



20TH FORUM DEDICATED TO PHYSIOLOGY OR MEDICINE—
PLATFORM FOR THE DIALOGUE BETWEEN SCIENTIFIC GENERATIONS
61ST MEETING OF NOBEL LAUREATES AT LINDAU
RETROSPECTS AND PROSPECTS 2011

Kuratorium für
die Tagungen
der Nobelpreisträger
in Lindau
Council for the Lindau
Nobel Laureate Meetings



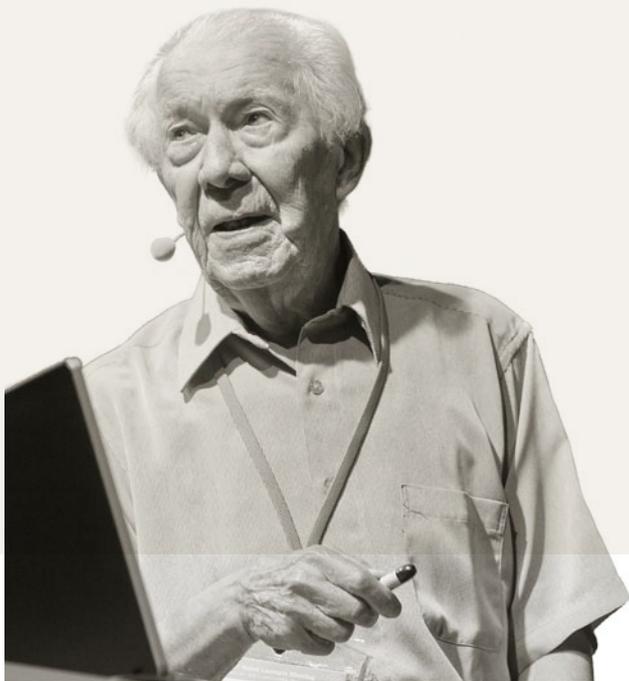
Stiftung Lindauer
Nobelpreisträgertreffen
am Bodensee
Foundation Lindau
Nobelprizewinners Meetings
at Lake Constance



The most enjoyable and rewarding aspect of the Lindau Meetings is the unique opportunity they offer to old scientists like myself for exchanging ideas with the young generation of investigators, represented by hundreds of gifted, motivated youngsters selected from all over the world. I know of nothing comparable. To me, the 2011 meeting was particularly valuable as it may well be my last and my topic was “the future of life”, a challenging problem for my young audience and their contemporaries. My parting message to them was: “My generation has made a mess of things. It’s up to you to do better. The future is in your hands. Good luck”. The response was gratifying and encouraging.

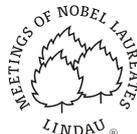
Christian de Duve

Physiology or Medicine, 1974



20TH FORUM DEDICATED TO PHYSIOLOGY OR MEDICINE—
PLATFORM FOR THE DIALOGUE BETWEEN SCIENTIFIC GENERATIONS
61ST MEETING OF NOBEL LAUREATES AT LINDAU
RETROSPECTS AND PROSPECTS 2011

Kuratorium für
die Tagungen
der Nobelpreisträger
in Lindau
Council for the Lindau
Nobel Laureate Meetings



Stiftung Lindauer
Nobelpreisträgertreffen
am Bodensee
Foundation Lindau
Nobelprizewinners Meetings
at Lake Constance

Global Health calls for Transnational Debates. The 61st Meeting of Nobel Laureates in Lindau



The Lindau Meetings of Nobel Laureates were founded as a European initiative for post-war reconciliation. In the exceptional initial conference on physiology or medicine held here in 1951, physicians from Germany sought for the free flow of information in their discipline and for open professional consultations with Nobel Laureates. 60 years later, the demand for a platform for the unconstrained exchange of scientific knowledge and for inspiring cross-cultural and inter-generational encounters among scientists is as strong as ever. The Council for the Lindau Nobel Laureate Meetings and the Foundation Lindau Nobelprizewinners Meetings at Lake Constance will thus continue the tradition of their joint 'Mission Education' to educate, inspire and connect aspiring young talents from all around the world by bringing them together with the most respected scientists of their fields.

This year, 23 Nobel Laureates devoted a whole week of their precious time and a great deal of energy to give captivating lectures, engage in inspiring discussions, and to reveal the vibrancy and fascination of science. Warmest thanks are due to each one of them for this overwhelming commitment.

With a strong awareness of the challenges imposed on global health, the participants in this year's meeting tackled central questions about the future of medicine and discussed the social responsibilities of scientists. New discussion formats like "Turning the Tables" and the Science Masterclasses added to the liveliness of the debates, and the several interactive panel discussions with ingenious speakers encouraged open reflections on controversial and pressing issues.

This year's new initiative to invite selected secondary school teachers to attend one day of the Nobel Laureate Meeting was designed to further extend the scope of the 'Mission Education'. We were delighted to welcome 18 teachers who have shown exceptional commitment to the education and inspiration of their pupils.

As in previous years, sustainability has been prominently featured in the Lindau Dialogue, reflecting its importance for our societies. Vividly showcasing how responsible research can contribute to a sustainable development, the Foundation's three-year exhibition series "Discoveries" on Mainau Island ended this year with a widely recognised interactive exhibition on cutting-edge health research: "Discoveries 2011: Health". We extend our thanks to the Federal Ministry of Education and Research for funding the project and integrating it into the past three "Years of Science", and we thank all exhibition partners and all other involved parties for their cooperation and dedication.

The most ambitious new project of the Lindau institutions is to make their rich collection of photos, videos, audio recordings and texts, compiled in 60 years of Nobel Laureate Meetings, accessible to the public. A preliminary version of our new Lindau Mediatheque was presented on the occasion of the 61st Lindau Meeting and will henceforth be continuously expanded and advanced. Students, pupils as well as everyone interested in natural and economic sciences is invited to explore this treasure trove containing one century of modern science history.

The dynamics of the scientific dialogue in Lindau will only be continued with the ongoing support of our partners. Therefore, the Council and the Foundation extend their sincerest thanks to all Academic Partners worldwide, as well as to all Maecenates, Patrons, Donors, and Benefactors.

With this report, the Council and the Foundation as well as the whole team of our office in Lindau invite you to explore the manifold projects of the 'Mission Education'.

A handwritten signature in black ink, reading "Bettina Lewandowski".

President of the Council for the Lindau Nobel Laureate Meetings

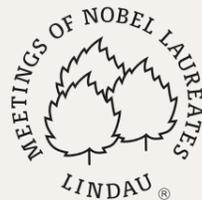
Our 'Mission Education' in 2011

The annual Lindau Nobel Laureate Meetings bring together Nobel Laureates and Young Researchers from around the world for a week of scientific exchange and inspiration. Their aim is to assemble brilliant scientific minds in order to facilitate a unique dialogue across and among generations, cultures and disciplines.

"Educate. Inspire. Connect". This is the leitmotif of the 'Mission Education' of the Council and the Foundation. "Education" does not just mean passing on textbook content or lab reports. What are the relevant topics for the future, and which global problems must be addressed? Exchange creates "inspiration"—like finding a new way of approaching a problem as a result of discussions with a Laureate or with another Young Scientist. Consequently, "Connect" stands for much more than personal networking, which is indeed indispensable for the success of teamwork today. It also means connecting the dots and gaining access to a bigger picture.

The Lindau Meetings are at the heart of the activities of the Council and the Foundation. They also serve as the starting point for a range of different projects. Within the framework of the 'Mission Education', these projects promote the dialogue between science and society. Their aim is to make the achievements of excellent research available to a broad public and to call for support for education and research as a sustainable investment in the future viability of societies.

Carefully selected projects such as the exhibition series "Discoveries" on Mainau Island, the new Lindau Mediatheque and the Lindau Teachers Initiative are extending the 'Mission Education' beyond the Lindau Meetings.



**EDUCATE.
INSPIRE.
CONNECT.**



61st Meeting of Nobel Laureates from 26th June to 1st July 2011

p. 6

23 Nobel Laureates from the fields of physiology or medicine and chemistry, the International President of the Nobel Peace Prize winning organisation "Médecins Sans Frontières", Unni Karunakara, as well as 566 highly talented Young Researchers from 78 countries attended this year's Meeting. One of the major topics was Global Health. The focus was also placed on the future of medicine and how research contributes to the development of new and more effective medications.

Beyond the 2011 Lindau Meeting



Exhibition "Discoveries 2011: Health" on Mainau Island from 20th May to 4th September 2011

p. 96

The third and final part of the exhibition series "Discoveries" extended the debate on the significance of science and research to the broad public. Aligned with the nationwide campaign "Year of Science 2011—Research for Our Health" of the German Federal Ministry of Education and Research, this year's exhibition centred on key issues in health research.



The new Lindau Mediatheque

p.104

The Lindau Meetings and the lectures given by the Nobel Laureates in Lindau have been carefully documented since 1951. Audio or video recordings of almost all lectures and panel discussions have been made. While continuing to make this treasure trove available to a broad audience around the globe, the Council and the Foundation will bring the mediatheque to a new level by enriching the content with the addition of new material.



Outreach Initiatives

p. 110

The Lindau Teachers Initiative, exhibitions with portraits by Peter Badge in Paris and Madrid, a panel discussion on the future of medical technologies in Munich, and a special matinee for Lindau citizens explaining the 2010 Nobel Prizes—these are examples of how the Council and the Foundation extend the outreach of their joint 'Mission Education' to a wider audience. These activities take place beyond the annual Meeting of Nobel Laureates and reach out to a broader audience.

Enabling the 'Mission Education'

p. 116

Organisation

p. 122

The 61st Meeting of Nobel Laureates

26th June—1st July 2011



Participants p. 8



Opening Day p. 20



The Scientific Programme p. 30



Abstracts p. 46



International Day hosted by the USA p. 66



Closing Day p. 70



Opportunities for Exchange and Dialogue p. 74



Associated Programmes p. 80



Communications p. 86

THE 61ST MEETING OF NOBEL LAUREATES

Participants

At the 61st Lindau Meeting of Nobel Laureates, 23 Nobel Laureates from the fields of physiology or medicine and chemistry met 566 Young Scientists from 78 countries. This was by far the most international Lindau Meeting ever. Almost 190 academies of science, research institutions and universities from around the world nominated the up-and-coming scientists, with the number of initial applications by Young Researchers reaching over 20,000. In 2011, the 61st Lindau Nobel Laureate Meeting was once again a hotspot for cross-generational dialogue between scientists—a forum where science serves as a common language for the discussion of issues of global significance beyond nationalities, gender, religions and cultures.



Nobel Laureate Ferid Murad and Young Researchers during one of the coffee breaks at the meeting.



61st Meeting of Nobel Laureates Participating Nobel Laureates



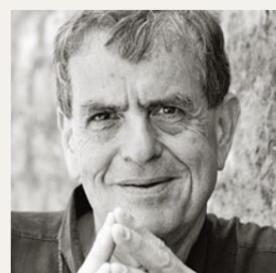
Peter C. Agre
USA
Chemistry, 2003



Werner Arber
Switzerland
Physiology or Medicine, 1978



Elizabeth H. Blackburn
Australia/USA
Physiology or Medicine, 2009



Aaron Ciechanover
Israel
Chemistry, 2004



Médecins Sans Frontières
Switzerland
Peace, 1999



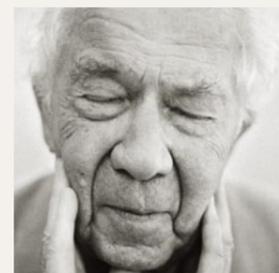
Hartmut Michel
Germany
Chemistry, 1988



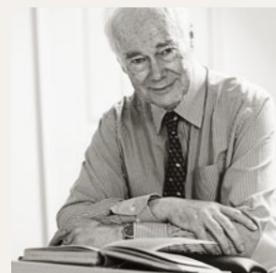
Ferid Murad
USA
Physiology or Medicine, 1998



Ei-ichi Negishi
Japan
Chemistry, 2010



Christian de Duve
Belgium
Physiology or Medicine, 1974



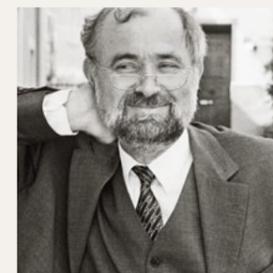
Sir Martin J. Evans
United Kingdom
Physiology or Medicine, 2007



Edmond H. Fischer
USA
Physiology or Medicine, 1992



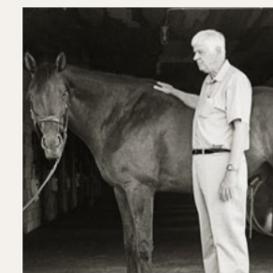
Harald zur Hausen
Germany
Physiology or Medicine, 2008



Erwin Neher
Germany
Physiology or Medicine, 1991



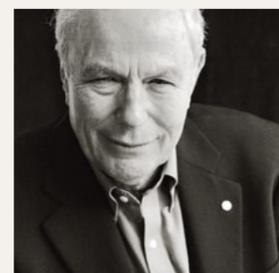
Bert Sakmann
Germany
Physiology or Medicine, 1991



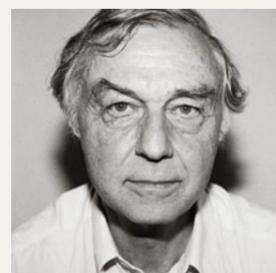
Hamilton O. Smith
USA
Physiology or Medicine, 1978



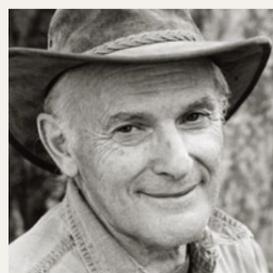
Oliver Smithies
United Kingdom/USA
Physiology or Medicine, 2007



Avram Hershko
Israel
Chemistry, 2004



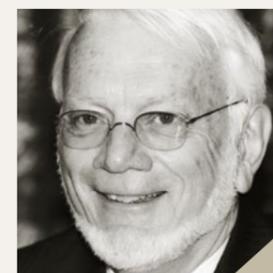
Robert Huber
Germany
Chemistry, 1988



Sir Harold W. Kroto
United Kingdom
Chemistry, 1996



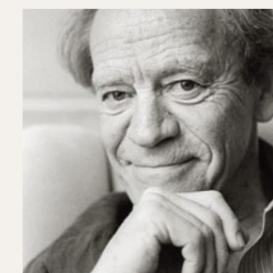
Jean-Marie Lehn
France
Chemistry, 1987



Thomas A. Steitz
USA
Chemistry, 2009



Roger Y. Tsien
USA
Chemistry, 2008



Torsten N. Wiesel
Sweden
Physiology or Medicine, 1981



Ada E. Yonath
Israel
Chemistry, 2009

▲ Nobel Laureates who took part for the first time in the Lindau Meetings.

Up-and-coming Scientists and Academic Partners

Approximately 500 to 600 Young Scientists are invited to participate in each Nobel Laureate Meeting. They are selected by the review panel of the Council in cooperation with nearly 190 Academic Partners in an international selection process involving academies of science, ministries, foundations as well as top-ranking research institutions and universities from around the world. Students, PhD students and Postdocs who have distinguished themselves through outstanding achievements in their fields are eligible to apply for participation, at the recommendation of internationally recognised scientific institutions.

As the first step, Young Scientists submit their application to one of these partners. Based on the selection criteria formulated by the Council for each meeting (see page 14), the Academic Partners carry out a preliminary evaluation, which is then forwarded to the review panel of the Council. Initially, more than 20,000 Young Scientists apply to attend each Lindau Meeting. With the help of the Academic Partners, this number is narrowed down to around 2,000 applicants, and these are submitted to the review panel. Based on scientific publications, tutorial experience, university grades, recommendations by professors and personal letters of motivation, the members of the review panel select roughly 550 of the most talented applicants to attend the Lindau Meeting. Chairmen of the Council's review panel for the 2011 Lindau Meeting were Professors Hans Jörnvall and Helmut Sies. They were assisted by Nadine Gärber and Julia Schürer in the Executive Secretariat, and also by Andreas Schmidt and Alexandra Wimbauer.

The international network of Academic Partners is continuously expanded, often with support of the the Federal Ministry of Education and Research (BMBF). For instance, a Memorandum of Understanding with Russia was signed in the presence of Federal Minister Annette Schavan during her visit to Moscow in the context of the Russian-German Year of Education, Science and Innovation in 2011/2012. Another Memorandum of Understanding was signed with the Fondazione Cariplo for Italy.



At a special reception for Academic Partners, representatives of Council and Foundation exchanged ideas and opinions with nominating institutions.

Furthermore, a Memorandum of Understanding with the Social Sciences and Humanities Research Council of Canada (SSHRC) was signed for the Economics Meetings. Valuable support in the process of approaching the SSHRC was given by Georg Schütte, State Secretary at the BMBF. A third agreement was signed with the Spanish National Research Council (CSIC). The Memoranda of Understanding serve to express a sense of cooperation, and ensure the participation of highly talented Young Scientists from these countries in the Meetings of Nobel Laureates.

In 2011, female scientists once again made up a significant number of the participants. 260 young female researchers took part in the 61st Lindau Nobel Laureate Meeting. These promising numbers are part of the efforts by the Council and the Foundation in cooperation with the Academic Partners to promote the participation of young women.

The Lindau Meetings are cooperating with "ResearchGATE" to provide an online alumni platform. The community was launched last year. Scientists who have attended one of the Lindau Meetings are invited to join the Lindau Nobel sub-community to connect with their fellow alumni. Thus, the discussions started during the meeting can continue on into the future.

FACTS & FIGURES

Representation by Country



There were 566 Young Researchers from 78 countries making this the most international Lindau Nobel Laureate Meeting ever (last year 68 countries were represented). Gender balance: 46% female, 54% male.

Albania	Egypt	Luxembourg	Slovakia
Argentina	Estonia	Malaysia	Slovenia
Armenia	Finland	Mexico	South Africa
Australia	France	Morocco	Spain
Austria	Georgia	Nepal	Sweden
Azerbaijan	Germany	Netherlands	Switzerland
Bangladesh	Ghana	New Zealand	Syrian Arab Republic
Belgium	Greece	Nigeria	Taiwan
Brazil	Hong Kong	Norway	Thailand
Bulgaria	Hungary	Pakistan	Togo
Cameroon	India	Palestine	Trinidad and Tobago
Canada	Indonesia	Peru	Turkey
Chile	Israel	Poland	Ukraine
China	Italy	Portugal	United Kingdom
Colombia	Japan	Republic of Korea	United States
Costa Rica	Jordan	Romania	Uruguay
Cuba	Kenya	Russian Federation	Vietnam
Czech Republic	Latvia	Saudi Arabia	Zambia
Denmark	Liechtenstein	Serbia	
Ecuador	Lithuania	Singapore	

FACTS & FIGURES

Selection Criteria

566 Young Researchers from around the world were selected to participate in the 61st Lindau Meeting. All engaged in the field of physiology or medicine or related disciplines, they can be grouped as:

- undergraduate students,
- master's and doctoral students, and
- young postdoctoral scientists.

The following standards and criteria serve to select participants from among all applicants. Participants shall

- show a genuine interest in science and research,
- show a strong commitment to their principal field of studies and to interdisciplinary work,
- receive strong support for their application from their academic advisor and/or from internationally renowned scientists, through a detailed letter of recommendation,
- be fluent in English, capable of active participation in discussions,
- be among the top 5 per cent of their class,
- not already have a permanent position (researchers with permanent positions—in particular on the professorial level—will generally not be admitted to the meeting),
- not have participated in previous Lindau Meetings,
- deliver fully completed applications.

Undergraduate students shall

- exhibit a solid general knowledge in the natural sciences and biology/medicine,
- have done some practical work and/or have laboratory experience.

Master's and doctoral students shall

- show excellent academic accomplishments,
- have produced some very good research work.

Postdoctoral scientists shall

- have up to 5 years of postdoctoral experience (should ideally be about 2-3 years after doctoral degree),
- have published results of their own scientific research in peer-reviewed journals, preferably as first author,
- have presented their work at international scientific meetings, preferably as lectures.

Winning a Nobel Prize is a dream for many, but sometimes it seems to be just a dream. Meeting and interacting with the Nobel Laureates and hearing about their work and personal experiences helped me to see them as real people. Beside this, it was also wonderful to meet so many Young Researchers from all over the world. Interdisciplinary work is the basis of research nowadays and at this meeting I had the opportunity to exchange ideas and build networks for the future. The Lindau Nobel Laureate Meeting was an invaluable opportunity of great inspiration for my personal and professional development.

Natalie Izurieta
Germany

FACTS & FIGURES

Academic Partners World-wide



Participants of the "Salzburg Group" meeting, mainly representing Academic Partner countries of the Lindau Nobel Laureate Meetings, and their host, Austria's Science and Research Minister Karlheinz Töchterle, met prior to the opening of the 61st Lindau Meeting.

A*Star (Singapore)	Elite Network of Bavaria
Academy of Finland	Estonian Academy of Sciences
Academy of Sciences (France)	European Commission
Academy of Sciences Malaysia	European Molecular Biology Laboratory (EMBL)
Academy of Sciences of the Czech Republic	European Molecular Biology Organization (EMBO)
Acatech	European Science Foundation
Agència de Gestió d'Ajuts Universitaris i de Recerca (Spain)	Federal Ministry of Education and Research (Austria)
Alexander S. Onassis Public Benefit Foundation	Fondazione Cariplo
Alexander von Humboldt Foundation	Fonds National de la Recherche (Luxembourg)
Association of Southeast Asian Nations (ASEAN)	Fonds National de la Recherche Scientifique (Belgium)
Australian Academy of Sciences	Foundation for Polish Science
Bangladesh Academy of Sciences	Frankfurt University
Bavarian Academy of Sciences and Humanities	Friedrich-Alexander-Universität Erlangen-Nürnberg
Bielefeld University	Friedrich Schiller University Jena
Boehringer Ingelheim	Gerhard C. Starck Stiftung
Charité Berlin	German Academic Exchange Service (DAAD)
Chilean Academy of Science	German Aerospace Center (DLR)
Christian-Albrechts-Universität zu Kiel	German Research Foundation (DFG)
Comstech	GWDG (Germany)
Confederación de Sociedades Científicas de España (COSCE)	Heidelberg University
Danish Agency for Science, Technology & Innovation	Heinrich Heine University Düsseldorf
Department of Energy (USA)	Helmholtz Association
Department of Science and Technology (India)	Hertie Foundation
Deutsche Bundesstiftung Umwelt	Human Frontier Science Program
Deutsche Telekom Stiftung	Humboldt-Universität zu Berlin
Dresden University of Technology	Ilmenau University of Technology
	Industriellenvereinigung Wien >

FACTS & FIGURES

Academic Partners World-wide

Internationale Bodensee-Hochschule (IBH)	The Royal Society (UK)
Jacobs University Bremen	The Scientific and Technological Research Council of Turkey (TÜBİTAK)
Japan Society for the Promotion of Science (JSPS)	Third World Academy of Sciences (TWAS)
Johannes Gutenberg University Mainz	Universidad de la República (Uruguay)
Justus Liebig University Giessen	Universität Leipzig
Karlsruhe Institute of Technology (KIT)	Universität Regensburg
Ladoke Akintola University of Technology	University Duisburg-Essen
Leibniz Association	University Medical Center Freiburg
Lithuanian Academy of Sciences	University of Basel
Lomonosov Moscow State University	University of Bonn
Ludwig-Maximilians-Universität München	University of Cologne
Mars, Incorporated	University of Göttingen
Max Planck Society	University of Hamburg
Microsoft Corporation	University of Latvia
Ministry of Higher Education & Scientific Research (Egypt)	University of Liechtenstein
National Academy of Sciences of Armenia	University of Rostock
National Institute of Health (USA)	University of Tübingen
National Science and Technology Development Agency (Thailand)	University of Würzburg
National Science Council (Taiwan)	University of Yaounde
National Science Foundation (USA)	Weizmann Institute of Science
Natural Sciences and Engineering Research Council of Canada (NSERC)	Wilhelm Sander-Stiftung
Nobel Foundation (Sweden)	Nobel Laureates who nominated
Oak Ridge Associated Universities (ORAU)	Young Researchers in 2011:
Pakistan Science Foundation	Peter C. Agre
Philipps-Universität Marburg	Martin Chalfie
Professor-Rhein-Stiftung	Aaron Ciechanover
Royal Netherlands Academy of Arts and Sciences (KNAW)	Edmond H. Fischer
Ruhr-Universität Bochum	Leeland H. Hartwell
RWE AG	Harald zur Hausen
RWTH Aachen University	Eric R. Kandel
Saarland University	Yuan-Tseh Lee
Siemens AG	Erwin Neher
Sino-German Center for Research Promotion	Andrew V. Schally
Slovenian Academy of Sciences and Arts	Oliver Smithies
Spanish National Research Council (CSIC)	Thomas A. Steitz
Südwestmetall – The Baden-Wuerttemberg Employers' Association of the Metal and Electrical Industry	Roger Y. Tsien
Swiss Federal Institute of Technology Zurich (ETH)	
Technische Universität Dortmund	
Technische Universität München	

FACTS & FIGURES

Results from the Participant Survey, Part I

The Lindau Nobel Laureate Meetings are a platform for the exchange of ideas and knowledge between generations of scientists. Every year, a survey is conducted among the participating Young Researchers in order to evaluate the success of the 'Mission Education'. This year's meeting was characterised by a particularly fruitful exchange between participants. As many as 97% of those polled feel that the meeting has enabled a dialogue with international peers – a new record in the history of the meetings.

In addition, the interdisciplinary character of the meeting is emphasised by the fact that 92% of the Young Researchers enjoyed possibilities for discussion with peers from different disciplines. This is yet another record.

Lastly, the ever-increasing efforts of the Foundation and the Council to communicate scientific multimedia content in the framework of the 'Mission Education' (see page 104) has raised the interest of the Young Researchers in this field: 93% would appreciate such resources.

Has this year's Lindau Nobel Laureate Meeting succeeded in fostering a dialogue...

...between Nobel Laureates and Young Researchers?

Very much	36%	
Rather yes	48%	
Rather no	14%	
Not at all	2%	

...between Young Researchers from different countries?

Very much	73%	
Rather yes	24%	
Rather no	3%	
Not at all	0%	

...between Young Researchers from different disciplines?

Very much	56%	
Rather yes	36%	
Rather no	8%	
Not at all	0%	

...that will influence your scientific career?

Very much	40%	
Rather yes	43%	
Rather no	16%	
Not at all	1%	

...that motivates you?

Very much	73%	
Rather yes	23%	
Rather no	4%	
Not at all	0%	

Are you interested in and would you use...

...a Lindau online community?

Very much	42%	
Rather yes	41%	
Rather no	13%	
Not at all	4%	

...an all-year Lindau blog?

Very much	25%	
Rather yes	36%	
Rather no	32%	
Not at all	7%	

...scientific online videos and multimedia?

Very much	62%	
Rather yes	31%	
Rather no	6%	
Not at all	1%	

...an online platform for scientific discussion?

Very much	44%	
Rather yes	39%	
Rather no	14%	
Not at all	3%	

FACTS & FIGURES

Results from the Participant Survey, Part II

As a matter of course for the Lindau Meetings, great attention was paid to professionally organising the meeting to the convenience of the participating Young Researchers. Three quarters of those polled gave the organisers the highest rating for their overall efforts. The general scientific programme was highly appreciated with 94% rating it good or excellent.

In addition, the approval of the opening ceremony has risen steadily in recent years with 48% of the Young Researchers rating it as excellent (2009: 40%, 2010: 46%). The same is true of other social events like the "Grill & Chill" barbecue, the Bavarian Evening and the boat trip to Mainau Island, which obtained more excellent ratings than at the last meeting. These results reflect the ongoing efforts of the Council and the Foundation to improve the Young Researchers' Lindau experience.

