

the
INTERACADEMY PANEL
on international issues

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a global network of science academies

IAP Conference "The Unity of Science" and General Assembly

1-6 December 2006

Bibliotheca Alexandrina

Alexandria, Egypt

Conference Booklet

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Program

Friday 1 December 2006

- 14.00 - 17.00 Registration of Participants (Hotel Helnan Palestine)
- 18.00 **Opening Ceremony at the Bibliotheca Alexandrina**
Opening Addresses
Director, BA, **Ismail Serageldin**
UNESCO Representative, **Gérard de Puymege**
TWAS, IAP Host Academy, **Mohamed H.A. Hassan**
IAP Co-Chairs, **Chen Zhu and Yves Quéré**
Minister of Higher Education and Scientific Research, **H.E. Hany Helal**
- 19.30 – 21.00 Dinner at the Graeco-Roman Restaurant, BA

Saturday 2 December 2006

Morning Session

Opening Lecture

Chair: Ralph Cicerone

- | | | |
|--------------|---|--------------------------|
| 9.00 – 9.50 | Science in Egypt from Imhotep to Zewail | <i>Ismail Serageldin</i> |
| 9.50 – 10.05 | Discussion | |

Mathematical Sciences

Chair: Edoardo Vesentini

- | | | |
|---------------|--|---------------------------|
| 10.05 – 10.55 | Mathematics, between Past and Future | <i>Jean-Pierre Kahane</i> |
| 10.55 – 11.10 | Discussion | |
| 11.10 – 12.00 | Refreshments and Poster Session | |
| 12.00 – 12.45 | Providing a Level-playing Field to World Citizens through Innovations in ICT | |
| 12.45 – 13.00 | Discussion | |
| 13.00 – 14.15 | Lunch at the Graeco-Roman Restaurant (BA) | |

Afternoon Session

Physical Sciences

Chair: Yuan Lee

- | | | |
|---------------|---|--------------------|
| 14.15 – 15.05 | Physics, Now and in the Future | <i>David Gross</i> |
| 15.05 – 15.20 | Discussion | |
| 15.20 – 16.05 | Emerging Applications of Intense Lasers in Sciences | <i>Jie Zhang</i> |
| 16.05 – 16.20 | Discussion | |
| 16.20 – 17.30 | Refreshments and Poster Session | |

Chair : Gunnar Öquist

- | | | |
|---------------|--|---------------------|
| 17.30 – 18.15 | Uncovering the Universe | <i>Teresa Lago</i> |
| 18.15 – 18.30 | Discussion | |
| 19.30 – 20.30 | Dinner at the BA | |
| 20.30 – 21.00 | <i>After-dinner Talk:</i>
The Earth's Polar Regions
and the International Polar Year 2007-08 | <i>Chris Rapley</i> |

Chair: Norihisa Doi

Sunday 3 December 2006

Morning Session

Life Sciences

Chair: Lorna Casselton

9.00 – 9.50	Biology Past and Biology Future: Where have we been and where are we going?	<i>Bruce Alberts</i>
9.50 – 10.05	Discussion	
10.05 – 10.50	New Trends in Microbiology	<i>Hu Zhihong</i>
10.50 – 11.05	Discussion	
11.05 – 11.40	Refreshments and Poster Session	

Earth Sciences

Chair: M. Shamsher Ali

11.40 – 12.25	The Shape of the Earth: From Erostothenes to the Space Age	<i>Kurt Lambeck</i>
12.25 – 12.40	Discussion	
12.40 – 14.00	Lunch at the Graeco-Roman Restaurant (BA)	

Afternoon Session

Chair: Mohsen Shoukry

14.00 – 14.45	Earth Simulation on the Earth Simulator	<i>Keiko Takahashi</i>
14.45 – 15.00	Discussion	
15.00 – 15.45	Earth Sciences in the Third Millennium: From Deep Earth to Social Issues	<i>Manuel A. Iturralde-Vinent</i>
15.45 – 16.00	Discussion	
16.00 – 16.30	Refreshments	

Science and Society

Chair: Anthony MBewu

16.30 – 17.15	Women for Science: A Leadership Role for Academies	<i>Johanna Sengers, Manju Sharma</i>
17.15 – 17.30	Discussion	
17.30 – 18.15	Social Sciences: Truthful or Useful?	<i>Pieter Drenth</i>
18.15 – 18.30	Discussion	

In Summary ...

Chair: Goverdhan Mehta

18.30 – 19.15 A Synthesis : Where Does Science go? *Édouard Brézin*

19.15 – 19.30 Discussion

19.30 – 20.30 Dinner at the BA

20.30 – 21.00 *After-dinner Talk:* **Chair: Joseph Malo**
GMO's: a Science-and-Society Issue *Jocelyn Webster*

Abstracts and Biographies

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Biology Past and Biology Future: Where have we been and where are we going?

