing
- 18:25 | *The Dilemma of Basic Research*
Daniel Kleppner
- 18:40 | Discussion
- 19:00 | Dinner at the Casina Pio IV

Tuesday November 13th 2018

SESSION VI – Physics

Chair: **Martin Rees**

- 9:00 | *Making the Revolutions of Quantum Technology Deliver for People and Planet*
Massimo Inguscio
- 9:20 | *Science Addressing Questions Not Easily Addressed by “the” Scientific Method. The Origins of Life*
Steven A. Benner
- 9:40 | Discussion
- 10:00 | Coffee Break

SESSION VII – Astronomy, Space

Chair: **Martin Rees** | continued

- 10:30 | *The Space Renaissance and Impacts on Humanity*
Will Marshall
- 10:50 | *The Uses of Small Satellites for Environmental Monitoring, Bringing We-Fi to Africa, and Related Opportunities*
Martin N. Sweeting
- 11:10 | *Exoplanets and Beyond*
Sara Seager
- 11:30 | *Our Place in Space and Time*
John D. Barrow
- 11:50 | Discussion

SESSION VIII – Biology, Genetics, Bio-Chemistry, Chemistry

Chair: **Vanderlei S. Bagnato**

- 12:10 | *Stem Cells and Tissue Regeneration*
Helen M. Blau

12:30	<i>The Role of Microscopy in Improving the Human Condition</i> Robert Eric Betzig
12:45	Discussion
13:00	Lunch at the Casina Pio IV
SESSION VIII – Biology, Genetics, Bio-Chemistry, Chemistry (continued)	
Chair: Vanderlei S. Bagnato	
14:30	<i>On Gene Biology and Evolution</i> Takashi Gojobori
14:45	<i>The Dependence Receptor Paradigm: When an Original Cell Death Pathway is Used as a Therapeutic Strategy Against Cancer</i> Patrick Mehlen
15:00	<i>From Basic Research on Amino Acid Polymers to the Most Used Drug Against Multiple Sclerosis</i> Michael Sela
15:15	Discussion
15:35	<i>Cancer Immunotherapy: Improved Treatment and Issues</i> Thierry Boon-Falleur
15:45	<i>Regulation of Protein Degradation and Endocytosis by Wnt Growth Factors</i> Edward M. De Robertis
15:55	<i>The CRISPR-Cas Technique for Gene Editing and its Impact on Society</i> Rafael Vicuña
16:05	Discussion
16:30	Coffee Break
Bloc 3. Transformative roles of science in societies	
This bloc attempts syntheses from Blocs 1 and 2, with presentations and discussions on transformative roles of science in societies and implications for science policy. Discussions with science policymakers address science policy, causes of lack of trust in science and what to do about that; pressure to do translational science and to justify basic science with utilitarian rather than epistemic arguments; roles of public and private research; sharing of science across countries; policy choices and their moral dimensions; education for science and curiosity, and fruitful relations between sciences and religions.	
SESSION IX – Future Science Policy Discussion Among Leaders of Science Organizations, Policy Makers, Religious Communities and Academicians	
Chairs: Wolf Singer and Joachim von Braun	
17:00	<ol style="list-style-type: none"> 1. Jean Pierre Bourguignon President of the European Research Council 2. Georg Schütte State Secretary of Education and Science, Germany 3. Lino Barañao Former Science Minister of Argentina 4. Rev. Antje Jackelén The Lutheran Archbishop of Uppsala in Sweden and Primate (inter pares) of the Church of Sweden 5. Jürgen Mittelstraß Academician, The Pontifical Academy of Sciences 6. Cardinal Lluís Martínez Sistach Archbishop Emeritus of Barcelona, Spain 7. H.E. Msgr. Marcelo Sánchez Sorondo Chancellor, The Pontifical Academy of Sciences <p><i>Panelists' statements (10 minutes each, followed by panel interaction with ample amount of time – till 19:00, as well as over dinner)</i></p>
18:30	Panelists' Discussion with Academicians and Guest Speakers
19:30	Dinner at the Casina Pio IV

SESSION X – Transformative Roles of Science, People and Education

Chair: **Jürgen Mittelstraß**

9:00 | *The Role of Science in the Culture of our Time (Modern or Pre-Aristotelic?)*