Please rate the following aspects:

Overall organisation

Excellent	75%	<div style="width: 75%;"></div>
Good	22%	<div style="width: 22%;"></div>
Fair	3%	<div style="width: 3%;"></div>
Poor	0%	<div style="width: 0%;"></div>

Information provided before the meeting

Excellent	59%	<div style="width: 59%;"></div>
Good	34%	<div style="width: 34%;"></div>
Fair	7%	<div style="width: 7%;"></div>
Poor	0%	<div style="width: 0%;"></div>

Young Researchers' registration desk

Excellent	71%	<div style="width: 71%;"></div>
Good	26%	<div style="width: 26%;"></div>
Fair	3%	<div style="width: 3%;"></div>
Poor	0%	<div style="width: 0%;"></div>

Internet access at meeting venue

Excellent	31%	<div style="width: 31%;"></div>
Good	21%	<div style="width: 21%;"></div>
Fair	16%	<div style="width: 16%;"></div>
Poor	32%	<div style="width: 32%;"></div>

Scientific programme in general

Excellent	50%	<div style="width: 50%;"></div>
Good	44%	<div style="width: 44%;"></div>
Fair	6%	<div style="width: 6%;"></div>
Poor	0%	<div style="width: 0%;"></div>

Please rate the following social events:

Opening ceremony

Excellent	48%	<div style="width: 48%;"></div>
Good	42%	<div style="width: 42%;"></div>
Fair	8%	<div style="width: 8%;"></div>
Poor	2%	<div style="width: 2%;"></div>

International Day/Get-together evening

Excellent	38%	<div style="width: 38%;"></div>
Good	43%	<div style="width: 43%;"></div>
Fair	15%	<div style="width: 15%;"></div>
Poor	4%	<div style="width: 4%;"></div>

"Grill & Chill" barbecue

Excellent	60%	<div style="width: 60%;"></div>
Good	35%	<div style="width: 35%;"></div>
Fair	5%	<div style="width: 5%;"></div>
Poor	0%	<div style="width: 0%;"></div>

Bavarian Evening

Excellent	49%	<div style="width: 49%;"></div>
Good	41%	<div style="width: 41%;"></div>
Fair	8%	<div style="width: 8%;"></div>
Poor	2%	<div style="width: 2%;"></div>

Boat trip and afternoon on Mainau Island

Excellent	60%	<div style="width: 60%;"></div>
Good	34%	<div style="width: 34%;"></div>
Fair	5%	<div style="width: 5%;"></div>
Poor	1%	<div style="width: 1%;"></div>

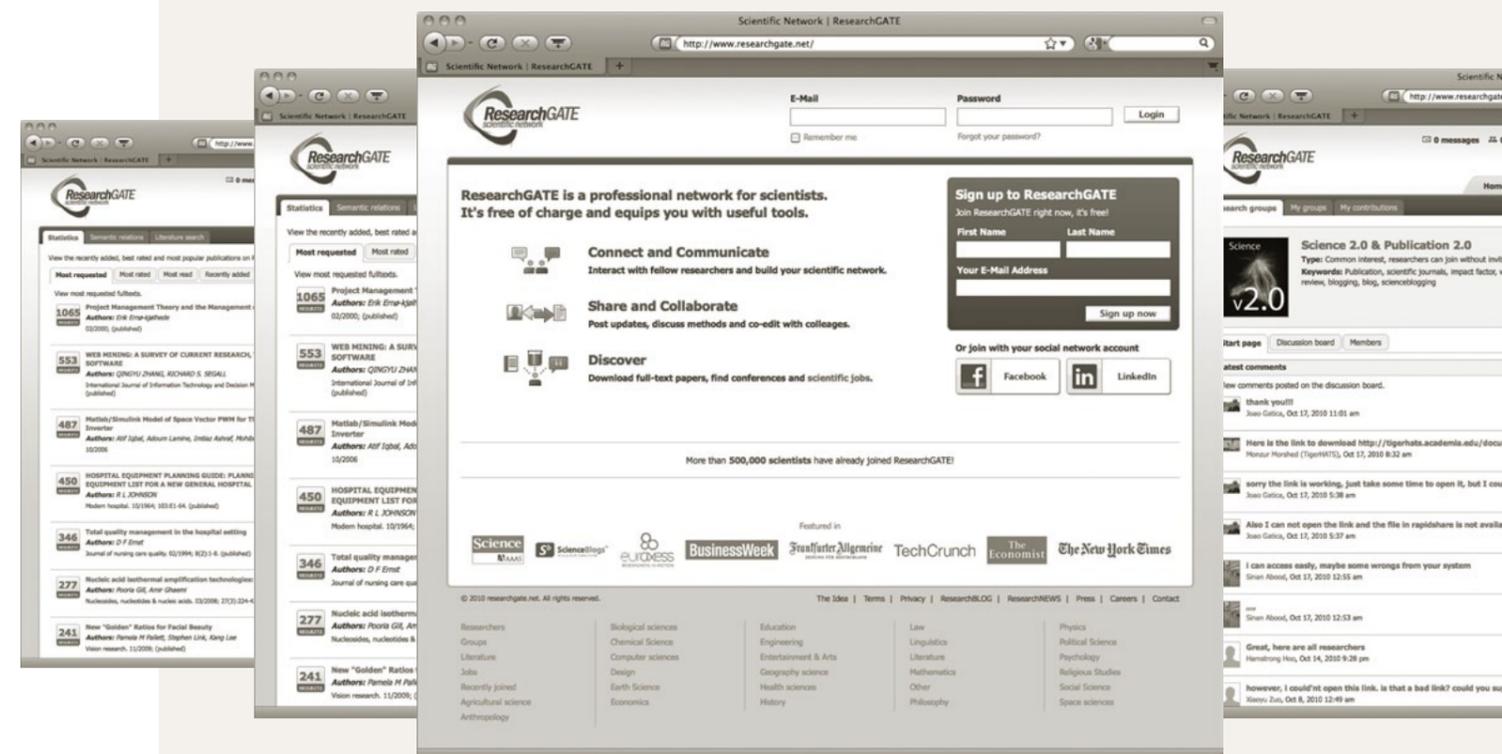
FACTS & FIGURES

The Online Community of the Lindau Meetings at ResearchGATE

Connecting the Lindau community online is a key strategy in the context of the 'Mission Education' of the Council and the Foundation. In order to make even better use of the high potential of the networks forged during the Lindau Meetings, the Council and the Foundation launched an exclusive Lindau community platform on ResearchGATE last year. It combines services such as Facebook, Twitter, LinkedIn, and Google-Docs with scientific databases like PubMed, ArXiv, and IEEE. Currently the community has over 400,000 members world-wide. Scientists who have attended the Lindau Nobel Laureate Meetings are invited to join the Lindau Nobel sub-community to connect with their fellow alumni.

ResearchGATE is a place for interactive collaboration.

Users can work together on documents, share articles, and get advice about experimental techniques here. They can join interest-based groups to trade ideas via discussion boards, share news with microblogs, and swap files, such as presentations, documents and articles, in the file-sharing section.



THE 61ST MEETING OF NOBEL LAUREATES

Opening Day

Countess Bettina Bernadotte, President of the Council for the Lindau Nobel Laureate Meetings, opened the 61st Lindau Meeting and presented the Council's highest recognition award to Hans Jörnvall. At the opening, the Foundation Lindau Nobelprizewinners Meetings at Lake Constance inducted Martin T:son Engstroem and William H. Gates III to its Honorary Senate. One of the principal topics of the meeting—"Global Health"—shaped the opening ceremony in the Inselhalle, and this was the central theme of the closing panel discussion on Mainau Island.



Wolfgang Schürer, Chairman of the Foundation, and Countess Bettina Bernadotte, President of the Council, welcoming William H. Gates III, co-founder of the Bill & Melinda Gates Foundation, to the 61st Lindau Meeting of Nobel Laureates.

Opening Day

The opening day of the 61st Lindau Meeting of the Nobel Laureates was devoted to the exchange between science, the public and the private sectors. In her address, Federal Minister Annette Schavan spoke about how delighted she was that the perception of the meetings is increasing exponentially, particularly in the political realm. The participation of several science and research ministers serves as a testament to the great interest being shown in the exchange with Laureates and Young Scientists: Russian Science Minister Andrei Aleksandrovich Fursenko visited the meeting at the invitation of Federal Minister Schavan as part of the “German-Russian Year of Education, Science and Innovation 2011/12”. Israeli Science Minister Daniel Hershkowitz, too, accepted the invitation.

Austria’s Science and Research Minister Karlheinz Töchterle and some of his guests travelled directly to Lindau after attending the fourth meeting of the “Salzburg Group” in Bregenz. In line with the motto “Setting the Scene for Europe 2020—on the Way to the EU Innovation Union”, he was joined by his counterparts and representatives from Central and Eastern Europe, Malta, Cyprus and Switzerland.

Together with Minister Töchterle and the Austrian Minister of Justice Beatrix Karl, Minister of Science and Higher Education Barbara Kudrycka (Poland), Director-General for Research and Innovation Robert-Jan Smits (European Commission), Director General for Science and Research Jan Hrusak (Czech Republic), Parliamentary Secretary for Consumers, Fair Competition, Local Councils and Public Dialogue Chris Said (Malta), and Georghios Georghiou, Permanent Secretary at the Planning Bureau of the Cypriot Government, engaged in discussions after the opening.



Countess Bettina Bernadotte presenting the Council’s highest award, the Lennart Bernadotte Medal, to Hans Jörnvall.

Lennart Bernadotte Medal for Hans Jörnvall

Countess Bettina Bernadotte, President of the Council for the Lindau Nobel Laureate Meetings, opened the event. In her speech, she highlighted the important role of science in shaping a future based on sustainability and advised the participating Young Scientists to get actively involved in shaping the future. She presented the Council’s highest award, the Lennart Bernadotte Medal, to Hans Jörnvall and thanked the long-standing Council member for his unstinting commitment to the Lindau Meetings. “You have helped steer us through a number of pitfalls and accompanied the meetings for eleven years,” said Countess Bettina Bernadotte.

Göran Hansson, Vice Chairman of the Board of the Nobel Foundation, passed on the best wishes of the Nobel Foundation. He encouraged the Young Scientists to challenge the Laureates during the meeting and to look for opportunities to speak with them. In her welcoming address, Federal Minister Annette Schavan spoke about what the meeting meant for politics: “The sovereignty of science and its incorruptible intellectuality makes it one of the most valuable business partners for politics. The solution to global problems requires scientific expertise and creativity from the scientific elite.” She also conveyed the regards of Federal Chancellor Angela Merkel.

Speakers at the Opening Ceremony



Countess Bettina Bernadotte, President of the Council

“There was a reason we chose “Global Health” as the focus of this year’s meeting. The issues of global health transcend individual perspectives and national borders. In many cases, they are closely interrelated with problems such as poverty or poor education. Poverty and poor education are mutually interdependent, and in almost all cases, they lead to insufficient knowledge, ineffective prevention, inadequate health care and thus to a seriously poor health situation. Many different actions are needed to even come slightly closer to a measurable improvement: We need better access to education. We need better access to medical supplies. And we need continuing research efforts, for example on infectious diseases and epidemics.”



Göran Hansson, Vice Chairman of the Board of the Nobel Foundation

“The Nobel Foundation spends all the interest from its assets on identifying the most important discoveries in science and on rewarding those who have made them with the Nobel Prize. These are, of course, important tasks, and we spend all our money on them. So we do not have much left for other important activities, such as inspiring young people to go into science. It is therefore of the utmost importance that others take up this task and the Lindau Meetings’ Council and Foundation have accepted this challenge in a wonderful way. The Nobel Foundation is grateful for the work you do here at Lindau and we also thank your sponsors who help make this wonderful meeting possible.”



Annette Schavan, Federal Minister of Education and Research:

“Science is fascinating—and a large part of this fascination springs from the meetings here in Lindau. For this reason, I was delighted to support the efforts to combine the evidence of these various encounters in a mediatheque—and to make this information accessible anywhere, anytime, using the resources of the modern media. The coordination efforts have, in the meantime, progressed so that this new joint project can start in the coming year.”



Martin Engström (right), founder and “spiritus rector” of the Verbier Festival & Academy, was inducted into the Honorary Senate of the Foundation.



William H. Gates III receiving the certificate of appointment from Wolfgang Schürer, Chairman of the Foundation.

New Members of the Honorary Senate: Martin Engstroem and William H. Gates III

During the opening ceremony, the Foundation Lindau Nobelprizewinners Meetings at Lake Constance inducted Martin T:son Engstroem and William H. Gates III into the Honorary Senate. They received this honour in recognition of their continuous personal commitment to opening up doors and opportunities for young talented individuals through targeted assistance measures. The Honorary Senate assembles personalities from science, industry and politics and serves as an advisor to the Board of Directors. The Chairman of the Board, Wolfgang Schürer, highlighted the similarities between the two new members: “Both Gentlemen share their dedication to the younger generation in their very own way. Bill and Melinda Gates’ philanthropic endeavours to promote global health and Martin Engstroem’s initiatives for the most promising young musicians have one thing in common: being role models, they serve as an inspiration.”

As founder and “spiritus rector” of the Verbier Festival & Academy, Martin T:son Engstroem set up an international forum for the promotion of talented young people, which has gone on to become one of the most innovative places for music in Europe since 1991. The Nobel Laureate Meet-

ings are to international science what the Verbier Festival & Academy is to the world of music. Knowledge transfer, inspiration and networking describe the common values and aims of both institutions—qualities that have been underlined by the acceptance of Martin T:son Engstroem to the Honorary Senate.

In recent years, William H. Gates III has dedicated a lot of his time to the Bill & Melinda Gates Foundation, which he founded together with his wife Melinda. The foundation focuses on global health and development and on improving the public education system in the US. Through his work for the foundation, he is making a tangible contribution to improving the living and education conditions of people around the world. His work is a source of inspiration for Young Scientists, showing them how science and research can help overcome global challenges. In recognition of these efforts, the Foundation Lindau Nobelprizewinners Meetings at Lake Constance has inducted him into its Honorary Senate. (Overview of all members of the Honorary Senate on p. 124).

New Members of the Honorary Senate



Martin T:son Engstroem, New Member of the Honorary Senate

“The Verbier Festival in Switzerland, which I created some 18 years ago, is bearing the fruit of my experience and of a dream I once had—to gather all this incredible (musical) talent and let talent inspire talent. There is probably no other place in the world which has such a conglomeration of fantastic musical talent. Some have honed their skills, while others are still developing them. Each year, I invite hundreds of such talented individuals to spend between three and six weeks in the mountain village of Verbier to develop their personal skills. We listen to them and follow them on an individual basis, but we also inspire them to work together with other musicians in chamber music. The ability to listen is as important as the ability to express yourself.”



William H. Gates III, New Member of the Honorary Senate

“At this phase of my life, I have the chance to work on health issues, agricultural issues, and on the need for innovation to help the poorest. This is why I am excited to be here. Because whether those innovations are new vaccines for malaria or a new seed that helps farmers with very little farmland to grow not only enough food to feed their family, but enough to afford to send their kids to schools—these type of breakthroughs are the opportunities that all of you Young Scientists will be able to participate in. And as I congratulate you on your progress so far, I ask you to consider the need of the poorest in the work that you do. Because I think advances there will be particularly important and without you paying attention to them it is possible they will not take place.”



As part of the opening ceremony, a panel discussion on challenges for science and research in the area of global health took place. The panellists were William H. Gates III, Sandra Chishimba (Young Researcher from Zambia), moderator Adam Smith, Nobel Laureate Ada E. Yonath and Jonathan Carlson (USA, not in the picture).

Discussion on Global Health

One of the principal themes of the meeting—“Global Health”—shaped the opening ceremony in the Inselhalle. This topic was also the central theme of the closing panel discussion on Mainau Island (more on both discussions on p. 32). While William H. Gates III, Nobel Laureate Ada E. Yonath and the two Young Scientists Sandra Chishimba (Zambia) and Jonathan Carlson (USA) discussed the challenges for science and research in the area of global health at the panel discussion during the opening ceremony, the final discussions on Mainau Island focused on the social and societal consequences of the lack of global health and the connection between wellbeing and health.

Foundation Dinner

Following a tradition, a dinner at the invitation of the Foundation Lindau Nobelprizewinners Meetings at Lake Constance concluded the opening day. Nobel Laureates, Council members and Honorary Senators of the Foundation attended the event along with honorary guests from science, politics and industry for the purpose of informal exchange. Wolfgang Schürer, Chairman of the Board of Directors, used the occasion to extend his sincere thanks to all members of the Foundation's endowment and benefactors of the 'Mission Education' for their support, without which the Nobel Laureate Meeting would not be possible. Daniel Hershkowitz, Israel's Minister of Science and Technology, emphasised that “the language of science is universal”. He went on to say that science and research are the means by which the world can be changed for the better—and the participants of the Nobel Laureate Meeting are testament to this.



Federal Minister Annette Schavan (left) and Nobel Laureate Robert Huber at the reception of the Foundation.



Nobel Laureate Aaron Ciechanover (centre) and Daniel Hershkowitz, Israel's Minister of Science and Technology (right).



William H. Gates III and Nobel Laureate Peter C. Agre before the Foundation Dinner.



Nobel Laureate Harald zur Hausen and the Austrian Minister of Justice Beatrix Karl.



Countess Bettina Bernadotte and Göran Hansson, Vice Chairman of the Board of the Nobel Foundation.



Andreas Büchting, KWS SAAT AG and Britta Seeler-Kreimeyer.



(From left) Sigmar Wittig, Deutsche Telekom Stiftung, and Adam Smith, Nobel Media.



(From left) Ethel-Michele de Villiers zur Hausen, Frank Mars, Catherine de Izarra and Matthias Kleiner, President of the DFG.



(From left) Science Ministers Daniel Hershkowitz (Israel), Barbara Kudrycka (Poland) and Annette Schavan (Germany).



(From left) Margit Hacker, Andreas Kreimeyer, BASF SE and Francis Yeoh, National Research Foundation Singapore.

Elom Kouassivi Aglago Morocco

The 61st Nobel Laureate Meeting was a unique experience for my future career as a researcher. Interacting with those great scientists was really interesting in that they were enthusiastic to share their discoveries, their experiences and especially their vision of the future. I particularly appreciated parallel discussions with Laureates and the trip to Mainau Island where discussions about global health were very constructive for a better and healthier world. The city of Lindau, perfectly surrounded by Lake Constance is a haven of tranquillity. One of the wonders of the meeting is networking with researchers from all over the world; accordingly Lindau is a very important cultural and scientific place. I think that the 61st Nobel Laureate Meeting has achieved the goal of connecting cultures and scientists.

Harald zur Hausen Physiology or Medicine, 2008

The 61st Meeting of the Nobel Prize Laureates in Lindau was a unique experience for all the participants. It has been a superb forum for exchanges between students and the Nobel Laureates. In addition, the large number of students from different countries created a very special atmosphere and an unusual intensive interaction between the students themselves, and the Nobel Laureates as well. I am firmly convinced that this meeting has been a great stimulus for all the participants, and everyone hoped that these meetings will be continued in the future.



THE 61ST MEETING OF NOBEL LAUREATES

The Scientific Programme of the 61st Lindau Meeting of Nobel Laureates

Global health, the medicine of the future and the societal responsibilities of scientists were the focal topics of this year's Lindau Meeting. Many of the Young Scientists came from developing countries where disease is rife—all the more reason, then, to link the meeting for the first time with the theme of "Global Health". Talks related to future medicine covered a wide area of topics, ranging from the specific, computer-aided development of new antibodies to anti-cancer drugs interfering with the cellular protein degradation machinery.

And scientists today are true citizens of the world, as Sir Harold W. Kroto remarked in Lindau. As many crucial issues in society ultimately hinge on scientific discoveries—many of them yet to be made—this global citizenship comes with responsibilities that often reach beyond the scientific community and are of great importance for society as such.

Bloggers on the official meeting blog at www.lindau.nature.com have seen and heard—and wrote about—the focal points of the meeting in the following articles.

The Nobel Laureate Meetings are continuously developing. After a test of the format "Turning the Tables" last year, it was incorporated into the official programme. On the suggestion of Nobel Laureate Roger Y. Tsien, so-called "Science Masterclasses" have been introduced. Bloggers also report on these new formats below.

Nobel Laureate Oliver Smithies during his lecture at the 2011 Lindau Meeting.





William H. Gates III at the panel discussion on “Global Health” during the opening ceremony. He told the audience that ten times more funding is focused on finding a cure for male baldness than on finding a cure for malaria.

Focus: Global Health

566 Young Scientists and 23 Nobel Laureates assembled at Lake Constance to discuss advances in medical research, absorb fresh inspiration and make contacts. With participants from 78 countries, this year’s Lindau Meeting of Nobel Laureates was more international than ever. Many of the Young Scientists came from developing countries where disease is rife—all the more reason, then, to link the meeting for the first time with the theme of “Global Health”. From the opening with a panel discussion on this topic to a range of lectures by Nobel Laureates and a final panel discussion on Mainau Island—global health was one of the central themes of the 61st Meeting of Nobel Laureates.

Panel at the Opening Ceremony

The stellar panel discussion at the opening ceremony included William H. Gates III, the founder of Microsoft and co-founder of the Bill & Melinda Gates Foundation, Nobel Laureate Ada E. Yonath, who won the 2009 Nobel Prize in Chemistry for her groundbreaking crystallography work revealing the structure and function of the

ribosome, and two bright Young Researchers, Sandra Chishimba, a malaria researcher from Zambia, and Jonathan Carlson, who is researching HIV/AIDS at Microsoft Research.

William H. Gates III urged Young Researchers to consider the needs of the poorest people in the world in their work. Threats to global health include HIV/AIDS and malaria, but William H. Gates III said that people in low-income countries do not have their medical needs met by their governments or companies. To put this into perspective, he told the audience that ten times more funding is focused on finding a cure for male baldness than on finding a cure for malaria, which kills 850,000 people a year.

The panel discussed how researchers could be encouraged to focus on studying neglected areas of global health. William H. Gates III said that basic research is really important to find a solution to global health problems in the future. His foundation looks for people who are specialists in various different fields, such as imaging and nanotechnology. Ada E. Yonath suggested a middle way between basic and applied research. She advised that Young Researchers should address a problem which is related to global health, and be persistent in their work.



Sandra Chishimba (Zambia)
Jonathan Carlson (USA)

For Sandra Chishimba, working in applied research is personal. She has previously contracted malaria, as have her family members. She worked on malaria transmission studies at the Macha Research Trust and at the Johns Hopkins Malaria Research Institute, both in Zambia. Sandra Chishimba said that now was the time to prioritise finding a vaccine for malaria. Jonathan Carlson, a computer scientist who studies how HIV adapts to its host, encouraged the scientific community to find a way to share data because the potential impact on global health is vast. If all of the data could be pooled, it might help find new solutions to the HIV/AIDS epidemic. “We have no way to officially merge the data,” Jonathan Carlson said, “It’s a technical problem that is very achievable.”

Peter C. Agre and Harald zur Hausen

Over the next five days, the Young Researchers were given a lot to think about with regard to their responsibility towards global health. At the International Get-Together on Monday night, Nobel Laureate Peter C. Agre gave a speech imploring the Young Researchers to work to eradicate malaria. With pictures, he showed the border between Zimbabwe and Zambia, and said “but there are no borders for malaria”.

Nobel Laureate Harald zur Hausen gave a lecture on the subject of infections in the origins of cancer. He won his Nobel Prize in 2008 for his research confirming that the human papillomavirus causes cervical cancer, the second most frequent cancer in women. There are 530,000 cases a year world-wide, and 80 per cent occur in ‘developing’ countries. Harald zur Hausen said the HPV vaccine could protect close to 100 per cent of previously non-exposed women, and likewise prevented the infection of cervical

precursor lesions. He went so far as to state that high-risk HPV could be completely eliminated in the future if all girls were vaccinated before reaching sexual maturity, and the vaccination of boys would close the circle of infection. Harald zur Hausen then described his current interest in the cause of colorectal cancer. He said that at the moment, 21 per cent of cancers were known to be caused by pathogens. For instance, Hepatitis B, Helicobacter and Schistosoma, which can result in cancer, are caused by bacterial, viral or parasite infections. If a pathogen in beef is the source of colorectal cancer, as he hypothesises it is, then 35 per cent of the world’s cancer cases could be traced back to an infection.

Global Health—Panel on Mainau Island

An impressive panel on global health closed the meeting, after a boat trip to Mainau Island. It began with a presentation by Hans Rosling, Professor of International Health at the Karolinska Institutet in Sweden. He showed an animated graph illustrating the way in which life expectancy and fertility have changed over time for each country. Hans Rosling said that in the 60s, there had been a clear ‘developing’ and ‘developed’ world division, with people in the developing world having big families and short lives, and the opposite for rich countries. But now this trend was reversing for ‘developing’ countries. Hans Rosling also showed an interactive graph displaying life expectancy versus income per capita on its axes. Again, he argued, that it was not possible to discern two strata in the trajectories of development, because some countries were now healthy and lagging behind in GDP, such as China. Hans Rosling said that it was thus more accurate to classify countries according to ‘high income’, ‘middle income’, ‘low income’ and ‘collapsed’.



Hans Rosling, Professor of International Health at the Karolinska Institutet in Sweden, during his presentation on Mainau Island.

The implications of Hans Rosling's analysis were discussed among a distinguished panel that included Nobel Laureate Harald zur Hausen from the German Cancer Research Center, Unni Karunakara, International Director of Médecins Sans Frontières, State Secretary Georg Schütte from the German Federal Ministry of Education and Research, and James Vaupel from the Max Planck Institute for Demographic Research.

James Vaupel: "Economic growth is going to be the real engine for growing health."

One thing that the panellists agreed on was that money was a strong determinant of the health of a country's citizens. James Vaupel said: "Economic growth is going to be the real engine for growing health." Money could be invested in resources such as medicines or services, or in biomedical research. Harald zur Hausen said that money needed to be focused on research in order to bring down the costs of treatments. For instance, the HPV vaccine is \$17 at its lowest price, which is out of reach for poor countries.

Hans Rosling's new classification of countries by income is also important for international relations, such as when considering what kind of assistance is the most appropriate for their economies. He thought that low-income and collapsed countries should be the

beneficiaries of international aid and that treatments should be made cheaper through intensified research." Unni Karunakara highlighted that some low-income countries did not have the capacity to expand their services because of a lack of qualified doctors or infrastructure, even if there had been a greater investment in healthcare as a percentage of GDP. He added: "Once you innovate treatment that people with low levels of education can do, then you can address the capacity problem."

Hans Rosling proposed 'fair trade' with middle-income countries, and said they should benefit from a relaxation of patent laws. He argued that some drugs were cheap enough to produce, such as small molecule therapies. But as they cost a lot to develop, they should be licensed out. Georg Schütte said that wealthy countries could support research to target the neglected diseases that affected poorer countries by creating international research and clinical trial partnerships. Research partnerships in poor countries also keep the intellectual rights where they need to be.

This text was contributed by Christine Ottery who was part of the international conference blog team 2011.

Read her posts at www.lindau.nature.com.



Ada E. Yonath and Thomas A. Steitz won the Nobel Prize in 2009 together with Venki Ramakrishnan for solving the structure of the ribosome.

Focus: Medicine of the Future

Nobel Prizes in the sciences are awarded for outstanding achievements with high impact in their respective fields of research. Often, the benefit of the acknowledged work for society is especially high and often immediate in the case of the Nobel Prize for Physiology or Medicine. Hence, at this year's meeting in Lindau and quite expectedly, several Laureates posed a question in their talks that is of outstanding interest for society: How do current research approaches shape the medicine of the future?

Talks related to future medicine covered a wide area of topics, ranging from the specific, computer-aided development of new antibodies to anti-cancer drugs interfering with the cellular protein degradation machinery. More general aspects were addressed in talks on therapeutic applications of stem cell research and the role preventive vaccination strategies can play in global health.

Structure-based Development of Novel Antibiotics

It is a never-ending race between research and microbes, but yet one of the biggest success stories of science and global health in the last century. Infectious diseases caused by bacteria can be specifically treated with antibiotics, resulting in a dramatic reduction in deaths caused by these illnesses. However, in recent years, the appearance of bacterial strains with multiple resistances against commonly used antibiotics are causing rising concern among clinicians and researchers alike. These emerging resistances in particular make the constant development of new antibiotics a necessity.

Antibiotics have diverse modes of action, all with one common denominator: they specifically target bacteria and leave human cells unharmed. Many medically relevant antibiotics target ribosomes, the cellular machinery for the synthesis of proteins. Ribosomes exist in both bacteria and human cells, however with subtle structural differences, giving rise to the specificity of this group of antibiotics.

Ada E. Yonath and Thomas A. Steitz won the Nobel Prize in 2009 together with Venki Ramakrishnan for solving the structure of the ribosome and for the elucidation of the mechanism of protein synthesis. Their detailed knowledge now enable the targeted modification of existing antibiotics, giving rise to novel, more effective compounds.



(From left to right) Sir Martin J. Evans, Peter C. Agre, Scientific Chairpersons Helmut Sies and Hans Jörnvall, Ferid Murad and Aaron Ciechanover on the panel "Biomedicine: The Future".

The development of new antibiotics, based on a structural and mechanistic knowledge of the ribosome, yet again puts us one step ahead in the race between medicine and pathogenic bacteria.

Protein Degradation Machinery as a Target for Cancer Therapy

Proteins are synthesised at the ribosome, a large part of them get degraded at the so-called proteasome. Candidate proteins for degradation are tagged inside cells by a small molecule called ubiquitin (also a protein) and thereby targeted for the proteasome. A three-step cascade involving so-called ubiquitin conjugating enzymes and ubiquitin ligases mark candidate proteins for degradation by attaching several of those small ubiquitin molecules in a linear chain to specific amino acids in the protein destined for its removal from the cellular protein pool. This signal is then recognised by the proteasome, a large molecular machine, which cuts up the ubiquitin-tagged proteins into its basic components, single amino acids.

The connection of this cellular mechanism for protein removal and cancer therapy is not clear-cut, but becomes obvious when understanding the molecular basis of tumour growth. Common to all cancer types is uncontrolled cell division of transformed tumour cells. The underlying genetic mutations have two main consequences for cells,

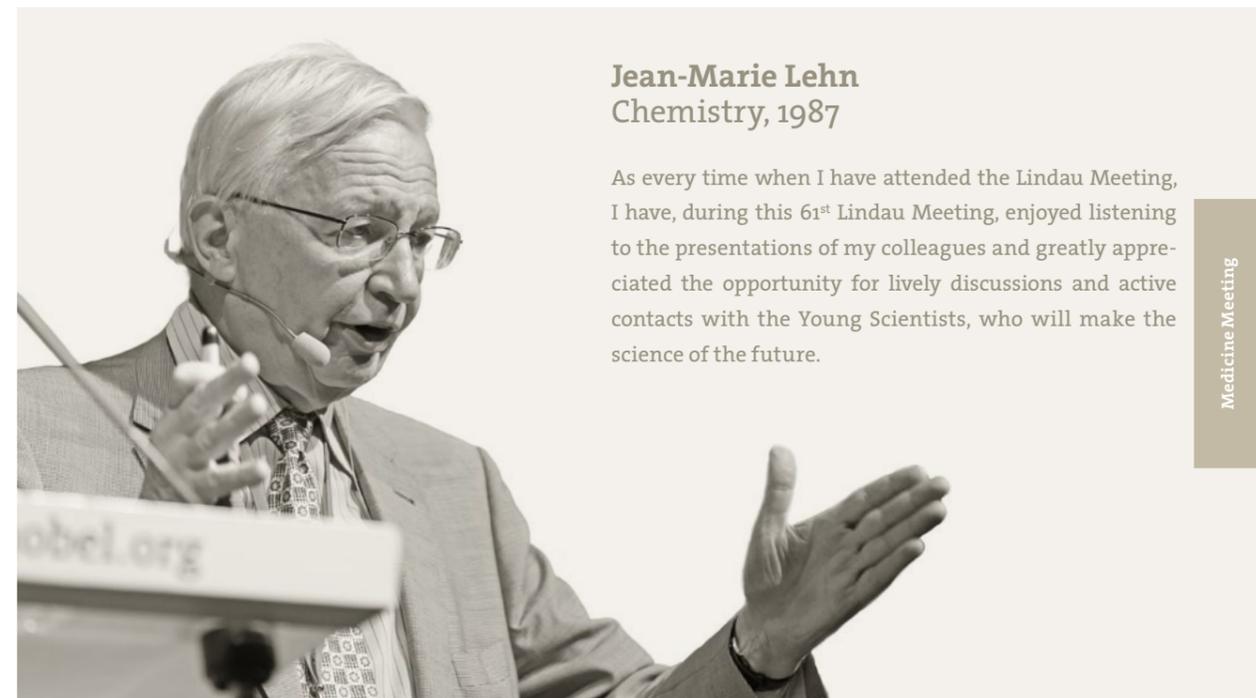
both leading to their unwanted proliferation. Either proteins promoting cell division are not removed efficiently enough, or tumour suppressor proteins get degraded excessively. Both these processes involve ubiquitin and the proteasome.

Avram Hershko and Aaron Ciechanover both exemplified the involvement of the cellular protein degradation machinery in cancer therapy in their talks in Lindau with the same drug: Bortozemib is a proteasome inhibitor which is therapeutically used for treatment of multiple myeloma, a form of bone marrow cancer. The drug acts by stabilising certain cell cycle proteins and by inducing apoptosis, programmed cell death.

The next therapeutic targets of the ubiquitin-proteasome system are also identified. The enzymatic cascade leading to the ubiquitin tagging, especially the specific E3 ubiquitin ligases but also some E2 conjugating enzymes, are considered promising candidates for interfering with cell proliferation in cancer.

Stem Cell-Based Therapies and Disease Prevention by Vaccination

Sir Martin J. Evans, who was the first to cultivate mouse embryonic stem cells in the laboratory, envisaged the use of one's own stem cells for tissue regeneration purposes.



