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# EUROPEAN SCIENCE AWARDS 2007



Prize for Science  
Communication



Marie Curie Awards



Descartes Prize  
for Transnational  
Collaborative Research

SUCCESS STORIES

# EUROPEAN SCIENCE AWARDS



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EUROPEAN COMMISSION

# EUROPEAN SCIENCE AWARDS 2007

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The background of the top half of the page features two wireframe human heads in profile, facing each other. They are rendered in a grid pattern of orange lines. The background is a solid orange color that transitions into a white curved shape at the bottom.

# Science Communication Prize

## Excellence in European science communication

The Science Communication Prize was launched in 2004 by the European Commission's Directorate-General for Research to help stimulating interest in science, promoting the understanding of scientific progress, and its implications in wider society. The prize reflects the European Union's aim to boost scientific culture, to support the communication of research results, and to encourage people to take on scientific careers.

The Prize recognises and rewards high-quality and accurate science communication activities aimed at a general audience. Under the 2007 Science Communication Prize, three laureates will each receive € 60 000 and two finalists will both receive € 5 000.

The Science Communication Prize targets organisations or individuals that have achieved outstanding results in science communication and have already been recognised with a prize or award by a European and/or national science communication prize organiser.

There are three science communication prize categories:

- The Communicator of the Year
- The Writer of the Year
- The Audiovisual Documentary of the Year



# Bringing black holes down to earth

*A world-class scientist who is also a best-selling author and an artist: Professor Jean-Pierre Luminet is a worthy champion of science and a science communicator of exceptional quality. His considerable literary production focuses on his own specialism, astronomy and cosmology, which he explores via a variety of media to communicate its fascinations to the general public and the younger generation. Whether working in print, on television, through exhibitions, music or the arts, he delivers accessible information of the highest quality and intelligence that speaks across cultures and values.*

Jean-Pierre Luminet is a true renaissance man. The Frenchman is a distinguished astrophysicist and Director of Research at the *Centre National de la Recherche Scientifique*, a renowned cosmologist at the *Observatoire de Paris, Laboratoire Univers et Théories*, as well as a poet, artist, communicator to the public and author of many varied multimedia productions.

His recent book 'Le destin de l'univers: trous noirs et énergie sombre' dealt with black holes and dark energy but was aimed squarely at the general public. It was praised for its outstanding scientific, historic, literary and esthetical qualities. In 2006, he also published 'Le Secret de Copernic', an essay on the astronomer Copernicus related in the style of a historical novel.

## **A model for communication**

Luminet's publications for a general audience share a number of features that make them a model for communicating science to the public. Their scientific content is rigorous and always up-to-date. He is not afraid to work in a diversity of publications and media: he has produced popular science books, historical novels, beautifully illustrated exhibition catalogues, multimedia productions for children and poetry. He is an artist, engraver and sculptor and has also collaborated with celebrated musicians. Luminet's work has been translated into a wide variety of languages including Chinese and Korean.

His works provide a depth of pan-European cultural values. One of his most important contributions has been the re-evaluation and promotion, based on extensive historical and scientific research, of the Belgian priest and cosmologist George Lemaître. Lemaître pioneered the application of Einstein's general theory of relativity to cosmology, suggested a pre-cursor of the law now named after the American Edwin Hubble, and proposed the first 'Big Bang' theory.

In 2006, Jean-Pierre Luminet was awarded the highly coveted 'Prix Doisteau-Blutet de l'information scientifique et technique' by the French *Académie des Sciences*. And it is the Académie who has nominated him for the European Science Communication Prize.

In its award, Jules Hoffman, President of the *Académie des Sciences*, describes Luminet as a talented astrophysicist who also "has an exceptional literary talent and uses his creativity to communicate the current results of his field to the public as well as decision-makers in the world of economics, thus contributing to better integration of science in our society."

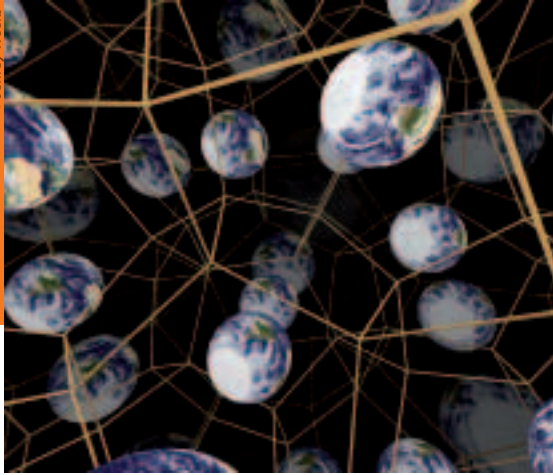
## **The scientist**

Luminet's main research areas involve the space-time structure of the universe that is described by Einstein's general theory of relativity and its subsequent developments. His main interests are on three scales: the infinitely small such as singularities – for example in the centre of black holes; the macroscopic scale such as black holes and their immediate environment; and at the cosmological scale including universal topology, problems in space-time. Luminet has published over 60 scientific papers.

Having completed a doctoral thesis on singularities in the solutions of general relativity equations at *Université de Paris*, Luminet spent several years researching black holes. His first major contribution was the simulation in 1979 of the optical distortions that would be caused by the intense gravitational field of a black hole. It should be noted that this work was carried out without the aid of modern computer tools.

In 1982, he was one of the first to study the effects of a star passing close to a super-massive black hole. A particular phenomenon that the work predicted was the destruction of a passing star due to strong gravitational tidal effects of the black hole producing a specific 'signature' from within distant galaxies. This signal was observed some twenty years later by the Chandra and XMM-Newton satellite telescopes in 2004.

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2007  
Communication Prize

### A wraparound universe

Since 1995, Luminet has been involved in cosmic topology in collaboration with numerous colleagues. He defined the concept that the universe might be spatially finite but without a definitive outer rim in his 'univers chiffonné' (wraparound universe) proposal. In 2003, following analysis of anomalies in the WMAP satellite data on the cosmic background radiation, he further proposed that the universe was positively curved with the same shape as a dodecahedron – a twelve-sided polygon.

Luminet also finds time to study cybernetics, epistemology (the theory of knowledge) and the history of science in addition to his varied cultural activities.

Luminet describes his own philosophy as follows: "I have always believed in the links between the various forms of human creation. In fact, different approaches – whether scientific, aesthetic, philosophical or other – give rise to different perceptions of the world, but with an underlying common imaginary element."

The impact of Luminet's communication work is considerable, in particular in French-speaking and European society. He has an ability to give a clear and historical vision of the fundamental contribution of European scientists to astronomy and our understanding of the Universe over some 25 centuries. In this manner he serves to illuminate the richness of European culture and the clear place of science within it.

In conclusion, it is hard to find in Europe today a science communicator who has reached the breadth, quality and quantity of production of Luminet. He has highlighted the intimate presence of European discoveries in the remote and recent past for the public, and contributed significantly to that body of scientific work.

## INFO

Jean-Pierre Luminet

### Category

Communicator of the Year

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# Stimulating young minds

*Children are naturally curious. They have an innate need to discover and learn about their environment. Delphine Grinberg has devoted her whole professional career to helping children learn and experience more about the world around them through the design of stimulating interactive exhibits. She has built on this work to write a series of books that explains simple scientific concepts in an entertaining but also educational way. She is especially skilled in communicating the excitement of scientific discovery to very young children.*

Delphine Grinberg has been designing and producing scientific exhibitions for children for over 20 years. Since 2001, she has also been putting this practical experience into writing experimental science books for children. The books describe simple and amusing experiments that bring science within the grasp of the smallest of hands. Grinberg says that she “loves making a mess” with children to get them to ask serious questions about the world around them. She takes particular care to try out and discuss with children each experiment she devises, whether in a book or an exhibition.

Giving children early contact with science – children as young as four years old are able to enjoy Grinberg’s books and activities – can inspire a life-long interest. Science as a fun activity that rewards with unique and useful insights is a lesson that many children have absorbed from the pages of one of Grinberg’s books.

## **Roberval recognition**

In recognition of her body of work for children, and in particular for her exceptional contribution to science books for younger children, Grinberg was given a Special Award in the 2007 Roberval Prizes in the General Public Category. The award was specifically for one of her more recent published works ‘Expériences pour Rouler’ (Experiments in Movement) co-published by Nathan and the Villette Science Centre in France.

The Roberval Prize was created in 1986 by the University of Technology of Compiègne to promote the sharing of knowledge between science and society. The Prize focuses on works produced in the French language that enable people to understand technology in its widest sense. The prize rewards exceptional authors of works dealing with technological subjects and their relationships with science, culture and society irrespective of the media used and the sector of the public targeted. Grinberg was nominated for the 2007 European Science Communication Prize by the Roberval Prize committee.

## **A body of work**

‘Expériences pour Rouler’ was the seventh in a series now numbering twelve volumes in the *CroqSciences* collection created by Grinberg and co-published by Nathan and the Villette Centre for Science and Industry. The collection publishes work that encourages a fun and educational approach to learning using scientific activities that can inspire young children from four years old to twelve. The idea for each book is to take a simple topic and awaken the children’s curiosity by provoking them to ask questions about the world around them.

Each book is more than a simple collection of activities, but takes a scientific approach by asking questions, suggesting experiments and producing conclusions. The experiments described make use of materials readily available at home.

A fun character leads the reader through each book giving hints and tips on experiments. An introductory quiz sets the scene in all the books that usually include seven or eight easy experiments, pop-up elements and other objects to aid explanation.

Grinberg’s first publication was ‘Le Chantier’ (The Workshop) in the Kiddidoc collection and she has been actively involved in the creation of the *CroqSciences* collection for which she has written 12 titles. Grinberg’s approach to writing children’s books is based on her extensive experience as a designer of scientific exhibitions aimed at youngsters and on the genuine enjoyment she has in organising scientific workshops in schools.

## **Exhibition experience**

From 1985 to 1989, Grinberg worked at the Villette Centre for Science and Industry on the design of eight temporary exhibitions for children including ‘The Five Senses’, ‘The Treasures of Tutankarton’, and ‘The Robots’. From 1989 to 1992, she was one of four designers at the Centre for Children within the main exhibition.



The Centre for Children is an area especially built on the scale of children aged three to twelve. The purpose of this special area was to awaken their curiosity, answer their questions and encourage communication with parents and teachers. It consists of two separate exhibition arenas. One area is for the younger children (3-5 years old) and allows the little ones to explore their senses and use their motor skills. The area for older children (5-12) currently focuses on the discovery of different cultures and the challenges of communication.

In 1994, Grinberg created a temporary exhibition on packaging (*Boîtes à malice*). She then designed three 'Inventomobiles', light experimental exhibitions, which have been touring country schools and colleges since 1995. This experience with micro-exhibitions led to a collaboration on a similar project with the Caracas Science Museum in Venezuela.

She has also organised an exhibition entitled 'The Train Uncovered' for the French National Railway Company (SNCF) in 2001 and from 2000 to 2004 she was heavily involved with the content and design of the permanent scientific discovery centre exhibition called 'The Vessel' in Strasbourg.

Since 2004, Grinberg has been working with the *Palais de la Découverte* (Discovery Centre) in Paris pursuing her curative work with responsibility for updating the museum's permanent exhibitions. While she is looking towards the future of how science is presented in scientific museums, she has organised three prototype exhibitions on light (2005), illusions (2006) and earthquakes and volcanoes (2007).

Grinberg is very interested in developing science experiments for schools and has been organising workshops in primary schools in priority education zones since 2000. In this way, Grinberg is continuing to try out new ideas to inspire the next generation.

## INFO

**Delphine Grinberg**

### Category

Writer of the Year

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# A cosmic conundrum

*The more abstract and theoretical aspects of cosmology and astrophysics are not usually the stuff of critically acclaimed and popular television. But the BBC Horizon series produced an analysis of the current thinking on dark matter, dark energy and the composition of the Universe that was not only brilliantly clear in its explanations but entertaining too.*

It may not be obvious, but apparently, most of our universe is missing. Not so long ago, science seemed to understand how the universe worked. Everything, including us, the Earth, the stars and even exotic supernovae and neutron stars, was made of atoms – all created in the ‘Big Bang’.

Now we are not so sure. According to the latest scientific ideas we only really know what around 4% of the Universe is made of. But what about the rest?

The BBC documentary ‘Most of our Universe is Missing’ set out to explain the true nature of the Universe in a programme that has been described as “Mind bogglingly clever” but explained “with a brilliant, and often humorous, clarity”.

The programme was written, produced and directed by Peter Leonard – his first documentary for Horizon: the BBC’s popular and long-running science series in the UK that is not afraid to challenge its audience.