Bruce Alberts

*Professor of Biochemistry and Biophysics,
University of California, San Francisco (UCSF), USA*

We have always underestimated cells; undoubtedly we still do today. But at least we are no longer as naive as we were when I was a graduate student in the 1960s. It turns out that we can walk and we can talk because the chemistry that makes life possible is enormously elaborate and sophisticated. Cells are the basic unit of life, and proteins make up most of their dry mass. But instead of a cell dominated by randomly colliding individual protein molecules, we now know that nearly every major process in a cell is carried out by assemblies of 10 or more protein molecules, comprising a “protein machine”. Indeed, the entire cell can be viewed as a factory that contains an elaborate network of interlocking assembly lines, each of which is composed of a set of different protein machines in defined positions.

There are many exciting challenges ahead for biologists. Living organisms are so complicated that we will need new methods of analysis to achieve any deep understanding of their molecular mechanisms. To take just one example, large organisms like ourselves are formed from thousands of billions of cells, which join together to form an elaborate cell cooperative. Because each cell in this cooperative must behave in a manner appropriate for the organism as a whole, the cells must constantly read the signals from their surroundings to decide whether to remain quiescent (the normal state for most of them), to multiply to create more identical cells, to both multiply and differentiate to produce cells of a different type, or to die for the good of their neighbors. Rarely, mistakes are made; some cause diseases such as cancer, destroying the whole cooperative. There are therefore both intellectual and practical reasons for scientists to concentrate on understanding how a cell makes decisions, a process that we might loosely refer to as “cell thinking.”

Speaker’s profile

Bruce Alberts, a respected biochemist with a strong commitment to the improvement of science and mathematics education, has returned to the Department of Biochemistry and Biophysics at the University of California, San Francisco, after serving two six-year terms as the president of the National Academy of Sciences (NAS).

During his tenure at the NAS, Alberts was instrumental in developing the landmark National Science Education standards that have been implemented in school systems nationwide.

*Alberts is also noted as one of the original authors of *The Molecular Biology of the Cell*, a preeminent textbook in the field now in its fourth edition. For the period 2000 to 2009, he serves as the co-chair of the InterAcademy Council, a new organization in Amsterdam governed by the presidents of 15 national academies of sciences and established to provide scientific advice to the world.*

Committed in his international work to the promotion of the “creativity, openness and tolerance that are inherent to science,” Alberts believes that “scientists all around the world must now band together to help create more rational, scientifically-based societies that find dogmatism intolerable.”

Widely recognized for his work in the fields of biochemistry and molecular biology, Alberts has earned many honors and awards, including 15 honorary degrees. He currently serves on the advisory boards of more than 15 non-profit institutions. He is an Overseer at Harvard University, a Trustee of the Carnegie Corporation of New York, a Trustee of the Gordon and Betty Moore Foundation, and the president-elect of the American Society of Cell Biology.

Since returning to UCSF last fall as a full-time professor in his old department of Biochemistry and Biophysics, Alberts has been focusing on applying aspects of what he learned in Washington --both about teaching and learning and about stimulating innovation -- to his local environment.

A Synthesis: Where does Science go?

Edouard Brézin

President

Académie des Sciences, France

In spite of the specialization often required when working on a given topic, the possibility of understanding the main issues across fields is still open, as exemplified in the classic "Consilience" by Edward Wilson, an essay on the unity of knowledge. The last century has seen a large influence of the physics way of approaching the living state, starting with Schrödinger, Delbrück, Crick and many others. In return now the post-genomic era of biology is driving many physicists, mathematicians, computer scientists into biology, or rather into an area in which many of the researchers do not feel the need to define themselves in terms of a traditional discipline. The cross fertilization of physics and mathematics has rarely been as strong as nowadays. We shall make a modest attempt to see through the main present trends.

Speaker's profile

Professor of Physics, Ecole Normale Supérieure. At present President of Académie des Sciences. (Foreign Member NAS & Royal Society). Main field : statistical physics and phase transitions.

From 1992-2000 (non executive) president of CNRS.

Social sciences: truthful or useful?

Pieter J.D.Drenth,

Hon. President,

All European Academies (ALLEA), The Netherlands.

Summary: In view of the vast variety of disciplines and sub-disciplines within the social and behavioural sciences, it is virtually impossible to present a comprehensive 'state of the art' of these sciences that does justice to their rich diversity. Therefore the paper will focus on a central theme that distinguishes the social and behavioural sciences from natural and life sciences: Not only do they analyse and study causes and conditions of peoples' behaviour and social environment, by their very study they also influence and change this behavioural and social reality. Consequently, the social and behavioural sciences are sometimes seen as or even claim to be applied sciences. This view has been opposed by others, who stress their fundamental character and defend a great reservation with respect to policy-orientation and applicability.

The issue of the primacy of 'truthfulness' or 'usefulness' will be discussed by describing the various modifications on the spectrum from pure, science-driven research on the one hand to auxiliary research that is meant to be supportive in respect of policy and decision making on the other. It will be shown that social and behavioural sciences have a legitimate place on all different points of this spectrum, and that in this respect they do not differ from other sciences.

At the same time it can and should not be denied, that much of the relevance of these sciences is derived from their unique contribution to societal development and policy making. Economic development, the advancement of a knowledge based society, growth through innovation (European Lisbon objective) just as much as the promotion of peace, social cohesion, and a scientific and educational culture in a society cannot be achieved optimally without the application of scientific knowledge in this area. Given this important contribution it is striking that in everyday practice and decision making the results of social and behavioural scientific research are all too often neglected. The paper will conclude with an analysis of this under-utilisation of social and behavioural scientific knowledge, and some recommendations for a change for the better.