Antonino Zichichi

9:15 | *Education for a Digital Sustainable Environment*

Antonio M. Battro

9:25 | *Science Education & Climate Change Authors*

Yves Quéré

9:35 | Discussion

10:05 | Coffee Break

SESSION XI – Conclusions of the 2018 Plenary

Chairs: **Jochaim von Braun** and **H.E. Msgr. Marcelo Sánchez Sorondo**

10:35 | Brief introductions by teams of Blocs 1, 2, and science policy implications based on a draft statement

1. **Martin J. Rees, Vanderlei S. Bagnato and Theodor W. Hänsch**: New Insights From Basic Sciences (Bloc 1)
2. **Wolf J. Singer, Nicole M. Le Douarin and Werner Arber**: Problem Solving Science Opportunities (Bloc 2)
3. Science Policy in Support of Trust in Science (Policy Debates Outcomes)

11:05 | General Discussion based on Final Statement

13:00 | Lunch at the Casina Pio IV

SESSION XII – Closed Session for Academicians

14:00 | *Self-Presentations*

1. **Helen M. Blau**
2. **Robert Eric Betzig**
3. **Steven Chu**
4. **Rev. Guy Joseph Consolmagno SJ**
5. **Mohamed H.A. Hassan**

14:50 | *Commemorations*

1. **Günter Blobel (Edward M. De Robertis)**
2. **Stephen W. Hawking (Martin J. Rees)**
3. **Fotis C. Kafatos (Nicole M. Le Douarin)**
4. **Félix Malu wa Kalenga (Vanderlei S. Bagnato)**
5. **Vera Rubin (Martin J. Rees)**

15:40 | *Award Ceremony of the Pius XI Medal*

1. **Noble Ephraim Banadda**
2. **David M. Sabatini**
3. **Miriam Serena Vitiello**

List of Participants

Werner Arber
Vanderlei S. Bagnato
Noble Ephraim Banadda
Lino Baraño
John Barrow
Antonio M. Battro
Steven A. Benner
Robert Eric Betzig
Helen M. Blau
Thierry Boon-Falleur
Jean Pierre Bourguignon
Joachim von Braun
Luis A. Caffarelli
Steven Chu
Aaron J. Ciechanover
William C. Clark
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Rev. Antje Jackelén
Daniel Kleppner
Klaus von Klitzing
Nicole M. Le Douarin

Jane Lubchenco
Wolfgang Lutz
H.Em. Card. Lluís Martínez Sistach
Will Marshall
Patrick Mehlen
Jürgen Mittelstraß
Salvador Moncada
Rudolf Muradian
José Nelson Onuchic
Yves Quéré
Peter H. Raven
Martin J. Rees
Carlo Rubbia
David M. Sabatini
H.E. Msgr. Marcelo Sánchez Sorondo
Hans Joachim Schellnhuber
Georg Schütte
Sara Seager
Michael Sela
Wolf J. Singer
Martin N. Sweeting
Rafael Vicuña
Miriam Serena Vitiello
Marcel Weber
Ada E. Yonath
Antonino Zichichi

Memorandum

- ▶ Pickup schedule from your hotels to the Casina Pio IV on 12, 13 and 14 November 2018:
 - Pick up from Crowne Plaza Hotel: 8:30 AM
 - Pick up from Casa Bonus Pastor: 8:30 AM
 - Pick up from the Domus Sanctae Marthae: 8:45 AM

- ▶ On 12 and 13 November the same buses will take you back to your hotels after dinner at 8:30 PM

- ▶ On 14 November buses will take you back to your hotel at 4:00 PM

- ▶ Lunch and dinner for the participants will be served at the Academy every day. If you are a vegetarian or have any dietary restrictions (food allergies, and/or religious restrictions), please let us know as soon as possible.

- ▶ WI-FI credentials

Network: **WLAN_PADS (WPA2)**

Password: **!!WIFI_2017_PADS!!**



MEDIA ENQUIRIES



All journalists and media operators who intend to participate must apply via the Holy See Press Office, through the online accreditation System available at: press.vatican.va/accreditamenti. All applications must be received no less than 48 hours before the event.



I giornalisti e gli operatori media che intendono partecipare devono fare richiesta alla Sala Stampa della Santa Sede attraverso il Sistema di accreditamento online, all'indirizzo: press.vatican.va/accreditamenti. Tutte le richieste dovranno pervenire entro 48 ore dall'evento.



Todos los periodistas y gráficos que deseen participar deben enviar una solicitud a la Oficina de Prensa de la Santa Sede a través del Sistema de acreditación online, en esta dirección: press.vatican.va/accreditamenti. Todas las peticiones deberán hacerse al menos 48 horas antes del evento.

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