## Expanding horizons

Peter Leonard initially trained as a scientist, graduating with a chemistry degree, but soon realised that the science life was not for him. Joining the BBC he trained in video and film editing. But he had the itch to write and direct. In the 1990s the BBC started to encourage multi-skilling in its technical and production personnel. This gave Peter the opportunity to direct programme segments; initially working in the BBC Arts department.

Peter had always wanted to direct a science-orientated piece and his first science programmes were in the BBC series ‘Inventions that changed the world’. Following this, Andrew Cohen, Horizon’s Editor, asked Peter if he would like to join his team.

The idea of covering the dark matter/dark energy debate arose after Horizon researchers picked up on an astrophysics conference where dissent on the ‘official’ explanation of the origin and existence of dark matter and energy was aired.

“The key was that there was a clear difference of opinion,” explains Peter. “And the subject itself was clearly fascinating. The idea that the Universe that we see represents only some 4% of the true mass is bizarre – but possibly more bizarre is that to explain our observations of the behaviour of that 4% theorists have ‘invented’ dark matter and dark energy – stuff that we can’t see or directly detect – yet this is cosmology’s party line.”

The programme was entered into the 2nd International Science Film Festival organised in Athens by the Centre of Applied Industrial Design in April 2007. The international jury awarded the documentary its scientific content prize citing “the clarity and humour by which a very complex scientific subject was exposed to a wider audience”.

## Accidental discovery

The documentary chronicles the ‘discovery’ of dark matter and the subsequent controversies. In 1974, the American astronomer Vera Rubin found that almost all of the stars in spiral galaxies are racing around the centre at approximately the same speed – which seemed to suggest that the universal laws of gravity laid out by Newton were not universal after all – and certainly did not apply in galaxies. The idea of variable gravity was controversial so another theory was needed to explain the ‘extra gravity’ observed by Rubin. She had discovered Dark Matter.

But what is it? Dark Matter must have mass but does not interact with ordinary matter. One answer is a hypothetical particle called the ‘neutralino’ that has the right mass, and should exist in suitably vast quantities – but has never been detected.

Not everyone is convinced by the elusive Dark Matter. Israeli astrophysicist Professor Milgrom took an alternative route and decided to rewrite Newton’s laws of gravity. Knowing the unpopularity of this approach, Milgrom worked on his theory in private until 1981. His ‘Modified Newtonian Dynamics’ simply showed how gravity could be a little stronger than we thought when considering the huge distances characteristic of galaxies.



### More darkness

But Dark Matter is not the only cosmological problem thanks to another accidental discovery by American Professor Saul Perlmutter in 1997. While looking at the expansion of the universe, he discovered that all stars and galaxies were unexpectedly accelerating away from each other. Something was pushing the stars apart. This anti-gravity force was completely new to science. Though what it actually is remains a mystery, it needed a name – Dark Energy had arrived!

Following Perlmutter's discovery, a universe consisting 4% ordinary matter, 21% Dark Matter, and 75% Dark Energy was named as cosmology's 'Standard Model'. But the standard model still has its sceptics who, like Professor Mike Disney from Cardiff University, cannot believe that such a huge and important set of theories can be based on so little physical evidence.

Fans of the dark stuff cite Professor Carlos Frenk's impressive computer simulations of the birth of the universe. Frenk, and his team at Durham University, insist that the simulations only work if the dark matter and dark energy of the standard model is invoked. Happily for Frenk, recent observations seem to confirm the quantity of each of the 'dark' components, leaving the doubters – for the time being – out of favour.

The proponents of Dark Matter, Dark Energy and variable gravity were all put under the spotlight in the Horizon programme in 50 minutes of scientific soap opera.

"I realised that explaining the physics would be a challenge, but the interplay of different opinions and personalities meant that the people rather than the science could feature," concludes Peter, "giving the programme a very human element and allowing the arguments to be developed in an understandable and hopefully entertaining manner."

### INFO

'Most our Universe is Missing' by Peter Leonard

#### Category

Audiovisual Documentary of the Year

#### Contact

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# Mathematics for the people

**Nuno Crato**  
Communicator  
of the Year



*Nuno Crato is a regular contributor of articles to newspapers, magazines, radio and TV programmes. Through these channels he brings a regular scientific perspective on a wide variety of current news and events to a vast audience. He is also the author of best-selling popular science books and takes a leading role in bringing the fascination of mathematics to the general public.*

© Nuna Antunes



Professor Nuno Crato's main research areas at the Technical University of Lisbon are in stochastic modelling and the statistical description of random events and their behaviour in time. He has made significant contributions in these fields in areas such as volatility persistence in financial markets and his applied stochastic models have found application in diverse end-uses from computer science to fishery forecasting. He has served as President of the International Symposium on Forecasting in 2000 and as the President of the Portuguese Mathematical Society since 2004.

In parallel, he has developed a wide variety of activities that help to popularise science. Since 1996, he has written a weekly column for Portugal's most popular newspaper (*Expresso*). For this, and other popular writing projects, he has been awarded prizes at both national (*Visionarium*) and international levels.

The European Mathematics Society's Raising Public Awareness Prize was awarded to him in 2003 for a three-part article that is typical of the 'Crato approach'. Primarily, it is easy to read but it is also informative and scientifically sound. The article described mathematical cryptography in the context of credit cards and, specifically, the growth of internet shopping. It addressed a topic of major public interest and dealt with it with humour, intelligence and a distinct journalistic style. Crato's writings have appeared in many diverse publications from in-flight magazines to historical journals. In total, he has written over 500 popular science pieces.

### Da Vinci code

In addition, he is author of many books on scientific issues. These are, like his articles, always topical. For example, his book on solar eclipses was published just prior to the 1999 Solar Eclipse, and his very successful co-authored book on science in the Da Vinci Code novel 'A Espiral Dourada' (The Golden Spiral) coincided with the international release of the film of the book.

He has also contributed regularly to radio and television. He developed a radio programme in collaboration with journalists in which he comments succinctly on scientific news and issues called '3 Minutos de Ciência' (Three Minutes of Science), on Radio Europa. He designed and appeared in a television short programme 'Ciência na Cidade' (Science in the City) in which he stressed scientific issues relating to many popular places, monuments and artefacts. He is one of the 'resident scientists' in the '4xCiência' television series and contributed to 'ABCiência' and other programmes.

As President of the Portuguese Mathematical Society, Crato has fostered dozens of events for children and students. These include Mathematics Saturday Afternoons, competitions and a Mathematics Fair which runs as a 'drop-in' type event during the summer and includes many hands-on activities from trigonometry to probability in addition to music and other cultural activities.

## INFO

**Nuno Crato**

### Category

Communicator of the Year

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# Getting inside our body

**Intérieur Corps**  
Audiovisual Documentary  
of the Year

Finalist



*A 3D multimedia exploration of the human body has been a critical and popular hit at the Cité des Science et de l'Industrie in Paris. Using the latest medical imaging hardware and state-of-the-art production, Intérieur Corps (Inside the Body) leads audiences on an educational journey that takes them to (and through) all parts of their body. A key element of the show is the incorporation of the viewer's own body as part of the experience!*

Since X-ray radiography was first introduced in 1895, medical imaging has undergone a continuous and incredible improvement. 'Intérieur Corps' (Inside the Body) looks back at the various stages in the development of imaging, from the first 'radiograph' to the most recent advances such as helicoidal scanning devices and Magnetic Resonance Imaging (MRI) techniques, using an original narrative and a stunning visual journey.

This amazing representation of the transparent living body offers spectators the opportunity to admire the human skeleton, organs, bodily movements and even brain activity and, at the same time, discover the fascinating world of medical imaging in a 3D experience. The presentation is projected onto four screens and invites the audience to become part of the visual adventure.

## Innovative imaging

The film 'Intérieur Corps' was commissioned by Maud Livrozet at the *Cité des Sciences et de l'Industrie* in Paris. The initiative reflected the museum's desire to offer its visitors an original and innovative audiovisual show to demonstrate the value and state-of-the-art in medical imaging.

In keeping with the relationship that the *Cité des Sciences et de l'Industrie* has developed with its visitors, which fosters an active approach to learning, the show encourages the audience to explore their own body by asking them to move and feel in response to the presentation.

A team of medical imaging engineers from Siemens Medical France and an associated medical imaging centre provided valuable expert advice to the production. A science philosopher, a radiologist specialising in MRI, a physio-therapist, a general practitioner and a psychotherapist also contributed to the script written by Henri-Louis Poirier. Poirier is the author of numerous fictional interactive audiovisual productions and a series of films adapted for use in museums, many of which have received awards.

## Medical jury

'Intérieur Corps' was awarded the Jury's Special Prize at the Festival of Film, CD-ROMs and Medical and Surgical Websites at the 'Entretiens de Bichat 2006' organised by *Expansion Formation et Edition*.

The 'Entretiens de Bichat' were started in 1947 and, each year, bring together several thousands of health professionals as the leading continuing professional development event for medical and health professionals in France. Part of this medical festival is the assessment of a wide range of written and audiovisual scientific information by a jury of eminent doctors.

The award citation emphasized the high standards and artistic qualities of the film and noted that it generated as much interest amongst doctors as for a general audience.

## INFO

**'Intérieur Corps' by Henri-Louis Poirier (Author-Director),  
commissioned by Maud Livrozet**  
© CSI/PY Films

### Category

Audiovisual Documentary of the Year


### Contact

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2007  
Communication Prize



*“Europe has no future without new generations of young and bright scientists. We need to motivate them, recruit them by letting them experience the unprecedented joy of scientific discovery.”*

**Prof. Peter Csermely**

Science Communication Prize  
winner 2004

*“The secret is not only in the scientific issue but in how you present this issue. If you want to trigger the public’s interest in science, you have to make science interesting.”*

**Sir David Attenborough**

Science Communication Prize  
winner 2004

*“The [Prize] has a significant impact on recognising and acknowledging science communication as an important part of science.”*

**Dr Anja C. Andersen**

Science Communication Prize  
winner 2005

*“The kids said that the experience stoked their interest in all kinds of scientific disciplines.”*

**Michael Seifert**

Science Communication Prize  
winner 2005

*“[Our mission] is to inspire the next generation of scientists, promote science as part of popular culture and translate the complexities of science, to help engage a wider audience.”*

**Wendy Sadler**

Science Communication Prize  
winner 2006

*“Excited children write in to express their joy at receiving the magazine and at learning new things from it.”*

**Dr Sheila Donegan**

Science Communication Prize  
winner 2006

*“The museum allows the public to come into direct contact with science and technology in new and exciting ways.”*

**Prof. Giuseppe Vittorio Silvestrini**

Science Communication Prize  
winner 2006

# The Final Reviewers



**Dr Suzanne de Cheveigné** – President of the 2007 Final Reviewers

Science communication

**Researcher, National Centre for Scientific Research (CNRS), Paris, France**

*Dr de Cheveigné is actively involved in science and society dialogue through her work at CNRS and as a member of the editorial committees of Science Communication and the French journal Hermès. Specialising in public perception of science, risk governance and how society relates to technology, she has taken an interest in media coverage, especially television, of biotechnology and environmental questions. She has also studied women's careers in science institutions. She is a member of the scientific committee of the Public Communication of Science and Technology (PCST) international network and of several EU expert groups looking at Science in Society issues. With numerous publications to her name in popular and scientific titles, she has put her scientific knowledge and communication skills to good use in lifting the barriers between science and the public.*



**Dr Anja C. Andersen**

Astrophysics, science communication

**Associate Professor, Dark Cosmology Centre, Niels Bohr Institute, University of Copenhagen, Denmark**

*Dr Andersen holds a PhD in astrophysics and works at the recently established Dark Cosmology Centre at the University of Copenhagen. Her research is focused on cosmic dust with the emphasis on the role of cosmic dust in the thermal, dynamic and chemical conditions in different astrophysical environments. Dr Andersen is widely known as an excellent communicator of science to the public as well as an enthusiastic advocate of women's participation in the natural sciences. In recognition of this, she has received several prizes, among them the Descartes Science Communication Prize 2005.*



**Dr Andrea Bandelli**

Consultant in science communication

**Consultant for 'Après Tendance', Amsterdam, The Netherlands**

*Dr Bandelli is an independent advisor on science communication initiatives. After working for NewMetropolis in Amsterdam (now 'NEMO') from 1995 to 1999, he became manager of the Science Learning Network, a worldwide on-line community of educators, students, schools, science museums and other institutions pursuing a new inquiry-based science education model. From 2000-2004, he was project manager of BIONET, a virtual collaborative exhibition on the life sciences, and he is currently leading DECIDE, a project to encourage democratic engagement in science centres and museums. He is an advisor for various science education institutions in Europe and the USA, and for the national research organisations of Brazil and South Africa. His articles on public engagement with science and informal learning have been published by the Nobel Foundation, the Science Museum in London and in several journals.*