Speaker's profile

Pieter J.D.Drenth (1935) studied psychology at the Vrije Universiteit in Amsterdam and the New York University, New York, USA. (PhD in 1960). He has been a Reader in statistics and testtheory from 1962-1967 and Professor of psychology from 1967- 2006 at the Vrije Universiteit in Amsterdam. He has published widely on research methods, intelligence theory, test theory, organizational psychology and cross cultural psychology, and lately on science theory, science policy and science and ethics. He was visiting professor at Washington University, St Louis (1966) and at the University of Washington, Seattle (1977). He was first supervisor of 40 PhD theses, five of which in Indonesia. Since 2006 he is Professor Emeritus at the VU.

He holds honorary doctors degrees from the University of Gent, Belgium (1980), and the Université René Descartes de Paris (1996).

From 1982 –1987 he served as Rector Magnificus of the Vrije Universiteit.

From 1990-1996 he was President of the Royal Netherlands Academy of Arts and Sciences, and from 1998 – 2000 Chairman of the Dutch Social Science Research Council.

From 2000 till 2006 he was President (and since 2006 Honorary President) of All European Academies (ALLEA).

Physics, Now and in the Future

David Gross

Director, Kavli Institute of Theoretical Physics

University of California, Santa Barbara, USA

As the 21st century begins physics continues to expand its horizons. I shall briefly review the many new directions of research and open questions that will guide physics over the next decades

Speaker's profile

David Gross is Frederick W. Gluck Professor of Theoretical Physics at the University of California, Santa Barbara (UCSB) and director of the Kavli Institute for Theoretical Physics also at the University. He joined the Institute for Theoretical Physics at the University of California, Santa Barbara in January 1997. He received his Ph.D. from the University of California, Berkeley in 1966 and then was a Junior Fellow at Harvard. In 1969 he went to Princeton where he was appointed Professor of Physics in 1972, and later Eugene Higgins Professor of Physics, and Thomas Jones Professor of Mathematical Physics. Professor Gross was an Alfred P. Sloan Foundation Fellow (1970-74), was elected Fellow of the American Academy of Arts and Sciences in 1985, Member of the National Academy of Sciences in 1986 and Fellow of the American Association for the Advancement of Science in 1987. He is the recipient of the J. J. Sakurai Prize of the American Physical Society in 1986, a MacArthur Foundation Fellowship Prize in 1987, the Dirac Medal in 1988, the Oscar Klein Medal in 2000, and the Harvey Prize of the Technion in 2000. He has received two honorary degrees. In 2004, he was selected to receive France's highest scientific honor, the Grande Médaille D'Or, for his contributions to the understanding of fundamental physical reality. He received the 2004 Nobel Prize in Physics for solving in 1973 the last great remaining problem of what has since come to be called "the Standard Model" of the quantum mechanical picture of reality. He and his co-recipients discovered how the nucleus of atoms works.

New Trends in Microbiology

Zhihong Hu

*Director, Wuhan Institute of Virology,
Chinese Academy of Sciences, China*

Despite their small size, microbes play an enormous role in processes that relate to nearly every aspect of our planet. And microbiology plays a unique and fundamental role in essentially every field of science.

With new techniques, it is now believed that over 99% of microbes on Earth are uncultured, representing a large untapped biological resources. This has greatly expanded our awareness of the diversity of microbes. Metagenomics, which refers to the study of a metagenome (all genomes present in an environmental sample), has been a powerful approach to assessing uncultured microbes since it was developed in the 90's. And environmental microbiology has been viewed as the most exciting field in microbiology. The genomics-enabled research on microbes in nature helps us to understand the origin, evolution and current composition of the biosphere, and the relationships between the biosphere and the environment. Research on microbes thriving in extreme environments (hot springs, salt or soda lakes, deep sea and deep subsurface) has been intensified, yielding a large number of new microbes, some of which are of potential use in various applications.

As of the beginning of October 2006, more than 380 complete bacterial and archaeal genome sequences, as well as about 1700 viral genomes are available on NCBI. Genome sequences have revealed the extent and the impact of lateral gene transfer, as well as the importance of point mutations in bacterial evolution. In part of its small genome, microbes serve as models for functional genomic studies such as gene transcription (transcriptomics), protein expression (proteomics), protein interaction, and metabolite network (metabolomics). Genomic studies also facilitate biotechnology such as pathogen diagnosis, vaccine and antimicrobial drug design.

The study of microbes has been extended from the laboratory to the natural communities. This has led to the identification of novel molecular mechanisms of cell–cell interactions, such as the Type III secretion system. Recent studies on microbe–host interactions led to a deeper understanding of innate immunity. We also begin to learn that microbes can cause chronic diseases that were previously thought to be due to genetics or environment ailments. The knowledge of host–pathogen relationship has facilitated our understanding of the eukarotic organisms.

Modern microbiology is a combination of many sciences. It has become an integrative science that simultaneously adopts the techniques from different scientific disciplines and impacts diverse scientific disciplines.