Jean-Marie Lehn Chemistry, 1987

As every time when I have attended the Lindau Meeting, I have, during this 61st Lindau Meeting, enjoyed listening to the presentations of my colleagues and greatly appreciated the opportunity for lively discussions and active contacts with the Young Scientists, who will make the science of the future.

Evans mentioned that stem cells can currently be successfully differentiated into muscle, nerve or skin cells, offering therapeutic applications, such as cell culture-assisted wound healing after severe burns. Increasing knowledge on stem cell reprogramming into specific cell types, as well as the possible storage and use of your own personal stem cells for differentiation in the laboratory may offer nearly unlimited therapeutic possibilities in the future. Damaged body organs may be possible to regenerate using your own cells. The use of this approach can prevent tissue rejection reactions and may enable circumvention of the current necessity to suppress the immune system for successful transplants of organs from foreign donors.

The Future of Personalised Medicine

In this year's Lindau Meeting, Aaron Ciechanover expressed great hope for the future of personalised medicine, an age in which medical treatments are customised and tailored to individual patients based on their specific kind of disease.

In some ways, personalised medicine already exists. Over centuries of medical progress, astute doctors fully recognised the diversity of patients who suffer from what appears to be the same disease. Based on their rudimentary knowledge of disease processes, empirical data and experience, physicians would then prescribe different combinations of medicines for different patients.

But in the absence of detailed knowledge of diseases at the genetic and molecular level, this kind of approach was naturally subjective; it continued to rely on extensive personal experience and ad hoc interpretations of incompletely documented empirical data.

This approach saw a paradigm shift in the latter half of the twentieth century as our knowledge of DNA and genetics revealed to us the rich diversity and uniqueness of individual genomes. Concomitantly, our knowledge of the molecular basis of disease led us to recognise molecular determinants unique to every individual. We are already taking advantage of this knowledge and harnessing it to personalise therapy.

The future of personalised medicine is both highly exciting as well as extremely challenging. There is much promise to be had in mapping the subtle genetic differences that make us react differently to diseases and their cures, but we will also have to be exceedingly careful to not lead ourselves astray with incomplete data, absence of causation and confirmation bias. It is a tough but ultimately rewarding problem which will lead to both fundamental understanding and new medical advances. It deserves our attention in every way.

This text was contributed by Tobias Maier who was part of the international conference blog team 2011.

Read his posts at www.lindau.nature.com.



The panel on “Being a (Responsible) Scientist” with Ei-ichi Negishi, Edmond H. Fischer, moderator Adam Smith, Thomas A. Steitz and Sir Harold W. Kroto provided participants of the meeting with a great opportunity to reflect upon their own status in society and their modus operandi.

Focus: Science and Society

Scientists today are true citizens of the world, as Sir Harold W. Kroto remarked in Lindau. As many crucial issues in society ultimately hinge on scientific discoveries—many of them yet to be made—this global citizenship comes with responsibilities that often reach beyond the scientific community and are of great importance for society as such.

The Lindau Meetings provide scientists with a great opportunity to reflect upon their own status and modus operandi. What does it take to become a good scientist in the first place? What are a scientist’s obligations towards society? And how does one meet these obligations? These issues surfaced frequently during the meeting, in individual lectures and during the student discussions, but most prominently at the panel discussion on ‘Being a (Responsible) Scientist’ with the Nobel Laureates Edmond H. Fischer, Sir Harold W. Kroto, Ei-ichi Negishi and Thomas A. Steitz.

Cooperation and Competition

In a larger context, science is a group endeavour, and the panellists stressed that collaboration, cooperation and a free flow of information are essential—“Science builds on science”, as Fischer put it. And scientists are in clear need

of cooperation: “The amount of information we are getting is so enormous that it is inconceivable that scientists could work alone, just by themselves.” The four Laureates emphasised that it requires expertise from all disciplines in a combined effort to see through the mist of all the apparently unrelated information.

Yet this point also raises the question of competition among scientists, often so hard to escape. Steitz and Negishi recommend embracing a positive kind of competition, where Young Scientists place themselves in surroundings with lots of people “better” than themselves in order to prosper. And prosper they must; the undeniable competition for a limited number of secure academic positions and its influence on the choice of research topics pursued is a very prominent topic among Young Researchers. Although most scientists present deem curiosity-driven research the most desirable ideal, there is always the concern that it is a path one will pay dearly for following. Sir Harold W. Kroto, however, disagrees strongly with such pessimism, and he admonished the audience to follow one’s own path irrespective of the opinion of others.

Basic Research contra Strategic Research

And society strongly depends on scientists following their instincts. Kroto once again drove this point home by citing an example. “Say we have Bill Gates here, and he has quite

a lot of money. And say he had a detached retina, and he would basically spend every penny on being able to see again. How would he spend his money? The obvious thing is to give it to all the top eye surgeons that he can find.” But that, he explained, most likely would not bring him closer to a solution. Because the solution to detached retinas was, in a way, thought up by the physicist Charles Townes, who wanted to build a high-frequency amplifier—which eventually led to the development of the laser. Kroto: “And after laser had been around for 20 years, some smart optician said ‘I can use this for eye surgery’. You’ll never be able to plan how to find that solution.”

As exemplified by the laser that was never ‘invented’ for eye surgery, almost all major breakthroughs come from unexpected fields. This fact—often to the irritation of the public—makes it impossible to predict the next discovery that will bring tremendous benefits for society. “You cannot buy a discovery, at whatever cost. Because you never know when it will come and from where it will come. And that’s the beauty of science,” emphasised Edmond H. Fischer. This fundamental message is probably the most difficult one to convey to the public, to decision makers and funding agencies that are eager to cut funding on basic research that apparently leads “nowhere”. Yet it is precisely this research that is vital in making truly new discoveries.

Getting it Right, Admitting if You’re Wrong

No human enterprise is free of mistakes; and the same applies to science. As hard as it may be, it is absolutely essential for all scientists to admit mistakes and to correct them. “One of our responsibilities as scientists is to get things correct,” said Thomas A. Steitz. There are many common reasons why mistakes are glossed over—politeness, saving face or the desire to avoid a painful confrontation. None of this should ever prevent scientists from pointing out errors—errors of their own or of others.

The panellists reminded the audience that observation is the ultimate judge of any hypothesis. Albert Einstein made this principle into an immortal aphorism, quoted by Edmond H. Fischer: “No experiment will ever prove that I’m right, but one experiment—at any time—can prove that I’m wrong.” Therefore it is not enough to simply propose interesting ideas. As Sir Harold W. Kroto pointed out: “I do not like scientists who put out hypotheses and then let other people try to prove them. If you make a proposal, then it is your responsibility to ensure that it is right.”

Scientists’ responsibility towards their peers is to do the experiments and subsequently describe them as clearly as possible, so that others can build upon their results.

Ultimately, science stands above each individual’s human aspiration to be “right”. Its rigorous premise—that observation is the final arbiter—ensures a special kind of scepticism towards unsubstantiated proposals from all sides. All panellists praised this element of doubt as the finest quality of science; a valuable distrust of one’s own set of beliefs that might also serve as a lesson for society. “If everybody could agree on this premise, if everybody could agree that they might be wrong, this would be the end of fanaticism—political, moral, ethnic, racial, and particularly the end of religious fanaticism,” said Fischer.

Citizen Academics— the Scientist’s Responsibilities

Although not every scientist is apt at assuming political responsibility, science as a whole must take a clear stand on all matters where scientists can offer expertise. This point was particularly stressed during the lectures by Christian de Duve and Sir Harold W. Kroto. Global challenges increase the demand for global discussions among all members of an emerging global society—scientific and non-scientific. For a new generation of Young Scientists, these global discussions were started in Lindau and are sure to continue into the future. However, what to do if parts of society do not want to listen? There is a lesson to be learned from many other social and political movements, which is: Never give up, never let go. Those who persist may eventually succeed—in the lab as well as in history.

This means that the responsibility of science towards society is twofold. One lies in the work itself, the other lies in constantly explaining this work to the rest of the world. Scientists should try to explain the mysteries of nature as best they can—also to alleviate public fears about the unknown. On the same note, Elizabeth H. Blackburn closed this year’s Lindau Meeting with Marie Curie’s optimistic quote: “There is nothing to be feared, only to be understood.”

This text was contributed by Lars Fischer who was part of the international conference blog team 2011 and by Markus Jahnel, participant at the meeting and guest blogger.

Read their posts at www.lindau.nature.com.



Focus: New Formats— “Turning the Tables” and “Science Master- classes”

Last year saw the introduction of a new format at the Lindau Nobel Laureate Meeting—the “Turning the Tables” discussion that returned this year. The idea behind this 90-minute panel is to facilitate a discussion where the Young Scientists themselves can share the stage.

Six PhD students from Nigeria, India, Colombia and the US as well as Nobel Laureates Peter C. Agre, Thomas A. Steitz and Torsten N. Wiesel took part in this year’s session, which was chaired by Scientific American’s Steve Mirsky. The panel was started with the most discussed questions in science—how hard should you be working to be successful? Does being a scientist allow you time for other non-scientific interests? The Young Researchers gave measured answers—most do spend up to 12 hours a day in the lab during the week, and typically pop into the lab at the weekends. But while stressing their commitment to hard work, there was also a sense that they are very aware of the importance of balance and moderation with arguments including the need to work efficiently, not necessarily for longer, and to exercise and stay healthy, too.

The importance of not becoming too blinkered or isolated also came up when Steitz highlighted the value of informal conversations in the scientific process—“Eating lunch alone in your office is bad science.” Referring warmly to his time at the Laboratory for Molecular Biology (LMB) in Cambridge, he noted how the regular tea and lunch breaks provided great opportunities to share ideas with colleagues in the same building. This was in contrast to the experience of one of the students, who described how her department’s efforts to set up a tea club had gradually petered out, with no one taking time to attend regularly. How do you schedule time for spontaneous conversations around often unpredictable experiments?

Not shying away from the big topics, the session ended with a conversation about women in science and whether it is possible to be a successful female scientist and to also raise children. All the male members of the panel were generally positive about the possibility of balancing work and family life, although they did make comments on the need to broker an agreement with one’s partner about how responsibilities would be shared. The female students were more concerned though, questioning how easy it would be to balance passions in two very different areas of one’s life.

This second “Turning the Tables” session was not so much turning the tables on the students as expanding the scientific spotlight to shine further into the sometimes dark corners of scientific life. Being able to discuss the profession openly and critically, regardless of whether a scien-



The “Science Masterclass” goes back to a suggestion by Nobel Laureate Roger Y. Tsien (left) who chose five Young Researchers for presentations and discussions (here with Tom Baden).

tist intends to leave after a PhD or become the next Nobel Laureate, should merit this extra attention.

Science Masterclass: Roger Y. Tsien

This year’s Lindau Meeting also held its inaugural “Science Masterclass”, which was an idea suggested by Nobel Laureate Roger Y. Tsien. The new format offers Young Researchers an intense platform to exchange ideas on their current research with a Nobel Laureate. There were two “Science Masterclasses” in this year’s schedule—one hosted by Roger Y. Tsien and one by Aaron Ciechanover.

A “Masterclass” is, in the original sense, a public lesson given by an excellent musician to help some advanced students to develop their musical ability through suggestions and constructive criticism. Now, Roger Y. Tsien is not a musician, he is a cell biologist—but one could say that he and his idea of a “Science Masterclass” sparked great enthusiasm among the lecturers and listeners: the hall was captured by the rhythm of science.

The five Young Scientists—selected by Roger Y. Tsien—were richly rewarded for their courage in presenting their work. Each had about 10 minutes to present his/her work and, above all, to state the scientific problem they were investigating, the details they wanted to solve and where they encountered setbacks. The “master” then assessed these challenges and looked for solutions for and with the respective “students”.

Tom Baden from the Center for Integrative Neurosciences in Tübingen is using optical methods to investigate activity in the retina and would like to capture the entire transfer of signals from the eye to the retina. There are 20 different types of nerve cells in the retina and he wants to capture the signal transfer for each cell type, thus determining which cell type reacts to which signals and in which form. Calcium or stress measurements are used here, but both of these methods have their pitfalls. To Tom Baden, Roger Y. Tsien said: “This is a technical problem.” The electrophysiological stress measurements always leave the question open about where exactly something happened and the calcium measurements cannot say when. Tsien himself has been trying to measure such signal transfers for the past 39 years and spoke about newly devised measuring methods which should improve measurements like these in his laboratory. Although these methods have not yet been published, Tsien told Tom Baden about them as they may be able to help him.

Tobias Brüggemann from the Institute of Physiology at the Life & Brain Center of the University of Bonn was the next to have the opportunity to present his work. He wants to investigate cardiovascular disease using optogenetic methods and can introduce targeted changes to enable cardiac cells to beat in time with blue light pulses—both in vitro (in a test tube) and in vivo (in a living organism). Roger Y. Tsien initially referred to a special publication—and Tobias Brüggemann replied that he was familiar with this work, but that it did not apply to his working group as it was working with concentrations that were too high. In the end, Tsien and Brüggemann came up with



“Science Masterclass” with Nobel Laureate Aaron Ciechanover.

a few approaches with the audience that Brüggmann may be able to use.

Next up were Natasha Behrendorff from the School of Biomedical Sciences of the University of Queensland (Australia) and Yang Liu, student at the Fudan University (China) and Dongdong Sun from the Fourth Military Medical University (China). It became clear that Roger Y. Tsien had put in a great deal of preparatory work for the Young Scientists and analysed the respective research systems with great precision. He gave each participant qualified advice, questioned results and made suggestions.

Science Masterclass: Aaron Ciechanover

Nobel Laureate Aaron Ciechanover hosted a second “Science Masterclass”: “Human Complex Diseases—From Basic Mechanisms via Social and Economical Considerations and onto a Potential Personalised Cure”. He pre-selected three Young Researchers to present their research:

Lena Burbulla, from the Hertie Institute for Clinical Brain Research in Germany, presented her work on Parkinson’s disease. Previous studies have associated Parkinson’s Disease with mitochondrial damage and oxidative stress. Lena Burbulla aims to find genetic mutations that lead to the expression of mortalin, a protein that binds mitochondria and affects mitochondrial morphology.

Geeta Negi, from the National Institute of Pharmaceutical Education and Research in India, presented her work on diabetes mellitus. She seeks to find a cure for diabetic neuropathy.

In addition, previous studies have shown that the transcription factor NF- κ B is activated in a number of neurological conditions, and that many of the inflammatory cascades in the patho-physiology of diabetic neuropathy are related to NF- κ B activation. Geeta Negi aims to find an inhibitor that could block NF- κ B in a given setting, while sparing other physiological conditions.

Avishek Anant, from the National Institute of Immunology in India, presented his work on tuberculosis. Three-quarters of tuberculosis cases occur between the ages of 15 and 54—during people’s most productive years. One of the major problems with tuberculosis is drug resistance. Inhibiting enzymes required for metabolic pathways of *Mycobacterium tuberculosis*—the bacterium responsible for causing tuberculosis—is one strategy to control tuberculosis. Avishek Anant is studying the branched-chain amino acid biosynthetic pathway of *Mycobacterium tuberculosis*.

Aaron Ciechanover said Parkinson’s disease, diabetes mellitus and tuberculosis are epitomes of 21st century diseases, and that human habits are the underlying causes. This was one of the reasons why he chose those three topics. “If we were to approach the problem, we must also know the historical, cultural, ethical and financial backgrounds behind the problem,” he concluded. Aaron Ciechanover wrapped up this “Science Masterclass” by saying that medicine is there to cure and heal problems, but medicine does not solve the whole problem.

This text was contributed by Lou Woodley and Felix Cheung who were part of the international conference blog team 2011.

Read their posts at www.lindau.nature.com.

Scientific Chairs



Hans Jörnvall (Member of the Council)

Hans Jörnvall is a Professor of Physiological Chemistry at Karolinska Institutet, where he was Chairman of the Department of Medical Biochemistry and Biophysics from 1993 to 1999. Since 2000, he has been Secretary of the Nobel Assembly at Karolinska Institutet. Professor Jörnvall has been a member of the Council for the Lindau Nobel Laureate Meetings since 1999.



Helmut Sies (Vice President of the Council)

Professor Sies was Chairman of the Institute for Biochemistry and Molecular Biology I at the Heinrich Heine University Düsseldorf from 1979. Professor Sies was the President of the North Rhine-Westphalian Academy of Sciences (2002-2005). He has been a member of the Council for the Lindau Nobel Laureate Meetings since 2005 and Vice President since 2009. As a student he took part in the Meeting of Nobel Laureates in 1963.

FACTS & FIGURES

Scientific Programme of the 61st Lindau Nobel Laureate MeetingMonday, 27th June

- 07.15 **International Breakfast**
One World One Health/supported by the USA
- 09.00 **Plenary Lecture**
Elizabeth H. Blackburn—Telomeres and Telomerase in Human Health and Disease
- 09.30 **Plenary Lecture**
Oliver Smithies—A Toolmaker's Story
- 10.00 **Plenary Lecture**
Harald zur Hausen—Infections in the Etiology of Human Cancers
- 10.30 Coffee Break
- 11.00 **Plenary Lecture**
Erwin Neher—Signals and Signaling Mechanisms in the Central Nervous System
- 11.30 **Plenary Lecture**
Ada E. Yonath—Climbing the Everest Beyond the Everest
- 12.00 **Plenary Lecture**
Hamilton O. Smith—Synthetic Genomics: Working with Whole Bacterial Genomes
- 12.30 Lunch Break
- 15.00 **Parallel Discussion Session**
Elizabeth H. Blackburn, Oliver Smithies, Harald zur Hausen, Erwin Neher, Ada E. Yonath, Hamilton O. Smith, Torsten N. Wiesel (What Fosters Excellence in Science?)

Tuesday, 28th June

- 07.15 **Science Breakfast**
Productive Partnerships: Considering the Part Played by Cross-Sector Collaboration in Driving Innovative Science from Bench to Everyday Life/supported by Mars, Incorporated
- 09.00 **Plenary Lecture**
Peter C. Agre—Aquaporin Water Channels: From Atomic Structure to Malaria
- 09.30 **Plenary Lecture**
Sir Harold W. Kroto—Créativité Sans Frontières

- 10.00 **Plenary Lecture**
Ei-ichi Negishi—Magical Power of d-Block Transition Metals: Past, Present and Future
- 10.30 Coffee Break
- 11.00 **Plenary Lecture**
Werner Arber—Updated Notions on Darwinian Evolution
- 11.30 **Plenary Lecture**
Jean-Marie Lehn—From Supramolecular Chemistry towards Adaptive Chemistry
- 12.00 **Plenary Panel Discussion**
Biomedicine: The Future with Peter C. Agre, Aaron Ciechanover, Sir Martin J. Evans, Ferid Murad. Chairpersons: Hans Jörnvall, Helmut Sies
- 13.15 Lunch Break
- 15.00 **Parallel Discussion Session**
Peter C. Agre, Sir Harold W. Kroto, Ei-ichi Negishi, Werner Arber, Jean-Marie Lehn
- 15.00 **Lecture & Discussion Session**
Edmond H. Fischer—Protein Cross Talk during Cell Signaling
- 15.00 **Science Masterclass Session**
Science Masterclass with Aaron Ciechanover Human Complex Diseases—From Basic Mechanisms via Social and Economical Considerations and onto a Potential Personalised Cure

Wednesday, 29th June

- 07.15 **Science Breakfast**
Personalised Medicine/supported by the Council for the Lindau Nobel Laureate Meetings
- 09.00 **Plenary Lecture**
Roger Y. Tsien—Engineering Molecules for Fun, Profit, and Clinical Relevance
- 09.30 **Plenary Lecture**
Sir Martin J. Evans—The Lability of the Differentiated State
- 10.00 **Plenary Lecture**
Avram Hershko—Roles of the Ubiquitin System in Health and Disease

- 10.30 Coffee Break
- 11.00 **Plenary Lecture**
Aaron Ciechanover—The Ubiquitin Proteolytic System as a Novel Drug Development Platform
- 11.30 **Plenary Lecture**
Bert Sakmann—Cortical Column—If You Don't Understand The Function, Do The Structure
- 12.00 **Plenary Lecture**
Hartmut Michel—Proton Pumping by Cytochrome c Oxidases
- 12.30 **Plenary Lecture**
Ferid Murad—Discovery of Nitric Oxide and Cyclic GMP in Cell Signaling and their Role in Drug Development
- 13.00 Lunch Break
- 15.00 **Parallel Discussion Session**
Sir Martin J. Evans, Avram Hershko, Aaron Ciechanover, Bert Sakmann, Hartmut Michel, Ferid Murad
- 15.00 **Science Masterclass Session**
Science Masterclass with Roger Y. Tsien
- 15.00 **Plenary Discussion Session**
Turning the Tables with Laureates and Young Researchers
Chairperson: Steve Mirsky (Scientific American)
- 16.30 Break
- 17.00 **Information Session**
Research Career Opportunities in Europe offered by the European Commission

Thursday, 30th June

- 07.15 **Science Breakfast**
Cancer: A Grand Challenge for Biomedical Research/supported by the German Cancer Research Center (DKFZ)
- 09.00 **Plenary Lecture**
Thomas A. Steitz—From the Structure of the Ribosome to the Design of New Antibiotics
- 10.00 **Plenary Lecture**
Robert Huber—Proteasome and HtrA/DegP Proteases, Structures, Mechanisms, and Drug Design

- 10.30 Coffee Break
- 11.00 **Plenary Lecture**
Christian de Duve—The Future of Life
- 11.30 **Plenary Panel Discussion**
Being a (Responsible) Scientist—with Sir Harold W. Kroto, Edmond H. Fischer, Thomas A. Steitz. Chairperson: Adam Smith (Nobel Media AB)
- 12.45 Lunch Break
- 15.00 **Parallel Discussion Session**
Christian de Duve, Robert Huber, Ei-ichi Negishi, Thomas A. Steitz

Friday, 1st July

- 07.15 **Boat Trip to Mainau Island**
upon invitation of the State of Baden-Württemberg
- 11.00 **Plenary Panel Discussion**
Global Health
Harald zur Hausen (DKFZ), Unni Karunakara (Médecins Sans Frontières), Hans Rosling (Karolinska Institutet), James W. Vaupel (Max Planck Institute for Demographic Research), Chairperson: Geoffrey Carr (The Economist)
- 13.00 Lunch Break
- 13.15 **Exhibition "Discoveries 2011: Health"**
- 16.00 **Conclusion and Farewell**
Countess Bettina Bernadotte
Laureates & Young Researchers

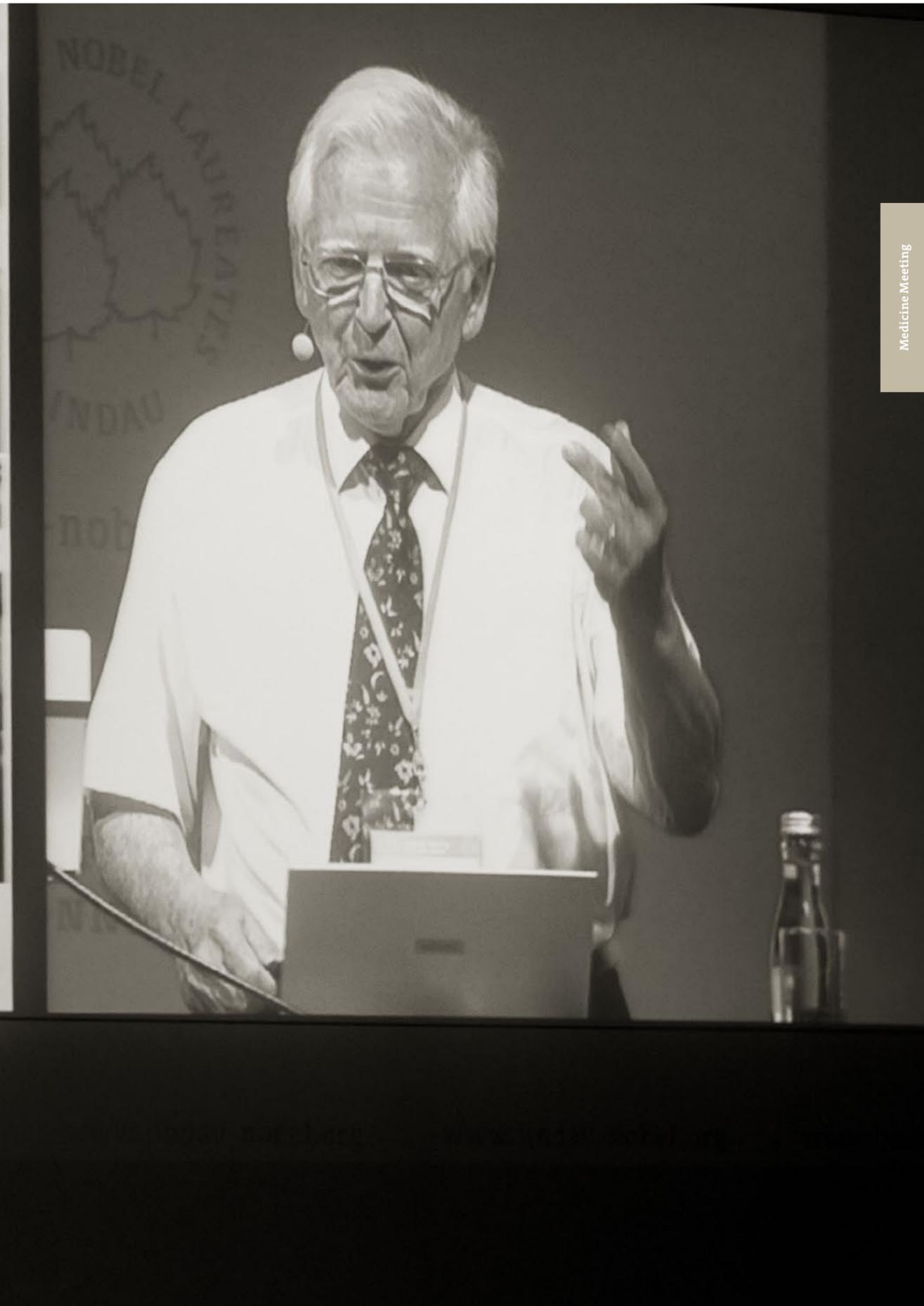
THE 61ST MEETING OF NOBEL LAUREATES

Abstracts of Lectures

22 lectures by Nobel Laureates, three panel discussions, two “Science Masterclasses”, the “Turning the Table” session and Science Breakfasts every morning—it was a packed programme for participants of the Lindau Meeting. On the following pages you will find abstracts of lectures which were provided by Nobel Laureates. Most of the lectures are available online at www.mediatheque.lindau-nobel.org.



Nobel Laureate Harald zur Hausen during his lecture at the 61st Lindau Meeting of Nobel Laureates.





Peter C. Agre:
**Aquaporin Water Channels:
 From Atomic Structure to
 Malaria**
 Available Online*

Peter C. Agre:

Aquaporin Water Channels: From Atomic Structure to Malaria

The aquaporin water channel proteins confer high water permeability to biological membranes. Discovered in human red cells, AQP1 has been thoroughly characterized biophysically, and the atomic structure of AQP1 has been elucidated. Twelve homologous proteins have been identified in humans. These are selectively permeated by water (aquaporins) or water plus glycerol (aquaglyceroporins). The sites of expression predict the clinical phenotypes. Individuals lacking Colton blood group antigens have mutations in the AQP1 gene. When deprived of water, AQP1-null individuals exhibit a defect in urine concentration and a marked reduction in fluid exchange from lung capillaries. AQP1 is expressed in multiple tissues where physiologically important fluid secretion is known to occur including cerebrospinal fluid in brain and aqueous humor in eye. AQP2 is expressed in renal collecting duct principal cells where membrane trafficking is regulated by vasopressin. Mutations in the human AQP2 gene result in nephrogenic diabetes insipidus, but too little AQP2 expression is found in clinical disorders of urinary concentration, such as lithium therapy and bed wetting. Too much AQP2 expression is found in disorders of fluid retention, such as congestive heart failure and pregnancy. AQP0 is expressed in lens fiber cells and mutations result in familial cataracts. AQP5 is expressed in the apical membranes of salivary and lacrimal glands and sweat glands, and mistargetting may occur in some patients with Sjogren's syndrome. Aquaporins have been implicated in other human clinical disorders such as brain edema, epilepsy, neuromyelitis optica (AQP4), anhidrosis (AQP5) renal tubular acidosis (AQP6). Aquaglyceroporins have been implicated in malaria, skin hydration (AQP3), glucose homeostasis during starvation and protection against arsenic poisoning (AQP7 and AQP9). Aquaporins are known to protect micro-organisms from freezing and osmotic shock. Plant aquaporins are involved in numerous processes including the uptake of water by rootlets and carbon dioxide by leaves. The physiological roles of aquaporin homologs are being pursued by multiple laboratories worldwide.



Werner Arber:
**Updated Notions on
 Darwinian Evolution**
 Available Online

Werner Arber:

Updated Notions on Darwinian Evolution

Charles Darwin had based his theory of biological evolution on the observation that phenotypic variants of a given species can sometimes overgrow their parental population, and had attributed this to selective advantage, i.e. to the impact of natural selection. It later became obvious that stable, inheritable, phenotypic variants are spontaneous mutants with altered DNA sequences. Since a few decades ago, one has been able to explore the molecular mechanisms which generate genetic variants. Interestingly, many kinds of specific molecular mechanisms contribute to the overall generation of genetic variants. These mechanisms can be classified into three natural strategies of genetic variation: (1) Local changes in the nucleotide sequence, (2) intragenomic rearrangement of DNA segments, and (3) acquisition of a foreign DNA segment by horizontal gene transfer. These investigations revealed that a number of specific gene products acting as variation generators and/or as modulators of the rates of genetic variation are at work together with non-genetic elements, such as intrinsic physico-chemical properties of molecules, random encounter and environmental mutagens. In conclusion: Natural reality actively takes care of biological evolution. Philosophical and practical aspects of this acquired knowledge will be discussed.



Elizabeth H. Blackburn:
**Telomeres and Telomerase
 in Human Health and
 Disease**
 Available Online

Elizabeth H. Blackburn

Telomeres and Telomerase in Human Health and Disease

Telomeres are the protective tips that stabilize the ends of chromosomes. The function of telomeres is to allow cells to divide while holding the genetic material intact. Telomeres contain specialized, simple repetitive DNA sequences that, together with their specifically-bound proteins, protect chromosome ends from damage. Every time cells divide, unless a process of telomere elongation intervenes, telomeres become shorter and shorter until, eventually, the cells die. Thus a telomere is analogous to

a “fuse” whose length determines the lifespan of cells—when the telomere “fuse” in cells becomes too short, either loss of cell replenishment capability or genomic instability (with the concomitant risk of the cell becoming cancerous) can result.

The telomere shortening process can be slowed, prevented or even reversed by the ribonucleoprotein enzyme telomerase. Telomerase rebuilds back the telomeres by adding telomeric DNA to them. By recognizing a worn-down telomere in a cell and elongating it by telomeric DNA addition, telomerase thus can effectively turn back the hands of the ticking clock that would otherwise be counting down the time to when the telomeric “fuse” will become too short and detonate. The degree of telomerase action therefore is a key factor in counteracting telomere shortening.