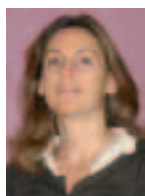


**Mr Philippe Bijvoet**

Science & educational television programmes

**Director at the VRT, Brussels, Belgium**

*Mr Bijvoet's long career in the Flemish public broadcaster, VRT, has focused on bringing science closer to society by producing high-quality scientific documentaries and programmes aimed at mass audiences. After studying at the Flemish Film, TV and Theatre Academy in Brussels – now part of Erasmus Hogeschool – he went on to work as a freelance TV director for the public broadcaster and private production companies before moving to the educational department of VRT in 1978. Since then, he has directed science, technology and historical programmes. Since 1999, he has been working on the science documentary series OverLeven. He is vice-president of the Science and Educational Experts Group of the European Broadcasting Union (EBU).*



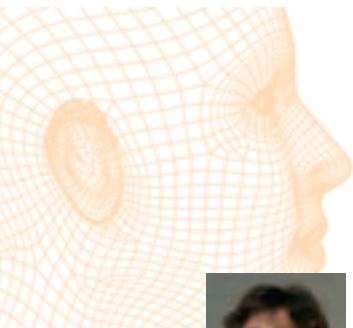
**Dr Athina Markantoni**

Social scientist, European affairs, communication

**Managing director of Euroscope Ltd, Greece**

*Dr Markantoni is a specialist in, among other things, communication, institution building and public administration reform, and is involved in a range of EU policy-making areas, such as evaluating the research Framework Programmes, gender issues, human resources, communication, and SME development. Cutting her teeth as a researcher at Athens University working on a social policy project in Greece, she*

# The Final Reviewers



*moved into the European political sphere as a trainer in EU affairs covering such topics as EU integration, EU institutions and decision-making procedures. Between 2001 and 2003, she worked as a development consultant at Planet Ernst & Young, responsible for setting up and managing the Business Acquisition Office. During this time, she conducted vocational training for senior Greek public administrators on EU issues to help them prepare for the EU presidency in 2003. She also worked as an expert on public administration reform and communication for the EU-funded project PCA II – Kyrgyzstan. From 2003 until February 2005, she was director of the International Unit at European Profiles SA. Currently, she is managing director of Euroscope Ltd.*



## **Dr Luisa Minoli**

EU-funded research

**EU adviser and author, API Varese and INNOVARE, Italy**

*Dr Minoli is responsible for EU projects at API Varese (The Association of Small and Medium-sized Enterprises of the Varese Province) promoting the interests of, and providing services to, associated enterprises in the field of European research programmes, and encouraging their participation in EU-funded projects. She is the coordinator of the technical committee of INNOVARE, the scientific magazine of CONFAPI (the Italian Confederation of SMEs) and the author of numerous articles focused on European research.*

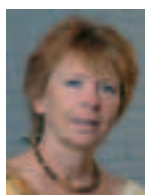


## **Mr István Palugyai**

Media studies and science communication

**Science editor, Népszabadság newspaper, Budapest, Hungary**

*With more than 25 years of experience in science journalism, in both printed and electronic media, Mr Palugyai is well placed to comment on the evolution of scientific communication over the decades. In addition to his editorial responsibilities on the weekly science, medicine, environment and IT pages at Népszabadság – Hungary's leading broadsheet newspaper with a circulation of up to 160 000 – he is also president of the European Union of Science Journalists' Associations (EUSJA) and was vice-president of the World Federation of Science Journalists (WFSJ) from 2004 to 2007. His stated ambition in these roles is to strengthen co-operation between European science journalists and to raise the level of journalism in this field across Europe and worldwide, as well as improving the training of science journalism.*



## **Ms Tina Zethraeus**

Science communication

**Swedish Research Council, Stockholm, Sweden**

*Ms Zethraeus is Project Manager at the Swedish Research Council since 2000, where she has been responsible for initiating and building the national web service Expert Answer, connecting journalists with researchers. Before that, she has had various positions as a journalist at the Swedish Radio, head of media relations at Uppsala University and head of information office at the Ministry of Education and Culture in the Swedish government. Her main professional goal is to stimulate the exchange between civil society and the research community. She has championed numerous activities to improve science communication, lately the Linnaeus' tercentenary celebration, and is especially interested in international co-operation and benchmarking.*



## **Dr Andreas Trepte** – Expert Panel Observer

Research analysis and science communication

**Head, Office of Research Analysis and Foresight, Max Planck Society for the Advancement of Science (MPS), Munich, Germany**

*Andreas Trepte leads the Office of Research Analysis and Foresight of the Max Planck Society for the Advancement of Science (MPS), whose 78 institutes are managed by leading researchers in the foremost fields of science. Trained as a social researcher and economist, Dr Trepte has become an expert in the development of today's science and technology and its ecosystem, ranging from research foresight to open access. At MPS, Dr Trepte launched innovative initiatives such as establishing a science news service, implementing new web technologies, and initiating the 'Science Tunnel', a worldwide travelling multi-media exhibition portraying the frontiers of cutting-edge research. As a science writer he is author of hundreds of research news stories. Previously, Dr Trepte served as Program Manager for building up new institutes and facilities in former Eastern Germany. He also served as research evaluation specialist at the German Science Council.*

# The Nominating Organisations

*Our special thanks go to the various prize-giving organisations across Europe that have provided the time and effort to select and submit their best winners of science communication activities as nominations for the 2007 Science Communication Prize.*

Académie des Sciences  
de l'Institut de France  
<http://www.academie-sciences.fr>

*With origins dating back to 1666, the Academy of Sciences of the Institute of France brings together the best French scholars and forms associations with excellent foreign scholars with the aim of advancing the sciences.*

Associació Catalana  
de Comunicació Científica  
<http://www.acccnet.net/>

*The Catalan Association of Scientific Communication was set up in 1990 as a professional body to bring together science communicators, science journalists, writers, publishers and scientists who share Catalan as a common language.*

Association des Musées et  
Centre pour le Développement  
de la Culture Scientifique et  
Industrielle  
<http://www.amcsti.fr>

*Founded in 1982, the AMCSTI groups together more than 200 cultural organisations (associations, museums, research organisations and national institutions) in France. This network is financed both by the French ministry of Research and the ministry of Culture.*

Association Science  
et Télévision  
<http://www.science-television.com>  
<http://www.parisscience.fr>

*The French Association for Science and Television (AST) includes 35 member companies that produce programmes in all genres, but with a significant portion devoted to science. They supply the vast majority of science programmes broadcast in France.*

Centre of Applied Industrial  
Design  
<http://www.caid.gr>

*The Centre of Applied Industrial Design (CAID) in Athens is a non-profit organisation established in 1992 that works with a network of European universities on training projects including e-business, cyber communications, and interactive multimedia.*

Danish Ministry of Science,  
Technology and Innovation  
<http://www.videnskabsministeriet.dk>

*The Ministry is responsible for research, information technology, innovation, telecommunications and university level education in Denmark.*

Deutsche  
Forschungsgemeinschaft  
<http://www.dfg.de>

*The Forschungsgemeinschaft (DFG) is Germany's largest research funding organisation with a budget of € 2 billion. It funds research in all fields and provides advice to governmental organisations.*

Deutsche Mathematiker  
Vereinigung  
<http://dmv.mathematik.de>

*With around 3 500 members, the DMV (German Society for Mathematicians) furthers the interests of mathematicians in Germany and the public's perception of mathematics.*

The European Mathematical  
Society  
<http://www.emis.de>

*The European Mathematical Society (EMS) furthers development of all aspects of mathematics in Europe. It consists of around 50 national mathematical societies and other interested bodies.*

The European Physical Society  
<http://www.eps.org>

*Created in 1968, the European Physical Society promotes physics and physicists in Europe. It provides an international forum to discuss science and policy issues, and represents some 100 000 members in 49 national societies.*

# The Nominating Organisations



**Expansion Formations  
et Editions**  
<http://www.expansionscientifique.com/>

*Expansion Formations et Editions is a private service company that through its subsidiary, Expansion Scientifique Française, organises the 'Entretiens de Bichat' that is the leading French national event for continuing education for health and medical professionals.*

**Festival 'A Nous de Voir –  
Science et Cinéma'**  
<http://www.anousdevoir.com>

*This film festival was created in 1987 and, since 2000, has been particularly interested in scientific films for francophone countries in Europe. Topics covered in the festival's 21-year-history include flora and fauna, biology, medicine, geology, astrophysics, technology and more.*

**International School  
for Advanced Studies**  
<http://www.sissa.it>

*The International School for Advanced Studies was founded in 1978, and is a centre for research and postgraduate studies leading to a PhD degree. It is unique in Italy and recruits students on an international basis by examination with successful students receiving a grant for the full period of study.*

**University of Jyväskylä**  
<http://www.jyu.fi>

*The University is a rapidly growing multidisciplinary institution with almost 15 000 degree students. Human, nature and technology form key elements of its scientific profile.*

**Jyväskylä University Foundation**  
<http://www.jyu.fi>

*The Foundation supports the University of Jyväskylä and its activities by promoting public awareness of its academic work.*

**Museos Científicos Coruñeses**  
<http://www.casencias.org>

*The Coruña Science Museum (also known as mc<sup>2</sup>) was Spain's first interactive public science museum opened in 1985. Since 1998, it has organised the international Prism Awards to recognise popularisation of science.*

**Premio Pirelli**  
<http://www.pirelliaward.com>

*Since 1996, the Pirelli International Award was the first international multimedia competition for the communication of science and technology entirely carried out via the internet. Awards are given to the best multimedia (audiovisual interactive) science communication in categories including physics, chemistry, mathematics, life sciences, information and communications technology (ICT).*

**The Slovenian Science  
Foundation**  
<http://www.szf.si>

*Since 1994, the Slovenian Science Foundation has been active in the area of science communication including regular training sessions for Slovenian researchers and an annual Slovenian Science Festival.*

**Swiss Academy of Sciences**  
<http://www.scnat.ch>

*The Swiss Academy of Sciences comprises a network of over 35 000 scientists that works for the promotion of research in all subjects and disciplines. It was formed in 1815.*

**TreAngeli**  
<http://www.treangeli.at>

*TreAngeli corporate communication consultants are based in Vienna, and have organised the .at-award for ten years. The .at-award was launched to boost the Austrian on-line creative market.*

**Université de Technologie de  
Compiègne – Prix Roberval**  
<http://prixroberval.utc.fr>

*The Roberval Prize was initiated in 1986 by the University of Technology of Compiègne to promote science and technology to the French speaking community and to promote the use of French in the production and dissemination of scientific knowledge.*



# Marie Curie Awards

## Promoting scientific excellence for European researchers through mobility and training

Established in 2003, the Marie Curie Excellence Awards give public recognition to outstanding achievements by scientists that have reached a level of exceptional excellence in their chosen field. Researchers of any nationality and in all fields of research are eligible provided they have benefited from one of the European Union funded researcher career support schemes. Known as the Marie Curie Actions, these popular and successful schemes aim to widen researchers' prospects throughout their career and promote excellence in European research.

Researchers can nominate themselves for the awards or be nominated by others. All nominees must have participated in a Marie Curie mobility and training scheme for a minimum of 12 months.

Each year, up to five Marie Curie Excellence Awards are selected by a distinguished jury. Each award is worth € 50 000 to the winner. The winners are free to use the prize money in any way they wish, but are expected to take part in public events to improve public understanding of science and to help promoting the attractiveness of a career in research.



# Can money buy happiness?



*Can economic growth make us all feel happier? Increased individual wealth can make life easier, but does it make our life more satisfying? And how can policy decisions at European and national levels affect our feeling of well-being? By developing novel economic analysis techniques the EURECONAW project is shining new light on these age-old questions that could help direct policy-makers towards the activities that can truly impact on the well-being of society.*

The past few years have witnessed a booming interest from researchers in economics on whether, and to what extent, per capita output and incomes are converging across EU regions. This is a central issue to the European Commission, especially in the context of its policy of greater socio-economic cohesion.

The EURECONAW project has pursued this notion using a novel procedure for identifying regional 'convergence clusters' that can correct potential problems generated by the short time horizon of the data used. The methodology implemented by Marie Curie Fellow Dr Luisa Corrado was initially applied to the analysis of sector productivity across the EU regions over the past 30 years.

But Corrado has also used related techniques to examine the relationship between income and well-being. "Traditionally, economic research has focused on collecting and analysing economic data, while little attention is paid to measuring social attitudes and personal states," says Corrado. "The main question I have addressed is: are the richest regions in Europe also the happiest? Who and where are the happiest people in Europe?"