Speaker's profile

Dr. Zhihong Hu received the B.S. degree (Virology and Molecular Biology) in 1986 from Wuhan University, China. She obtained the M.S. degree (Virology) in 1989 from Wuhan Institute of Virology, Chinese Academy of Sciences (CAS) and afterwards became a staff of the institute. In 1993, with a Marie Curie fellowship she went to Wageningen Agricultural University, the Netherlands, for virology research and later obtained a sandwich PhD fellowship from the university. She obtained the PhD. degree from Wageningen Agricultural University in 1998. From 1997 she is Professor at Wuhan Institute of Virology (CAS) and from 2000 she is the Director of the Institute. During her tenure as a Director, the research programs of Wuhan Institute of Virology expanded to cover research on insect viruses, HIV, SARS coronavirus, influenza virus, hepatitis viruses (HBV & HCV), and tumor virology. Her researches mainly focus on molecular biology of baculovirus. After the SARS outbreak in 2003, she becomes interested in the epidemiology and animal reservoir of SARS-CoV and her institute had identified bats as the animal reservoir of SARS-CoV.

Earth Sciences in the Third Millennium: From Deep Earth to Social Issues

Manuel A. Iturralde-Vinent

Academician

Cuban Academy of Sciences, Cuba

The exiting revolution taking place in the development of new technologies is providing a highway for basic and applied sciences, among them, to Earth Sciences. Nowadays, within short time lapse are becoming available new techniques, new methods and new equipments of remote sensing, geophysics, images processing, earth tomography, rock and mineral analysis, radiometric dating, and data processing. All these achievements are steaming the possibilities of understanding earth dynamics, as demonstrated by recent achievements in geosciences.

Nevertheless, the cost of acquisition, exploitation and maintenance of these technologies are growing very fast, and the standards are constantly sharpened, making obsolete previous techniques within a short time period. This is producing a widening gap between those countries and institutions that can afford to obtain these techniques and those which are not. In the same road goes the high cost of access to international scientific publications.

Additionally, some very successful organizations providing financial support for interdisciplinary and international earth sciences projects, as the UNESCO's International Geoscience Program (IGCP) and the Association of Geoscientists for International Development (AGID), have seen a strong budgetary reduction. Along this trend, the UNESCO's Earth Science Division was closed and fused with the Division of Ecological Sciences, some universities have close or downsized their basic Earth Science programs, and several countries have reduced support for research in Earth Science. This trend was mainly caused by the misconception that we know already what we need to know of our planet, and no geology but other sciences will solve our problems.

On the other hand, natural disasters related to geological processes (earthquakes, tsunamis, volcanic eruptions, landslide, flash flows, among others) are claiming thousands of lives and destroying properties in rapid progression. Reserves of basic metals, natural raw materials and energy resources are fast reducing, indicating that humanity is reaching a point of no-return. Only continuous basic and applied research in Geosciences will produce the necessary knowledge to save life and environment, create new resources and, ultimately, improve the quality of life.

These facts lead to applause the INTERNATIONAL YEAR OF PLANET EARTH (<http://www.yearofplanetearth.org/>). Since the United Nations proclaimed 2008 as the International Year of Planet Earth, subtitled "Earth Sciences for Society", it is important that all countries and scientists join this initiative, in order to call the attention of governments, states and international organization to support earth science research and educate the people to take the right steps in order to protect humanity from natural disasters and to use the Earth resources more sustainably.

Speaker's profile

Geologist, Universidad de Oriente, Cuba, 1975 ,Ph.D, Instituto Superior Politécnico J. A. Echeverría, 1995, Academician, Cuban Academy of Sciences, 1997. Senior researcher, National Museum of Natural History, Cuba ,Adjunct senior professor, Higher Polytechnic Institute J.A. Echeverría Specialization: Caribbean Geology, Paleontology, Paleogeography, Plate Tectonics and Biogeography, Environmental Geology and Karstology. Junior micropaleontologists (1964-1968, Head of the Department of Engineering Geology at the National Institute of Hydraulic Resources (1968-1970), Assistance to Professor of Geology while studying Geology at the Higher Polytechnic Institute and the University of Oriente(1971-1974), Researcher in charge of regional mapping projects, Institute of Geology and Paleontology (1975-1981), Head of Project of Geological Prospecting in Central Cuba (1982-1987), Senior Researcher and Curator, National Museum of Natural History (1988-today). Participated and/or lead national and international research project with the UNESCO/IUGS IGCP Program, the National Geographic Society, the American Museum of Natural History, and other NGOs. Participated and/or organized national and international scientific events in Cuba and many other countries, included the International Geological Congresses of Moscow, Brazil, and Italy. He has published more than 200 research papers, books and edited several monographs

Providing a level playing-field to world citizens through Innovations ICT

Ashok Jhunjunwala

*Professor, Department of Engineering,
Indian institute of Technology, India*

Information and Communication Technologies (ICT) have had a very rapid development over the last couple of decades. It is changing the way we live, the way we work and the way we interact. But far more important, it is giving an opportunity to the disadvantaged to overcome the centuries of neglect and denial of opportunities. Indeed the world is becoming flat. But this is a mere beginning, indicating the potential of ICT. The talk will present some efforts in this direction and focus on what needs to be done to convert this potential into reality.