Telomerase is found in various human cell types. It is a unique reverse transcriptase because although, like the well-known retroviral reverse transcriptases, it has a catalytic protein, telomerase is a ribonucleic acid complex containing an essential, dedicated RNA as well as protein subunits. The RNA of telomerase contains a short sequence that is copied into the telomeric DNA, and in addition, this RNA also has evolutionarily conserved structures that are crucial to the enzymatic reaction of telomerase.

In humans, telomerase is often over-activated in malignant cancer cells, contributing to their uncontrolled growth. However, throughout human life, the telomerase in normal cells may become insufficient, because telomeres often wear down in cells, and telomere shortening in normal cells in the human body has been linked to diseases that increase with aging. In fact, through many clinical studies, telomere shortness has emerged as a potential marker for biological aging, because telomere shortness is associated with the major diseases of aging—including cardiovascular disease, cancer, diabetes, diseases of poor tissue replenishment and diseases of poor immune function, inflammation—and a higher risk of mortality. The insights gained from the research on telomere biology are not so much related to people living longer than normal, but rather, relate to the goal of living longer in good health—that is, augmenting the so-called “health-span”. “Health-span” can be contrasted with the term “lifespan”,

*Available Online: corresponding lecture available at www.mediathèque.lindau-nobel.org



Aaron Ciechanover:
The Ubiquitin Proteolytic System as a Novel Drug Development Platform
 Available Online

which only tells one how many years a person lives, but does not give information about the quality of life and health during the years a person is alive. Therefore, an important challenge is the application of this growing knowledge of telomeres and telomerase to forestalling some common diseases and improving human health.

Aaron Ciechanover:
The Ubiquitin Proteolytic System as a Novel Drug Development Platform

Between the 50s and 80s, most studies in biomedicine focused on the central dogma—the translation of the information coded by DNA to RNA and proteins. Protein degradation was a neglected area, considered to be a non-specific, dead-end process. While it was known that proteins do turn over, the high specificity of the process—where distinct proteins are degraded only at certain time points, or when they are not needed any more, or following denaturation/misfolding when their normal and active counterparts are spared—was not appreciated. The discovery of the lysosome by Christian de Duve did not significantly change this view, as it was clear that this organelle is involved mostly in the degradation of extracellular proteins, and their proteases cannot be substrate-specific. The discovery of the complex cascade of the ubiquitin solved the enigma. It is clear now that degradation of cellular proteins is a highly complex, temporally controlled, and tightly regulated process that plays major roles in a variety of basic cellular processes such as cell cycle and differentiation, communication of the cell with the extracellular environment and maintenance of the cellular quality control. With the multitude of substrates targeted and the myriad processes involved, it is not surprising that aberrations in the pathway have been implicated in the pathogenesis of many diseases, certain malignancies and neurodegeneration among them, and that the system has become a major platform for drug targeting.



Christian de Duve:
The Future of Life
 Available Online

Christian de Duve:
The Future of Life

Ever since its first appearance more than 3.5 billion years ago, life has evolved without guiding plan, propelled by: 1) its own intrinsic properties, which, with the help of outside energy, provided the necessary driving force; 2) accidental genetic modifications, which created variation; 3) natural selection, which favored the variant forms best fit to survive and reproduce; and 4) environmental conditions, which set the selection criteria.

An occurrence of crucial importance in this long history has been the genesis of nerve cells, or neurons, in the animal line. This event initiated the progressive development of the brain, culminating, some 200,000 years ago, in the most powerful product of biological evolution: the human brain. This acquisition proved to be a fantastic asset for the species concerned—our species—allowing it to expand its population about one-million-fold since its forebears first arose in the heart of Africa and separated from their Neanderthal relatives, to occupy almost every habitable site of our planet, and to exploit a major part of natural resources for its sole benefit.

This phenomenal evolutionary success, driven by the blind force of natural selection, regardless of late consequences, has generated grave menaces that increasingly endanger the future of life, including human life, on Earth. If natural selection is allowed to remain in charge unchecked, the outcome can only be a severe impoverishment of the living world, leading to growing deprivations, sufferings and conflicts within the human species and ending in its final extinction under conditions that can only be pictured as apocalyptic.

This frightening outcome is not inevitable. Thanks to this very brain that has allowed our success, we can do what no other living species is able to do: look beyond the immediate present, evaluate the effects of future actions, make appropriate decisions, and act accordingly, against natural selection if need be. For this to happen, humanity needs wisdom, a quality that is not included in its genetic endowment and must be acquired epigenetically by education. It is to be hoped that the required guides will come forth—and, especially, be followed, considering that some,

like Jesus, Buddha or Confucius, have already existed—before it is too late.

Bibliography
 C. de Duve. *La Génétique du Péché Originel* (Paris: Odile Jacob, 2009). *Genetics of Original Sin* (New Haven CT: Yale University Press, 2010). *Die Genetik der Ursünde* (Heidelberg: Spektrum Akademischer Verlag, 2011).

Sir Martin J. Evans:
The Lability of the Differentiated State

Many classical studies have shown that cell fates become progressively restricted during development and that this restriction is typically irreversible. This has led to the dogma of the Stability of the Differentiated State: cells cannot typically move from one differentiated state to another. The recent reports of experimental manipulation of cell differentiation and fate by use of transcription factors must lead to a reevaluation of this concept. Retrospectively these results should not surprise us as there are many well-established examples of “trans-differentiation”, both in spontaneous regeneration and in particular experimental situations.

Differentiation is a metastable state and as we start to understand mechanism, simple dogmas prove unhelpful guides.

Edmond H. Fischer:
Protein Cross Talk in Cell Signaling

The main focus of the talk will be on signaling by tyrosine phosphorylation, which has been directly implicated in the regulation of cell growth, differentiation and transformation. External signals coming in the form of mitogenic hormones and growth factors act on transmembrane receptors that are themselves tyrosine kinases. These, in turn, transduce the signals with the help of a variety of adapter or docking proteins that interact with one another in a tinker-toy sort of way, through a diversity of binding domains, thereby initiating different signaling pathways. Some of the properties of these modules will be detailed. The src-homology 2 domain (SH2), in addition to allowing



Harald zur Hausen:
Infections in the Etiology of Human Cancers

Available Online

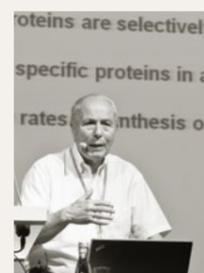
adapter or linker proteins to bind to activated receptors, can also serve as an internal conformational switch to regulate the activity of various enzymes. The PH domain recruits protein to the membrane while the PDZ domain, which is usually found in multiple copies within a protein, serves mainly to cluster ion channels and receptors on the membrane, and bridge them to the cytoskeleton. Transmembrane protein tyrosine phosphatases, which catalyze the reverse reaction, also have a modular structure, often containing immunoglobulin-like and/or fibronectin type III repeats. Surprisingly and contrary to the tyrosine kinase growth factor receptors that respond mainly to circulating ligands, the tyrosine phosphatase receptors display all the hallmarks of cell adhesion molecules. This would suggest that they are involved in, or regulated by, cell-cell or cell-matrix interaction, with the exciting possibility that they might be directly implicated in contact inhibition. Tyrosine phosphatases do not act unidirectionally. They are not merely scavenger enzymes, present only to remove the phosphate groups introduced by the kinases. Under certain circumstances, they can act synergistically with the kinases to enhance a cellular response. Some of the problems that confront us in the field of cell signaling and remain to be solved will be summarized.

Harald zur Hausen:

Infections in the Etiology of Human Cancers

During the past century a number of chemical and physical risk factors for human cancers have been identified. Only relatively recently, mainly during the past 30 years, have infectious agents been identified as important human carcinogens. Besides a larger number of viral infections identified as risk factors for divergent and in part highly prevalent human cancers, also bacteria and parasites play a significant role. The bacterium *Helicobacter pylori* represents a major cause of gastric cancer, parasitic infections cause bladder (*Schistosoma haematobium*) and liver cancers (liver flukes).

Remarkable differences exist in the mechanism of cancer induction between individual potentially carcinogenic infections. Some viruses (high risk papillomaviruses,



Avram Hershko:
Roles of the Ubiquitin System in Health and Disease

Available Online

Epstein-Barr virus, Kaposi' sarcoma virus, Merkel cell polyomavirus and human T-lymphotropic retrovirus) act as direct carcinogens. Here, persistence and expression of specific viral oncogenes are required for the maintenance of the malignant phenotype of the infected cells. Replication incompetence emerges as a major factor for the carcinogenic function of this group of agents. Other infections contribute to malignant transformation indirectly, e.g. human immunodeficiency viruses by immunosuppression, commonly followed by the activation of other latent potentially tumorigenic viruses. Alternatively, induction of chronic inflammations, resulting in the production of oxygen and nitrogen radicals seems to result in random genetic and epigenetic modifications of the host cell genome with the eventual outcome of malignant growth. The number of required genetic or epigenetic modifications in host cell genes seems to determine the long latency periods between primary infection and cancer occurrence, frequently covering several decades. Although we can presently link more than 20% of the global cancer incidence to infectious events, some data will be summarized suggesting a role of infectious agents in additional common human cancers.

References:

H. zur Hausen. *Infections Causing Human Cancer*. Wiley-VCH, Weinheim/New York (Publ.), pp. 1-517, 2006.

H. zur Hausen. The search for infectious agents of human cancers: where and why. *Nobel lecture. Virology*, 392: 1-10, 2009.

Avram Hershko:

Roles of the Ubiquitin System in Health and Disease

The selective degradation of many short-lived proteins in eukaryotic cells is carried out by the ubiquitin-mediated proteolytic system. In this pathway, proteins are targeted for degradation by covalent ligation to ubiquitin, a highly conserved small protein. The ligation of ubiquitin to protein involves the successive action of three types of enzymes: the ubiquitin-activating enzyme E1, a ubiquitin-carrier protein E2 and a ubiquitin-protein ligase, E3. The selectivity and the regulation of the degradation of a specific protein are usually determined by the properties

of its specific ubiquitin ligase (E3) enzyme. We have been studying two ubiquitin ligase complexes that have important roles in different aspects of cell cycle regulation. One is the cyclosome, or Anaphase-Promoting Complex (APC/C), which acts on mitotic cyclins and some other cell cycle regulators in exit from mitosis. The APC/C is activated at the end of mitosis by phosphorylation, a process that allows its further activation by the ancillary protein Cdc20. A different complex, which belongs to the SCF (Skp1-Cullin-F-box protein) family of ubiquitin ligases, is involved in the degradation of p27, a mammalian G1 Cdk inhibitor, following mitogenic stimulation. Its action is triggered by Cdk2-dependent phosphorylation of p27, as well as by the increase in levels of a specific F-box protein, Skp2, that takes place in the G1 to S-phase transition.

Work from other laboratories has shown that ubiquitin-mediated degradation of regulatory proteins is involved in a large variety of basic biological processes including the control of cell proliferation, inflammation and immunity, embryonic development, signal transduction and gene expression. Abnormalities in protein degradation are involved in diseases such as some types of cancer and neurodegenerative disorders. The mode of the involvement of the ubiquitin system in cancer will be discussed in some detail.

References:

Hershko, A. (2005) The ubiquitin system for protein degradation and some of its roles in the control of cell division (Nobel lecture). *Cell Death Differ.* 12, 1191-1197.

Hershko, A. (2009) Some lessons from my work on the biochemistry of the ubiquitin system. *J. Biol. Chem.* 284, 10291-10295.

Hershko, A. (2010) From rabbit reticulocytes to clam oocytes: in search of the system that targets mitotic cyclins for degradation. *Mol. Biol. Cell* 21, 1645-1647.



Robert Huber:
Proteasome and HtrA/DegP
Proteases, Structures, Mech-
anisms, and Drug Design

Available Online

Robert Huber:

Proteasome and HtrA/DegP Proteases, Structures, Mechanisms, and Drug Design

Within cells or subcellular compartments, misfolded and/or short-lived regulatory proteins are degraded by protease machines, cage-forming multi-subunit assemblages, the proteasome and HtrA/DegP. They are essential components in very complex regulatory pathways and interaction networks, the UPS (ubiquitin proteasome system) and the UPR (unfolded protein response), respectively. Their activity is precisely regulated by maturation from inactive precursors and sequestration of their proteolytic active sites within the particles (proteasome) and by activation of latent forms and oligomerization upon signaling by substrate (HtrA/DegP).

Both systems have proven (proteasome) or promise (HtrA/DegP) to be valuable targets for novel therapeutic drugs and antibiotics. The analyses of numerous crystal structures of the proteasome and the HtrA/DegP protein families complexed with ligands in conjunction with functional studies have provided a sound basis of structure-based design and development of many novel chemical entities as potential clinical candidates.

References:

Clausen, T., Kaiser, M., Huber, R. and Ehrmann, M. (2011). HTRA proteases: regulated proteolysis in protein quality control. *Nature Reviews Molecular Cell Biology* 12,152-162.

Gräwert, M. A., Gallastegui, N., Stein, M., Schmidt, B., Kloetzel, P. M., Huber, R. and Groll, M. (2011). Elucidation of the α -keto-aldehyde binding mechanism: A lead structure motif for proteasome inhibition. *Angewandte Chemie Int. Ed.* 50, 542-544.



Sir Harold W. Kroto:
Créativité Sans Frontières

Available Online



Jean-Marie Lehn:
From Supramolecular
Chemistry Towards Adaptive
Chemistry

Available Online

Sir Harold W. Kroto:

Créativité Sans Frontières

Children are not the only ones who instinctively appreciate the elegant beauty of highly symmetric structures such as the soccer ball and “play” with them. Artists, architects, scientists, mathematicians and engineers are also fascinated by elegant structures and use them in their creative efforts. Leonardo da Vinci drew the magnificent image Leonardo da Vinci drew magnificent images and Buckminster Fuller designed geodesic domes.

When C_{60} Buckminsterfullerene was discovered it was its elegant symmetry that captured the imagination of scientists and non-scientists alike. More subtle yet no less cathartic responses are engendered in the minds of people who possess the fluency to appreciate not only the beauty of mathematical symbols but also the intricate elegance of their operations as well as their value in applications. Like Nicole, a physics grad student (and Lindau participant in 2010), who writes: My tattoo is the Taylor expansion of sine. I consider it the most beautiful thing I have ever learned. I got the tattoo after my freshman year at MIT. It has additional meaning to me since $\sin(x) \sim x$ is one of the most useful things in physics.

Indeed mathematics, in particular symbolic algebra, is arguably our most treasured intellectual creation, as mankind finally realised that it was the language in which the Universe speaks and reveals its deepest and most spiritually moving secrets.

The presentation will explore some of the common aspects of the creative response—sans frontières—from an appreciation of the forms discovered by scientists and readily appreciated visually to the mathematical forms created by humans as well as the elegant creations of artists through which they explore the human condition.

However something new has just entered the equation—the Internet—and it is arguable that it has catalysed more human creativity than any invention since the printing press as individuals are now able to broadcast on every topic imaginable and in particular use the GooYouWiki World to help to improve education globally.

It is a fascinating and thought-provoking fact that it is the appreciation of patterns both simple and complex that abound in the physical and natural world as well as

in mankind’s symbolic and artistic creations that, when combined with human curiosity, have driven advances in understanding at every level and changed every aspect of the modern world.

Jean-Marie Lehn:

**From Supramolecular Chemistry
Towards Adaptive Chemistry**

Supramolecular chemistry lies beyond molecular chemistry. It aims at implementing highly complex chemical systems from molecular components held together by non-covalent intermolecular forces and effecting molecular recognition, catalysis and transport processes. A further step consists in the design of systems undergoing self-organization, i.e. systems capable of spontaneously generating well-defined functional supramolecular architectures by self-assembly from their components, thus behaving as programmed chemical systems.

Supramolecular chemistry is intrinsically a dynamic chemistry in view of the lability of the interactions connecting the molecular components of a supramolecular entity and the resulting ability of supramolecular species to exchange their components. The same holds for molecular chemistry when the molecular entity contains covalent bonds that may form and break reversibly, so as to allow a continuous change in constitution by reorganization and exchange of building blocks. These features define a Constitutional Dynamic Chemistry (CDC) on both the molecular and supramolecular levels.

CDC takes advantage of dynamic constitutional diversity to allow for variation and selection in response to either internal or external factors to achieve adaptation.

The implementation of selection in chemistry introduces a fundamental change in outlook with respect to the usual molecular chemistry. The combination of dynamics and reversibility with constitutional and structural diversity points towards the emergence of Adaptive and Evolutionary Chemistry.

Illustrations from applications of this approach to biochemical systems will be given.



Hartmut Michel:
Proton Pumping by Cytochrome c Oxidases

Hartmut Michel:

Proton Pumping by Cytochrome c Oxidases

In biology, membranes are barriers for the transport of ions and polar substances. They are even electric insulators. These properties are exploited by the living cells for signal propagation in neurons and for energy transduction. For energy transduction nature uses mitochondrial and bacterial membranes by building up electric voltages (potentials) and ion gradients. Most of the energy used by the human body is made available by the respiratory chain in mitochondria in the form of the universal biological energy carrier adenosine-5'-triphosphate ("ATP"). The mitochondrial respiratory chain contains four electron transferring complexes, the last one in the chain being cytochrome c oxidase. This enzyme transfers electrons from cytochrome c onto oxygen and consumes protons to form water as a product. This reaction creates an electric voltage and a pH difference across the membrane, because cytochrome c delivers its electrons from the outer surface of the membrane whereas the protons originate from the inner surface of the mitochondria or bacteria. In addition, the enzyme translocates ("pumps") four protons from the inner to the outer surface per reaction cycle enhancing both the electric voltage and pH difference. This so-called "electrochemical proton gradient" drives protons back via the ATP-synthase leading to the synthesis of the ATP from adenosine-5'-diphosphate ("ADP") and inorganic phosphate. The reaction catalysed by the cytochrome c oxidase is understood insufficiently and the subject of controversial discussions. The active site of the enzyme, where oxygen is reduced and water is formed, consists of a heme-iron and a copper atom. It is located in the centre of the membrane. There are proton transfer pathways in the enzyme which allow and control the access of protons, required for water formation, to the active site. One of these pathways is also used for protons to be pumped. However, it is e.g. unclear which chemical entity is bound in the active site when the enzyme is in its oxidized form. Evidence will be presented that the oxidized form is a peroxide dianion, the classical cycle may have to be revised completely.



Ferid Murad:
Discovery of Nitric Oxide and Cyclic GMP in Cell Signalling and their Role in Drug Development
Available Online

Ferid Murad:

Discovery of Nitric Oxide and Cyclic GMP in Cell Signalling and their Role in Drug Development

The role of nitric oxide in cellular signaling in the past three decades has become one of the most rapidly growing areas in biology. Nitric oxide is a gas and a free radical with an unshared electron that can regulate an ever-growing list of biological processes. Nitric oxide is formed from L-arginine by a family of enzymes called nitric oxide synthases. These enzymes have a complex requirement for a number of cofactors and regulators including NADPH, tetrahydrobiopterin, flavins, calmodulin and heme. The enzymes are present in most cells and tissues. In many instances, nitric oxide mediates its biological effects by activating the soluble isoform of guanylyl cyclase and increasing cyclic GMP synthesis from GTP. Cyclic GMP, in turn, can activate cyclic GMP-dependent protein kinase (PKG) and can cause smooth muscles and blood vessels to relax, decrease platelet aggregation, alter neuron function, etc. These effects can decrease blood pressure, increase blood flow to tissues, alter memory and behavior, decrease blood clotting, etc. The list of effects of nitric oxide that are independent of cyclic GMP formation is also growing at a rapid rate. For example, nitric oxide can interact with transition metals such as iron, thiol groups, other free radicals, oxygen, superoxide anion, unsaturated fatty acids, and other molecules. Some of these reactions result in the oxidation of nitric oxide to nitrite and nitrate to terminate the effect, while other reactions can lead to altered protein structure function and/or catalytic capacity. These effects probably regulate bacterial infections, inflammation of tissues, tumor growth, and other disorders. These diverse effects of nitric oxide that are cyclic GMP dependent or independent can alter and regulate numerous important physiological events in cell regulation and function. Nitric oxide can function as an intracellular messenger, an autacoid, a paracrine substance, a neurotransmitter, or as a hormone that can be carried to distant sites for effects. Thus, it is a unique molecule with an array of signaling functions. However, with any messenger molecule, there can be too little or too much of the substance, resulting in pathological events. Some of the methods to regulate ei-

ther nitric oxide formation metabolism or function have been in clinical use for more than a century, as with the use of organic nitrates and nitroglycerin in angina pectoris that was initiated in the 1870s. Inhalation of low concentrations of nitric oxide can be beneficial in premature infants with pulmonary hypertension and increase survival rates. Ongoing clinical trials with nitric oxide synthase inhibitors and nitric oxide scavengers are examining the effects of these agents in septic shock, hypotension with dialysis, inflammatory disorders, cancer therapy, etc. Recognition of additional molecular targets in the areas of nitric oxide and cyclic GMP research will continue to promote drug discovery and development programs in this field. Current and future research will undoubtedly expand the clinician's therapeutic armamentarium to manage a number of important diseases by perturbing nitric oxide formation and metabolism. Such promise and expectations have obviously fueled interests in nitric oxide research for a growing list of potential therapeutic applications. There have been and will continue to be many opportunities from nitric oxide and cyclic GMP to develop novel and important therapeutic agents. There are presently more than 80,000 publications in the area of nitric oxide research. The lecture will discuss our discovery of the first biological effects of nitric oxide and how the field has evolved since our original reports in 1977. The possible utility of this signaling pathway to facilitate novel drug development and the creation of numerous projects in the pharmaceutical and biotechnology industries will also be discussed.

References:

- Ignarro L and Murad F. (eds) Nitric Oxide: Biochemistry, Molecular Biology and Therapeutic implications. *Advances in Pharmacology*, 34: 1-516. Academic Press, 1995.
- Murad F. Signal transduction using nitric oxide and cyclic guanoside monophosphate. Lasker Award. *Journal of the American Medical Association*. 276: 1189-1192. 1996.
- Murad F. Discovery of some of the biological effects of nitric oxide and its role in cellular signaling. Nobel Lecture. *Bioscience Reports* 19: 133-154. 1999 and Les Prix Nobel. 1998 (the Nobel Prizes. 1998). Pp. 273-307. 1999.
- Murad F. Shattuck Lecture. The Discovery of nitric oxide and cyclic GMP in cell signaling and their role in drug development. *New England J. Med* 355:2003-2011.2006.



Ei-ichi Negishi:
**Magical Power of d-Block
 Transition Metals: Past,
 Present and Future**
 Available Online

Ei-ichi Negishi:

**Magical Power of d-Block Transition
 Metals: Past, Present and Future**

Until recently, most of the 24 d-block transition metals had been used primarily as useful materials for (i) construction and also as tools and containers, etc., (Ti, Zr, Fe and their alloys with V, Cr, Mn, Co, Ni, etc.), (ii) precious and ornamental items (Au, Pt, Ir, Os, Ag, etc.), and (iii) electromagnetic applications (Cu, Nb, Ta, W, Re, etc.). Over the past several decades, their superb properties as chemically useful substances, especially as catalysts for chemical reactions, have been increasingly recognized. “Why are they so useful as catalysts?”

In most cases, their superb catalytic properties may be attributed to one or both of the following: (1) ability to provide simultaneously both filled nonbonding valence-shell orbitals (one or more) and empty valence-shell orbitals (one or more) within thermally stable species and (2) ability to undergo simultaneously both reduction and oxidation under one set of reaction conditions in one reaction vessel.

A combination of these two properties can be exploited in devising a wide variety of useful catalytic reactions for formation and cleavage of C–C, C–H, C–O and other bonds. For critically important C–C bond formation, a) reductive elimination, b) carbometalation, and c) migratory insertion may be exploited. As representative examples of reductive elimination and carbometalation, the Pd-catalyzed cross-coupling proceeding via reductive elimination and Zr-catalyzed asymmetric carboalumination of alkenes (ZACA) proceeding via carbometalation will be discussed.

Many more novel catalytic one- and two-electron processes via organotransition metals will be discovered and developed.



Erwin Neher:
**Signals and Signalling
 Mechanisms in the Central
 Nervous System**
 Available Online

Erwin Neher:

**Signals and Signalling Mechanisms
 in the Central Nervous System**

Our brain is a network of about 10^{11} neurons, which are connected by synapses. A neuron typically receives input from about 10000 other neurons, which can be either excitatory or inhibitory. The neuron integrates these inputs and generates an ‘action potential’ (or an electrical nerve impulse), when its membrane potential surpasses a certain threshold. This impulse travels along the nerve fiber and excites or inhibits thousands of other neurons, to which the fiber is connected via synapses.

My work over the last 40 years has been concerned with the two most basic signaling mechanisms in the brain: ion channels, which mediate the electrical excitability of nerve fibers and neurotransmitter release, which is the process by which a nerve ending sends a signal to the receiving or ‘postsynaptic’ cell. In the first part of this lecture I will give an overview of the early studies (together with Bert Sakmann) on the development of the patch clamp technique, which allowed us to record currents flowing through individual ion channels, and I will explain how the availability of a new sensitive recording technique led to the discovery of a multitude of ion channel types, which fulfill numerous signaling tasks in basically all types of tissues and organisms.

In the second part I report on some more recent findings regarding the Ca^{++} -dependence of neurotransmitter release and the mechanisms of short-term synaptic plasticity. The term ‘synaptic plasticity’ describes the fact that connection strengths between the neurons of our brain change constantly in a use-dependent manner. These changes occur on many time scales and underly many of the computational capabilities of our brain. Molecular mechanisms for the fast forms, so-called ‘short-term plasticity’, are still a matter of debate.

The ‘Calyx of Held’, a glutamatergic presynaptic terminal in the auditory pathway has unique properties for the study of neurotransmitter release. It is large enough that quantitative biophysical techniques, such as voltage clamp, Ca^{++} fluorimetry, and Ca^{++} -ions uncaging can be applied. Using these experimental tools, we have studied the role of Ca^{++} and other second messengers in neuro-

transmitter release and short-term synaptic plasticity (see E. Neher and T. Sakaba, 2008, Neuron 59, 861-872 for review). The lecture will cover a number of biophysically interesting aspects of neurotransmitter release, such as the amplitude and time-course of the ‘nanodomain Ca^{++} signal’ near open channels, which triggers release, and the depletion and refilling of synaptic vesicle pools.

Bert Sakmann:

**Cortical Column—If You Don’t Under-
 stand The Function, Do The Structure**

Soma location, dendrite morphology and presynaptic innervation represent key determinants of functional responses of individual neurons, such as sensory-evoked spiking. Here, we reconstruct the three-dimensional networks formed by thalamocortical afferents from the lemniscal pathway and excitatory neurons of an anatomically defined cortical column in rat vibrissa cortex. We objectively classify nine cortical cell types and quantify the number and distribution of their somata, dendrites and thalamocortical synapses. Somata and dendrites of most cell types intermingle, while thalamocortical connectivity depends strongly upon the cell type and the three-dimensional soma location of the postsynaptic neuron. Correlating dendrite morphology and thalamocortical connectivity to functional responses revealed that the lemniscal afferents can account for cell type- and location-specific subthreshold and spiking responses after passive whisker touch. The results provide a quantitative three-dimensional anatomical description of the cell type-specific lemniscal synaptic wiring diagram and elucidate structure-function relationships of this physiologically relevant pathway at single-cell resolution.



Bert Sakmann:
**Cortical Column—If You
 Don’t Understand The
 Function, Do The Structure**



Hamilton O. Smith:
Synthetic Genomics: Working with Whole Bacterial Genomes

Hamilton O. Smith:

Synthetic Genomics: Working with Whole Bacterial Genomes

Using a computer analogy, one can think of a cell's cytoplasm as the hardware and the genome as the operating system. In the case of simple organisms such as bacteria, it is likely that scientists in a few years will be able to design and write new operating systems, and construct new strains of bacteria that can do useful things.

It is now possible in some special cases to take a bacterial genome sequence from a computer database, assemble that sequence from synthetic oligonucleotides, and clone it in yeast as a centromeric plasmid. The genome can then be engineered using yeast genetic tools, or it can be engineered during the prior chemical synthesis step. The engineered synthetic genome can be installed into a recipient cell cytoplasm, a process that we have called "transplantation". Under appropriate selection for the new genome, the original components of the recipient cytoplasm are replaced in early divisions and the cell takes on a phenotype determined by the synthetic genome. The new cell now operates under the control of the designed synthetic genome. In the future, we expect that scientists will be able to construct cells that are controlled by synthetic genomes that are designed to make a variety of useful products. As an example of the above, we obtained the sequence of the bacterium, *Mycoplasma mycoides* subspecies *capri* and chemically synthesized it in a series of steps. We started with 1100, 1kb cassettes made from oligonucleotides, assembled them 10-at-a-time in yeast to make 110, 10 kb pieces. These were taken 10-at-a-time and assembled to make eleven 100 kb pieces. These were then assembled in yeast, using the yeast's natural recombination system. The full-sized genome was transplanted from yeast into *M. capricolum*, a related species, which has a cytoplasm suitable for expressing the synthetic *M. mycoides* genome. The resulting "synthetic" cell contains a number of designed features, but phenotypically is very similar to a wild type *M. mycoides* cell.

Our next step is to remove in a step-wise fashion the non-essential genes of the synthetic *M. mycoides* genome to



Oliver Smithies:
A Toolmaker's Story

produce a minimal cell. By study of such a minimal cell, we hope to gain a better understanding of the essentials of cellular life.

Recommended reading:

Lartigue C, Vashee S, Algire MA, Chuang RY, Benders GA, Ma L, Noskov VN, Denisova EA, Gibson DG, Assad-Garcia N, Alperovich N, Thomas DW, Merryman C, Hutchison CA 3rd, Smith HO, Venter JC, Glass JI. Creating Bacterial Strains from Genomes that have been Cloned and Engineered in Yeast. *Science*. 2009 Sep 25;325(5948):1693-6.

Gibson DG, Glass JI, Lartigue C, Noskov VN, Chuang RY, Algire MA, Benders GA, Montague MG, Ma L, Moodie MM, Merryman C, Vashee S, Krishnakumar R, Assad-Garcia N, Andrews-Pfannkoch C, Denisova EA, Young L, Qi ZQ, Segall-Shapiro TH, Calvey CH, Parmar PP, Hutchison CA 3rd, Smith HO, Venter JC. Creation of a bacterial cell controlled by a chemically synthesized genome. *Science*. 2010 Jul 2;329(5987):52-6.

Oliver Smithies:

A Toolmaker's Story

Looking back over 60 years as a bench scientist, I see how often new tools have led to quantum increases in our understanding of biology—a connection that I will illustrate by sharing with you some experiments in which I have participated.