In 2004, Luisa Corrado was awarded a 20-month Marie Curie Intra-European Fellowship to study at the University of Cambridge under the supervision of Prof. Sean Holly. She came to Cambridge with an outstanding academic and research record. She took her BA degree in Economics at the University of Rome Tor Vergata, and was ranked first in the class list. She then repeated this distinguished performance for her MSc in Economics and Management. She subsequently took two PhDs, one in Monetary Economics and another in Economics, at the University of Rome and the University of Warwick. Since 2006, she has held the position of Associate Professor at the University of Rome Tor Vergata. She is author of several articles published in prestigious international economic journals and recipient of recognitions for her research such as the Scottish Economic Society's Sir Alec Cairncross Prize.

## Spatial Disparities in Income and Well-Being

The aim of Corrado's research was to understand which factors, beyond income and material conditions, play a significant role in determining individual well-being and whether the attributes of those closest to us regionally affect us more than national trends and beliefs. There is a remarkable interest from academia, policy-makers and the media on these topics and Corrado hopes the Marie Curie award will be crucial to wider dissemination of these results.

While previous research has indicated a reduction of overall EU regional convergence from the mid-1980s onwards, the Cambridge research suggests a diverse convergence dynamics with a large number of regional convergence clusters in the four sectors examined (agriculture, manufacturing, market and non-market services), indicating that there is no single EU-wide convergence process, but different convergence paths in different economic sectors across different parts of the EU.

For example, the study found that agriculture and manufacturing show only a moderate degree of convergence which may reflect persistent patterns of regional specialisation, while the service sectors are displaying the highest degree of convergence. The results also indicate that in the service sectors the importance of the EU funding in determining the observed outcome is increasing over time.

## But how do you feel?

Traditional stereotyping suggests that Southern Europeans with their warmer Mediterranean climate and, perhaps, more relaxed attitudes are far happier and more satisfied with life than their northern European counterparts. However, examining information at three levels of society – individual, regional and national – Corrado's research tells a different tale.

From analysis of ESS data collected in 2002 and 2004, Italy, Greece, Portugal and France are among the lowest-scoring countries in terms of well-being. While Scandinavian countries are highest: 85% of Danish respondents report

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2007  
Marie Curie Awards

levels of happiness above the European average in 2002 and 80% in 2004. Looking at the data for life satisfaction, Denmark once again is top with 88% reporting levels of life satisfaction above the EU-15 average and 82% in 2004.

But what makes us happy? One of the most consistent trends is that those with the highest levels of happiness also reported the highest levels of trust in their governments, the police and the justice system, as well as those around them. Happier people also tended to have plenty of friends and acquaintances, as well as at least one very close friend, or a partner. The report also confirms the old adage that money can't buy you happiness. In countries where the population generally said that they trusted the government and other institutions, a high income made people happier still – but in those countries where such trust was lacking, even the richest tended to be less happy.

"Unfortunately, unhappy people are unlikely to change their lives simply by hopping on the next plane to Copenhagen," says Corrado. "People who were indigenous citizens of the country they lived in tended to be happier than those who were not, probably because these people usually know more of the people around them and have wider social networks."

The clear research message to policy-makers is that they should promote social inclusion, because that brings the psychological integration that is essential to national happiness. "It is not enough for governments to focus on improving wealth," concludes Corrado. "Our well-being would be more likely to prosper in a mutually supportive and trusting society."

### Continuing

Following the results of the EURECONAW project, Corrado was awarded a new Marie Curie Fellowship in 2006 to continue her research at Cambridge until the end of 2009. This is a unique result within the Marie Curie fellowship scheme, and it clearly demonstrates the quality of her work, its novelty and importance.

## INFO

**EURECONAW** – Spatial Disparities and Convergence in Income and Well-Being across Europe

### Panel

Economics

### Host institution

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# Targeting killer T-cells for cancer



*A possible way to combat cancer is to better understand the transcriptional regulation of genes that are important for development and signalling of lymphoid cells of the immune system. Dr Batu Erman's laboratory uses molecular, cellular and immuno-biology techniques to study specific signal transduction mechanisms in lymphocytes. At Sabanci University in Istanbul, he has established a new laboratory with expertise previously not available in Turkey, and he has initiated several new lines of research of immediate social relevance.*

Dr Batu Erman's interests lie in understanding the transcriptional regulation of genes important for development and with signal transduction of lymphoid cells of the mammalian immune system. The work focuses on the T-cell receptor (TCR) and the interleukin-7 receptor (IL7R), two receptors that control the differentiation, survival and the function of T lymphocytes otherwise known as 'Killer T-cells'. Aberrant TCR signals causing the survival and proliferation of T lymphocytes have been shown to result in autoimmune diseases. Marie Curie Action funding is supporting Erman to find inhibitors of the signal transduction pathway that is activated by TCR.

Dr Erman had a distinguished early scientific career in the United States. After a BA in Biochemistry and Molecular Biology at Hamilton College, New York, Erman spent a year at Oxford University before embarking on his PhD at Brandeis University, Massachusetts. He subsequently spent six years on postdoctoral research at the US National Institute of Health (NIH) where he was noted as a superb scientist with an extremely broad repertoire of experimental expertise including molecular biology, cell biology and immunology.

### **Return to Turkey**

He decided to move back to his native Turkey to start a research career in Europe. In September 2004, supported by Marie Curie funding, he joined Sabanci University in Istanbul to establish a new research team in this young, innovative and research oriented University.

In the few years that Erman has been back in Turkey, he has established a highly successful scientific research programme in T-cell signalling and development. As a result, he has attracted both students and postdoctoral fellows to his laboratory and has designed and constructed a number of highly novel gene vectors that have already resulted in the generation of unique experimental mice.

His aim is to conduct basic molecular biology and immunology research in Turkey; a developing country where these subjects are relatively unexploited. Erman has three main research objectives: "I want to conduct research that has clear social relevance, I want to train a new generation of young Turkish molecular biologists, and I want to produce some high visibility, high impact publications from this new scientific centre in the outer regions of the European Research Area."

### **Chernobyl inheritance?**

Following the Chernobyl disaster in 1986, cancer rates (especially lymphoma – cancers of the lymphatic system) in Turkey have risen dramatically, presumably because of an increased mutation rate due to the geographical proximity of Turkey to the Ukraine. This makes cancer and immune system research of great social importance in Turkey.

With that in mind, Erman is looking to gain a better understanding of the TCR signal transduction pathway and therefore of immuno-deficiency disease mechanisms. Secondly, he will gain an understanding of the development and normal function of the lymphoid system to obtain clues about its malfunctions that generate immunodeficiencies, lymphomas and leukaemia. Following this, his group will conduct fundamental research with a view to developing drugs that target cell survival.

### **Knock-out research**

Erman's laboratory has already generated several transgenic, knock-out and knock-in mouse models for collaborative projects. This work is pioneering because health researchers in Turkey currently do not use transgenic and knock-out animal models. Erman is collaborating with international colleagues in this project that will open new horizons in Turkish health research. He believes that as more health researchers become interested in generating transgenic animal models for their research this will increase collaborations with his laboratory. "The funding will be far reaching, as it will invest in local and regional collaborations and share our expertise in these techniques," says Erman.

## **TCELLTARGETING** Molecular Biological Targeting of T Lymphocyte Signal Transduction and Development



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One of the factors that is downstream of the TCR is the transcription factor NF- $\kappa$ B. Unfortunately, for drug development purposes, NF- $\kappa$ B is a transcription factor that is activated by many signal transduction pathways. Therefore, targeting NF- $\kappa$ B is not promising as blocking this transcription factor is likely to have a widespread adverse effect. Erman's approach has been to identify natural protein inhibitors of this transcription factor from divergent species. He is using cDNAs from the experimental model plant *Arabidopsis thaliana* in mammalian tissue culture cells to identify gene products that will bind to and inhibit human NF- $\kappa$ B transcription factors.

"Our molecular biology research on T lymphocytes can be characterised as basic research with a view to developing drugs that target immunodeficiency diseases, lymphomas and leukaemia," says Erman. "Our aim is to find novel components of signal transduction pathways which can become targets for drugs."

A further socially relevant scientific collaboration that Erman's group is engaged in is a project with the Istanbul Faculty of Medicine at Istanbul University, on the molecular mechanism of Familial Mediterranean fever (FMF). This disease is a hereditary inflammatory disorder that frequently affects patients originating from around the Mediterranean Sea. Using the molecular biological techniques established in the Erman laboratory, proteins that are associated with the gene product that is responsible for the FMF disorder have been identified. While the gene responsible for this disorder was known, the mechanism of this disease was not known, and Erman's work will identify possibilities for future drugs that can target this illness.

### INFO

**TCELLTARGETING** – Molecular Biological Targeting of T Lymphocyte Signal Transduction and Development

#### Panel

Life Sciences

#### Host institution

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# From nanotubes to new electronic devices



*During Dr Andrea Ferrari's Marie Curie-sponsored PhD at Cambridge University, he worked on ultra-thin carbon films, a critical part of the hard drive technology, at the heart of many consumer electronics. This was just the start of a successful career for the young researcher that combines fundamental multi-disciplinary science with a keen eye for application and innovation. The research being performed by Ferrari is laying the basis for future high-performance and high-value technologies.*

Dr Andrea Ferrari works at the frontier between engineering, physics and materials science, specialising in carbon nanotechnology. Carbon based materials play a major role in today's science and technology, and carbon nanotubes are at the centre of the ever-growing field of nanotechnology. There are also many non-crystalline carbons, for example amorphous, diamond-like and nanostructured carbons. These are used as coatings in numerous everyday applications, in information technology, and the automotive market.

Ferrari came to Cambridge following academic success as a graduate engineering student in Italy. The Marie Curie Fellowship at Cambridge was on nanoscale properties of amorphous carbons. "The aim was to achieve a deeper understanding of the structural properties of these materials and to provide industries with simple criteria and techniques for production line characterisation and quality control," explains Ferrari. His work on ultra-thin carbon films for high storage density hard disks not only helped to develop the microdrive – now at the core of many consumer electronics – but also resulted in a deeper understanding of the growth of ultra-thin films that are just a few monolayers thick.

"Receiving a Marie Curie Fellowship in 1998 allowed me to come to Cambridge for my PhD research," says Ferrari. "The freedom of research and mobility provided by this grant was key to allowing me to pursue my research interests." Following his PhD, Ferrari started to build his own research group at Cambridge, with a focus on carbon nanotubes (CNTs), graphene, and semiconductor nanowires (NWs).

### **Nano-carbons and Raman scattering**

Ferrari's success was to develop a model to explain the Raman spectra of carbon films. Raman scattering is the inelastic scattering of light by lattice vibrations, it gives immediate information on bonding and is non-destructive. This model is now the key reference in the field and explains forty years of apparently contradictory measurements in the literature.

Another non-destructive technique, X-Ray reflectivity (XRR), was next. Ferrari and his co-workers in Italy and the UK used XRR to precisely obtain density, thickness, roughness and internal layering of carbon films, down to the nanometre range. These crucial parameters were previously determined by time-consuming, destructive and much less precise methods. Most research labs and industries now use the XRR technique for carbon films. Further work using Brillouin scattering to make non-destructive measurements of the elastic constants of extremely thin layers and methods to reduce the as-grown stress in carbon films followed.

More recently, Ferrari and his group are working on graphene. This material is at the centre of a new emerging research area due to its interesting electronic properties governed by relativistic-like quantum physics. They have worked on identifying single graphene layers by Raman spectroscopy and have shown how the Raman spectra evolve as the number of layers increases.

Together with European collaborators, they have shown that doped graphene is a clear example of breakdown of the Born-Oppenheimer approximation, which assumes that the lighter electrons adjust instantaneously to the motion of the heavier atomic nuclei.

### **Nanotubes**

Nanotubes are rolled up graphene sheets that have many unique, extreme properties including the highest Young's modulus, and the highest thermal conductivity known. Their electronic properties, such as their band gap, depend on their twisting or "chirality". Semiconductor nanowires of different materials can also be deposited. The electronic properties of NWs mainly depend on their diameter.

Ferrari and his colleagues developed a simple technique to deposit polar semiconductors' nanostructures, and control their growth shape to produce nanowires, nanoribbons or nanosaws on demand. They demonstrated that surface diffusion is the key factor in the growth of carbon nanotubes



and this allowed the controlled growth of CNTs at low temperatures. This could allow direct integration of CNTs into electronic circuits.

Further work targeted the electronic and optical properties of CNTs and the use of Raman spectroscopy as a reliable non-destructive tool to sort CNTs according to their electronic properties. His group has shown that the ultimate performance of nanotube transistors is limited by electron scattering with atomic vibrations (phonons). This work paves the way to improve these devices by removing these relatively 'hot' phonons.