Speaker's profile

Prof. Ashok Jhunjunwala is Professor of the Department of Electrical Engineering, Indian Institute of Technology, Chennai, India. He received his B.Tech degree from IIT, Kanpur, and his MS and Ph.D degrees from the University of Maine. From 1979 to 1981, he was with Washington State University as Assistant Professor. Since 1981, he has been teaching at IIT, Madras. Dr. Jhunjunwala leads the Telecommunications and Computer Networks group (TeNeT) at IIT Madras. This group is closely working with industry in the development of a number of Telecommunications and Computer Network Systems and has incubated a number of technology companies to develop world class Telecom Access products. Dr. Ashok Jhunjunwala has been awarded Padma Shri in the year 2002. He has been awarded Shanti Swarup Bhatnagar Award in 1998, Dr. Vikram Sarabhai Research Award for the year 1997, Millennium Medal at Indian Science Congress in the year 2000, H. K. Firodia for "Excellence in Science & Technology" for the year 2002, Shri Om Prakash Bhasin Foundation Award for Science & Technology for the year 2004, Awarded Jawaharlal Nehru Birth Centenary Lecture Award by INSA for the year 2006 and IBM Innovation and Leadership Forum Award by IBM for the year 2006. He is a Fellow of INAE, INSA and NAS and a member of Prime Minister Scientific Advisory Committee. Dr. Jhunjunwala is a Director in the Board of SBI, BEL, Polaris, Sasken, Tejas, NRDC, and IDRBT. He is a member of Prime Minister Scientific Advisory Committee.

Uncovering the Universe

Maria Teresa Lago

*Full Professor, School of Sciences,
University of Porto, Portugal*

Over the last decades Astronomy has made a tremendous progress in its objective of understanding the Universe we live in and are part of. Our current understanding of the cosmological structures and their physical properties, the way they are formed and evolve – from planets and stars to clusters of galaxies - rests firmly on the ability to incorporate techniques, tools and knowledge from many other fields of Science. At the same time, and because of the extreme nature of the objects and conditions it deals with, Astronomy became a major driving force for many developments in those other fields.

Once again we are on the verge of opening new windows of observation and the resulting new opportunities will certainly exceed by far our current expectations. Our knowledge and understanding of the Universe grows steadily and fast, pointing to new frontiers still to be uncovered.

Speaker's profile

Teresa Lago was born in Lisboa and graduated at the School of Sciences, University of Porto (BSc in Mathematics, Licenciatura in Surveying Engineering. She obtained a Master Degree and later a PhD (1979) in Astronomy at the Sussex University, UK. In 1983 she was responsible for setting-up the first Astronomy Degree in the country and later an European Masters Degree, an European Interuniversity Masters Degree (1994), a Masters in the Teaching of Astronomy (1997) and a Doctoral Programme in Astronomy (2003), all at the School of Sciences, University of Porto. She was a member of the Executive Board of the "European Astrophysics Doctoral Network" involving over thirty universities and research institutions in Europe (1986-1997). In 1985 she received the Henri Chrétien Award (American Astronomical Society). She prepared the national plan to develop Astronomy at request of the National Research Council (1987) and in 1988 founded the Centre for Astrophysics at the University of Porto, which she directed for eighteen years. She is Associate of the Royal Astronomical Society, UK (1990) and member of the Academiae Europaeae (1992). She is a member of the Council of the European Southern Observatory (ESO) the organization for Astronomy in Europe and coordinates the Scientific Council for "Earth & Space Sciences" of the National Research Council. She has been involved in various EC Panels (DG XII) and Science Advisory Committees and Boards namely, Space Science Advisory Committee (ESA), School of Cosmic Physics (Dublin Institute for Advanced Studies), Astronomy & Space Science (Academy of Finland). From 1999-2002 she was President of "Porto 2001 – European Capital of Culture" a wide-ranging 250 million euros national project.

She is a founding member of the European Research Council Scientific Council.

Most relevant activities include: Training in Astronomy (graduate and post-graduate), the promotion of science and scientific culture, research in Astrophysics. Research activities cover multi-wavelength observations and modelling of the atmospheres, winds and stellar activity of low mass stars in the context of stellar evolution.

The Shape of the Earth: From Erosthenes to the Space Age

Kurt Lambeck

President

Australian Academy of Sciences, Australia

The study of the shape of the Earth is called Geodesy. This may appear to be an arcane subject but it has been a matter of speculation and measurement for millennia. Its very foundation may well be Egypt. There are good practical reasons for knowing the shape and dimensions of our planet for mapping, navigation, satellite trajectory calculations, etc. But there is also a very significant science interest. The shape of the Earth is determined by its mass distribution – in the solid earth, and on the surface including oceans, ice sheets, atmosphere and ground and surface waters. As deformations occur within the planet and as surface mass is redistributed on its surface, the shape of the earth is modified. The shape, and its changes, is therefore an integrated expression of what happens in the Earth system. It therefore plays a central role in geology – to determine the density variations inside the crust and mantle and hence the stress-state of the planet and a measure of tectonic and geological zonation. As accuracies of measurement have improved, it also provides a measure of the redistribution of mass in the oceans – of changing currents and of changing sea levels – in the ice sheets, in the atmosphere – of seasonal exchanges in atmospheric mass between the hemispheres – and in ground and surface water storage. Monitoring the shape of the Earth is therefore also a monitoring of the environmental state of the planet.