When I first began bench work, in 1948, many uncertainties about the nature of proteins remained. The invention of the ultra-centrifuge by Svedberg (Nobel Prize, 1926) had removed some by showing that proteins had defined molecular weights. But his tool raised new problems, one of which indirectly led to my thesis problem. When mixtures of two proteins of different sizes, such as serum globulin (MW ~ 140,000) and serum albumin (MW ~ 70,000), were centrifuged, the larger protein appeared to dissociate and form the smaller. My thesis problem was to measure the osmotic pressures of protein mixtures to see whether any dissociation was detectable non-centrifugally. I enjoyed my experiments, but did not resolve the puzzle.

Tiselius' invention (Nobel Prize, 1948) of protein electrophoresis provided another tool, which as a post-doc I used to study the homogeneity of β 2-lactoglobulin. In my hands, this tool also had anomalies, although in the hands of others it proved invaluable. For example, with it

Pauling & Itano (1949) showed that sickle cell anemia is a molecular disease. In my first job, I tried a different form of electrophoresis, on filter paper, to study insulin, but insulin absorbed to paper and would not migrate. If I used a moist bed of starch grains instead of paper no absorption was likely (Kunkel & Slater, 1952), but determining the electrophoretic pattern would require measuring the protein content of 40 segments cut from the moist bed of starch grains. Avoiding that task led me somewhat serendipitously to invent a new tool—molecular sieving gel electrophoresis (Smithies, 1956), which in various forms molecular biologists continue to find indispensable. Using it, I discovered that several serum proteins had genetic variants.

The next tool that influenced my work and that of the whole biological community was the invention of recombinant DNA techniques (Berg, Nobel Prize, 1980). But scientists' concerns that some cloned DNAs might be hazardous (Berg et al., 1975) led my friend Fred Blattner at the University of Wisconsin, an expert in bacteriophage genetics and in working with DNA, to derive a cloning vector that would not grow outside the laboratory. I joined him in executing this task, and I learned how to work with DNA and bacteria. Fred's Charon phages provided the first really successful tool certified for use in cloning human DNA. Together our groups used it to clone the genes coding for fetal hemoglobin, and I began to think about using cloned DNA to correct human genetic diseases.

A new tool was needed—a means of using cloned DNA to correct a mutant human gene in suitable cells. That tool, invented by our group (Smithies et al., 1985) and by Thomas & Capecchi (1987), and its application to modify genes in the mouse genome via embryonic stem cells (Evans & Kaufmann, 1981) led to another Nobel Prize, and to a new era of biology. In North Carolina we had an exciting time using the tool to determine how genetic variations affect common complex diseases.

My own research has returned to studying gels. I am making gold nanoparticles that we use to see if the kidney separates proteins by gel permeation. Experiments continue to be a joy.



Thomas A. Steitz:
From the Structure of the Ribosome to the Design of New Antibiotics

Available Online

Thomas A. Steitz:

From the Structure of the Ribosome to the Design of New Antibiotics

Structural studies of the ribosome exemplify the evolution of structural studies in cell biology from the early negatively stained images of macromolecular assemblies in whole cells, to a detailed atomic understanding of the mechanism of action of a large assembly. The earliest electron microscopic (EM) images by George Palade capturing the ribosome in the cell were initially called Palade Particles. Biochemical studies in the 60s showed that the larger subunit of this 2.6 MDa RNA-protein assembly catalyzed peptide bond formation while interactions of the anticodon of tRNA with mRNA bound to the small subunit effected translation of the message; the binding of the aminoacyl-tRNA to the A site and binding of the peptidyl-tRNA to the P site were identified, and translocation of the peptidyl-tRNA from the A site to the P site following peptide bond formation was hypothesized. Proceeding from the early reconstructions of the shapes of the two interacting subunits from negatively stained images by Jim Lake (1976) to the current atomic resolution structures of the 70S ribosome and of its large and small subunits captured in various functional states, the mechanistic level of structural insights into ribosome function now exceeds that achieved in the early structural studies of lysozyme, carboxypeptidase and ribonuclease.

Mechanistic details of the decoding of messenger RNA at the atomic level have been derived by the Ramakrishnan lab from 3.0 Å resolution structures of the 30S ribosomal subunit complexed with mRNA and tRNA substrate fragments as well as more recent structures of tRNA substrates or fragments complexed with the 70S ribosome determined at resolutions between 3.7 Å and 2.8 Å by the Noller and Ramakrishnan labs. Structural insights into the peptidyl transferase reaction, as well as its inhibition by antibiotics, have come from structures of substrate and intermediate complexes with the 50S ribosomal subunit at resolutions that range variously between 3.3 Å and 2.3 Å from the Steitz lab. The first atomic model of the 70S ribosome derived from a 5.5 Å resolution map by the Noller lab using the atomic structures of the 30S and 50S sub-

nits showed the interactions between the two subunits and the general positions of tRNA molecules bound to the A-, P- and E-sites, while the most recent higher resolution structures of the 70S ribosome show further details of the interactions made by tRNAs with the P site and E site. Also, a more complete and detailed structure of the ligand free 70S E. coli ribosome from the Cate lab has shown two conformations of the "head" domain of the small subunit that is related to the process of tRNA and mRNA translocation. Structures of the release factors 1 and 2 and the appropriate mRNAs bound to the 70S ribosome calculated from the Noller and Ramakrishnan labs provide insights into the termination of polypeptide synthesis. Recent crystal structures of the 70S ribosome captured in various states of tRNA delivery by elongation factor Tu and translocation by elongation factor G from the Ramakrishnan lab have shown EF-Tu delivering an aminoacyl-tRNA and EF-G promoting translocation as well as ratchet-like relative rotations of the large and small subunits.

More recently, we have also obtained structures of the 70S ribosome with protein factors. The protein factor EFP stimulates the formation of the first peptide bond, and our structure of the 70S ribosome with f-met-tRNA and EFP bound shows that the EFP binds adjacent to the P-site tRNA interacting with both the anticodon stem-loop and the acceptor stem. It is presumably positioning the P-site tRNA for peptide bond formation. We have also determined the structures of the 70S ribosome with two different hibernation factors. One binds the A site on the 30S subunit that overlaps with the P-site and A-site tRNAs, thereby preventing their binding. The other factor binds near the 3' end of the 16S rRNA where the Shine-Delgano mRNA sequence binds, which would also prevent the initiation of protein synthesis.

These structural studies of the ribosome are not only providing a detailed look at the process of protein synthesis, but also demonstrate that the ribosome is a ribozyme and that rRNA undergoes substrate ligand induced conformational changes in order to achieve specificity, just as is seen in protein enzymes. The ribosome is 2/3 RNA and 1/3 protein. Our structural studies of the Haloarcula marismortui (Hma) large subunit showed that the site of

peptide bond formation (the peptidyl transferase center) consists entirely of rRNA and our structures of many different complexes of the large subunit with various substrate, intermediate and product analogues, along with kinetic and biochemical studies of others, have illuminated the mechanism of peptide bond formation. Binding of the correct substrate to the A site results in a conformational change in the rRNA and a reorientation of the peptidyl group of the P-site substrate. The 2'OH of A76 of the A-site tRNA is H-bonded to the α-amino group of the A-site substrate. This structure of the pre-reaction substrate complex and other kinetic and biochemical data support a proton shuttle mechanism in which the 2'OH of A76 receives a proton from the attacking α-amino group thereby enhancing its nucleophilicity, while it donates a proton to the 3' oxygen of A76 of the peptidyl-tRNA as it is being deacylated. A movie of this process (with music) based on many structures will show the mechanism of peptide bond formation.

The ribosome is a major target of antibiotics which are seen to bind either the large or the small subunit or to both subunits simultaneously. We have determined the structures of many different families of antibiotics bound to the Hma large subunit or to the Thermus thermophilus (T.th.) 70S ribosome, and those structures inform how the various antibiotics inhibit protein synthesis by the ribosome. They also suggest why various resistance mutations in the ribosome make the ribosome insensitive to specific antibiotics. We have also determined the structures of complexes of mutant ribosomes with antibiotics to validate the proposed mechanisms of antibiotic resistance produced by the mutations.

The rise of antibiotic resistant bacteria is becoming a major global health problem. MRSA is reported to now result in about 100,000 deaths annually world-wide. The structures of our antibiotic complexes with the ribosome are currently being used for structure based drug design to create new compounds that are effective against MRSA and other antibiotic resistant bacterial strains. The strategy being employed by Rib-X Pharmaceuticals, Inc., in New Haven, Connecticut is to design new compounds that chemically link a portion of one known antibiotic



Roger Y. Tsien:
Engineering Molecules for Fun, Profit, and Clinical Relevance

Available Online

to a part of another antibiotic that is observed to bind to an adjacent site. Using computational approaches for the design of new compounds, many cycles of compound synthesis and evaluation are resulting in new potential antibiotics that are effective against resistant strains being created. One compound made by Rib-X Pharmaceuticals, Radezolid, has successfully completed phase II clinical trials and many other compounds are in their antibiotic development pipeline.

Our structural studies of the ribosome and its complexes with many functionally important ligands are not only providing important insights into how this macromolecular machine works, but are now also leading to practical benefits to human health.

References:

Moore, P.B. and Steitz, T.A. The roles of RNA in the synthesis of protein. In: RNA World, 3rd edition, (R.F. Gesteland, T.R. Cech and J.F. Atkins, eds.), Cold Spring Harbor Laboratory Press, pp. 257-285 (2006).

Steitz, T.A. A structural understanding of the dynamic ribosome machine. *Nature Reviews: Mol. Cell Biol.* 9: 243-253 (2008).

Steitz, T.A. From the structure and function of the ribosome to new antibiotics. *Angew. Chem. Int. Ed. (Nobel Lecture)* 49: 4381-4398 (2010).

Schmeing, T.M. and Ramakrishnan, V. What recent ribosome structures have revealed about the mechanism of translation. *Nature* 46: 1234-1242 (2009).

Roger Y. Tsien:

Engineering Molecules for Fun, Profit, and Clinical Relevance

Molecules to observe and manipulate biological systems and disease processes can be devised by a variety of strategies, ranging from pure chemical design and total synthesis to genome mining and high-throughput directed evolution. Examples of both successes and failures will be chosen from my own experience, including calcium indicators, molecular voltmeters and photomultipliers, fluorescent proteins, and peptides that light up tumors and nerves. The key personal challenge is to match one's own neuroses and pleasures with research challenges that will have the widest possible impact.



Ada E. Yonath:
Climbing the Everest Beyond the Everest

Available Online

Ada E. Yonath:

Climbing the Everest Beyond the Everest

The challenges associated with pursuing ribosomal crystallography can be described as a series of Everest climbing. At each step, when reaching the summit, a taller and more difficult one became exposed. Snapshots of this story will be described.

Ribosomes are the universal cellular machines that act as very efficient polymerases that translate the genetic code into proteins. They possess spectacular architecture accompanied by inherent mobility, which facilitate their smooth performance as RNA enzymes. The peptide bond formation site is located within a universal internal symmetrical region connecting all of the remote ribosomal features involved in its functions. The elaborate architecture of this region positions ribosomal substrates in appropriate stereochemistry for peptide bond formation, for substrate-mediated catalysis, and for substrate translocation. The high conservation of this symmetrical region implies its existence irrespective of environmental conditions and indicates that it may be a remnant of a prebiotic RNA machine that is still functioning in the contemporary ribosomes.

Adjacent to the peptide bond formation site is an elongated tunnel, along which nascent chains progress until they emerge out of the ribosome. This tunnel is involved in signaling and gating functions, provides the binding site of the first cellular chaperone that encounters the emerging nascent chain, and hosts a major family of antibiotics that target the ribosome.

A decade of structural studies on antibiotics targeting ribosomes yielded several imperative take-home lessons. Among them are the structural bases for the antibiotics' modes of function, including induced fit and remote interactions; the basis for antibiotics synergism; the differentiation between ribosomes of pathogens vs. those of higher organism; the mechanisms of resistance to antibiotics, including secondary conformational rearrangements caused by remote mutations; cross-resistance to ribosomal antibiotics. Within this frame, parameters allowing for clinical usage of antibiotics targeting fully conserved regions, such as the peptidyl transferase center, have been identified; common and specific pathways of cross resistance have been proposed; and minute chemical differences that can turn competition into synergism have been characterized. Based on those insights, the feasibility of design of advanced efficient antibiotics and/or of the improvement of the existing compounds could be assessed, thus paving the way to exciting developments in this area.



I have attended several meetings at Lindau and I always find them excellent. The ability to interact with very bright students is always enjoyable.

Ferid Murad
 Physiology or Medicine, 1998

THE 61ST MEETING OF NOBEL LAUREATES

International Day hosted by the USA

The “International Day” was hosted by the USA. Beginning with the Science Breakfast in the port of Lindau through to the presentations by Peter C. Agre and Frank Mars at the get-together evening, participants of the meeting were invited to find out more about the science and research landscape in the USA. The USA followed India (2009) and the European Union (2010) as hosts and gave an insight into American science and culture during the conference programme on Monday. The tradition of holding International Days will continue at the 62nd Lindau Meeting in 2012, for which Singapore will take the role of host.



Peter C. Agre and Young Researchers at the get-together evening which was part of the “International Day” hosted by the US.

Global health was one of the focal points of this year's meeting (see p. 32). The "International Day", which was organised by the USA this year, also explored this topic and offered opportunities for an intensive exchange between Laureates and Young Scientists. The US National Institutes of Health (NIH), the Department of Energy (DOE) as well as the Oak Ridge Associated Universities (ORAU) organised the event, which was supported by Mars, Incorporated.

The "International Day" began early on Monday morning with a Science Breakfast on board the MS Lindau. Nobel Laureate Peter C. Agre, Irene Eckstrand of the National Institute of General Medical Sciences and Cindy Liu, a Young Researcher from Northern Arizona University, discussed the topic "One World One Health" (for more information, see p. 84).

As part of the "International Day", Laureates and Young Researchers gathered for a traditional get-together evening. Taking place since the very first Lindau Meeting in 1951, this event enables the participants to converse in an open and informal atmosphere. Countess Bettina Bernadotte, President of the Council for the Lindau Nobel Laureate Meetings, opened the evening and introduced Frank Mars, President of Mars Symbioscience. He emphasised the value of cooperation in science and research: "Health is a global issue that depends on collaboration and innovation across many diverse research disciplines, ranging from biomedical to botanical, health to nutrition, from treatment to prevention".

The evening continued with a video message by the Director of the National Institutes of Health, Francis Collins. Collins' message focused on the "responsibilities held by the bright minds of tomorrow—the Lindau Young Researchers—to make great strides in the field of biomedical research and global health." In closing, Collins offered a few bold words of encouragement for the Young Researchers: "Go forth and lead! The world of science is waiting for you."

Young Researcher Cindy Liu then introduced Nobel Laureate Peter C. Agre, who gave an overview of current issues associated with malaria research. His presentation included a sequence of touching images from Agre's research visits to Zimbabwe and Zambia, and explained that it is the obligation of nations such as the US to be at the forefront of medical research with respect to the containment and cure of malaria. "Drug resistance is a big problem with malaria, so we need to have new solutions. My contribution to this is to inspire young people to enter the field," said Agre later in an interview with blogger Christine Ottery. In a moving lecture on the evening of the "International Day", Peter C. Agre made an inspiring plea to get involved in the research field of global health.

After the talks and presentations, the Laureates and Young Researchers had the opportunity to engage in discussions at their dinner tables, with typical American food on the menu. The dinner was followed by the traditional Lindau polonaise, led by Countess Bettina Bernadotte and Count Björn Bernadotte.



Frank Mars, President of Mars Symbioscience, at the get-together evening.



The audience was encouraged to be part of the discussion on malaria research.



In a video message, the Director of the National Institutes of Health, Francis Collins, greeted participants.



Nobel Laureate Peter C. Agre spoke about his research on malaria.



Elizabeth H. Blackburn and Young Researchers.



The traditional polonaise was again part of the evening.

THE 61ST MEETING OF NOBEL LAUREATES

Closing Day

During the boat trip on Lake Constance, the fourth such trip organised by the State of Baden-Württemberg, the guests were shown Baden-Württemberg in all its innovative splendour. Minister-President Winfried Kretschmann welcomed all participants on board the MS Sonnenkönigin, where attendees had the opportunity to get acquainted with the research landscape of the state.



Baden-Württemberg's Minister-President Winfried Kretschmann welcomed all participants on board the MS Sonnenkönigin, together with Theresia Bauer, State Minister of Science, Research and the Arts (centre).

Medicine Meeting

By tradition, the closing day of the Lindau Nobel Laureate Meetings is held on Mainau Island. For the fourth year in a row, the State of Baden-Württemberg hosted this inspirational day together with the Bernadotte family. Baden-Württemberg's Minister-President Winfried Kretschmann welcomed all participants on board the MS Sonnenkönigin. After the boat left Lindau for Mainau Island, Kretschmann presented the federal state to the audience, focusing on Baden-Württemberg's excellent scientific infrastructure.

The boat trip offered plenty of opportunities to speak with representatives from science and industry based in Baden-Württemberg. Seven universities and a number of research institutes, such as the German Cancer Research Center and the European Molecular Biology Laboratory in Heidelberg, showcased their projects and facilities.

On Mainau Island, the scientific programme of the 61st Lindau Nobel Laureate Meeting came full circle, revisiting the topic of "Global Health" by a panel discussion (see page 32). Afterwards, Baden-Württemberg together with Baden-Württemberg International and BIOPRO Baden-Württemberg GmbH invited participants for lunch before they all had a chance to visit the exhibition "Discoveries 2011: Health". This outreach project within the 'Mission Education' was part of the "Year of Science 2011—Research for Our Health" of the German Federal Ministry of Education and Research (see page 96).

In her speech at the closing ceremony in front of Mainau castle, Nobel Laureate Elizabeth H. Blackburn thanked the Bernadotte family for their hospitality on behalf of the participating Laureates and congratulated the Council and the Foundation for organising the meeting. As a first-time attendee at Lindau, she was impressed by the inspirational atmosphere. "Nothing in life is to be feared. It is only to be understood"—with this quote from Marie Curie, Blackburn encouraged the Young Researchers to make curiosity the driving force behind their scientific careers. Theresia Bauer, State Minister of Science, Research and the Arts of Baden-Württemberg also bade farewell to the participants. "As an international forum, the Nobel Laureate Meetings emphasise that open mindedness and

science belong together. They further demonstrate how much the general public benefits from the work of scientists world-wide," said Minister Bauer. After an address by the Mayor of Constance, Horst Frank, Ivan Pchelin from Russia, on behalf of the Young Researchers, thanked not only the Nobel Laureates for their openness and willingness to educate, inspire and connect, but also the Council and the Foundation for "perfect organisation and comprehensive support".

Finally, Countess Bettina Bernadotte called upon the Young Scientists to continue the friendship and maintain contact with those they met during this past week and to play their part in solving the challenges of the future.

In the year of the 50th anniversary of the Green Charter, a manifesto for sustainability initiated by Count Lennart Bernadotte, the late father of Countess Bernadotte and co-founder of the Nobel Laureate Meetings, a panel discussion and exhibition underpinned the joint responsibility of science and society in ensuring a sustainable future for our planet. The Charter was passed on 20th April 1961, eleven years before the first UN environmental conference. It advocates that man should live in harmony with nature. "The basic principles of our life are under threat, because vital elements of nature are being contaminated, poisoned and destroyed," states the Charter—a sentence that is still a highly topical issue today, half a century later. The manifesto describes the conflict between the use and the preservation of natural resources. It laid the basis for a societal sustainability debate, which would go on to be the subject of intense discussion over subsequent decades. In the last three years, the issues of water, energy and health were raised by the exhibition series "Discoveries" and by the discussion panel that took place after each Meeting of Nobel Laureates on Mainau Island. In this way, young people—whether they were visitors to the exhibition or participants of the meeting—were made aware of the importance of such issues.



Minister-President Winfried Kretschmann introduced Baden-Württemberg to participants.



Nobel Laureate Thomas A. Steitz and Young Researchers on board the MS Sonnenkönigin.



Minister-President Winfried Kretschmann on Mainau Island welcoming participants to the Federal State of Baden-Württemberg.



The official farewell ceremony took place in front of Mainau castle.



Nobel Laureates and Young Researchers alike visited the exhibition "Discoveries 2011: Health".

THE 61ST MEETING OF NOBEL LAUREATES

Opportunities for Exchange and Dialogue

The concept of the Lindau Nobel Laureate Meetings involves offering participating Young Researchers numerous opportunities to exchange views with each other and the Nobel Laureates. In addition to traditional events such as evening meals with the Academic Partners and welcome parties, the “Grill & Chill: Connecting Cultures” barbecue, that was introduced for the first time last year, has become a set part of the meeting’s programme.

Roger Y. Tsien, Young Researchers and Lindau citizens enjoyed the “Grill & Chill” barbecue which took place for the second time.



Welcome Parties & Academic Partners' Dinners

Participants of the 61st Lindau Nobel Laureate Meeting had the first chance to get to know each other on Sunday evening. Following the opening ceremony, welcome parties were held at several locations in Lindau at the invitation of the US Department of Energy, the National Science Foundation, the Oak Ridge Associated Universities (ORAU), Mars, Incorporated, the Foundation Lindau Nobelprize-winners Meetings at Lake Constance, and the Spielbank Lindau. They presented Young Researchers with plenty of opportunities to initiate conversations with their peers from all over the world.

Inviting the "best talents" attending the Lindau Meetings to an informal dinner has a long tradition. Again this year, selected Academic Partners of the 61st Lindau Nobel Laureate Meeting availed of the opportunity to meet with Young Researchers at a dinner with the Nobel Laureates on Tuesday evening. Among these Academic Partners were the Sino-German Research Center, the Nobel Foundation, the Max Planck Society, Lockheed Martin, Elite Network of Bavaria, the US Department of Energy (DOE), the German Research Foundation (DFG), the German Academic Exchange Service (DAAD) and the Alexander von Humboldt Foundation.

Grill & Chill: Connecting Cultures

The appealing setting and relaxed atmosphere of the "Grill & Chill" barbecue on Tuesday evening at Lindau Toskanapark captivated over 800 guests. Jointly organised by the City of Lindau and the Council, this informal event gave both the meeting attendees and numerous locals the opportunity to socialise and make new acquaintances. Living up to the motto "Connecting Cultures", Young Researchers from all around the world mingled with Lindau citizens and host families, science journalists and Nobel Laureates. In their welcome addresses, the Lord Mayor of Lindau, Petra Meier to Bernd-Seidl, and Countess Bettina Bernadotte thanked Lindaupark shopping centre and the other sponsors, as well as the many supporters and volunteer helpers of the event for their commitment.

The proceeds from the nominal charge went to the Lindau institutions of the Foundation Haus der kleinen Forscher ("House of the Little Researchers"), which promotes nationwide early-childhood education in the natural sciences and technology.

Concert by the Verbier Festival Chamber Orchestra

Addressing both the mind and the senses, a concert of classical music on Wednesday evening provided sophisticated entertainment for all attendees of the meeting. A string octet of the renowned Verbier Festival Chamber Orchestra enchanted the audience at Lindau city theatre with works from Dimitry Shostakovich and Felix Mendelssohn-Bartholdy.

Ranked among the best training orchestras in the world and comprising approximately one hundred young musicians aged between 17 and 29 from thirty countries, the Verbier Festival Orchestra offers a unique opportunity for talented young musicians to network and develop within a professional environment. It is known for its prestigious concerts and impassioned commitment and has played with the world's greatest conductors and soloists.

Emphasising the common aim of promoting young talents from all over the world, the Council and the Foundation of the Lindau Meetings expressed their special thanks to Martin T:son Engstroem, "spiritus rector" of the Verbier Festival in Switzerland and newly inducted member of the Honorary Senate of the Foundation, for once again bringing the esteemed musicians to Lindau.



Nobel Laureate Werner Arber and a Young Researcher at one of the Academic Partners' Dinners.



In a special afternoon session Mike Rogers, Policy Officer of the Marie Curie Programme at the European Commission, presented research career opportunities in Europe.



Citizens of Lindau, Young Researchers and Nobel Laureates enjoyed the "Grill & Chill" barbecue.



Petra Meier to Bernd-Seidl, Lord Mayor of Lindau (left), and Countess Bettina Bernadotte opening the "Grill & Chill" barbecue.



The Verbier Festival Chamber Orchestra gave a concert at the Stadttheater of Lindau.



The international ensemble performed musical pieces written by Dimitry Shostakovich and Felix Mendelssohn Bartholdy.



Bavarian science and lifestyle come together at the “Bavarian Evening”.



At the invitation of the Free State of Bavaria and the Elite Network of Bavaria all participants got to know both Bavarian lifestyle and the vibrancy of the Bavarian science and research sector.



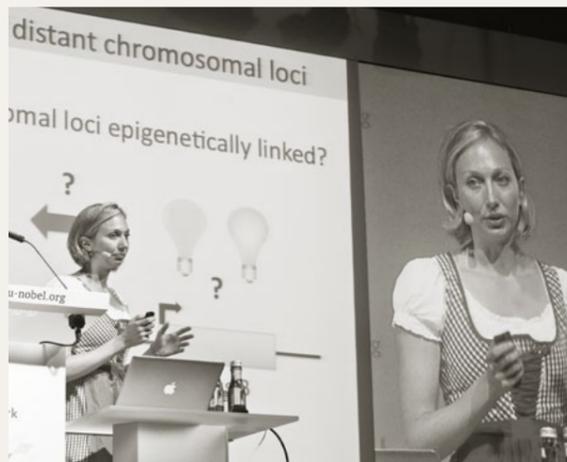
As a moderator, Nobel Laureate Robert Huber lead through the Bavarian Evening.



The Bavarian Minister of State for Science, Research and the Arts, Wolfgang Heubisch, and Simone Bauer who won the design competition for the 2011 conference bag.



Short lecture by Young Scientist Dennis Zimmermann, post-graduate in the Elite Network Doctorate Programme: “Transport of Pigment-filled Organelles”.



Short lecture by Young Scientist Karina Zillner, research fellow in the Elite Network: “Epi-combing—Genome-scale Single Molecule Analysis of Epigenetic DNA Marks”.

Bavarian Evening

With a special programme that fused demanding scientific presentations of current research topics with entertaining performances by folk musicians and dancers, the Bavarian Evening proved that tradition, modernity and progress can be brought together in harmony.

At the invitation of the Free State of Bavaria, the meeting participants had the opportunity to learn about the diverse funding services of the Elite Network of Bavaria and about the vibrancy of the Bavarian science and research sector. The Bavarian Minister of State for Science, Research and the Arts, Wolfgang Heubisch, welcomed the participants to Lindau, the “Mecca of the world’s most excellent Young Researchers and scientists”. He underlined the importance of the Lindau Meetings in times of email and video telephony: “Nothing can replace personal contacts and interchange”. Emphasising the importance of cooperation in science and research, Minister Heubisch extended an invitation to the attendees to visit Bavaria and its many esteemed science and research institutions.

Two short presentations given by scholars of the Elite Network of Bavaria exemplified the high standards and cutting-edge approaches of research conducted in Bavaria. As moderator of the evening, Nobel Laureate Robert Huber talked about some interesting aspects of the presentations and gave both presenters the opportunity to further clarify the significance of their work to the audience of Nobel Laureates, representatives of academia and research, and the Young Researchers from around the world.

Post-Conference Programmes

For one week, the Lindau Nobel Laureate Meeting brings together scientists for a unique cross-generational dialogue. However, outreach projects like the new media-theque and the exhibition on Mainau Island resonate beyond this week.” In addition, the post-conference programmes held by partners of the meetings are also an example of this.

On the closing day of the meeting, Bayer AG invited 19 participants to a poster session on Mainau Island. Young Scientists, some of them coming from Armenia, Azerbaijan, Chile, Ecuador or Uruguay, had the opportunity to present their own research work and to exchange opinions with representatives from various research departments of the company.

Following this year’s meeting, the State of Baden-Württemberg and the German Research Foundation invited participants to learn more about German research institutions. The five-day information-gathering trip through Baden-Württemberg brought twelve participants to facilities such as the “Weltzentrum der Medizintechnik” (lit: World Centre of Medical Technology) in Tuttlingen, to the Spemann Graduate School of Biological and Signalling Studies at the Freiburg Institute for Advanced Studies, to the Max Planck Institute for Development Biology in Tübingen and to the German Cancer Research Center (DKFZ) in Heidelberg. The German Research Foundation (DFG) invited 20 Indian participants to get acquainted with selected research institutions in Berlin, Braunschweig, Heidelberg and Hanover in the week following the meeting. At the headquarters of the DFG in Bonn, the group received first-hand information on forms of support for Young Scientists from abroad. Here as well, this delegation had the chance to speak with a group of young Chinese scientists, who visited a range of scientific institutions in Germany at the invitation of the Sino-German Center for Research Promotion.

The success of such programmes following the Nobel Laureate Meeting is demonstrated among other things by the number of individuals who later actually return to institutes and other scientific institutions. The Sino-German Center for Research Promotion, for example, can look back on an impressive outcome to its post-conference programme: Since 2000, nearly 200 Young Researchers from China have participated in the Lindau Meetings. 15 per cent of them returned to Germany with a scholarship to a German scientific institution.

THE 61ST MEETING OF NOBEL LAUREATES

Associated Programmes

Over the course of the past 60 years, the Lindau Nobel Laureate Meetings have evolved into an international forum for science and research. The Council and the Foundation are constantly looking for new partners who share the same goals and values. A steady dialogue between these partners generates ideas for new and innovative formats. Firmly believing in the importance of building bridges between science, politics and business, the Council and the Foundation welcome formats that help to foster such dialogue.

The Federal Ministry of Education and Research organised a special boat trip before the official opening of the 61st Lindau Meeting. Federal Minister Annette Schavan invited her Russian colleague Andrei Aleksandrovich Fursenko, representatives from national and international science organisations and Young Researchers on the boat trip.





Chief Technology Officers of international corporations met to discuss future challenges for both science and business with Nobel Laureates at the Innovation Round Table.

Innovation Round Table

On the day before the opening of the 2011 Lindau Meeting, Nobel Laureates, Maecenates and Benefactors of the Lindau Meetings and Chief Technology Officers (CTO) of international corporations met to discuss future challenges for both science and business. Taking place for the second time after 2010, the Innovation Round Table can trace its origins back to an initiative by Nobel Laureate Martin Chalfie. The underlying idea of bringing together exceptional scientists and representatives of research-driven business in an informal and open atmosphere met with high universal acclaim from last year's participants. Building on the success of the first Innovation Round Table in 2010, this year five Nobel Laureates and 11 CTOs met in Lindau to continue this exceptional as well as exclusive dialogue.

A short welcome speech by Andreas Barner, Speaker of the Executive Board of Boehringer Ingelheim and Co-Chair of the Round Table, was followed by an introductory lecture on the topic "Communicating Advances, Advancing Communications" by Nobel Laureate Aaron Ciechanover. Afterwards, participants joined specific discussion groups which focused on topics ranging from "Conflicting Goals vs. Joint Strategies" to "Research Ethics: Compliance or Integrity?". Bringing together representatives from aca-

demia and industry facilitated a lively debate not only about the value of fundamental research, but also about the paramount importance of communicating industrial research to the public.