Another focus is the study and exploitation of the non-linear optical properties of CNTs for photonic devices. This work is leading towards a new range of CNT-based ultra-short pulse lasers that are expected to find a range of applications including optical communications, bio-medical instruments, chemical analysis, time resolved spectroscopy and electro-optical sampling. They have recently demonstrated the first ultra-fast, nanotube-mode-locked, widely tunable laser.

Ferrari's vision is to develop a new class of polymer based optoelectronic devices embedding the optical and electronic functionalities of CNTs and NWs. These devices will combine the fabrication advantages of polymer photonics, with the tunable active and passive optical properties of CNTs and NWs.

"I believe that fundamental science plays a crucial role in underpinning and generating future technologies," claims Ferrari. "Europe enjoys a strong position in the nano-sciences that needs to be translated into a real competitive advantage for European industry."



## INFO

**CNANO** – Carbon Nanotechnology

### Panel

Engineering

### Host institution

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# Shining light on dark energy



*Dark Energy is one of the great mysteries of modern science. First suggested in 1998, dark energy acts as a repulsive force against the attractive force of gravity. It is used in cosmology to help explain the observed expansion of the Universe that appears to be accelerating rather than decelerating as previously expected. Over the decade since its discovery, Professor Robert Nichol has focused on the stuff of dark energy, first by confirming its existence using independent methods and, more recently, by studying its properties, and working to reveal its true physical nature.*

In 1998, astronomers discovered that the expansion of the Universe was accelerating, driven by a repulsive force now known as 'dark energy'. The discovery of dark energy was a great shock. The only way to understand the accelerating expansion of the Universe was to postulate either this new repulsive force, which counteracts gravity, or to modify Einstein's General Theory of Relativity. This led to efforts to make independent measurements that could confirm the existence of dark energy.

## Stalking a dark force

A key experiment in this effort was (and is) the Sloan Digital Sky Survey (SDSS) that started collecting data in 2000. It is one of the most ambitious and successful surveys of the Universe ever undertaken. Whilst studying in the US, Professor Nichol became a senior member of the SDSS (joining in 1993) and was responsible for obtaining the first spectroscopic data from this experiment in 1999. Since then, he has focused on quantifying the highly clustered pattern of galaxies found in our 'local' part of the Universe, which is thought to be caused by the gravitational amplification of tiny density fluctuations created in the early Universe.

The statistical properties of this clustering pattern can be accurately predicted if the content of the Universe is known. In 2003, the SDSS collaboration published its first detailed measurements of the clustering of galaxies which, when combined with results from the Cosmic Microwave Background (CMB) measurements, showed that ~70% of the Universe was comprised of dark energy, with a further ~25% of the Universe being dark matter and the final ~5% being normal matter. Further studies have largely confirmed this "concordance model" for the content of the Universe.

In addition, dark energy can also be 'observed' at work through its effect on the rate at which large structures in the Universe (for example the 'Great Wall' of Galaxies found in the SDSS) evolve with cosmic time. This can be measured using the Integrated Sachs-Wolfe (ISW) effect which adds the effect of the many tiny shifts in the energy of light from the CMB as it passes through these evolving galactic

structures. The size of the ISW effect is a direct measure of the strength of gravity on large scales, and a powerful test of general relativity and dark energy.

Nichol led a team of SDSS researchers to study the ISW effect by comparing the distribution of millions of galaxies seen in the SDSS against the CMB light and measured a positive correlation between the two. "The CMB was slightly hotter – but only a few parts in a million – behind the largest structures seen in the SDSS," says Nichol. "This provided physical evidence for the existence of dark energy as a repulsive force as it is changing the growth of large structures in the Universe."

## Yes, but what is it?

The answer to what dark energy is revolves around two fundamental questions: is dark energy a 'Cosmological Constant' (its value remains fixed regardless of time or location in the Universe)? And is dark energy a new form of matter in the Universe, or simply a reflection of our lack of understanding of gravity? "To answer both these questions requires new observations of the Universe using massive surveys of the Cosmos as the dark energy signal can only be detected on very large scales," explains Nichol.

Nichol started his career in the UK as a graduate student at the University of Edinburgh, but left for the US in 1992, staying there for 12 years, and eventually becoming a faculty member of the Department of Physics at Carnegie Mellon University. He returned to Europe with the help of a Marie Curie Chair at the Institute of Cosmology and Gravitation in the University of Portsmouth in 2004 and he also received a Marie Curie International Reintegration Grant from 2005.

Since his return to Europe, Nichol has focused his research on these two questions and has already made significant progress. However, much more work is required especially in designing and constructing new surveys of the Universe, and again Nichol has been leading the way in this endeavour both at national and international levels.



But research led by Nichol at Portsmouth is already pointing the way using the latest measurements of the Baryon Acoustic Oscillations (BAO) from the SDSS experiments. The BAO represent an alternative 'standard ruler' in the Universe. And the new results measure the content of the Universe to better than 10% accuracy – further confirming the need for dark energy. In the future, the BAO measurements will be taken at greater distances in the Universe allowing the team to test if the density of dark energy changes with time or remains constant. They can also be used to test theories of modified gravity. This and other new large international experiments will begin collecting data at the beginning of the next decade and should measure the density of dark energy to an accuracy approaching 1%.

### **Red shift**

In addition, Nichol has recently measured the ISW effect to a red shift of one; this represents a look back in time of nearly 8 billion years (60% of the age of the Universe). He discovered a signal consistent with dark energy that is also consistent with that seen locally now. The result suggests that dark energy is simply a 'Cosmological Constant' as originally suggested by Einstein. "Unfortunately, the observed value of this constant is ~100 orders of magnitude too small compared to predictions from particle physics!" concludes Nichol. "This is a fundamental problem for physics that will only be solved through either a complete theory of quantum gravity or a major modification to our understanding of gravity and space-time."



## **INFO**

**DarkEnergy – Observing Dark Energy**

### **Panel**

Physics

### **Host institution**

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# Radical route to inflammation



*Study of the role of messenger molecules derived from lipids in inflammation and the function of body's immune cells is opening new therapeutic routes for a variety of medical conditions. The role of small molecules such as nitric oxide (NO) and lipid peroxides is of particular interest to Dr Valerie O'Donnell who is a key figure in this field. An early Marie Curie fellowship helped to launch her on a career that has taken her to the leading edge of European research on lipid signalling molecules and free radicals.*

Dr Valerie O'Donnell works on free radicals and inflammation at Cardiff University. Her research is aimed at discovering new lipid signalling molecules in inflammation and immune cell function. Lipid signalling is broadly defined as any biological signalling event that involves a lipid (a range of fat-soluble molecules that include as sub-classes fats, oils, waxes and cholesterol amongst others) messenger that binds to a receptor. A key characteristic of lipids is that they can diffuse through cell membranes.

Following her first degree, O'Donnell did her PhD at the University of Bristol where she worked in collaboration with SmithKline Beecham to characterise the mechanism of action of a series of compounds that are now the most widely used tools for inhibiting leukocyte superoxide generation. The generation of oxygen radicals is a weapon used by white blood cells to defend the body, but can produce severe 'collateral damage' around an infection site.

In 1994, O'Donnell moved to the laboratory of Angelo Azzi in Berne, Switzerland, to study another aspect of superoxide generation: this time the mechanisms of tumour necrosis factor- $\alpha$  (TNF $\alpha$ ) activation of mitochondrial superoxide generation. It was in Switzerland that she obtained her first personal fellowship grant: a Human Capital and Mobility (BIOTECH 1) Fellowship from the European Union under the fledgling Marie Curie Action scheme. "This was a very important personal achievement for me," says O'Donnell. "The awarding of my first personal fellowship from the EU was a pivotal point in my career."

### **Nitric oxide and lipid oxidation**

From Bern, O'Donnell headed for the Centre for Free Radical Research in University of Alabama at Birmingham, USA. This is a centre of excellence for study of oxidative pathways in human disease. Here she made a series of key observations that form the basis of her continuing studies today. In particular, with Bruce Freeman she studied the formation of nitrolipids, a new family of signalling lipids generated by nitration of unsaturated fatty acid. These nitrolipids have significant anti-inflammatory activities in

a number of cellular systems and could yield potential therapeutic applications. "This research has opened up a new area in eicosanoid research, which we hope may lead to design new treatments that regulate inflammation," comments O'Donnell. Eicosanoids are signalling molecules made by oxidation of 20-carbon essential fatty acids. They exert complex control over many bodily systems, mainly in inflammation and immunity, and are messenger molecules for the central nervous system.

### **Inflammation research in Wales**

In 1999, she returned to the UK to the School of Medicine, now part of Cardiff University, and is part of the Infection, Immunity and Inflammation Grouping. Her research at Cardiff focuses on nitric oxide metabolism by activated vascular (blood) cells. O'Donnell's work has characterised NO interactions with enzymes such as lipoxygenase, cyclooxygenase and NADPH oxidase that result in decreased NO bioactivity both in vitro and in vivo.

"These studies are of clinical relevance since decreased NO is a hallmark of vascular disease," explains O'Donnell. "Understanding the pathways involved may lead to design of therapies that could improve NO bioactivity and slow progression of diseases such as atherosclerosis, the inflammation of arterial blood vessels, and high blood pressure."

One recent study found that interactions with NO and cyclooxygenase could potentially underlie vascular complications of non-steroidal anti-inflammatory compounds (NSAIDs – an example is aspirin). Along with colleagues in Nashville, O'Donnell showed that a lack of NO led to an NSAID-dependent elevation in blood pressure and platelet activation in vivo. This suggested that targeting the NO pathway could reduce risk of certain side-effects in patients prescribed these drugs for the long-term. The studies were very timely as Vioxx (an effective NSAID) was voluntarily withdrawn by Merck in 2005 due to a high level of unexpected cardiovascular-related side effects that killed a number of patients. Her work is shedding some light on the factors that may predispose patients to risk.



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### Lipid mass spectrometry

Two years ago, thanks to a significant grant from the Wellcome Trust and funding from Cardiff University, O'Donnell's group acquired a state-of-the-art mass spectrometer that has enabled them to branch out in a significant new direction. "The system at Cardiff is the only Q-Trap mass spectrometer focused solely on eicosanoid research in Europe that we know of," says O'Donnell. Previously, her team relied on colleagues in the US for this analysis.

"The Mass Spectrometer represents a significant and exciting acquisition for us in terms of development of new technologies and approaches to study eicosanoid biology," concludes O'Donnell. "I am committed to ensure that this instrument becomes a central resource for lipid research locally within the University, and both nationally and internationally."

Now O'Donnell's group is able to both identify and structurally characterise novel eicosanoid-containing lipids present at low concentrations in biological samples. The machine has already identified potential novel signalling mediators that are made by activated blood cells including monocytes and platelets. Some of these molecules have been generated in the laboratory and are being used for in vitro and in vivo studies. The idea is that they may act to regulate immune cell function and could in the future be developed as inflammation-regulatory therapies for clinical use.