In this lecture I will discuss some of the methods that have been used to measure the Earth and will focus on what has been learnt about the Earth itself and the relevance of this information to the monitoring of the state of the planet.

Speaker's profile

Kurt Lambeck is Distinguished Professor of Geophysics at the Australian National University. His research interests range through the disciplines of geophysics, geodesy and geology with a focus on the deformations of the Earth on intermediate and long time scales and on the interactions between surface processes and the solid earth.

Professor Lambeck has been at the Australian National University since 1977, including ten years as Director of the Research School of Earth Sciences. He is currently also strategic science advisor to National Geospatial Reference System of Geoscience Australia and President of the Australian Academy of Science.

Analysis, models and simulations

Pierre-Louis LIONS

Member

Académie des Sciences, France

The goal of this lecture is to illustrate how mathematics interact with other sciences in the context of numerical simulations and modelling in order to solve. We first present several examples of such interactions for industrial and engineering sciences applications. We next discuss modelling issues and conclude by a brief illustration of the role of some branches of mathematics.

Speaker's profile

P.-L. Lions, born on August 11th, 1956 in Grasse (France) Professor at Collège de France and at Ecole Polytechnique Member of the Acad. Sciences (Paris), Acad. Technologies (Paris), Acad. Lincei (Roma), Istituto Lombardo (Milano), Acad. Europea Honorary degrees at Heriot-Watt University (Edinburgh), City University (Hong-Kong) Chairman of the Scientific Councils of ELECTRICITE DE FRANCE, FRANCE TELECOM, CEA-DAM, Ecole Normale Supérieure Scientific Director of the chair « Finance and Sustainable Development » Advisor at INRIA Member of the Board of Directors of ALCATEL, SARK and CHANNEL BRIDGE Scientific Consultant with ASTRIUM ST, BNP PARIBAS, REECH AIM Author of more than 350 research articles and 5 research books in Mathematics and their Applications Awarded many scientific prizes including the Fields Medal (Zurich, 1994)

The Earth's Polar Regions and the International Polar Year 2007-2008

Chris Rapley, CBE

Director

British Antarctic Survey, UK

In a warming world ice melts. Satellite and field data show that climate-related changes are taking place in the polar regions faster than had been predicted even five years ago. Yet there are still major uncertainties about what will happen and how quickly. The International Polar Year 2007-2008, which will start next March, aims to provide new and unprecedented insights into these and a wide range of other scientific issues, as well as engaging the public, schoolchildren and policy makers the world over. Prof Rapley will describe the context for the IPY 2007-2008 and summarise its aims, structure and content.

Speaker's profile

Prof Chris Rapley CBE is Director of the British Antarctic Survey. Prior to this he was for four years the Executive Director of the International Geosphere-Biosphere Programme at the Royal Swedish Academy of Sciences in Stockholm. This followed an extended period as Professor of Remote Sensing Science and Associate Director of University College London's Mullard Space Science Laboratory.

He has a first degree in physics from Oxford, an M.Sc. in Radioastronomy from Manchester University, and a Ph.D. in X-ray astronomy from University College London.

As well as being a member of numerous national and international scientific Boards and Committees, he is currently President of the Scientific Committee for Antarctic Research and a member of the Joint Committee for the International Polar Year 2007-2008.

He is a Fellow of St Edmund's College Cambridge, an Honorary Professor at University College London and at the University of East Anglia, and a Distinguished Visiting Scientist at NASA's Jet Propulsion Laboratory.

His research interests include Earth remote sensing, climate change and earth system science, as well as a more general interest in the organisation, leadership and management of science.

Science in Egypt from Imhotep to Zewail

Ismail Serageldin

Director

Bibliotheca Alexandrina, Egypt

Speaker's profile

Ismail Serageldin is Director of the New Library of Alexandria (BA) and chairs the BoD of each of its affiliated research institutes and museums. He is Distinguished Professor, Wageningen University, Netherlands. He serves as Chair and member of numerous advisory committees for academic, research, scientific and international institutions. He was chairman of the Consultative Group on International Agricultural Research, and founder and chairman of the Global Water Partnership and the Consultative Group to Assist the Poorest. Serageldin was Vice-President of the World Bank (1993-2000). He has published extensively on a variety of topics including biotechnology, rural development, sustainability, and the value of science to society. He holds a BSc in engineering from Cairo University and a MSc and PhD from Harvard University and has received 18 honorary doctorates. His research interests include Poverty reduction; food security; agriculture; economics and sustainable development; water issues; culture and heritage; education; gender issues.