Saturday Boat Trip upon Invitation of Minister Schavan

For the third time, the Federal Ministry of Education and Research organised a special boat trip before the official opening of the 61st Lindau Nobel Laureate Meeting. On the occasion of the German-Russian Year of Education, Science and Innovation, Federal Minister Annette Schavan invited her Russian colleague Andrei Aleksandrovich Fursenko, Minister of Education and Science of the Russian Federation, on the boat trip. Previously, they had visited the exhibition "Discoveries 2011: Health" on Mainau Island. 66 Young Researchers were invited to join the ministers and representatives from the fields of science and politics for a panoramic dinner cruise on the MS Lindau. All participants took the opportunity to exchange ideas and speak of their expectations for the forthcoming Lindau Meeting. In addressing the attendees, Federal Minister Schavan pointed out how important this dialogue is in order to build bridges between science, politics and business. Only joint and international efforts will be able to formulate effective answers to global issues.

Quotes from Participants of the "Innovation Round Table"



Andreas Barner,
Speaker of the Executive Board,
Boehringer Ingelheim

"The private and confidential atmosphere of the Innovation Round Table was the first highlight of the Lindau Meeting. The format allowed for the exchange of knowledge in an open dialogue between different worlds and viewpoints, without platitudes, sometimes controversial, but always with a strong focus on inspiring issues of high general relevance."



Andrew Herbert,
Chairman of Microsoft Research EMEA

"The CTO Innovation Round Table Briefing provides an excellent opportunity for business leaders to engage in lively debate with Nobel Laureates on important matters that affect companies, society and government in fundamental and challenging ways."



Thomas Geelhaar,
CTO Chemicals at Merck

"The discussion between academic and industrial research on the communication of science had for me two highlights: On the one hand the need to publish detailed scientific results to get to the unpredictable breakthroughs and on the other hand the need to communicate to the public translated knowledge rather than information."

Science Breakfasts

As a new format which was established in 2010, the Science Breakfasts received very positive feedback from last year's participants. Science Breakfasts offer partners of the Lindau Meeting a unique platform for presenting and discussing their scientific research with some of the best talents from around the world. The Council and the Foundation were pleased to give participants of the 61st Lindau Nobel Laureate Meeting the opportunity to attend one of four Science Breakfasts. Partners like Mars, Incorporated, the German Cancer Research Center (DKFZ) and the US National Institute of General Medical Sciences agreed to contribute and offered insights into current and future scientific research topics from their organisations. Additionally, the Council for the Lindau Nobel Laureate Meetings hosted a fourth Science Breakfast with the kind support of Nobel Laureate and Member of the Council Hartmut Michel.



Monday's Breakfast: "One World One Health"

Organiser: The United States of America

Panellists: Nobel Laureate Peter C. Agre, Young Researchers Jayodita Ganghvi (Stanford University) and Cindy Liu (Northern Arizona University), Irene Eckstrand (Programme Director, National Institute of General Medical Sciences)



Wednesday's Breakfast: "Personalised Medicine—Opportunities and Prospects"

Organiser: Council for the Lindau Nobel Laureate Meetings

Interview with Nobel Laureate Hartmut Michel



Tuesday's Breakfast: "Productive Partnerships: Considering the Part Played by Cross-Sector Collaboration in Driving Innovative Science from Bench to Everyday Life"

Organiser: Mars, Incorporated

Panellists: Nobel Laureate Elizabeth H. Blackburn, Frank Mars (President of Mars Symbioscience), Young Researcher Diego V. Bohórquez (Duke University), Adam Smith (Moderator, Editorial Director of Nobel Media)



Thursday's Breakfast: "Cancer: A Grand Challenge for Biomedical Research"

Organiser: German Cancer Research Center (DKFZ)

Panellists: Nobel Laureate Harald zur Hausen, Otmar D. Wiestler (CEO of the DKFZ), Stephan Herzig (Head of the DKFZ Joint Research Division "Molecular Metabolic Control")



THE 61ST MEETING OF NOBEL LAUREATES

Communications

The “Lindau Dialogue” met with increased media interest in Germany and abroad. 130 journalists from more than 30 countries covered the 2011 Meeting of Nobel Laureates. The long-standing partnership with Nature Publishing Group resulted in the publication of a special supplement which appeared in Nature. The successful online communications were thus further expanded. Media coverage in Germany was also significant due to the ongoing media partnerships with the Frankfurter Allgemeine Zeitung and Deutsche Welle TV. Additionally, an increasing number of international TV stations demonstrated interest in the meeting, e.g. from Poland, France, Algeria, the Netherlands and Austria.



130 journalists from more than 30 countries covered the 2011 Meeting of Nobel Laureates.

Communications

Building on the successful communication efforts of last year's Lindau Meeting, media attention of the 61st Meeting of Nobel Laureates was once again significant. The Council and the Foundation continued their successful approach to an integrated communications effort. A new strategic approach was established in cooperation with the Cariplo Foundation from Italy and the Spanish National Research Council (CSIC). For the first time, joint communication objectives were identified and implemented in the media address. This model promises intensive attention in the future in the countries concerned, which will at the very least benefit the Academic Partners in the application process for future meetings.

Of central importance to this success was the long-standing partnership with the Nature Publishing Group. The focal point of all social media activities was once again the official meeting blog at www.lindau.nature.com. Hosted by Nature Networks and closely linked to Scilogs as well as the new Lindau Mediatheque, the blog provided insights into the topics, participants and the atmosphere of the 61st Meeting of Nobel Laureates. For the first time, Spanish and Chinese language blog posts were incorporated into the site, thus significantly increasing awareness about the Lindau Meetings in China and in the Spanish-speaking world. Thanks to a special presence at the guest blog section of the Scientific American website, the US readership could also be reached.

Science journalist Beatrice Lugger led an international team of science bloggers including Yvonne Buchholz, Lucas Brouwers, Felix Man Ho Cheung, Lars Fischer, Tobias Maier, Christine Ottery and Lou Woodley in the coverage of this year's meeting. Supported by Ashutosh Jogalekar, who contributed individual posts participating virtually from the US, and by Jakob Dettmar at Lindau, they covered a wide range of topics—from interviews with participants to wrap-ups and assessments of lectures and panel discussions, and impressions of the social events.



The blog team (from left): Felix Man Ho Cheung, Lars Fischer, Tobias Maier, Christine Ottery, Beatrice Lugger, Yvonne Buchholz, Lucas Brouwers and Lou Woodley.

As visitor numbers suggest, the official meeting blog is beginning to evolve into a popular repository of articles for people interested in the Lindau Meetings beyond the actual week of the event. One task for the future will be to keep providing content between two meetings. A first step in this direction is the ongoing online discussion between Nobel Laureate Martin Chalfie and a Young Scientist on the blog, which will be incorporated into an article for Nature Outlook.

2011 Nature Video Project

Continuing the successful joint video project with Nature Publishing Group, four additional educational videos were filmed during the 61st Lindau Nobel Laureate Meeting. Since 2008, a film team led by Martin Freeth and Charlotte Stoddart have been presenting the interaction between Nobel Laureates and Young Researchers in 10-minute films. Thanks to the long-term support of Mars, Incorporated, this unique project now comprises almost 20 educational videos covering a wide range of topics including physics, chemistry and physiology and medicine. All of the films are freely accessible on the new Lindau sub-page of the Nature website at www.nature.com/lindau.

2011 NATURE VIDEO PROJECT

The Virus Catchers—with Harald zur Hausen

Young researchers Jan Gralton and Sven-Eric Schelhorn are fascinated by the minute world of viruses. They have plenty of questions for Harald zur Hausen, who won a Nobel Prize for proving that human papillomaviruses (HPV) can cause cervical cancer. All three are worried by public distrust of the HPV vaccine, which was made possible by zur Hausen's work.

Combating Cancer—with Edmond H. Fischer

Nobel Laureate Eddie Fischer was born in Shanghai in 1920. Since then, China has emerged as an economic superpower. Now it's becoming a scientific heavyweight too. Tong Qing belongs to the newest generation of Chinese scientists. She decided to study cancer after a family friend became ill with breast cancer. In this film, she tells Fischer about life and research in China today.

Bench or Bedside?—with Ferid Murad

Camelia-Lucia Cimpianu is trying to decide between a career as a researcher or a practising doctor. In this film, she seeks advice from Nobel Laureate Ferid Murad who faced the same dilemma as a medical student in the 1960s. Murad chose the bench, and he subsequently discovered that a gas called nitric oxide (NO) acts as a signalling molecule in the cardiovascular system. It turns out that NO plays a role in many diseases—and possibly in the head trauma cases that Camelia studies.

A Life in Science—with Elizabeth H. Blackburn

Elizabeth H. Blackburn grew up in Hobart on the Australian island of Tasmania. It was a long journey from there to a Nobel Prize and the lab she runs at the University of California in San Francisco. Malaria researcher Clare Smith is also a Hobart girl, and she's trying to decide whether to follow in Blackburn's footsteps and move overseas after she finishes her PhD. Karina Zillner is from Germany. Like Clare, she's in the final stages of a PhD. She's developed a method for analysing sections of repetitive DNA. Karina hopes her technique might be used in Blackburn's lab, where they study telomeres—repetitive sections of DNA that protect the ends of chromosomes.

Hungry for Knowledge—with Oliver Smithies

Oliver Smithies is a toolmaker. He shared the Nobel Prize for discoveries that led to the development of knockout mice. Diego Bohórquez uses mouse models to understand how our gut regulates appetite. He has wanted to meet Smithies ever since he moved from his native Ecuador to Duke University in the United States. When the two meet in Lindau they have an instant rapport and soon they're sharing ideas about their research projects and talking about what makes a successful scientific collaboration.

Featured video

15 September 2011
Strands of life



Unlike other scientific conferences, the scope of the annual Meeting of Nobel Laureates in Lindau is very broad. The participants enjoy exchanging ideas across disciplines and often they find surprising connections. We followed a diverse bunch of young researchers as they met with Nobel laureates. By the end of the meeting, several collaborations were in the pipeline! This trailer gives you a flavour of the films that follow.

2011

strands of life

In 2011 the focus was on physiology &

2010

a meeting of minds

In 2010, Lindau celebrated its 60th

This year's sponsor

Mars, Incorporated - Committed to Science

MARS Mars invests in science to tackle business challenges and make a difference to people and the planet.
Visit Mars.com to learn more.

Behind-the-scenes



Filming Bill Philips in the middle of Lake Constance presented many challenges. We had to deal with the sun,



The German Academic Exchange Service (DAAD) invited German and international science journalists on a press tour through Southern Germany starting with the Lindau Meeting.



Germany's international broadcaster, Deutsche Welle TV, covered the 2011 Lindau Meeting of Nobel Laureates extensively.



National radio Deutschlandfunk and DRadio Wissen covered this year's meeting.



Cover of the special supplement by German newspaper "Frankfurter Allgemeine Zeitung".



The research done by participating Young Researchers and their impression about the Lindau Meetings was of great interest to the media.



Introduced at the 2010 Lindau Meeting, the conference newspaper was again produced this year.

Further Media Outreach

Press Tour of the DAAD

On the occasion of the 61st Lindau Meeting, the German Academic Exchange Service (DAAD) invited German and international science journalists on a one-week press tour through Southern Germany. Starting with the Lindau Meetings, participating journalists experienced the "Lindau Dialogue" first-hand. The group of journalists from Europe, Latin America and Asia also visited renowned research institutions and universities in Constance, Heidelberg and Martinsried.

Deutsche Welle TV

Germany's international broadcaster, Deutsche Welle TV, covered the 2011 Lindau Meeting of Nobel Laureates extensively. Manuela Kasper-Claridge spoke with Nobel Laureate Erwin Neher for the programme "Das Interview" about the future of medicine and the importance of the Lindau Meeting. An entire edition of the science programme "Projekt Zukunft/Tomorrow Today" was once again dedicated to the 61st Lindau Nobel Laureate Meeting.

DRadio Wissen

As one of the founding members of the "Hörsaal" (lit: lecture hall) format, the Lindau Meetings are especially proud that the German radio station "DRadio Wissen" continues to broadcast lectures given by Nobel Laureates in Lindau in their weekly science show "Hörsaal" (Thursdays at 8.05 pm). Based on the lectures available from the new Lindau Mediatheque, "Hörsaal" offers the audience the unique chance to learn about the award-winning research carried out by Nobel Laureates.

Frankfurter Allgemeine Zeitung

The German newspaper "Frankfurter Allgemeine Zeitung" (FAZ) published a special supplement on the Saturday following the 61st Lindau Nobel Laureate Meeting. With extensive coverage of the many aspect of this year's Lindau Meeting, the 8-page supplement also included

interviews with the newly inducted member of the Foundation's Honorary Senate, William H. Gates III, as well as with Nobel Laureates and Young Researchers.

Lindauer Zeitung

Covering the Lindau Meetings since its beginnings, the daily Lindauer Zeitung—a local edition of the regional newspaper Schwäbische Zeitung—published a special dual-language (German/English) supplement for the 61st Lindau Nobel Laureate Meeting. In addition, both Lindauer and Schwäbische Zeitung extensively covered the 2011 Lindau Meeting in their print and online editions.

TV Coverage and Online Broadcasts

Thanks to external support, it was possible to garner the interest of several international TV stations. Journalists and TV crews from TVP (Poland), Thai TV (Thailand) as well as Astro Awani (Malaysia) travelled to Lindau in order to cover the 61st Meeting of Nobel Laureates. Television broadcasters such as Bayerischer Rundfunk (BR), SWR and ORF were also present. Similar to previous years, TV footage was broadcasted through the channels of the European Broadcasting Union (EBU) and a large number of TV stations including channels from Algeria (Télédiffusion d'Algérie), Spain (IB3 Televisió), Japan (Television Tokyo Channel 12), Luxembourg (Broadcasting Center Europe), Portugal (Radiotelevisao Portuguesa) and the Russian Federation (Rossijskoe Teleradio) picked up the material and incorporated it into their schedule.

Thanks to the kind support of the International Conference of Lake Constance (IBK), lectures and panel discussions held during the 61st Lindau Nobel Laureate Meeting were made available online as videos on demand through the new Lindau Mediatheque (see page 104). Based on the smooth streaming technology, users from around the globe were able to watch the videos of an event approximately 1 hour after it was concluded. Again, the videos of lectures held by Nobel Laureates and panel discussions were in high demand. More than 10,500 visitors with 116,000 page views were registered during the 2011 Lindau Meeting.



(From left to right) US Consul General Conrad R. Tribble together with Thomas Ellerbeck, Countess Bettina Bernadotte and Wolfgang Schürer at the press conference of the Council and the Foundation.

Collaboration with Science Journalists' Associations

Successful and long-standing relationships with science journalist associations in Europe, Latin America, USA and the Arab World contributed significantly to the international character of the 61st Lindau Nobel Laureate Meeting. The European Union of Science Journalists Associations (EUSJA) celebrated its 50th anniversary this year. At the general meeting of country delegates, five years of cooperation with the Nobel Laureate Meetings was a second cause of celebration in addition to this anniversary. For this reason, Christian Rapp and Jan Keese (Executive Secretariat) travelled to Budapest to pass on the best wishes of the Council and Foundation at an informal dinner with the delegates and to discuss the prospects for intensive cooperation.

Thomas Ellerbeck is the spokesman and member of the Council and a member of the Board of the Foundation. In this honorary capacity, he is responsible for the communication activities of the Lindau Nobel Laureate Meetings.

The Communications Department at the Executive Secretariat in Lindau is headed by Christian Rapp. He is tasked with the planning and implementation of the Council's and Foundation's communications projects. His team includes communications officer Jan Keese and Trainee Christian Schumacher. Markita Landry, participant of the 2010 Lindau Meeting, was a member of the team in June and July. During the Lindau Meeting, the communications team was supported by Lisa Suckert and Maria Regele. As in previous years, the two freelance journalists Beatrice Luggner and Joachim Pietzsch carried out research work on the topics at this year's meeting and prepared these for the media.

International Press Coverage



LA NACIÓN—ABC RADIO (AUSTRALIA)—FOLHA DE S. PAULO—EL MERCURIO—AL-AHRAM DAILY NEWSPAPER—RBB KULTURRADIO—VIDEOSCIENZA—LA CRÓNICA DE HOY—MEDIA VPRO NOORDERLICHT—MOSKOVSKAYA PRAVDA—NATURE—ARD—LANCET—SCIENTIFIC AMERICAN—MILWAUKEE JOURNAL SENTINEL—ARS TECHNICA—ORF—FRANKFURTER ALLGEMEINE ZEITUNG—DEUTSCHE WELLE DW—SÜDKURIER—DAPD—SCHWÄBISCHE ZEITUNG—DPA—STUTTGARTER ZEITUNG—HAMBURGER ABENDBLATT—DEUTSCHLANDFUNK—TIMES OF INDIA—THE POLISH RADIO—ST.GALLER TAGBLATT—MATICHON NEWSPAPER THAILAND—THE ECONOMIST—SCIENCE & TECHNOLOGY DAILY CHINA—FOCUS—FINANCIAL TIMES DEUTSCHLAND

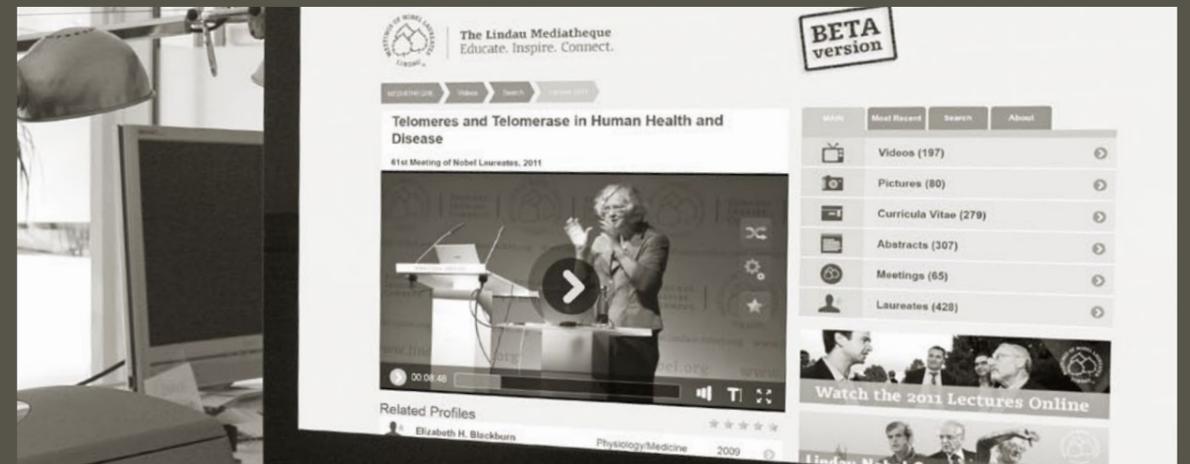
Beyond the 2011 Lindau Meeting

ENTDECKUNGEN / DISCOVERIES
GESUNDHEIT / HEALTH
2011



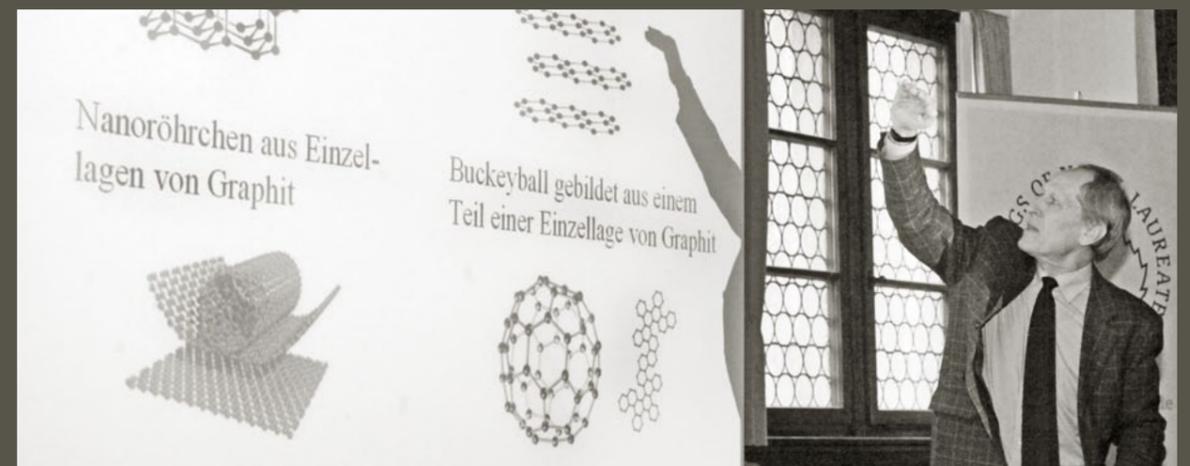
“Discoveries 2011: Health” Exhibition on Mainau Island from 20th May to 4th September 2011

p. 96



The new Lindau Mediatheque

p. 104



Outreach Initiatives

p. 110

BEYOND THE 2011 LINDAU MEETING

"Discoveries 2011: Health"

Exhibition on Mainau Island from 20th May to 4th September 2011

The third exhibition of the "Discoveries" series constituted another link in the chain of successful approaches to extend the debate on the significance of science and research to the broad public. Aligned with the "Year of Science 2011—Research for Our Health" of the German Federal Ministry of Education and Research, this year's exhibition centred on key issues in health research, and was thus also closely interconnected with the guiding themes of the 61st Lindau Meeting of Nobel Laureates on Physiology or Medicine. The exhibition was opened 20th May 2011 by Countess Bettina Bernadotte (President of the Council), Wolfgang Schürer (Chairman of the Board of the Foundation) and Helge Braun (Member of Parliament and State Secretary at the Federal Ministry of Education and Research).

ENTDECKUNGEN /DISCOVERIES 20
GESUNDHEIT /HEALTH 11



"Discoveries 2011: Health"

The last edition of the "Discoveries" exhibition project on Mainau Island was organised in 2011.

Discoveries 2011: Health

Like the previous two exhibitions in the series, which dealt with the vital resource of water (2009) and the future of energy (2010), this year's exhibition focused on an integral and indispensable issue of the ongoing sustainability debate: health. Health research is constantly striving to improve the quality of human life and will remain at the centre of public interest and discussions. The co-founder and "spiritus rector" of the Lindau Meetings, Count Lenart Bernadotte, had always been certain that science and research have the potential to maintain the wellbeing of the environment and of human society. The exhibition series "Discoveries" commemorated his commitment.

Exhibition Partners

At the heart of the exhibition was people, covering issues related to the prevention, detection, treatment and curing of diseases and showcasing the challenges and achievements of cutting-edge health research. Organised jointly by the Foundation Lindau Nobelprizewinners Meetings at Lake Constance and Mainau GmbH, and funded by the Federal Ministry of Education and Research, the exhibition consisted of 18 outdoor pavilions in the setting of Mainau Island, each arranged and maintained with great dedication by a different partner institution. In addition, an educational trail of herbs and medicinal plants and an art installation on the subject of rare diseases were set up.

Project management for the exhibition was carried out by the Executive Secretariat, namely Wolfgang Huang (concept and overall management), Christian Schumacher (partner relations, pavillon contents, communications) and Julia Schürer (onsite partner management). Further support was provided by the Mainau staff, especially Lena Hermann.

"Join in and Discover!"

Directed at visitors of all ages and with different educational backgrounds, the exhibition primarily provided interactive elements to convey comprehensible information and inspire ongoing debates on its topics. Each pavilion contained at least one interactive exhibit, which illustrated and visualised the information given in texts and pictures on walls. Among the most exciting exhibits was a huge model of the human brain at the pavilion of the Deutsche Sporthochschule Köln (DSHS), weighing over 600 kilograms and providing visitors with basic information on neurosciences. The Max Planck Society invited the public to learn more about how it is working to combat infectious diseases through basic biomedical research. Visitors could also test their senses of sight, hearing, smell, touch and taste at the Fraunhofer pavilion, and find out about its research projects related to the senses. Everyone was invited to do fitness and dexterity exercises in the pavilion of the University of Konstanz, or to try their luck at the genetics lottery developed by the University Hospital and Medical Faculty of Heidelberg to reflect upon the difficult issue of rare diseases. Boehringer Ingelheim presented a research expedition trail that explained the causes of the widespread disease diabetes, suggested preventive measures and showcased the latest research findings for treatment. Mars, Incorporated provided an insight into cross-sector research with their pavilion on the health benefits of flavanols, a group of natural compounds found in cocoa and other fruits and vegetables.

A team of competent exhibition guides offered tours and readily answered the visitors' questions. As part of the "Exhibition Rally" leading through the 18 pavilions, children were provided with booklets containing questions related to pavilions. Everyone who managed to work out the correct answer could take part in a draw with attractive prizes. The concept of combining educational knowledge transfer with an experience of entertainment and fun was recurrent throughout the exhibition. By the end of the exhibition, all 20,000 booklets had been given out to children and their accompanying families, making this outreach initiative within the project a complete success.



The exhibition "Discoveries 2011: Health" was officially opened on 23rd May 2011 by Countess Bettina Bernadotte (President of the Council), Wolfgang Schürer (Chairman of the Foundation) and Helge Braun (Parliamentary State Secretary at the Federal Ministry of Education and Research, MP).



Federal Minister Annette Schavan and her Russian colleague Andrei Aleksandrovich Fursenko visited the exhibition on their way to the opening of the 61st Lindau Meeting.



A team of competent exhibition guides offered tours and readily answered visitors' questions.



Nobel Laureates Christian de Duve and Oliver Smithies were among the guests visiting the exhibition during the closing day of the 2011 Lindau Meeting on Mainau Island.



Children participating in the "Exhibition Rally" leading through the 18 pavilions of the exhibition.

Exhibition Partners—Pavilion Titles

- **Foundation Lindau Nobelprizewinners Meetings at Lake Constance**
Introductory Pavilion: Healthy Throughout Life
- **Federal Ministry of Education and Research (BMBF)**
Research for Our Health
- **Deutsches Hygiene-Museum Dresden**
Hormones: Mighty Molecules
- **German Centre for Diabetes Research**
Research for a Future without Diabetes
- **Boehringer Ingelheim**
Explore Diabetes: The Treasure of the Islets of Langerhans
- **Interdisziplinäre Diabetes-Fußstation Klinikum Konstanz (Clinical Centre of Constance)**
The Foot: A Marvel at Risk?
- **Institute of Sport-Gerontology, German Sport University Cologne**
Prevention—From Childhood to Old Age
- **Werner Reichardt Centre for Integrative Neuroscience, University of Tübingen**
A Pure Question of Nerves—Understanding Brain Functions
- **Max Planck Society for the Advancement of Science**
"To Your Health!"—Research for the Medicine of Tomorrow
- **German Cancer Research Center (DKFZ)**
Cancer Protection is Possible
- **BIOPRO Baden-Württemberg GmbH**
Benefiting People: Biotechnology Research in Baden-Württemberg
- **Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e. V.**
With All Our Senses
- **Department for Plastic Surgery and Hand Surgery, Klinikum rechts der Isar and Faculty of Medicine, Technische Universität München, Research Group CAPS (Computer Aided Plastic Surgery)**
Engineering Meets Medicine
- **Weleda AG**
Life is Rhythm—Rhythm is Life
- **University of Konstanz**
"Healthy for Life"—Health Research at the University of Konstanz
- **University Hospital and Medical Faculty of Heidelberg**
Rare Diseases—What Counts is the Individual
- **Mars, Incorporated**
Discovering the Benefits of Flavanols for Human Health
- **Mainau GmbH**
Activity Pavilion: "What You've Always Wanted To Know"
- **Walther Schoenberger Pflanzensaftwerk GmbH & Co. KG**
Info Tour Herbs & Natural Remedies: Ancient Herbal Science for a Modern Life
- **Akademie für Lebenskunst/Galerie im Einstein, Berlin**
Art Installation "seltenes alphabet"

Activity Days—Cooperation Partners

AOK Baden-Württemberg: Project "ScienceKids – Kinder entdecken Gesundheit", Federal Ministry of Education and Research: Year of Science 2011—Research for Our Health, German Cancer Research Center (DKFZ): Cancer Information Service, Diabetes Forum Konstanz e. V., Europa-Miniköche Bodensee, Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e. V./Fraunhofer Institute for Process Engineering and Packaging IVV, GEA – Zentrum für Gesundheit Radolfzell, Grundschule Engen, Jugend forscht – Landeswettbewerb Baden-Württemberg, Jugend forscht – Landeswettbewerb Bayern/"Schüler experimentieren", Karate Team Bodensee e. V., Kirstin Diehl Stiftung/Verein zur Förderung der Krebsmedizin e. V./Klinik für Tumorbiologie Freiburg, Klinikum Konstanz/Klinik für Viszeral-, Kinder- und Gefäßchirurgie, Krumbach Familienstiftung, Landratsamt Konstanz: Initiatives "BeKi Bewusste Kinderernährung" and "Blickpunkt Ernährung", Landratsamt Konstanz/Amt für Gesundheit und Versorgung, Landratsamt Ravensburg: Initiative "KIG Kinder im Gleichgewicht" (Project of Euregio Adipositas), University of Konstanz, University Hospital and Medical Faculty of Heidelberg, Walther Schoenberger Pflanzensaftwerk GmbH & Co. KG





Pedagogical and Educational Offers

Visiting school classes were at the centre of considerations on the pedagogical value of the exhibition. They had free admission and could prearrange the focal points of special guided tours. To enable teachers to prepare their pupils in advance, four dossiers with teaching material and background information on key topics of the exhibition had been compiled by www.lehrer-online.de and made available for free download via the exhibition website www.mainau-entdeckungen.de. By the end of the exhibition (4th September 2011), more than 120 school classes had visited the exhibition and the material had been accessed more than 47.000 times on the website. Thus the exhibition truly achieved one of its main goals: to get more young people interested in science and research.

Special Events

Kids, families, adults and seniors were all invited to join in the many activities of three so-called "Activity Days". The additional programme on these days was set up with the support of the exhibitors and several initiatives, associations and foundations from the Lake Constance region. Children were taught how to prepare healthy meals and snacks, which foods are essential for healthy nutrition and why sports and physical exercise are so important when it comes to staying fit. There were stands targeted specifically at adults and these gave inoculation advice, detailed information on cancer and diabetes, and information on complementary medicinal treatment. Karate shows, theatre plays, a children's choir and many more activities added to the interactivity of the exhibition.

Scientific Guidance

The expert guidance and advice from all members of the scientific council, chaired—as in the previous two years—with exceptional commitment by Bernhard Graf (Institute for Museum Research, Prussian Cultural Heritage Foundation) proved to be invaluable in planning the exhibition. In her role as Deputy Chairperson, Andrea Wegener (Max Planck Society) also provided tremendous support to the project.