### INFO

**FreeRad** – Studies into the biological actions of free radicals and lipids in inflammatory disease

#### Panel

Life Sciences

#### Host institution

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*“My international mobility was fundamental for me to gain a broad perspective on research, to work in different conditions and experience different ways of conducting research.”*

**Stefano Zapperi**

Marie Curie Excellence Award  
winner 2004

*“I believe mobility was crucial in my scientific development, and has helped me to build up a network of international expertise in my research area.”*

**Jens Marklof**

Marie Curie Excellence Award  
winner 2004

*“Research offers new challenges every day, and gives you the opportunity to work with talented and enthusiastic people. There is no other occupation like it.”*

**Gadi Rothenberg**

Marie Curie Excellence Award  
winner 2004

*“**Geographic** mobility is an important asset of a scientific career, because **subject** mobility is not always necessary.”*

**Gadi Rothenberg**

Marie Curie Excellence Award  
winner 2004

*“Mobility and exchanges of people are the soul of the success of a Research Institute.”*

**Maria Pia Cosma**

Marie Curie Excellence Award  
winner 2005

# Grand Jury Members

*The following members of the 2007 Descartes Grand Jury selected the Marie Curie winners.*



**Prof. Mary Osborn** – Chair of the Marie Curie Grand Jury 2007

Cell biology

Max Planck Institute for Biophysical Chemistry, Göttingen, Germany, and past president of the International Union of Biochemistry and Molecular Biology

*Born in the UK, Mary Osborn studied physics at the University of Cambridge (UK) and obtained her PhD in biophysics from Penn State University (USA). Later career stages took her to Harvard (USA), to the Laboratory of Molecular Biology in Cambridge (UK), to Cold Spring Harbor Laboratory (USA) and then to the Max Planck Institute for biophysical Chemistry in Göttingen (DE), where she also became honorary professor in the medical faculty at the Georg August University (DE). She was awarded the Meyenburg Prize and the L'Oréal/UNESCO Prize for her work on cytoskeletal and nuclear proteins in animal cells. Professor Osborn is a member of the European Molecular Biology Organisation and holds an honorary doctorate from the Pomerian Medical Academy in Szczecin (PL). She was a trustee of the Swedish Foundation on the Environment, MISTRA, and has chaired both the Scientific Advisory Board of the European Molecular Biology Laboratory in Heidelberg, and the Cell Biology Section of Academia Europaea. From 2003 to 2006, Professor Osborn was the president of the International Union of Biochemistry and Molecular Biology (IUBMB), an organisation representing biochemists and molecular biologists in 72 countries.*

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**Prof. Tatiana Birshtein**

Chemistry/Physics

Principal Research Scientist, Institute of Macromolecular Compounds, Russian Academy of Science (IMC RAS), St Petersburg, and Professor of St Petersburg State University, Russia

*Born and educated in Leningrad (presently St Petersburg), Tatiana Birshtein's scientific career has been connected with the IMC RAS since 1958. She is the author of a monograph entitled "Conformations of macromolecules", with OB Ptitsyn (issued in 1964 in Russian and later translated and published abroad), and more than 250 papers in the field of the statistical mechanics of polymeric systems. For many years, she has been the group leader in International and Russian Grants. She has sat on the editorial board of several polymeric journals: Macromolecular Theory and Simulations (1992-2002), Polymer Science (Russian, 1988-1999), Acta Polymerica (1990-1999) and Biophysical Chemistry (1983-1997). Professor Birshtein has received a large number of awards, including Honoured Professor, Honoured Research Scientist for the Best Scientific Publication in Russia in 2000, and the Medal for the Defence of Leningrad (1944). In 2007, Professor Birshtein won the L'Oréal-UNESCO "Women in Science" prize for Europe.*



**Prof. Cristina Gavrilovici, MD, PhD, MA**

Bioethics and medicine

Associate Professor in Bioethics, University of Medicine and Pharmacy (IASI), and Member of the Bioethics Committee, Romanian College of Physicians, Romania

*Dr Cristina Gavrilovici has a background in bioethics and medicine, having acquired a PhD cum laude in medicine (paediatrics) and a Master of Arts in bioethics. She completed her training in Romania and the United States. Currently, she is a member of the Romanian Bioethics Committee Associated to Romanian College of Physicians. Her main areas of interest are research ethics, ethical issues in genetic technologies and procreative liberties. She has published in both paediatric nephrology research and bioethics domains.*



**Prof. Andrzej Górski**

Medicine and bioethics

Professor, Medical University of Warsaw (MUW), Poland, and vice-president of the Polish Academy of Sciences

*Born in Poland, Andrzej Górski studied medicine at the MUW. Between 1974 and 1976, he was a Fulbright scholar at the Sloan-Kettering Institute for Cancer Research in New York (USA). His major research interests focus on immunology, transplantation and bacteriophages. Between 1996 and 1999, he was rector of the MUW. Professor Górski has organised eight international conferences in the field of ethics in science, and currently chairs the bioethics commission at the Polish Ministry of Health. He is a member of the Polish Academy of Sciences and the Polish Academy of Arts and Sciences.*

# Grand Jury Members



## **Dr Rossella Palomba**

Demography

**Director of Research at the National Research Council – Institute for Population and Social Policies, Italy**

*Italian Rossella Palomba is head of the Department of Population, Social Behaviour and Policies at the National Institute for Population Research and Social Policies in Rome, Italy. Her main fields of interest are related to the analysis of changes in family structure and behaviour, couple formation and dissolution, fertility, and gender roles. Dr Palomba was a member of the National Committee for Sociology, Statistics and Economy, the National Committee for the Environment, and the Italian Representative on the European Commission-appointed Committee on Human Potential and Mobility. She was vice-president of UNESCO's European Observatory on Population Education and Information. She also held the presidency of the Italian Committee for Valorisation of Women in Science. Dr Palomba has written ten books and more than 150 articles in international and national scientific journals. She is also the Italian Ambassador for Equal Opportunities in Science.*



## **Prof. Karen Siune**

Social sciences

**Director, Danish Centre for Studies in Research and Research Policy, University of Aarhus, Denmark**

*Karen Siune has headed the Danish Centre for Studies in Research and Research Policy at the Aarhus University since 2004. Before then, from 1997 to 2003, she built up the Danish Institute for Studies in Research and Research Policy, an independent governmental research institute attached to the Ministry of Science, Technology and Innovation. Her areas of research interest include the role of science in society, comparative research in policy studies and citizens' attitudes towards science. During her successful career, Professor Siune has held various faculty positions at the universities of Aarhus (DK) and Michigan (USA). She has also sat on several Danish government commissions. Between 2002 and 2006, she chaired the Science and Society Advisory Group connected to the Sixth Framework Programme for Research. From 1995 to 2001, Professor Siune was vice-president of the European Advisory Committee on Statistical Information in the economic and social spheres (CEIES). She has also been involved in a number of EU-funded research programmes.*



## **Prof. Edward P.J. van den Heuvel**

Astronomy

**2002 Descartes Prize winner**

**Professor of Astrophysics at the University of Amsterdam (UA), The Netherlands**

*Until 2005, Edward P.J. van den Heuvel had chaired The Netherlands Foundation for Research in Astronomy for nine years. He has been a Professor of Astrophysics at UA since 1974, and was director of the Astronomical Institute and the Centre for High Energy Astrophysics until January 2005. He has carried out astrophysical research at the universities of Utrecht (NL), Brussels (BE), California (Santa Cruz and Santa Barbara) in the United States and at the Institute for Advanced Study in Princeton (USA). He led the team which was awarded the 2002 Descartes Prize for the discovery of the places of origin of giant cosmic explosions producing the cosmic bursts of gamma-ray radiation.*



# Descartes Research Prize

## Excellence in European scientific collaborative research

The Descartes Prize for Transnational Collaborative Research has been awarded annually since 2000 by the European Commission's Directorate-General for Research.

The Prize is open to any transnational research team that has achieved outstanding scientific or technological results through collaborative research in any field of science, including economics, social sciences and humanities. Nominated research teams must involve at least one research entity from a European Union Member State.

For the 2007 edition of the Prize, the three research laureate teams described in the following pages will share € 1 360 000.

Nominations for Descartes Prizes may be submitted by the scientific team themselves or by public or private organisations, such as research centres, foundations or universities. The Prize is open to all collaborative research whether funded via a European Community Research programme or not.



# Listeria research leads fight on infection



*As our armoury of antibiotics becomes less effective and new infectious diseases emerge, novel routes to fight infection are required. Through the detailed study of one important food-borne pathogen – Listeria monocytogenes – the European research consortium VIRLIS has opened the door to new strategies to combat both old and new health threats. The comprehensive multi-disciplinary approach employed has contributed to Europe’s world-leading role in global research on infection biology and set benchmarks that are the reference for future studies in this field.*

Listeria monocytogenes is a bacterium responsible for one of the most severe food borne infections. However, it was not actually recognised as a food-borne pathogen until the mid-eighties. Today, the bacterium is one of the most studied organisms in infection biology and is a reference model for infectious diseases in general. This is largely thanks to the extensive research on Listeria undertaken over more than ten years by the European research consortium VIRLIS.

The consortium involves eight research groups from three European countries (France (2), Germany (3) and Spain (3)) and has been at the forefront of major advances in the study of the molecular and cellular basis for the virulence of this bacterial pathogen.

Professor Pascale Cossart, from the Institut Pasteur in Paris, is the coordinator of the VIRLIS project. “We initially started working on Listeria in the late 80’s in collaboration with Spanish colleagues,” she explains. “This bi-lateral collaboration grew into a larger EC-funded study that formed the basis of the VIRLIS consortium from 1996 and continues today.”

### **A systems approach**

The VIRLIS partners all realised the potential for Listeria monocytogenes to be a model for infectious diseases. Although this bacterium was not responsible for a large number of clinical cases, it possessed a number of specific properties that predicted it could serve as a model system for the study of other bacterial diseases. Listeria grows fast and it can be genetically manipulated. It belongs to a genus of bacteria that contains both pathogenic and non-pathogenic species. The bacterium can infect tissue culture cells for in-vitro studies and has the striking property that it can invade a wide variety of cells. It is able to cross three specific host barriers: the intestinal, the placental and the blood-brain barriers. The infection can in part be reproduced in laboratory animals.

A major strength of the VIRLIS effort has been its multi-disciplinary approach. The various research groups in the consortium bring the tools of molecular biology,

epidemiology, cell biology, physiology and animal studies amongst other skills to examine all aspects of Listeria’s behaviour.

“This allows us to obtain and integrate a wide variety of data from specific detailed studies on a single protein expressed by the bacterium to whole animal studies where we can follow the infection path,” says Cossart. “Effectively, the VIRLIS group has been employing a ‘systems biology’ type of approach before the term was introduced.”

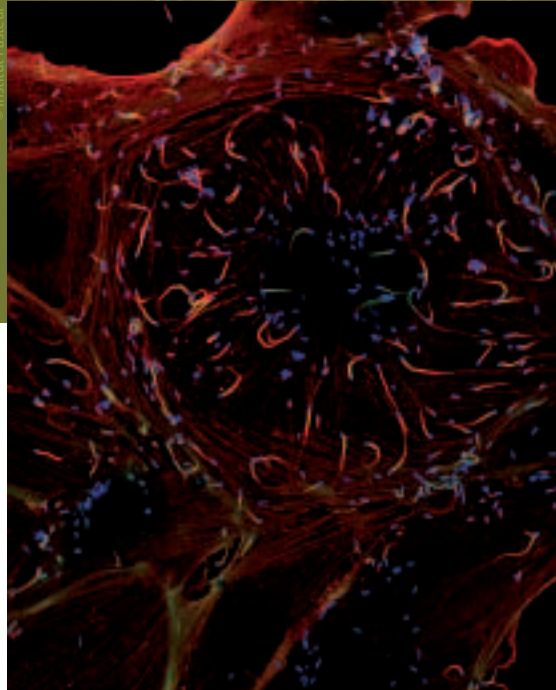
One clear benefit of the VIRLIS consortium has been that an initially highly competitive attitude between different European research groups has transformed into a highly fruitful world-class collaboration that is highly complementary.

### **Good Listeria, bad Listeria**

The consortium’s combined efforts have revealed the genetic and cellular basis of Listeria’s highly evolved ability to enter mammalian cells, its ability to move relatively unhindered both within and between cells, and how it avoids detection and destruction by the host’s defence mechanism.

A significant achievement was the sequencing of the genome of Listeria monocytogenes and that of its non-pathogenic ‘cousin’ Listeria innocua. This allowed comparisons to be made and identified the specific virulence factors of the pathogenic species. “We were effectively comparing the good with the bad,” says Cossart. “This greatly helped the identification and characterisation of the Listeria virulence factors and the regulatory mechanisms that underlie them.”

This work, together with studies on mechanisms involving surface proteins on the bacteria – the mechanisms that allow the bacteria to survive in the host and the strategies used by the bacteria to target and cross host barriers – have built a fund of new knowledge about the way infectious agents multiply and disseminate within a host.



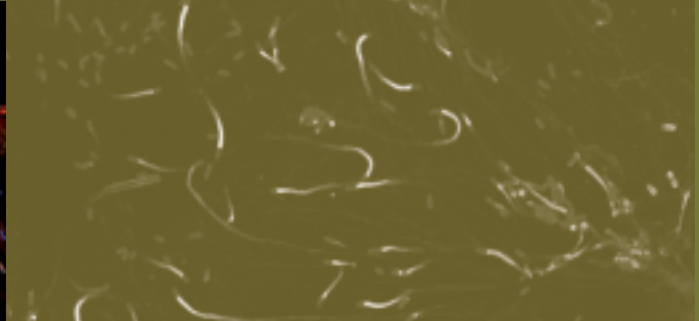
### New weapons against infection

Infectious diseases are a leading cause of death and illness worldwide. The reappearance of old pathogens (tuberculosis), the emergence of new pathogens (avian flu), the rise of antibiotic resistant strains of bacteria, and the exceptional threat of bio-terrorism all stress the urgent need for new therapeutic and diagnostic methods.

A pre-requisite for the rational design and generation of new anti-infectious treatments is detailed knowledge of the process of infection. The findings of the VIRLIS consortium have led to the establishment of a number of general concepts and principles in infection biology that are prompting the development of new therapeutic methods, creating novel sensitive diagnostic techniques and building new strategies to fight infectious disease.

"Antibiotics are no longer 'the' solution for everything – in fact, today, in many cases they are no solution at all," says Cossart. "Our research has built a solid basis for new anti-infection drugs and agents."