Women for Science: A Leadership Role for Academies

Johanna SENGERS *Scientist emeritus, US National Institute of Standards and Technology (NIST), USA.*
Manju SHARMA, *President and Executive Director of the Indian Institute of Advanced Research, India*

The world's academies of science, engineering, and medicine must take immediate action to help remedy the widespread, persistent and wasteful under representation of women in scientific and technical fields, says a 2006 report by the InterAcademy Council (IAC). The advisory report, *Women for Science*, is addressed primarily to the world's academies, which received copies in June, 2006. Women typically make up less than 5 percent of an academy's members. As a start, the academies themselves need to implement internal management practices that encourage and support women, and influence policymakers and other leaders to bring about broader change. The report urges academies to formally commit to the full inclusion of women in their organizations, in any research institutes they manage, and throughout the S&T community. It recommends a management tool developed for accommodating diversity (be it gender, ethnic, or religious) to the advantage of an organization, and of all its members. "Good management practice" when women form a minority requires commitment from the top leadership, sensitivity to gender issues, clear criteria for promotions and awards, professional training and mentoring, and inclusion of women in formal and informal organizational networks. Among the recommendations are the following: Academies need to create a structure at the highest level that is responsible for addressing gender-equity issues, formulating and overseeing action plans, and monitoring progress. Academies are encouraged to develop concrete ways to give visibility to women scientists, add female members and include women members in leadership positions. Given their prestige and alliances with governments, universities, and nongovernmental organizations, academies must play advocacy and leadership roles beyond their own doors. Academies are asked to support higher education of women in science, engineering, and industrial management, while advising governments to remove barriers to their education and employment. Furthermore, they must help to empower in S&T arenas not only professional women but also women at the grassroots level in the developing world. Academies are requested to establish and promote science and technology "knowledge centers," where women scientists and engineers can work with grassroots women of their own culture on technologies for local needs and applications, thus enabling science and technology capacity building. Academies need to pay attention to gender aspects of the research they sponsor, the studies they undertake and the reports they publish. Academies must act both individually and jointly. The IAC and IAP have begun to collect data categorized by sex from their constituent academies, so progress can be measured. IAC is initiating a website, where academies can exchange ideas about programs that have proven successful, and about initiatives they are taking. It will be developed in conjunction with professional and women's organizations that have made their mark in promoting women for science and present links to relevant web sites. IAP member academies are urged to respond to the advisory report, and results from these responses will be presented on the IAC inaugurated website.

Speakers' profiles

Johanna (Anneke) LEVELT SENGERS, scientist emeritus at the US National Institute of Standards and Technology (NIST, obtained her Ph.D. in physics at the University of Amsterdam. Her main professional interest is the behavior of fluids and fluid mixtures near critical points. Group Leader at NIST from 1978 to 1987 and a NIST Fellow from 1983 to 1995, she is past President of, and was the US representative to, the International Association for the Properties of Water and Steam. Member both of the US National Academy of Sciences and National Academy of Engineering, Dr Levelt Sengers is a corresponding member of the Royal Netherlands Academy of Arts and Sciences. She has received an honorary doctorate from the Technical University Delft, Netherlands, both US and international awards, and was the 2003 North American Laureate of the L'Oréal - UNESCO 'For Women in Science' Awards.

Manju SHARMA, President and Executive Director of the Indian Institute of Advanced Research, , Gujarat, India and former Secretary to the Government of India for the Department of Biotechnology. Responsible for boosting biotechnological development in India, she set up many new research institutes and spread the educational network for biotechnology all over the country. She initiated major programmes for the inclusion of women in science and technology and has received honorary doctorates from many universities in India, as well as many national and international awards. She was the first female President of India's National Academy of Science ,member, Board of Governors of the UN University's Institute for Advanced Studies, member, Advisory Panel on Agricultural Biotechnolog, US Agency for International Development, Fellow of the Academy of Sciences for the Developing World (TWAS).

Earth Simulation on the Earth Simulator

Keiko Takahashi

Group leader, Earth Simulator Centre

Japan Agency for Marine-Earth Science and Technology, Japan

The Earth Simulator has given us tremendous gifts both in our lives and research fields. We have been faced with various forms of highly unusual events such as global warming, earthquakes and weather extremes. However, we had never a measure of how to accurately predict what is going to happen in the future. The Earth Simulator has enabled atmospheric/ocean scientists to run weather forecast and climate projection with more than 1,000 times increased resolutions compared conventional simulations. The dramatic change in simulation science brings us a lot of information about nature.

The Earth Simulator can trace its history back in 1996. The promotion of research & development for the Earth Simulator has been reported to the Science Technology Agency in Japan as a part of the Global Change Prediction Plan. It was the starting point of the Earth Simulator Project. Since starting of operation of the Earth Simulator in March of 2002, the Earth Simulator is still being one of the most powerful supercomputer in the world.

Five years have passed from the beginning of its operation and the number of users amounts to than about 800 scientists every year. Research activities on the Earth Simulator has become widely not only in Geosciences but also in industrial applications such as designing auto-mobiles, engines and devices, nanotechnology, and material science and so on. Through various simulations performed on the Earth Simulator, interdisciplinary collaborations have been organized for understanding nature with integrated approaches.

In my talk, I will introduce system configuration of the Earth Simulator and its unique characteristics and advantages. Especially, focusing on Geosciences, leading simulation results of weather forecast, projection of climate change such as global warming and El Nino, and earthquakes will be present. In addition, near future plans on the Earth Simulator will be introduced.