Scientific Council

Bernhard Graf, Chairman of the Council
Institute for Museum Research,
Prussian Cultural Heritage Foundation

Philipp Baum
Boehringer Ingelheim

Michael Boutros
German Cancer Research Center (DKFZ)

Annette Grütters-Kieslich
Charité-Universitätsmedizin Berlin

Claus-Dieter Kroggel
Fraunhofer Group for Life Sciences

Gisela Olias
German Institute of Human Nutrition (DIfE)

Klaus Vogel
Stiftung Deutsches Hygiene-Museum

Andrea Wegener, Deputy Chair of the Council
Max Planck Society for the Advancement of Science e.V.

Retrospect

From the opening on 20th May to its conclusion on 4th September, the exhibition was open to approximately 550,000 visitors of Mainau Island and received wide acclaim from health research stakeholders and the general public. A media partnership with Südkurier Medienhaus contributed to the extensive coverage in Lake Constance region. Further communication measures by the Executive Secretariat and partners of the exhibition also helped to raise awareness nationwide, e.g. the special supplement on the 61st Lindau Meeting of Nobel Laureates by Frankfurter Allgemeine Zeitung (FAZ).

The patron of the exhibition, Federal Minister of Education and Research, Annette Schavan, hailed it as "one of the highlights of the Year of Science 2011". To mark the visit by Minister of Education and Science of the Russian Federation, Andrei Fursenko, against the background of the German-Russian Year of Education, Science and Innovation 2011/12, Minister Schavan invited her colleague to a guided tour of the exhibition before travelling on to the opening of the 61st Lindau Meeting of Nobel Laureates.

The Years of Science were launched by the Federal Ministry of Education and Research and the German science initiative Wissenschaft im Dialog (WiD) in the year 2000. Centring on different key issues of science and research each year and with a special focus on young people, they provide a platform for the exchange of ideas, thoughts and knowledge between science and society.

BEYOND THE 2011 LINDAU MEETING

The New Lindau Mediatheque— a Digital Treasure Trove

The Lindau Mediatheque is an ambitious project within the framework of the 'Mission Education' of Council and Foundation. The Lindau Nobel Laureate Meetings bring together Laureates and Young Scientists for one week—the mediatheque will bring the work of Laureates to life for the remaining 51 weeks of the year. A basic test version was launched in 2008 and this will be shut down in order to start the new mediatheque.

The new mediatheque of the Lindau Meetings is now available as a beta version at www.mediathèque.lindau-nobel.org



Both the meetings and the lectures given by the Nobel Laureates have been carefully documented since they first began in 1951. Up until just a few years ago, audio recordings were taken of almost all lectures and panel discussions; video recordings have been made since 2005. There is also an extensive picture archive, which serves as a comprehensive account of all meetings. The resulting multimedia archive represents one of the most extensive collections of top-level scientific lectures. The objective of the Lindau Mediatheque is to make this “digital treasure trove” (as it was dubbed by the Frankfurter Allgemeine Zeitung, FAZ) available to users and visitors from across the globe by means of a state-of-the-art web interface. Significant advances in the digitalisation of the content have been made in the last three years thanks to the financial support of the Gerda Henkel Foundation. Due to the kind support of the Bayerischer Rundfunk (BR) it is also possible to make the earliest recordings available in the mediatheque.

In 2012, the mediatheque project will start the next phase with the launch of the “New Mediatheque”, during which a comprehensive editorial concept will be realised and content will be added on a continuous basis. This extension process includes the definition of topic clusters, continuous cataloguing and digitalisation as well as the translation and transcription of content. Minister Schavan highlighted the importance of the mediatheque and announced the support of her ministry in her speech at the opening ceremony of the 61st Lindau Nobel Laureate Meeting. The project, which will be financed by the German Federal Ministry of Education and Research and the Carl Zeiss Foundation is to be finalised in three years’ time. In the meantime, a beta version is accessible at www.mediatheque.lindau-nobel.org.

Content Covering 428 Laureates and 65 Lindau Meetings

To date, 174 video lectures, 288 abstracts and 279 CVs covering 428 Laureates and 65 Lindau Meetings are available online. Unfortunately, no audio recordings from the first meeting in 1951 have been found so far. Therefore, the mediatheque timeline begins with two lectures from the 1952 Lindau Meeting: Otto Hahn (Nobel Prize for Chemistry in 1944) lecturing on “Radiochemistry and the Fission of Uranium”, and Frederick Soddy (Nobel Prize for Chemistry in 1922) speaking about “Isotopes”. In cooperation with the Council’s Executive Secretariat, Anders Bárány, former Vice-Director of the Nobel Museum as well as member of the Royal Swedish Academy of Sciences, is continuing to edit selected lectures. He also provides a commentary that establishes the correct historical context for the lectures. Adam Smith, the Editorial Director of nobelprize.org, is another advisor to the mediatheque project.

Audio documents and annotated historical pictures are put in context with atmospheric video films. Lectures in languages other than English—a limited number of lectures is available in the original German language, particularly from the early years of the meetings—are going to be transcribed and translated into English in order for them to be accessible to a broad international audience. The intention is to later expand the spectrum of languages covered through cooperation with international Academic Partners and academies of science—Spanish, Italian or Chinese transcriptions may then be available. A first step in this direction is a cooperation agreement with the Italian Fondazione Cariplo. This international outreach project will not only improve the mediatheque’s accessibility, but will also raise international awareness of the ‘Mission Education’.

The new Lindau Mediatheque will offer subtitles for lectures held in Lindau. To make all materials in the mediatheque even more accessible to a wider audience, additional language editions will be incorporated into this new feature.

Another feature of the new mediatheque will be transcriptions of lectures held by Nobel Laureates in Lindau.

The screenshot shows the website interface for a lecture titled "Why our Proteins Have to Die so We Shall Live" by Aaron Ciechanover. The page includes a video player, a transcription window, and a list of related content. The transcription window is open, showing the text of the lecture. The video player shows a speaker at a podium. The related content section lists other lectures with video thumbnails and titles.

Research Profiles will offer additional background information on the research done by Nobel Laureates. Short but effective breakdowns of the available literature authored by a specific Laureate provide aspiring and established scientists with a starting point to inform themselves about the research done by the respective Laureates.

The Lindau Mediatheque
Educate. Inspire. Connect.

Research Profile of Ciechanover Aaron

Most highly cited papers

Hershko, Avram, and Aaron Ciechanover. "The Ubiquitin System." *Annual Review of Biochemistry* 67.1 (1998): 425-79. Print.

Glickmann, M. H., and A. Ciechanover. "The Ubiquitin-proteasome Proteolytic Pathway: Destruction for the Sake of Construction." *Physiological Reviews* 82.2 (Apr 2002): 373-428. Print.

Ciechanover, A. "The Ubiquitin-proteasome Proteolytic Pathway." *Cell* 79.1 (Oct 1994): 13-21. Print.

Hershko, A., and A. Ciechanover. "The Ubiquitin System for Protein Degradation." *Annual Review of Biochemistry* 61.1 (July 1992): 761-807. Print.

Dautry-Varsat, A., A. Ciechanover, and H. F. Lodish. "pH and the Recycling of Transferrin during Receptor-Mediated Endocytosis." *Proceedings of the National Academy of Sciences* 80.6 (Apr 1983): 2258-262. Print.

Most recent publications

Ciechanover, A. "Intracellular Protein Degradation: from a Vague Idea through the Lysosome and the Ubiquitin-proteasome System and onto Human Diseases and Drug Targeting." *Medicina (Buenos Aires)* 70.2 (2010): 105-19. Print.

Shabek, Nitzan, and Aaron Ciechanover. "Degradation of Ubiquitin: The Fate of the Cellular Reaper." *Cell Cycle* 9.3 (Feb 2010): 523-30. Print.

Kashuba, E., M. Yurchenko, S. P. Yenamandra, B. Snopok, L. Szekely, B. Bercovich, A. Ciechanover, and G. Klein. "Epstein-Barr Virus-encoded EBNA-5 Forms Trimeric Protein Complexes with MDM2 and p53 and Inhibits the Transactivating Function of p53." *International Journal of Cancer* 128.4 (2010): 817-25. Print.

de Bie, P., D. Zaaroor-Regev, and A. Ciechanover. "Regulation of the Polycomb Protein RING1B Ubiquitination by USP7." *Biochemical and Biophysical Research Communications* 400.3 (Sep 2010): 389-95. Print.

Lecuona, E., H. Sun, C. Vohwinkel, A. Ciechanover, and J. I. Szajder. "Ubiquitination Participates in the Lysosomal Degradation of Na,K-ATPase in Steady-state Conditions." *American Journal of Respiratory Cell and Molecular Biology* 41.6 (2009): 671-79. Print.

Articles in Nature, Science, PNAS

Ciechanover, Aaron. "Timing: Proteolysis: from the Lysosome to Ubiquitin and the Proteasome." *Nature Reviews Molecular Cell Biology* 6.1 (Jan 2005): 79-87. Print.

Hershko, Avram, Aaron Ciechanover, and Alexander Varshavsky. "The Ubiquitin System." *Nature Medicine* 6.10 (2000): 1073-081. Print.

Mayer, A., N. Siegel, A. Schwartz, and A. Ciechanover. "Degradation of Proteins with Acetylated Amino Termini by the Ubiquitin System." *Science* 244.4911 (June 1989): 1480-483. Print.

Zaaroor-Regev, D., P. de Bie, M. Scheffner, T. Noy, R. Shemer, M. Heled, I. Stein, E. Pikarsky, and A. Ciechanover. "Regulation of the Polycomb Protein Ring1B by Self Ubiquitination or by E6-AP May Have Implications to the Pathogenesis of Angelman Syndrome." *Proceedings of the National Academy of Sciences* 107.15 (2010): 6788-793. Print.

Shabek, N., Y. Herman-Bachinsky, and A. Ciechanover. "Ubiquitin Degradation with Its Substrate, or as a Monomer in a Ubiquitination-independent Mode, Provides Clues to Proteasome Regulation." *Proceedings of the National Academy of Sciences* 106.29 (2009): 11907-1912. Print.

Books

Mayer, R. J., Aaron J. Ciechanover, and Martin Rechsteiner, eds. *Protein Degradation*. Weinheim: Wiley-VCH, Print.

Vol. 1: *Ubiquitin and the Chemistry of Life* (2005)

Vol. 2: *The Ubiquitin-Proteasome System* (2005)

Vol. 3: *Cell Biology of the Ubiquitin-Proteasome System* (2006)

Vol. 4: *The Ubiquitin-Proteasome System and Disease* (2007)

Ciechanover, Aaron J., and Maria G. Masucci, eds. *The Ubiquitin-Proteasome Proteolytic System: From Classical Biochemistry to Human Diseases*. Vol. 9. River Edge, NJ: World Scientific, 2002. Print. Recent Advances in Human Biology.

Ciechanover, Aaron J., and Alan L. Schwartz, eds. *Cellular Proteolytic Systems*. New York: Wiley-Liss, 1994. Print.

Imprint

'Mission Education': From Data to Comprehensive Understanding

A major motivator behind the mediatheque project is the idea of interweaving the worlds of science and society. The Nobel Laureates, who have utilised their scientific expertise to the greatest benefit of society, are ambassadors and role models of this approach—as mediators between the two worlds and as guarantors of a sublime level of content quality. Thanks to the support of donors and the assistance of experts, the mediatheque is in a position to provide high-quality and high-value information free of charge to everyone with an interest in science.

Data becomes information becomes knowledge becomes comprehensive understanding—facilitating the progression along this value chain is at the core of the mediatheque concept. Only when specialised scientific information is embedded into a greater context and only if the dots are connected to paint a bigger picture can there be true public appreciation of scientific endeavours. The mediatheque project deals with this challenge by integrating diachronically interweaved, interdisciplinary information into its overall concept. The sophisticated editorial concept ensures that carefully researched and target group-oriented content offers additional information about each Nobel Laureate and their lectures and that this information is easily accessible. One tool to achieve this are so-called topic clusters, which combine media from more than six decades in order to make topics like the "Big Bang Theory" or "Personalised Medicine" easily accessible to a wider public. They bring together the original voices of some of the pioneers of a field with explanations by a narrator. In this respect, the mediatheque will follow in the footsteps of the "Discoveries" exhibition series on Mainau Island (see p. 96) in which special focus was placed on explaining scientific outcomes to a broad public.

Benefiting from the new Lindau Mediatheque

The new mediatheque is an excellent resource for aspiring and established scientists, as it offers enriched and developed but unabridged and unfiltered original scien-

tific material. The comprehensive supply of media is an ideal source of information for carrying out research and preparing topics for particular meetings, in some cases maybe even a Lindau Meeting. The high scientific relevance of the mediatheque content is exemplified by the recent creation of a habilitation project, which focuses exclusively on the picture archives associated with the Lindau Meetings and investigates the changes in the visual language of scientific communication. The extensive content processing of lectures and other documentation available in the archive means that we can expect a range of exciting, perhaps even surprising, insights into the history of science in the future. For example, it was recently discovered that the last lecture given by Laureate Niels Bohr was in fact held in Lindau.

The mediatheque will not only conserve the Laureates' contributions to the Lindau Meetings for years to come, it will make their lectures available for free, 365 days of the year. Hence, the mediatheque may encourage Laureates to come back to Lindau to share their new results and insights, especially knowing that these will be heard beyond Lindau.

The mediatheque may also become a valuable feature of the "Lindau Teachers Initiative" launched this year. By allowing teachers to harness the Laureates' inspirational scientific and personal charisma for their lessons, it may help to bring abstract issues to life in the classroom. Moreover, it offers plenty of resources to support a modern, media-aided approach towards teaching, e.g. mini-lectures (edited short versions of lectures), etc. By providing this type of content, the Council and Foundation aim to attract more students to scientific subjects.

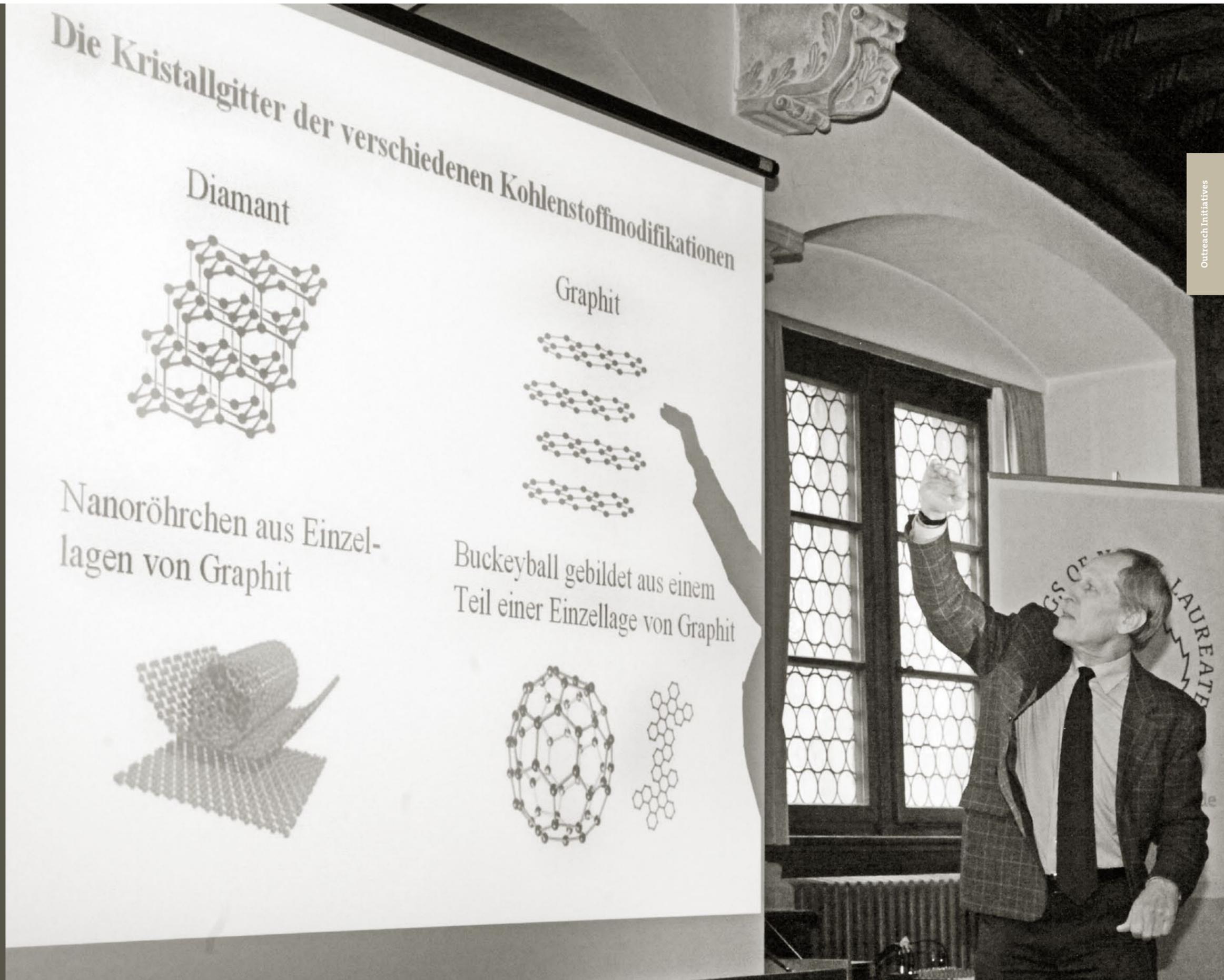
Furthermore, journalists will be able to use the mediatheque for their own research and thus supplement their scientific-historical research with "Lindau perspectives". In addition, new cooperation possibilities will open up as a result of transcribed and translated lectures in different languages, something which can be seen in "Deutschland-radio Wissen". Every week, the "Hörsaal" ("Lecture Hall"/ every Thursday at 8.05 p.m.) features an entire lecture from the archive of the Lindau Meetings.

BEYOND THE 2011 LINDAU MEETING

Outreach Initiatives

The 'Mission Education' of the Council and the Foundation encompasses initiatives that reach beyond the Lindau Meetings of Nobel Laureates. Like the projects described above—exhibitions and media theque—the benefits of the initiatives introduced here extend far beyond the Lindau Meetings themselves. The teacher initiative strengthens the 'Mission Education' by creating a link between school education and leading research. The exhibitions with the portraits of Peter Badge—in Paris and Madrid—show that the project of the Foundation Lindau Nobelprizewinners Meetings at Lake Constance, having begun more than eleven years ago, has not lost any of its appeal. The panel discussion organised by Siemens AG in Munich on the future of medicine and an exhibition with photographs from Volker Steger, or the matinee organised together with the Lindauer Zeitung which presented the Nobel Prizes of the year 2010 to an interested general public in Lindau, are not just proof of the great interest in the discoveries of the Laureates. They also show the work of the Council and Foundation in pursuing the 'Mission Education' outside the actual Nobel Laureate Meeting and demonstrate its efforts to facilitate communication between science and society.

Burkhard Fricke, Physics Professor and member of the Council for the Lindau Nobel Laureate Meetings demonstrates how the experimental physicists Andre Geim and Konstantin Novoselov discovered graphene.



The Lindau Teachers Initiative

This new initiative of the Council and Foundation is designed to build a bridge between school education on the one side and the international science community on the other. Committed teachers do not merely educate young people. They encourage curiosity and an eagerness for knowledge in children and adolescents with true-to-life topics, pupil-centred classes and exciting excursions. Thus, inspiring school education is often the basis for later scientific careers. In cooperation and with support of Vodafone Foundation Germany, the Foundation Haus der kleinen Forscher, Karl Heinz Beckurts-Stiftung and International Lake Constance Conference (IBK), a group of selected teachers was invited to attend the 61st Lindau Meeting of Nobel Laureates on Tuesday, 28th June.

Nominated for their strong commitment in teaching natural sciences at school and in extra-curricular activities, 17 teachers from Germany and one teacher from Austria took advantage of the opportunity to hear the lectures by Nobel Laureates Peter C. Agre, Sir Harold W. Kroto, Ei-ichi Negishi, Werner Arber and Jean-Marie Lehn. Following the panel discussion on “The Future of Biomedicine”, the group was invited by Nobel Laureate Erwin Neher to exchange thoughts on how to convey the fascination of science and research to young people. “The experience of meeting young enthusiastic people from around the world, who all share a passion for science and research and a curiosity for their work, was most inspiring for me—especially with regard to my profession. As teachers, we try to generate enthusiasm in our pupils and encourage them to stay inquisitive throughout their lives,” said Kathrin Woltering, teacher at Englisches Institut Heidelberg.

The invitations for the teachers were funded by Vodafone Foundation Germany and supported by the German Philologists’ Association (Deutscher Philologenverband, DPhV). As initiators of the German Teachers’ Prize “Deutscher Lehrpreis – Unterricht innovativ”, Vodafone Foundation Germany, the DPhV and Heraeus Bildungstiftung strive to raise public awareness of the teaching profession. Eight of the 18 invited teachers are winners of the German Teachers’ Prize 2010 and 2009.

Exhibitions in Paris and Madrid

The “International Year of Chemistry” of the United Nations in 2011 is coordinated by UNESCO and the International Union of Pure and Applied Chemistry (IUPAC). Its objective is to familiarise the broad public with achievements in chemistry and their contributions to human well-being. In this context, the achievements of outstanding chemists are recalled. With an exhibition of 76 portraits of Nobel Laureates in Chemistry by Peter Badge, the project in cooperation with the Foundation Lindau Nobelprizewinners Meetings at Lake Constance featured at the official opening of the “International Year of Chemistry”. Badge’s portraits show the Laureates as people beyond their research institutions. The project, which has been ongoing since 2000, features snapshots taken in empathy; often very personal. They all reflect the intelligence, curiosity and wisdom of each individual scientist. The exhibition was held from January to March in the Musée des Arts et Métiers in Paris and was organised with the support of the new Academic Partner of the Nobel Laureate Meetings, the Centre National de la Recherche Scientifique (CNRS). De Gruyter published the “Peter Badge—Nobel Chemists” catalogue with articles by authors such as Irina Bokova (Director General of UNESCO) and Nobel Laureate Aaron Ciechanover. Under the title “Internationale Exzellenznetzwerke: Perspektiven für die deutsch-spanische Zusammenarbeit in Wissenschaft und Forschung” (lit: “International Excellence Networks: Perspectives for German-Spanish Cooperation in Science and Research”), the German Academic Exchange Service (DAAD) and the Universidad Autónoma de Madrid (UAM) organised German-Spanish “University Days” from 6th to 7th June. The event was part of the Espacio de encuentro hispano-alemán series, which took place

The Lindau Teachers Initiative



Teachers at Lindau 2011 (from left to right):

Herrmann Heinzelmann (Kreisgymnasium Riedlingen), Rudolf Öller (Bundesgymnasium Blumenstraße, Bregenz/Austria), Kai Stahl (Hohenstaufen-Gymnasium, Kaiserlautern), Cornelia Rieck (Rupprecht Gymnasium, Munich), Hans Peter Wolter (Integrierte Gesamtschule Contwig), Uwe Metzner (Paul-Prätorius-Gymnasium, Bernau), Thomas Ellerbeck (Member of the Council and Board of Foundation of the Lindau Meetings), Kathrin Woltering (Englisches Institut Heidelberg), Janna Pahnke (Stiftung Haus der kleinen Forscher, Berlin), Martina Blazek (Berufsbildende Schule Montabaur), Ole Müller (Carl-Friedrich-Gauß-Gymnasium, Frankfurt/Oder), Erwin Neher (Nobel Laureate), André Remy (Adolfinum, Moers), Hiltrud Krey (Max-Eyth-Schule, Schiffdorf), Andreas Lisson (Gerhart-Hauptmann-Realschule, Gelsenkirchen), Petra Wickenkamp (Vodafone Foundation Germany), Burkhard Fricke (Member of the Council), Gerhard Wellmann (Anne-Frank-Schule, Eschwege), David Deißner (Vodafone Foundation Germany), Frank Heinrich (Carl-Friedrich-Gauß-Gymnasium, Frankfurt/Oder), Mario Sader (Max-Steenbeck-Gymnasium, Cottbus), Wilfried Wentorf (Heinrich-Heine-Schule, Gymnasium des Kreises Plön, Heikendorf), Andreas Kämmerer (Johannes-Gutenberg-Gymnasium, Waldkirchen).



Selected teachers were invited by Nobel Laureate Erwin Neher to exchange thoughts on how to convey the fascination of science and research to young people.



Burkhard Fricke, Physics Professor from Kassel and member of the Council for the Lindau Nobel Laureate Meetings in a discussion with participating teachers.

until the end of June across Spain under the patronage of King Juan Carlos I and Federal President Christian Wulff. Nobel Laureate in Physiology or Medicine, Erwin Neher, was a guest speaker at the opening of the “University Days”. Neher has many contacts with expert colleagues and institutions in Spain. As part of the event, DAAD and the Executive Secretariat of the Nobel Laureate Meetings organised an exhibition with portraits of German Nobel Laureates photographed by Peter Badge. 21 photographs were shown in the UAM.

Future of Medical Technology: Discussion in Munich

After this year’s Nobel Laureate Meeting, a panel discussion on the future of medical technology was organised by Siemens in cooperation with the Foundation Lindau Nobelprizewinners Meetings at Lake Constance and the Technical University of Munich. It was held on 2nd July. Three Nobel Laureates—Aaron Ciechanover, Hartmut Michel and Werner Arber—along with Markus Schwaiger, Clinic Director at the Department of Nuclear Medicine in the Klinikum rechts der Isar, and Hermann Requardt, CEO of the Healthcare Sector at Siemens AG, discussed the most important technological trends in medical technology, how illnesses can be detected earlier and treated more effectively with the aid of new diagnostic and therapeutic procedures, and how intelligent IT systems can prevent wrong or ineffective treatments.

After the panel discussion, the audience had the chance to visit the exhibition “Nobelpreisträger in Lebensgröße” (lit: “Nobel Laureates in Life Size”) by the renowned science photographer Volker Steger. Many of his photographs were taken during the Lindau Meetings.

Future Exhibition Projects

Exhibitions of the portraits of Peter Badge are also planned in 2012. The project by the Foundation Lindau Nobelprizewinners Meetings at Lake Constance began in 2000 and has been continued ever since with the support of Klaus Tschira Stiftung gGmbH. Exhibitions in Israel, the USA, Germany and other countries as well as book projects (e.g. Wiley-VCH, “Nobels—Nobel Laureates photographed

by Peter Badge”, 2008) have made the portraits accessible to an international audience. The series is set to continue into the future.

With the Nobel Museum in Stockholm and Munich-based photographer Volker Steger, discussions on a joint, international exhibition project were held in 2011. Olov Amelin, Director of the Nobel Museum, and Adam Smith, Editorial Director of nobelprize.org, held talks with representatives from the Council and Foundation in the Lindau administration office for this purpose. Launch of the exhibition is scheduled for the 62nd Meeting of Nobel Laureates (2012).

Matinee “Explaining Nobel Prizes”

Most of the guests at the matinee on 30th January 2011 in the old town hall of Lindau had never heard of the new “wonder material” of graphene. And the secrets of palladium-catalysed coupling in organic synthesis had up until then remained hidden to most Lindau residents. In 2010, Nobel Prizes were awarded for these ground-breaking discoveries.

Before the new Laureates come to one of the next meetings in Lindau, scientists introduced the Laureates and classified their scientific accomplishments—particularly with respect to their importance for mankind. About 150 Lindau citizens came to this matinee, which was organised by the Council for the Nobel Laureate Meetings and Lindauer Zeitung.

Burkhard Fricke, Physics Professor from Kassel, member of the Council for the Lindau Nobel Laureate Meetings and also Lindau alumnus, used coal and sellotape to demonstrate how the experimental physicists Andre Geim and Konstantin Novoselov discovered graphene. Nobel Laureates in Chemistry Richard Heck, Ei-ichi Negishi and Akira Suzuki, on the other hand, were introduced by Alexander Düfert, a young alumnus participant of the 2009 Lindau Meeting. The work of Robert Edwards, Nobel Laureate in Physiology or Medicine, was introduced by Marcel Leist, Professor as well as Academic Partner at the University of Konstanz. Wolfgang Schürer, Chairman of the Board and Scientific Co-Chair of the Economics Meeting, explained the research of Peter A. Diamond, Dale T. Mortensen and Christopher A. Pissarides. Ralf Geisenhanslüke, Editor-in-Chief of Schwäbische Zeitung, was moderator of the matinee.



With an exhibition of 76 portraits of living Nobel Laureates in Chemistry by Peter Badge, a project supported for many years by the Foundation Lindau Nobelprizewinners Meetings at Lake Constance was featured at the official opening of the “International Year of Chemistry” in Paris, France.



(From left) German Ambassador Reinhard Silberberg and Christine Arndt from the DAAD España together with Nobel Laureate Erwin Neher at the opening of the “University Days” in Madrid, Spain.



Nobel Laureate and member of the Council for the Lindau Nobel Laureate Meetings Hartmut Michel at the exhibition of Volker Steger in Munich. It was organised by Siemens and the Technical University of Munich in cooperation with the Foundation Lindau Nobelprizewinners Meetings at Lake Constance.

BEYOND THE 2011 LINDAU MEETING

Enabling the 'Mission Education'

In 2011, the Foundation continued its successful strategy of securing financial stability for the meetings and the 'Mission Education'. The establishment of a public-private partnership for the Lindau Meetings has proven to be a sustainable concept.

Total contributions to the endowment of the Foundation could be increased to € 24 million; however, due to historically low interest rates, earnings have remained rather low.

Project-related support and donations in kind are thus more important than ever for maintaining the standard of the meetings and enhancing this dynamic. The Council and Foundation are committed to sustaining this development.



Enabling 'Mission Education'

The Laureates' Gallery at the entrance to Lindau Island.

Contributions to the Endowment

Although the volatility in global financial markets has also had its impact on the Lindau Nobel Laureate Meetings, it must be noted that all endowment contributors have continued their commitment. Furthermore, new supporters have been attracted to the 'Mission Education'. This reflects the relevance of the Lindau scientific dialogue across and among generations and cultures as well as its continuous progress.

Swiss Re, the world's second-largest reinsurance company, has joined the endowment as Principal Patron and has also taken on the role of Academic Partner by nominating candidates for the 4th Lindau Meeting on Economic Sciences. Mars, Incorporated, Porsche AG, Lockheed Martin, Siemens, Bayer and the Volkswagen Group have increased their donations to the endowment.

They have joined a circle of excellence with members from the public and the private sector.

Partnerships with international foundations have again been strengthened with contributions by the Jacobs Foundation and Fondazione Cariplo. The Lindau Foundation aims at reaching out and broadening international cooperation.

Although the endowment has been enhanced from €21.5 million in 2010 to the current level of €24 million, the increase in capital currently does not offset the loss in earnings as a result of historically low interest rates. The Foundation's strategy of raising project-related funds in addition to the endowment therefore remains essential.

The Foundation hereby ensures the continuous development of the meetings and the Lindau 'Mission Education' from both a short-term and long-term perspective.