Cossart is very proud of the work of VIRLIS. "This type of research is an outstanding example of an in-depth fundamental research aimed at combating future health threats," she believes.



## INFO

VIRLIS – Molecular and cellular basis of the virulence of the food borne pathogen *Listeria monocytogenes*

### Category

Life Sciences

### Partners

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# Marvellous molecular motors



*Biology is a master of nanotechnology. Most biological processes rely on naturally evolved nanomachines to achieve complex tasks such as photosynthesis. Human abilities to make and use nanotechnology are in their infancy, but the potential impact on society is huge. A European team has made some of the first functional examples of synthetic motors on a molecular scale and many other potentially useful nanomachines. This pioneering work is laying the foundations of the next economic revolution.*

Nanotechnology is a word we are all becoming familiar with. We are told it has the potential to make a huge impact on society: an impact comparable to that delivered by the steam engine, electricity or the transistor. But the realisation of that vision is still some way off.

“To best appreciate the technological potential of controlled molecular-level motion you need to appreciate that nanomotors and molecular-level machines lie at the heart of every significant biological process from harvesting energy from the sun to the way our muscles move and even the way we think,” says Professor David Leigh of Edinburgh University and coordinator of the SynNanoMotors consortium.

In contrast, no human technologies exploit controlled molecular motion in any way at all. Our technologies all function through static or equilibrium processes. But thanks to the recent work of SynNanoMotors and other leading research groups, this looks set to change.

### First synthesis

The origin of the consortium's work was a chance discovery. In 1995, Leigh's group was synthesising novel chemical sensors. In particular, a large macrocycle molecule had been identified as a possible receptor for CO<sub>2</sub>. A route to make the macrocycle was devised using a simple condensation reaction. However, the experimental result was not the targeted large ring molecule but a catenane – two inter-threaded molecular rings looking (in molecular terms) like a chain link! Leigh describes this new type of chemistry as like “threading the eye of a needle but at the nano-scale”.

This remarkable outcome from a straightforward one-step synthesis opened the door of a system that could provide prototype simple molecular machines. But to truly exploit this opportunity would need a multi-disciplinary approach and thus the team that would become SynNanoMotors was formed.

Six European research groups make up the SynNanoMotors team. Leigh at Edinburgh leads the chemists that make the

molecules and the other five members are involved in characterisation and modelling activities. The *Consiglio Nazionale delle Ricerche* in Bologna are experts in atomic force microscopy and nanotechnology, while the *Commissariat à l'Energie Atomique* in Paris brings linear and non-linear optic skills for application testing. The University of Amsterdam provides a range of spectroscopic techniques to characterise the molecules, and the physicists at the Dutch University of Groningen are skilled in the art of producing and examining thin films. The University of Bologna provides molecular simulation expertise that underpins the understanding of the results obtained and identifies future molecular targets.

For their first five years the consortium worked to find out more about the catenane system, control the synthesis and understand its behaviours to design further new systems and applications. In the subsequent five years they moved on to try to control the movement within the molecules and allow it to respond to external stimuli. This is key to using the molecular motion to make real molecular nanomachines that can interact with the outside world.

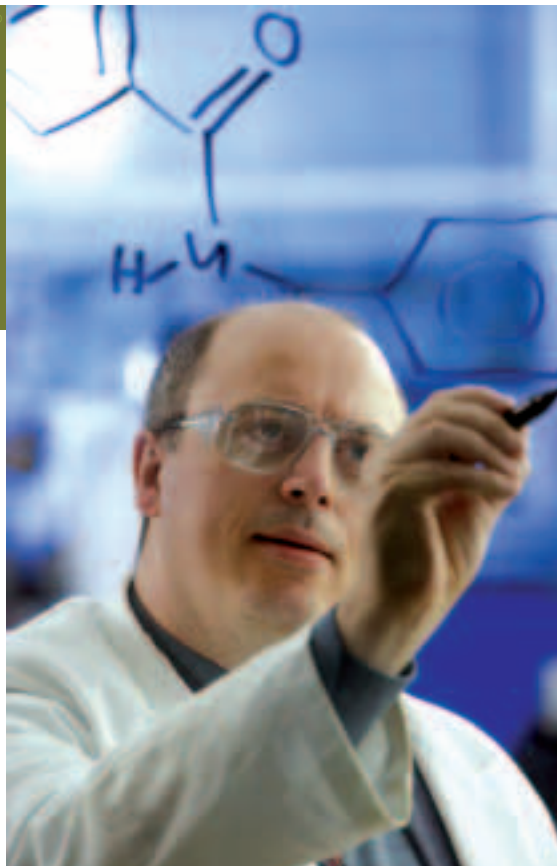
### Wheels and axles

As the knowledge of the catenane system grew, it was possible to modify the synthesis to produce another novel class of compounds called rotaxanes. This class of molecule can be essentially described as a wheel on an axle. Methods were developed including use of electric fields, light and mechanical perturbations to control the positioning of the ‘wheel’ on the ‘axle’ in a molecular shuttle mechanism.

The rotaxane molecules have remarkable properties, and in 2003 the group showed that they could self-assemble on the nanoscale into ridge and groove structures. This could have applications in high density information storage. The material can also be used as a molecular switch in polymer films for smart tags or labels.

A surface modified with rotaxanes has demonstrated the transport of liquid droplets ‘uphill’ on a macroscopic scale when stimulated by light. Further work led to the first

## SynNanoMotors The Realisation of Some of the World's First Working Synthetic Molecular Motors and Mechanical Nanomachine



2007  
Descartes Research Prize

synthetic hydrogen bonded rotary molecular motor and 'energy' and 'information' ratchet molecular motors. And this is only the beginning for molecular nanomachines.

### Education and interaction

The SynNanoMotors work has highlighted the tremendous strength of European nanoscience. The six research groups have attracted some of the best graduate and post graduate students from all over the world. And the consortium has ensured that these young scientists received the high quality, multi-disciplinary training that will boost their nanotech careers and keep Europe at the forefront of nanotechnology.

Not surprisingly, the work of SynNanoMotors has attracted much media attention over the years, and news of the research has been widely followed in both the scientific and popular media. It is a fast paced field of science. "With the development of molecular nanomachines there is the real possibility of developing truly smart materials: materials that can change shape, form and properties as we wish," says Leigh. "It sounds like magic – but it is actually sound, exciting and fundamentally important science."

### INFO

**SynNanoMotors** – The Realisation of Some of the World's First Working Synthetic Molecular Motors and Mechanical Nanomachines

#### Category

Basic Sciences – Chemistry

#### Partners

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# Ice cores reveal climate change clues



*To predict the future it is necessary to understand the past. In the field of climate change study of past environmental variation is limited, especially for events in the distant past. But ice cores extracted from deep in the polar regions offer a unique insight. The European EPICA project ventured to Antarctica to retrieve two continuous ice cores that extend the historical climate record back 800 000 years. Their analysis of the ice within these cores has made an extremely significant contribution to improving understanding of climate change, its mechanisms and consequences.*

The European consortium that grew into EPICA was largely established during a large European project (GRIP) initiated in Greenland in 1990. The success of the Greenland research allowed the EPICA community to propose an Antarctic project. Ice cores retrievable from Greenland could take the record back 125 000 – 145 000 years, but Antarctica has much older ice to offer with the potential to go back over one million years.

The scope and size of the project was huge and involved considerably more challenges than the Greenland operations. Due to the size and duration of the undertaking, EPICA was financed via national contributions and a series of EU projects, the first being during FP5. European community funding has been continuous in supporting this important work over more than a decade.

### Ice space

Two drilling sites were selected for ice core extraction: one in the Indian Ocean sector of Antarctica called Dome C and the other in Dronning Maud Land in the Atlantic Ocean sector. Operating in Antarctica resembles in many ways space exploration. The environment is alien and hostile. It is only possible to drill during the three-month Antarctic summer. At other times it is just too cold.

All equipment had to be brought by ship to the coast and then hauled to the drill sites by surface traverse. Near the coast deep crevasses are a constant danger. But the inland Antarctic interior is like a very cold dessert. "It is beautiful and very peaceful," says Dr. Hubertus Fischer, EPICA leader from the Alfred-Wegener Institute. "It really feels like being in the middle of nowhere. But one advantage is that if you are not sick when you get there you won't get sick – it is a sterile environment."

An Ice Core Drill works like an apple corer recovering at maximum a three-metre-long core. Both EPICA ice cores were drilled to a depth of 3 000 metres. At the deeper levels the process slows down and the retrieved cores get shorter. To complete the EPICA cores each took between 3 000 and 5 000 drill runs over several drilling seasons.

### Hot results

Analysis of the EPICA cores has significantly extended our climate knowledge and the results have become the 'gold standard' for data on past changes in Antarctic climate. "From the cores ancient environments can be reconstructed including temperature, precipitation rate, atmospheric composition (CO<sub>2</sub>, CH<sub>4</sub>, NO<sub>2</sub> and other greenhouse gases (GHGs)) and we can use the N<sub>2</sub>/O<sub>2</sub> isotope ratio as a reference for dating samples," says Fischer. "We can look at aerosols (sea salt and mineral dust) deposited in the ice, which are important for other bio-geochemical cycles and the radiative budget of our planet."

The EPICA team has now established a record of the Antarctic climate extending back 800 000 years showing how it has evolved over this period. One significant finding is that the 'warm', interglacial periods prior to 450 000 years ago were significantly cooler than those experienced in more recent cycles. And the amount of CO<sub>2</sub> in the atmosphere and the Antarctic climate have been tightly coupled over the entire period examined.

### Highest GHGs levels now

The ice cores reveal that atmospheric levels of CO<sub>2</sub> and CH<sub>4</sub> – the two most important GHGs – are now at their highest levels for the last 800 000 years. Today, the level of CO<sub>2</sub> is about 30% greater than the previous record, and there is two to five times more methane.

## EPICA European Project for Ice Coring in Antarctica

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2007  
Descartes Research Prize

The ice cores also allow a unique and direct comparison between northern and southern hemispheres. High resolution analysis reveals a tight coupling of climate events in Greenland and Antarctica. This supports ideas on the influence of ocean heat transfer that may impact on current climate modelling.

Another significant result shows that mineral dust aerosol is an order of magnitude higher in glacial times compared to warmer times. This additional dust (which also contains iron) was capable of fertilising the marine biosphere – in particular to fix more CO<sub>2</sub> in the Southern Ocean. Models suggest that this iron fertilisation of the southern seas could only reduce CO<sub>2</sub> concentrations by ~30-40 ppm at most.

### More work to do

The work of the 12-member-EPICA consortium is continuing. Currently, EPICA members are involved with a major project in Greenland with other international partners. But they are also interested in searching for older ice in Antarctica that could extend the record back to 1.5 million years.

This would be interesting because, around 900 000 years ago, there was a clear change in the climate system. Since that time the glacial/interglacial cycle has been roughly 100 000 years. Before then, the cycle was 40 000 years. Hopefully, ice core data can help explaining this.

The Descartes Prize will be used to continue and coordinate efforts in the EU research community that built EPICA. "It will be used to support continuing meetings including annual meetings of students and technical workshops – providing the 'academic glue' that keeps international collaborations functioning," concludes Fischer. "And it will help in the planning for our next Antarctic project."