Speaker's profile

Dr. Keiko Takahashi is Group Leader, Earth Simulator Center, Japan Agency for Marine-Earth Science and Technology

Educational background 1985: B.S.: /Complex Function Theory/ Dept of Mathematics/Tsuda College: 1987 Master/ System Science/Interdisciplinary Graduate School of Science and Technology/Tokyo Institute of Technology 1991 Ph.D./System Science/ Interdisciplinary Graduate School of Science and Technology/Tokyo Institute of Technology

Research activities, Computational Fluid Dynamics Formal Method Theory Concurrent/Parallel Computational Algorithms, Complexity Theory Parallel Computing Architecture, Genetic Algorithms, Complexity Theory Oceanic Modeling, Atmosphere Modeling, Coupled Ocean-Atmosphere Modeling, High Performance Computing Coupled Ocean-Atmosphere-Sea Ice Modeling High Performance Computing Multi-scale multi-physics simulations of weather/climate

GMOs: a Science and Society Issue

Jocelyn Webster

Executive Director

AfricaBio, South Africa

The development of modern biotechnology and genetically modified organism (GMOs) has impacted on all areas of biological science in today's world. For example the use of these technologies allows scientists to: isolate genes to produce specific products or change the expression levels of identified genes or identify specific genes to allow more accurate selective breeding or even to move genes from one species to another.

While scientists have developed these elegant and precise new technologies to make unique medicines, produce new foods, make new industrial products and address global challenges such as environmental and energy issues, society has been left behind.

The general public often reacts to modern biotechnology and their feelings of loss of control, lack of understanding or an overload of conflicting information in a negative manner rather than embracing these new solutions. Yet this science that society may need for its future survival is moving ahead day by day.

Society's dilemma with GMOs will be highlighted in this presentation through the discussion of modern agricultural biotechnology and its relevance to developing countries.

Speaker's profile

Prof. Jocelyn Webster is the Executive Director of AfricaBio, the Biotechnology Stakeholders Association based in South Africa. This organization is a non-political, non-profit biotechnology stakeholders association serving as a factual reference point and a forum for informed discussion on biotechnological and biosafety issues in Africa. To date, Prof. Webster has many publications in international journals, contributions to scientific books and has presented over 70 papers at national, regional and international conferences and workshops.

Prof. Webster sits on several boards of agricultural and biotechnology based organizations and has more than 30 years experience in R&D in biological sciences with skills and experience in: Medical and industrial microbiology, Medical immunology, Microbial genetics and plant biotechnology.

Prof. Webster has also established her own biotechnology consulting business, ProBio, which provides services to industries, academia and research organizations both nationally and internationally.

Emerging applications of intense lasers in sciences

Jie Zhang

*Director General, Bureau of Basic Sciences
Chinese Academy of Sciences, China.*

One of the most remarkable advances in laser technology is the chirped pulse amplification (CPA) technique invented in mid-1980s, leading to a rapid development of a new class of compact ultraintense lasers, operating in a power range from terawatt to petawatt. When such a laser beam is focused onto a target with a focal spot of a few micrometers in diameter, the laser intensity on the target surface is extremely high, approaching 10^{22}W/cm^2 presently. Under such an ultraintense laser irradiation, target surface will be highly ionized, forming a relativistic plasma. The new physics and applications under such extreme conditions are emerging rapidly during the past decades. In this presentation I will concentrate on the applications of the ultraintense lasers in sciences, not including the exciting ultrafast phenomena such as the generation of attosecond pulses, the fast dynamics in chemistry, etc. These applications will bring us into a new era of a sustainable development of our societies. The main topics include:

- Advanced approach to fusion - fast ignition
- Advanced ultrahigh-gradient particle accelerators
- Novel light sources from THz to x-ray regime (including the Compton scattered x-rays when coupled with other technologies, i.e., electron beams)
- Potential sources of energetic particles
- Laser nuclear science
- Advanced diagnostics (i.e., imaging, backlighting, and radiography)
- Laboratory of astrophysics

Speaker's profile

1986-1988 PhD in Optical and Atomic&Molecular Physics, Institute of Physics, Chinese Academy of Sciences, Beijing China, 1982-1985 MSc in Solid State Physics, Department of Physics, Neimenggu University, Huhhot, China, 1978-1981 BSc in Physics, Department of Physics, Neimenggu University, Huhhot, China

Academic Positions:

2003-Present Director General, Bureau of Basic Sciences, Chinese Academy of Sciences, Beijing, China, 2003-Present Academician of the Chinese Academy of Sciences, 2002-Present Director of a large science project of the Chinese Spallation Neutron Source (CSNS), 1998-2003 Deputy Director, Institute of Physics, Chinese Academy of Sciences, Beijing, China, 1998-Present Deputy Director and Director (2003), Laboratory of Optical Physics, Chinese Academy of Sciences, Beijing, China, 1998-Present Professor, Academician (elected in 2003), Institute of Physics, Chinese Academy of Sciences, Beijing, China, 1991-1998 Senior Research Scientist working on x-ray lasers and high field physics at the Rutherford Appleton Laboratory, Chilton, OX11 0QX, UK, 1989-1990 Alexander-von-Humboldt Research Fellow, working on x-ray lasers and laser-plasma physics at the Max-Planck-Institut für Quantenoptik, D-85748 Garching, Germany, 1988-1989 Research Assistant at the Institute of Physics, Chinese Academy of Sciences, Beijing, China,

Participants List