## INFO

EPICA – European Project for Ice Coring in Antarctica

### Category

Earth Sciences

### Partners

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Stockholm University, Sweden

#### Dr Eric Wolff

National Environmental Research Council/British Antarctic Survey, United Kingdom



*“The team benefited greatly from the increase in scientific standing by winning the prize, not only in Europe but throughout the medical world”*

**Prof. Alan Lehmann**

Descartes Laureate 2000

*“[The prize] has enabled me to hire post-docs and buy new equipment to continue the research in the spirit of the Descartes Prize – through European collaborative research.”*

**Prof. Alain Fischer**

Descartes Laureate 2005

*“It was a great honour to win the award and the ‘knock-on’ effect has been to help bringing Multiple Sclerosis to the forefront of the European medical agenda.”*

**Prof. Lars Fugger**

Descartes Laureate 2002

*“As a social scientist [the prize] has come as a welcome and unanticipated mark of respect from fellow scientists in very different disciplines.”*

**Prof. Roger Jowell**

Descartes Laureate 2005

*“[The prize] emphasizes not only scientific excellence and effective collaboration, but also a social dimension in research.”*

**Prof. Howard Jacobs**

Descartes Laureate 2004

*“These results are not only of relevance to today’s scientific professionals. They also help stimulating young peoples’ interest in astronomy, physics and basic research, forming an important foundation for a society increasingly based on science and technology.”*

**Prof. Andrew Lyne**

Descartes Laureate 2005

*“Through the Descartes award, scientists and science policy-makers have a good vehicle to highlight the joy of discovery in science, and to show that the results of science matter to society.”*

**Prof. Anders Karlsson**

Descartes Laureate 2004

*“This achievement was only made possible through the cooperation of four teams from complementary engineering fields of study and application.”*

**Dr Athanasios Konstandopoulos**

Descartes Laureate 2006

# Grand Jury Members

*The 2007 Descartes Grand Jury also comprises the members already mentioned for the selection of the Marie Curie winners.*

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**Dr Claudie Haigneré** – President of the Descartes Grand Jury 2007

Astronaut and neuroscientist

**Senior Adviser to the director-general of the European Space Agency, France**

*A medical doctor and neuroscientist by training, Claudie Haigneré is a senior adviser to the director-general of the European Space Agency. She is also a faculty member at the French Academy of Technology, the International Academy of Astronautics (IAA) and the Academie des Sports. Dr Haigneré is the only professional woman astronaut in Europe. She has taken part in two space missions: the first scientific mission (Cassiopee) aboard MIR, the Russian space station, in 1996, and another (Andromede) on the International Space Station in 2001. Dr Haigneré is also a qualified station and spacecraft flight engineer and a cosmonaut rescuer for Soyuz. She became a member of the European Astronaut Corps on joining the ESA in 1999. She has held two ministerial posts in the French government: Research and New Technologies (2002-2004) and European Affairs (2004-2005). She has been decorated by the French State, receiving the prestigious Commandeur de la Légion d'Honneur and Chevalier de l'Ordre National du Mérite. She has also received the Russian Order of Friendship between the Peoples, and another for Personal Valour.*



**Prof. Jan Balzarini**

Medicine

**2001 Descartes Prize winner**

**Rega Institute for Medical Research, Katholieke Universiteit Leuven, Belgium**

*Jan Balzarini is on the board of directors of the International Society for Antiviral Research and Professor at the Rega Institute for Medical Research. He studied biology and bioengineering at the KU Leuven in Belgium. In 1984, he obtained a doctorate in bioengineering. He attended the National Institutes of Health in Bethesda, MD, for a post-doctorate focusing on the discovery and pharmacology of novel medicines against HIV. Back at the Rega Institute, he further expanded his antiviral research, coordinated a variety of research networks sponsored by the European Commission, and was at the core of the discovery of an entirely novel class of therapeutics for HIV and hepatitis B. He won a Descartes Prize in 2001, the Blaise Pascal Medal of the European Academy of Sciences in 2003, and the Sanofi-Aventis Award of the American Society of Microbiology in 2006. Jan Balzarini is currently head of the Laboratory of Virology and Chemotherapy at the Rega Institute.*



**Prof. Pierre Coulet**

Physics

**Professor at the University of Nice, France, and Senior Member of the Institut Universitaire de France**

*Pierre Coulet's association with the Descartes Prize began in 2001, as panel president for the basic sciences panel. He was a researcher at France's Centre National de la Recherche Scientifique (CNRS) between 1975 and 1987. He co-founded the Institut Non-Linéaire de Nice in 1991, which he headed between 1995 and 2002. He also founded and heads the Institut Robert Hooke. He has won several awards, including Germany's highest, the Humboldt Prize, and sits on various science panels, including that of the Institut Universitaire de France. His long list of publications in the fields of dynamical systems, chaos, turbulence and self-organisation (in fluids, liquid crystal, chemical reaction and biological systems) includes many major peer-reviewed journals.*



**Prof. Patrick Cunningham**

Genetics

**Chief Scientific Adviser to the Irish Government, and**

**Professor of Animal Genetics at Trinity College, University of Dublin, Ireland.**

*Patrick Cunningham was formerly deputy director (research) at the Irish National Agriculture and Food Research Institute (1980-1988), visiting professor at the Economic Development Institute of the World Bank (1988), and director of the Animal Production and Health Division of the UN's Food and Agriculture Organisation (1990-1993). He has published extensively on the genetics of domesticated animals. He is co-founder and chairman of the biotechnology company IdentiGEN. He has been president of the European and World Associations of Animal Production, and served on the European Life Sciences Group which advised former Research Commissioner Philippe Busquin.*

# Grand Jury Members



## **Prof. Elmars Grens**

Biomedicine/Genetics/Biology

**Scientific Director, Latvian Biomedical Research and Study Centre, Riga, Latvia**

*Born and educated in Latvia, Elmars Grens graduated from the University of Latvia's faculty of chemistry, and is currently a professor of molecular biology at the same university. He is a member of the Latvian Academy of Sciences, the Russian Academy of Sciences and Academia Europaea. Professor Grens is also a Chairman of the Latvian Science Council and a member of the Strategic Analysis Commission under Auspices of the President of the Republic of Latvia. His main research interests are in the field of biomedicine, namely gene structure and expression, molecular virology, gene and protein engineering, and recombinant biotechnology.*



## **Prof. Nouzha Guessous Idrissi**

Medicine and bioethics

**Professor of Medical Parasitology, and former Chair of UNESCO's International Bioethics Committee**

*Educated in Morocco and France, Nouzha Guessous Idrissi has been teaching and carrying out research in the field of medical parasitology for some 28 years, as a Professor at the Medical Faculty of Casablanca University and the former head of the Diagnosis and Research Laboratory at the University Hospital of Casablanca. Her wide lab and field research in Morocco has covered such topics as leishmaniasis and the interaction between parasites and their environment. Since 1999, she has been acting as an expert for the UN-sponsored Special Programme for Research and Training in Tropical Diseases (TDR). Concomitantly, Professor Idrissi is a founding member of the Moroccan Organisation of Human Rights, a consultant for women rights NGOs, and a member of the Royal Advisory Commission for the Revision of the Moroccan Family Code. She has also been dedicating more of her attention to the field of bioethics. In Morocco, she is a member of the Ethics Committee for Biomedical Research and of the Moroccan Association for Bioethics. Internationally, she has sat on UNESCO's International Bioethics Committee since 2000 – she became vice-chair in 2002 and was the Chair from 2005 to 2007.*



## **Prof. Lucia Mendonça Previato**

Microbiology

**Institute of Biophysics Carlos Chagas Filho, Federal University of Rio de Janeiro, Brazil, and member of the Brazilian Academy of Science**

*Lucia Mendonça Previato was born and educated in Brazil. From 1972 to 1976, she undertook her graduate studies at the Federal University of Rio de Janeiro, where she was awarded a PhD in microbiology and immunology. In the late 1970s, she did post-doctoral work on carbohydrate chemistry at the National Research Council of Canada, Saskatoon and on glycobiology at the Department of Biochemistry, University of California, Berkeley (USA). In 1980, she established a Surface Structure of Microorganisms Laboratory at the Federal University of Rio de Janeiro's Institute of Microbiology, which she directed until taking up her present position, in 2001, at the Carlos Chagas Filho Institute of Biophysics' Laboratory of Glycobiology, located at the same university. Her honours include the National Research Council of Brazil's Top Research Career Investigator (1986); the Petrobras Award's National Invention Prize (1987); the Rio de Janeiro State Award for Biological Sciences (1999); the National Order of Merit in Science (Ordem Nacional do Mérito Científico) (2001); the L'Oréal-UNESCO Laureate for Latin America (2004); and the winner of the 2007 TWAS Prize in Biology. Professor Mendonça Previato has been the editor-in-chief of Annals of the Brazilian Academy of Science from 2003 to 2007. Professor Mendonça Previato's scientific contributions have focussed on the treatment and prevention of Chagas' disease that currently afflicts an estimated 17 million people in Central and South America. Her studies have helped shed light on the molecular basis responsible for communication between host cells and Trypanosoma cruzi, a protozoan parasite responsible for the disease.*



## **Prof. Gretty M. Mirdal**

Psychology

**Professor, Transcultural and Clinical Psychology, University of Copenhagen, Denmark**

*Gretty M. Mirdal is professor of transcultural and clinical psychology at the University of Copenhagen. She is an expert in the areas of mental and physical health in migration and health psychology. Professor Mirdal is also involved in international research policy and administration at the highest level. Professor Mirdal is the former chair of the Committee for the Humanities and Social Sciences at France's Agence Nationale de la Recherche, she sat on the European Research Advisory Board (EURAB), and in the grand jury of the Institut Universitaire de France. She presently chairs the Standing Committee for the Humanities at the European Science Foundation; is a member of the board of the Danish Research Foundation (Danmarks Grundforskningsfond); and she is a member of the Scientific Board of France's Centre National de la Recherche Scientifique. She is a fellow of the Royal Danish Academy of Sciences and Letters.*

*During its eight-year history, the Descartes Research Prize Grand Jury has also been honoured by contributions from:*

**Prof. Marcia Barbosa**

*Professor of physics, Universidade Federal do Rio Grande do Sul, Brazil  
2006*

**Prof. Jean-Patrick Connerade**

*Former President EuroScience, Lockyer Professor of Physics Imperial College London  
2004-2006*

**Prof. Yves Copens**

*Professor of Palaeoanthropology and Prehistory at the Collège de France  
2004-2006*

**Prof. Ene Ergma**

*Former President of the Descartes Grand Jury and former President of the X Riigikogu, the Estonian Parliament (2003-2006), currently Vice-President  
2002-2005*

**Prof. Ayse Erzan**

*Member of the Turkish Academy of Sciences and winner of the L'Oréal-UNESCO European prize for Women in Science 2003  
2006*

**Dr Leo Esaki**

*Nobel Prize winner in Physics (1973)  
2004-2005*

**Prof. José Mariano Gago**

*Minister of Science, Technology and Higher Education, Portugal  
2003-2004*

**Dr Sirkka Hämäläinen**

*Former Member of the Executive Board of the European Central Bank, Frankfurt  
2000*

**Prof. Helena Ilnerová**

*Former President, Czech Academy of Sciences  
2001-2004*

**Mr Pantelis Kyriakides**

*Former Vice-President, European Patent Office  
2000-2001 and 2003-2004*

**Sir John Maddox**

*Former editor of Nature  
2000-2002*

**Prof. Federico Mayor-Zaragoza**

*Former Director General of UNESCO  
2000*

**Dr Ulf Merbold**

*Former astronaut and former coordinator of the International Space Station at the European Space Agency  
2000-2002 and 2005*

**Dr Yves Michot**

*Former President, Défense Conseil Internationale, former President of 'Aérospatiale' (France) and former President of the Descartes Grand Jury  
2000-2002*

**Prof. Ben Mottelson**

*Nobel prize winner in physics (1975). Joint Nordic Research Institute / Niels Bohr Institute University of Copenhagen  
2000*

**Prof. Helga Nowotny**

*Former Chair, European Research Advisory Board under FP6  
2004*

**Prof. Wubbo Ockels**

*Former astronaut and European Space Research and Technology Centre Professor at the Technical University of Delft  
2003-2006*

**Prof. Nikolai Platé**

*Late Vice-President, Russian Academy of Sciences  
2000-2002 and 2004*

**Dr Beatrice Rangoni Macchiavelli**

*Former member of the European Economic and Social Committee and Editor La Tribuna  
2000*

**Dr Anna C. Roosevelt**

*Professor of Anthropology, University of Illinois, USA  
2000-2003*

**Prof. Nadia Rosenthal**

*Head of the European Molecular Biology Laboratory (EMBL) Monterotondo Outstation, Italy  
2005-2006*

**Prof. Margarita Salas Falgueras**

*Research Professor at the Spanish Research Council (CSIC) and former President of the Institute of Spain  
2001*

**Mr Ion Siotis**

*Former Research Director at the National Centre for Science Research 'Demokritos', Athens, Greece  
2002-2005*

**Dr Susan Solomon**

*Senior scientist at the National Oceanic and Atmospheric Administration (NOAA) Boulder, Colorado, USA  
2005*

**Mr Jean Stéphane**

*Director of Glaxo SmithKline Biologicals, Rixensart, Belgium  
2000*

**Mr Rudi Thomaes**

*CEO of the Federation of Enterprises in Belgium, former President and CEO, Alcatel Bell  
2001-2003*

**Dr Georges Vassiliou**

*Former President of the Republic of Cyprus (1988-1993) and visiting professor at Cranfield University, UK  
2005-2006*

**European Commission**

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The **Descartes Research Prize**, now in its eighth year, rewards transnational research teams having achieved outstanding scientific or technological results through collaborative research in any field of science. The **Marie Curie Awards** honour the 'best of the best' researchers who have benefited from a Marie Curie Action: an increasingly successful programme that exists to support their career development across Europe. And the **Science Communication Prize**, introduced in 2004, celebrates the finest European science communicators in three categories: Science Communicator of the Year, Science Writer of the Year, and Audiovisual documentary of the Year.