It is the multiple leverage generated by the joint efforts of the Foundation itself, its contributors, the project supporters and the in-kind donors, coming from both the public and the private sector together with a strong backing in science institutions and our Academic Partners that makes the Lindau strategy so effective.

Support for the 61st Lindau Nobel Laureate Meeting

Despite the monodisciplinary focus of the 61st Lindau Meeting compared to last year's anniversary interdisciplinary meeting, it was the clear intention of the organisers to retain the high standard of the "Lindau Dialogue". Consequently, the quality of service in the areas of meeting infrastructure, technology and services, in addition to accommodation and catering, has been maintained or improved.

The generous support of the Benefactors of the 61st Lindau Meeting of Nobel Laureates enabled the Lindau institutions to welcome all selected candidates to Lindau, regardless of their financial background and based solely on their scientific achievements.

As in the years before, the largest single donor was the German Federal Ministry of Education and Research. The Ministry further enhanced and deepened its support by also financing the exhibition "Discoveries 2011: Health" as part of an integral approach.

All long-term public partners such as the German Research Foundation (DFG), the International Lake Constance Conference (IBK), the Free State of Bavaria, the State of Baden-Württemberg and also the OPEC Fund for International Development (OFID) have continued their support, providing highly welcomed stability and sustainability. A new agreement with the European Commission, bringing its support to a new level, is currently under negotiation and is close to being finalised.

The ongoing commitment of science-promoting foundations is another important cornerstone of Lindau's framework. This year, the Boehringer Ingelheim Foundation, the Robert Bosch Stiftung, the Deutsche Telekom Stiftung, the Hertie Foundation, the Joachim Herz Stiftung, the Jacobs Foundation, the Else-Kröner-Fresenius-Stiftung, and the Klaus-Tschira-Stiftung have fostered the 'Mission Education' with their contributions.

Most of those foundations have partnered with the Lindau Foundation to establish fellowship programmes, which have become crucial in ensuring the participation of Young Researchers from countries enduring economic hardship.



Merck KGaA kindly provided a maximum brightness video projector and LC displays for the outdoor panel discussion at Mainau Island.



Sennheiser electronic GmbH & Co. KG provided high quality microphone systems and support for all events.



JURA Elektroapparate AG supplied all participants of the 61st Lindau Meeting with coffee-making facilities.



Bottled water was provided by EnBW Energie Baden-Württemberg AG.

As the Lindau Meetings are reaching out to more and more countries each year, with a special focus on Africa and Latin America, these fellowship programmes have proven to foster the very core of Lindau's goals. As a consequence, the Foundation aims at establishing further fellowship programmes with additional partners in the years to come.

The programme of the meeting was enriched with financial and organisational support from the International Day host, the United States of America (see page 66), and the Elite Network Bavaria for the Bavarian Evening (see page 79). The highly successful new format of Science Breakfasts was realised jointly with the USA, Mars, Incorporated, and German Cancer Research Center (DKFZ). Further Principal Benefactors contributing significantly to the success of the meeting include BASF, Bayer, EnBW, Mars, Incorporated, Microsoft and Porsche.

Donations in Kind

Especially in challenging economic times, only the interplay of project-related support and donations in kind makes it possible to organise the Nobel Laureate Meetings and ensure they have a high standard without putting further burden on the budget. The Council and Foundation are grateful that many long-term partnerships could be continued for the 61st Lindau Meeting. These include:

- The wireless network infrastructure, fully equipped Internet working stations and a "Futurists' Household Showroom" were realised by T-Systems of Deutsche Telekom AG.
- Audi and VW shuttle limousines for the transport of Nobel Laureates and other special guests were provided by the Volkswagen Group.



The Volkswagen Group (VW and Audi) kindly provided transportation for Nobel Laureates and other special guests.



Deutsche Telekom AG kindly supplied participants with wireless Internet access and fully equipped Internet workstations.

- An allotment of world-wide flight tickets provided by Deutsche Lufthansa AG allowed smooth booking of flights for Laureates.
- Sennheiser electronic GmbH & Co. KG ensured the excellent acoustics by providing high-quality microphone systems and support for all event locations.
- JURA Elektroapparate AG supplied coffee-making facilities for all participants.
- Bottled water was provided by EnBW Energie Baden-Württemberg AG.
- Mondi Europe & International provided high-quality paper for selected prints.
- Lindaupark contributed to the success of the “Grill & Chill” barbecue by providing food and consumables, while the City of Lindau made the location available at no cost.
- Use of the city bus lines was offered for free by the Stadtwerke Lindau, as well as entrance to most local public baths and to the Picasso exhibition (City of Lindau).

New collaborative ventures could be set up with the following donors:

- The production of web streams of lectures was offered as a donation by Baas TV, while Level 3 Communications and Axinom GmbH provided bandwidth capacity for high-demand distribution.
- German pharmaceutical and chemical company Merck KGaA, being a pioneer of liquid crystal technology, provided a maximum brightness video projector for the outdoor panel discussion at Mainau Island as well as LC displays.
- OSRAM AG contributed to the stage quality of the meeting and its social programme with effect lights.

Lindau Mediatheque

As the preparatory phase of the Lindau Mediatheque, supported by the Gerda Henkel Foundation and the Fachinformationszentrum Karlsruhe (FIZ) which provided examples for transcriptions as well as literature research, has been completed, the new project could be officially launched as the funding for the upcoming three-year project cycle will be guaranteed by the Carl Zeiss Stiftung and the German Federal Ministry of Education and Research. This ensures the long-term success of this ambitious new venture. Further details can be found on page 104.

Exhibition

In its final year, the exhibition series “Discoveries 2011: Health” has once again been a tremendous success due to the relevance of the topic and the attractive presentation. This exhibition was realised with the financial support of the German Federal Ministry of Education and Research as a part of the Year of Science 2011 and with the many dedicated and enthusiastic contributions by the exhibitors, which generated the extra leverage to ensure success. Learn more about the exhibition on page 96.

Prospects

The Foundation is committed to continuing its successful partnerships with endowment contributors and to welcoming new partners to the ‘Mission Education’. The Foundation and Council plan to establish new fellowship programmes for all disciplines to enable the participation of Young Scientists from all countries of the world, regardless of their financial capabilities. In addition to financial support, institutions such as the Alexander von Humboldt Foundation, the OPEC Fund for International Development (OFID), the German Research Foundation (DFG), the German Academic Exchange Service (DAAD) and others are contributing to this by identifying, nominating and supporting candidates from the less privileged regions of the world.

Donations in kind will continue to play an important role, especially with the challenging situation of the outdated “Inselhalle” venue, which requires strenuous efforts to ensure the excellence of the “Lindau Dialogue”.

The responsibility for the Foundation’s strategy, acquisitions and negotiations with the endowment partners lies with the Chairman of the Board, Wolfgang Schürer. Relation management is a joint task of the Chairman and the Managing Director, Nikolaus Turner. Werner Ebke is responsible for legal issues, and Thomas Ellerbeck for communications. The close cooperation with the Council and its Executive Secretariat has ensured the continued and increased level of support. The investment committee of the Foundation decides on the portfolio strategy of the Foundation’s endowment, thus ensuring the financial stability of the meetings. The Chairman of the Board upholds close relations with decision-makers in the fields of science, business and politics, both on a national and international level to further enhance the impact of the ‘Mission Education’. The work of the Boards of the Foundation and the Council is carried out on a pro-bono basis, amounting to several hundred working days per year.

Ivan Potapenko Norway

The 61st Lindau Nobel Laureate Meeting was most definitely one of the greatest highs in my scientific career, uniquely balancing the rich educational programme with an unparalleled social interactivity. Having brought some of the most prolific scientists of recent decades together in one location, it was an unmatched experience to be able to both to listen to their lectures and then have a chance to discuss the various topics with them. Even setting the top-notch scientific discourses aside, the sheer inspirational potential of these talks was immeasurable for me as a Young Scientist, reinvigorating and compelling me to explore further—both my own field and far beyond. But perhaps the single most outstanding aspect of this meeting that I believe sets it apart from others, was the social component. Meeting other Young Researchers from a variety of fields—despite being seemingly as far apart as they could possibly be, brought about a sudden realisation in me of how intertwined and interdependent today’s research really is. While it is all too easy to constrict one’s perspectives to a single direction of research, this meeting was an eye-opener for new horizons of novel approaches, alternative disciplines and an unequalled occasion to think out of the box.



BEYOND THE 2011 LINDAU MEETING

Organisation

The year 2011 has been characterised by a peak in activities as part of the 'Mission Education'. The realisation of two Nobel Laureate Meetings, the third part of the exhibition series "Discoveries" on the topic of health, the kick-off of the ambitious new project "Lindau Mediatheque" as well as a variety of complementary projects and procedural changes have only been possible through the joint efforts of the Council and Foundation members as well as the staff at the Executive Secretariat.



The Young Researchers' Support at the Inselhalle conference venue.

Council for the Lindau Nobel Laureate Meetings

Foundation Lindau Nobelprizewinners Meetings at Lake Constance

HONORARY PRESIDENT
Count Lennart Bernadotte (†)

BOARD
Countess Bettina Bernadotte, President
Wolfgang Schürer, Vice-President
Helmut Sies, Vice-President
Nikolaus Turner, Treasurer

MEMBERS
Werner F. Ebke
Thomas Ellerbeck
Peter Englund
Burkhard Fricke
Astrid Gråslund
Martin F. Hellwig
Hans Jörnvall
Wolfgang Lubitz
Hartmut Michel

CORRESPONDING MEMBERS
Lars Bergström
Sten Orrenius
Dagmar Schipanski

PERMANENT GUESTS
Gabriela Dür
Petra Meier to Bernd-Seidl

HONORARY PRESIDENTS
Count Lennart Bernadotte (†)
Roman Herzog

HONORARY SENATE
Josef Ackermann
Suleiman Jasir Al-Herbish
José Manuel Barroso
Christof Bosch
Ernesto Bertarelli
Martin Engstroem
William H. Gates III
Ulrich Grete
Roman Herzog
Klaus J. Jacobs (†)
Henning Kagermann
Malcolm D. Knight
Pamela Mars
Angela Merkel
Joachim Milberg
Johannes Rau (†)
Annette Schavan
Shri Kapil Sibal
HRH Princess Maha Chakri Sirindhorn
Edmund Stoiber
Erwin Teufel
Daniel Vasella
Ernst-Ludwig Winnacker
Martin Winterkorn

BOARD
Wolfgang Schürer, Chairman
Countess Bettina Bernadotte
Werner F. Ebke
Thomas Ellerbeck
Nikolaus Turner, Managing Director

SECRETARIAT
Monika Reichert

OFFICE OF THE CHAIRMAN
Andreas Böhm, Senior Research Associate to the Chairman
Karin Ejckelhof, Personal Assistant to the Chairman

EXECUTIVE SECRETARIAT
<p>Director</p> <p>Wolfgang Huang</p>
<p>Conference Management</p> <p>Susanne Wiczorek, Deputy Director</p> <p>Katja Merx (as of 1st February 2011)</p>
<p>Young Researchers' Support</p> <p>Nadine Gärber</p> <p>Julia Schürer (up to 31st October 2011)</p> <p>Alexandra Wimbauer</p>
<p>Communications</p> <p>Christian Rapp (up to 31st December 2011)</p> <p>Jan Keese</p> <p>Christian Schumacher</p>
<p>Science and Research</p> <p>David Siegel (as of 1st July 2011)</p>
<p>Office Management, Guest Relations, Accounting</p> <p>Anke Elben</p> <p>Monika Reichert</p>

Words of Thanks

The year 2011 has also been a year of change, with two of the most distinguished, longest-standing Council members leaving the Council after three decades. The dedicated and excellent contributions of Laureate Werner Arber as well as of Jürgen Uhlenbusch will be seriously missed, as well as their much-sought-after advice and foresight. The Council would like to express its warmest words of thanks for their outstanding work.

At the same time, Laureate Hartmut Michel has been welcomed as a new member to the Council.

After six years of service for the Executive Secretariat, the team's head of communications, Christian Rapp, has chosen to follow new paths; together with speaker of the Council, Thomas Ellerbeck, he built up the communications work for the Lindau Laureate Meetings almost from scratch. The Council would like to convey its sincerest thanks and appreciation for his enormous commitment and the many eminent milestones accomplished.

The Executive Secretariat has been supported in the conduct of the meetings by Maria Regele, Lisa Suckert, Felice Puopolo, Melachrini Georgas, Markita Landry and Sabine Neufang. The exhibition "Discoveries 2011: Health" has been supported by the Mainau staff and Lena Hermann in particular. Highly valued contributions to the media-theque have been made by Anders Bány and Adam Smith.

Last but not least, the 'Mission Education' would have been much less successful without the contributions of the Chairman's office at St. Gallen, namely Andreas Böhm, Karin Ejckelhof and Gabriella Hauser.

The Council and Foundation Board would like to thank all who have contributed to this year's successes for their outstanding work.

Maecenates, Patrons, Donors of the Foundation

MAECENATES		
Audi AG	Freistaat Bayern	SAP AG
Bayer AG	Lockheed Martin	Siemens AG
Deutsche Bank AG	Corporation	Verband der Bayerischen
Dr. Ing. h.c. F. Porsche AG	Mars, Incorporated	Metall- u. Elektroindustrie
Ecoscientia Stiftung	McKinsey & Company	
EnBW Energie Baden-Württemberg AG	Microsoft Corporation	
	RWE AG	
PRINCIPAL PATRONS		
Bertarelli Foundation	Südwestmetall Verband der	Verein der Bayerischen
Lonza AG	Metall und Elektroindustrie Baden-	Chemischen Industrie e.V.
NOVARTIS International AG	Württemberg e.V.	Volkswagen AG
Principality of Liechtenstein	Swiss Re	
PATRONS		
Deutsche Telekom Stiftung	Klaus Tschira Stiftung gGmbH	Verein Deutscher Ingenieure e.V.
Holcim Ltd	Robert Bosch GmbH	
PRINCIPAL DONORS		
Fondazione Cariplo	LGT Group Foundation	Tchibo Holding AG (maxingvest ag)
Jacobs Foundation	Monika and Wolfgang Schürer	Verband der Chemischen Industrie e.V.
Jungbunzlauer AG	Synthes-Stratec Inc.	Hansjörg Wyss Medical Foundation
DONORS		
acatech—Deutsche Akademie der Technikwissenschaften	Familie Graf Lennart Bernadotte af Wisborg	Ruth Schilling
Alexander and Katalin Dembitz	GfK Nürnberg e.V.	Sal. Oppenheim jr. & Cie. KGaA
Alexander S. Onassis Public Benefit Foundation	GfK SE	Sparkasse Memmingen-Lindau-Mindelheim
Alice and W. Simon Newman	Hilti Foundation	Sparkassenverband Bayern
Artur Fischer	Hovalwerk AG	Ulrich B. Stoll
Bärbel and Joachim Milberg	Ivoclar Vivadent AG	Vacheron Constantin
Boehringer Ingelheim GmbH	Liechtensteinische Landesbank AG	Verwaltungs- und Privatbank AG
Carl Zeiss AG	Lyndon L. and Mrs. Olson	
ETO Group	Paula Hirsch	and the Friends of the Foundation
	Pwc PriceWaterhouseCoopers IL	

Benefactors

PRINCIPAL BENEFACTORS		
BASF SE	EnBW Energie Baden-Württemberg AG	Land Baden-Württemberg
Bayer AG	European Commission	Mars, Incorporated
Boehringer Ingelheim Stiftung	Freistaat Bayern—	Merck KGaA
Bundesministerium für Bildung und Forschung (BMBF)	Staatsministerium für Wissenschaft, Forschung & Kunst	Microsoft Corporation
Carl Zeiss Stiftung	Gemeinnützige Hertie Stiftung	The OPEC Fund for International Development (OFID)
Deutsche Forschungsgemeinschaft (DFG)	International Lake Constance Conference (IBK)	Robert Bosch Stiftung GmbH
Deutsche Telekom AG	Jacobs Foundation	Volkswagen Group
Deutsche Telekom Stiftung	Joachim Herz Stiftung	
Dr. Ing. h.c. F. Porsche AG	Klaus Tschira Stiftung gGmbH	
Else Kröner-Fresenius-Stiftung		
BENEFACTORS		
Alexander S. Onassis Public Benefit Foundation	Fundação Caluste Gulbenkian	Siemens AG
AUDI AG	Gebrüder Weiss GmbH	Sparkasse Memmingen-Lindau-Mindelheim
Baas Film GmbH	Gerda Henkel Stiftung	
Baden-Württemberg International	Helmholtz Association of German Research Centres	Spielbank Lindau
Big Image Systems GmbH	Hewlett-Packard, L.P.	Staatliche Lotterieverwaltung (Bayern)
BIOPRO Baden-Württemberg	Jura Elektroapparatebau AG	Stadt Lindau (B)
Christa und Hermann Laur-Stiftung	Lennart-Bernadotte-Stiftung	Stadtverkehr Lindau (B) GmbH
Deutsche Bank AG	Lindauer Zeitung	Stadtwerke Lindau (B) GmbH & Co. KG
Deutsche Bank Stiftung	Lindaupark	Stifterverband für die Deutsche Wissenschaft e.V.
Deutsche Lufthansa AG	Lista Office AG	Stiftung van Meeteren
Deutscher Akademischer Austauschdienst (DAAD)	Lockheed Martin Corporation	Südkurier GmbH Medienhaus
Eduard Rhein Foundation	Mainau GmbH	US Department of Energy
Elitenetzwerk Bayern	Max-Planck-Gesellschaft	Vacheron Constantin
Erholungswerk Post Postbank	Mondi Europe & International	Vodafone Stiftung Deutschland
Telekom e.V. Villa Alwind	MS Management Service AG	gGmbH
ETO Group	The Nobel Foundation	Wellcome Trust
Fachinformationszentrum Karlsruhe (FIZ)	OKI Systems (Deutschland) GmbH	Wilhelm Sander-Stiftung
Fondation du Festival & Académie de Verbier	OSRAM AG	Wissenschaftsgemeinschaft
Fondazione Cariplo	Peter Dornier Stiftung	Gottfried Wilhelm Leibniz e.V.
Förderverein Römerbad e.V.	PricewaterhouseCoopers AG (PwC)	
Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V.	Professor-Rhein-Stiftung	and anonymous Benefactors
	ProLindau Marketing GmbH & Co. KG	
	Qiagen GmbH	
	SAP AG	
	Sennheiser electronic GmbH & Co. KG	

Preliminary Account for the 61st Meeting of Nobel Laureates 2011

(as of 31st September 2011, including expected income and expenses until 31st December 2011)

REVENUES PART I

Donations and funds from the public sector (Bundesministerium für Bildung und Forschung (BMBF), European Commission, Freistaat Bayern – Staatsministerium für Wissenschaft, Forschung & Kunst, International Lake Constance Conference (IBK), Land Baden-Württemberg, Ministerium für Wissenschaft, Forschung und Kunst Baden Württemberg, Stadt Lindau, U.S. Department of Energy, U.S. National Institutes of Health), **from institutions aiding the advancement of science** (Deutsche Forschungsgemeinschaft (DFG), Deutscher Akademischer Austauschdienst (DAAD), Fraunhofer – Gesellschaft zur Förderung der angewandten Forschung e. V., Helmholtz Association of German Research Centres, Max-Planck-Gesellschaft, Wissenschaftsgemeinschaft Gottfried Wilhelm Leibniz e. V.), **from industry** (BASF SE, Bayer AG, Deutsche Telekom AG, Dr. Ing. h.c. F. Porsche AG, EnBW Energie Baden-Württemberg AG, Mars, Incorporated, Merck KGaA, Microsoft Corporation, Volkswagen Group, AUDI AG, Baas Film GmbH, Baden-Württemberg International, Big Image Systems GmbH, BIOPRO Baden-Württemberg, Deutsche Bank AG, Deutsche Lufthansa AG, ETO Group, Gebrüder Weiss GmbH, Hewlett-Packard, L.P., Jura Elektroapparatebau AG, Lindauer Zeitung, Lindaupark, Lista Office AG, Lockheed Martin Corporation, Mainau GmbH, Mondi Europe & International, MS Management Service AG, OSRAM AG, PricewaterhouseCoopers AG (PwC), ProLindau Marketing GmbH & Co. KG, Qiagen GmbH, Sennheiser electronic GmbH & Co. KG, Siemens AG, Sparkasse Memmingen-Lindau-Mindelheim, Spielbank Lindau, Staatliche Lotterieverwaltung (Bayern), Stadtverkehr Lindau (B) GmbH, Stadtwerke Lindau (B) GmbH & Co. KG, Südkurier GmbH Medienhaus, Vacheron Constantin) and **charitable or non-profit organisations** (Boehringer Ingelheim Stiftung, Carl Zeiss Stiftung, Deutsche Telekom Stiftung, Else Kröner-Fresenius-Stiftung, Gemeinnützige Hertie Stiftung, Jacobs Foundation, Joachim Herz Stiftung, Klaus Tschira Stiftung gGmbH, The OPEC Fund for International Development (OFID), Robert Bosch Stiftung GmbH, Alexander S. Onassis Public Benefit Foundation, Christa und Hermann Laur-Stiftung, Deutsche Bank Stiftung, Elitenetzwerk Bayern, Erholungswerk Post Postbank Telekom e.V. Villa Alwind,

Fondation du Festival & Académie de Verbier, Fondazione Cariplo, Förderverein Römerbad e.V., Fundação Caluste Gulbenkian, Gerda Henkel Stiftung, Lennart-Bernadotte-Stiftung, The Nobel Foundation, Peter-Dornier-Stiftung, Stifterverband für die Deutsche Wissenschaft e.V., Stiftung van Meeteren, Vodafone Stiftung Deutschland gGmbH, Wellcome Trust, Wilhelm Sander-Stiftung) and the Foundation Lindau Nobelprizewinners Meetings at Lake Constance with its **Maecenates** (Audi AG, Bayer AG, Deutsche Bank AG, Dr. Ing. h.c. F. Porsche AG, Ecoscientia Stiftung, EnBW Energie Baden-Württemberg AG, Freistaat Bayern, Lockheed Martin Corporation, Mars, Incorporated, McKinsey & Company, Microsoft Corporation, RWE AG, SAP AG, Siemens AG, Verband der Bayerischen Metall- u. Elektroindustrie), **Principal Patrons** (Bertarelli Foundation, Lonza AG, NOVARTIS International AG, Principality of Liechtenstein, Südwestmetall Verband der Metall und Elektroindustrie Baden-Württemberg e.V., Swiss Re, Verein der Bayerischen Chemischen Industrie e.V., Volkswagen AG), **Patrons** (Deutsche Telekom Stiftung, Holcim Ltd, Klaus Tschira Stiftung gGmbH, Robert Bosch GmbH, Verein Deutscher Ingenieure e.V.), **Principal Donors** (Fondazione Cariplo, Jacobs Foundation, Jungbunzlauer AG, LGT Group Foundation, Monika and Wolfgang Schürer, Synthes-Stratec Inc., Tchibo Holding AG (maxingvest ag), Verband der Chemischen Industrie e.V., Hansjörg Wyss Medical Foundation), **Donors** (acatech – Deutsche Akademie der Technikwissenschaften, Alexander and Katalin Dembitz, Alexander S. Onassis Public Benefit Foundation, Alice and W. Simon Newman, Artur Fischer, Bärbel and Joachim Milberg, Boehringer Ingelheim GmbH, Carl Zeiss AG, ETO Group, Familie Graf Lennart Bernadotte af Wisborg, GfK Nürnberg e.V., GfK SE, Hilti Foundation, Hovalwerk AG, Ivoclar Vivadent AG, Liechtensteinische Landesbank AG, Lyndon L. Olson and Mrs. Olson, Paula Hirsch, PricewaterhouseCoopers AG (PwC), Sal. Oppenheim jr. & Cie. KGaA, Sparkasse Memmingen-Lindau-Mindelheim, Sparkassenverband Bayern, Ulrich B. Stoll, Vacheron Constantin, Verwaltungs- und Privatbank AG) and the **Friends of the Foundation**.

AMOUNT	1.450.425,42 EUR
--------	------------------

REVENUES PART II

Participant Fees and Travel, Boarding or Lodging Reimbursements for Young Researchers (A*Star Graduate Academy (Singapore), Academy of Finland, Academy of Sciences Malaysia, acatech – Deutsche Akademie der Technikwissenschaften, Alexander S. Onassis Public Benefit Foundation, Alexander von Humboldt-Stiftung, Association of Southeast Asian Nations (ASEAN), Austrian Federal Ministry of Science and Research, Confederación de Sociedades Científicas de España (COSCE), Danish Agency for Science, Deutsche Bundesstiftung Umwelt, Deutsche Telekom Stiftung, Deutsches Zentrum für Luft- und Raumfahrt e. V. (DLR), Elitenetzwerk Bayern, Else-Kröner-Fresenius-Stiftung, European Molecular Biology Organization (EMBO), European Molekular Biology Laboratory (EMBL), European Science Foundation, Fondazione Cariplo, Fonds National de la Recherche Scientifique (FNRS), Foundation for Polish Science, Gegencia de Gestio d'Ajuts (Spain), Gemeinnützige Hertie-Stiftung, Gesellschaft für wissenschaftliche Datenverarbeitung mbH, Human Frontier Science Program, Industriellenvereinigung Wien, Consejo Superior de Investigaciones Científicas (Spain), Internationale Bodensee Hochschule, Japan Society for the Promotion of Science (JSPS), Lithuanian Academy of Sciences, Lockheed Martin Corporation, Lomonosov Moscow State University, Mars, Incorporated, Ministry for Higher Education and Scientific Research, National Science and Technology Agency (Thailand), National Science Council of Taiwan, NSERC-CRSNG (Canada), Oak Ridge Associated Universities, Pakistan Science Foundation, Professor-Rhein-Stiftung, Qiagen N.V., Riga Stradins University, RWE Stiftung gGmbH, Siemens AG, Sino-German Center for Research Promotion, Slovenian Academy of Sciences (SASA), The Royal Netherlands Academy, The Royal Society (UK), TÜBITAK, Universität Liechtenstein, University of Latvia, Weizmann Institute of Sciences).

AMOUNT	356.000,00 EUR
--------	----------------

AMOUNT REVENUES PART I	1.450.425,42 EUR
------------------------	------------------

AMOUNT REVENUES PART II	356.000,00 EUR
-------------------------	----------------

TOTAL AMOUNT OF REVENUES	1.806.425,42 EUR
---------------------------------	-------------------------

ADDITIONAL DONATIONS IN KIND AND PRO-BONO SERVICES:

Artificial Image, Audi AG, Axinom GmbH, Big Image GmbH, Deutsche Lufthansa AG, Deutsche Telekom AG, EnBW Energie Baden-Württemberg, Fondation du Festival & Académie de Verbier, Gebrüder Weiss GmbH, Hewlett-Packard, L.P., Jura Elektroapparatebau AG, Land Baden-Württemberg, Lennart-Bernadotte-Stiftung, Lindauer Zeitung, Lista Office AG, Mainau GmbH, Mondi Europe & International, MS Management Service AG, Nobel Foundation, ProLindau Marketing GmbH & Co. KG, Sennheiser electronic GmbH & Co. KG, Stadtwerke Lindau (B) GmbH & Co. KG, Vacheron Constantin, Volkswagen Group, Warth, Klein & Leutenecker, Zumtobel Lighting GmbH.

Any deficit that may arise upon presentation of all costs as of 31st December 2011, will be balanced by an existing letter of indemnity provided by the Foundation Lindau Nobelprizewinners Meetings at Lake Constance.

Preliminary Account for the 61st Meeting of Nobel Laureates 2011

(as of 31st September 2011, including expected income and expenses until 31st December 2011)

EXPENDITURES	(AMOUNT)	(AMOUNT)
Travel		Printed Matters 34.843,03 EUR
Laureates	71.837,49 EUR	
Young Researchers	8.925,32 EUR	Outreach
Media	16.996,81 EUR	Web Stream, Recording 26.403,72 EUR
Other	22.661,32 EUR	Video Diaries, etc. 4.725,50 EUR
		EB Teams & Global Distribution 26.842,30 EUR
Lodging		Blog & Online Communications 3.350,00 EUR
Laureates	30.624,00 EUR	Nomination Outreach 60.000,00 EUR
Young Researchers	202.742,56 EUR	Mediatheque 73.880,20 EUR
Media	19.081,40 EUR	
Other	44.429,10 EUR	Press & Media
		Consulting & Production 25.501,00 EUR
Boarding		Photographers 16.586,63 EUR
Laureates	16.955,59 EUR	Distribution & Monitoring 10.031,52 EUR
Young Researchers	137.076,87 EUR	Website 10.000,00 EUR
Media	4.265,60 EUR	Other Services 2.499,43 EUR
Other	9.395,28 EUR	
		Other Meeting Costs 20.849,05 EUR
Scientific Programme & YR Selection	9.375,00 EUR	
		Executive Secretariat*
Venues & Equipment		Staff 240.168,14 EUR
Rental Fees Locations	43.431,22 EUR	Operating Costs (Rent, Utilities, etc.) 13.417,16 EUR
Tents, inc. Mainau	75.100,60 EUR	Communications 3.522,35 EUR
Technical Equipment	157.878,35 EUR	Accounting, Legal Advice 4.226,60 EUR
Utilities & Services	975,70 EUR	Office Supplies 5.775,97 EUR
Onsite Staff	58.394,98 EUR	Office Equipment & Maintenance 1.150,97 EUR
Translation	3.250,68 EUR	Insurances 1.248,19 EUR
Transfers	6.342,70 EUR	IT Services, Hardware, Software 23.990,61 EUR
Various Items	5.209,24 EUR	Job Trainings & Job Applications 7.616,42 EUR
Supporting Programme	52.772,66 EUR	
EXPENDITURES as of 31st October 2011		1.614.351,26 EUR
Expected Expenditures until 31 st December 2011		189.159,83 EUR
TOTAL AMOUNT OF EXPENDITURES		1.803.511,09 EUR

* The total annual expenses of the Executive Secretariat have only in part been attributed to the 61st Lindau Nobel Laureate Meeting.

Dimitra Kiritsi Germany

The first word that comes into my mind when thinking back to the 61st Lindau Nobel Laureate Meeting is 'inspiring'. It made me reflect on my work and desire to achieve my goals even more. I remember 3 scientists and their talks the most: Elizabeth Blackburn with her exceptional work on telomeres, Christian de Duve with his moving presentation on the future and Oliver Smithies with a stimulating reflection on a scientist's life.

What I enjoyed most was the boat trip to Mainau, not only for being able to appreciate the 'flowering island', but furthermore for the opportunity to mingle with people from varied disciplines and also getting to talk to the Laureates in a more relaxed environment. The organisation of the meeting was almost perfect; what I think could be done better is if we got to know persons with similar working interests easier, e.g. you could suggest other scientists who might have similar interests. Once more, thank you so much for making this experience possible!

Werner Arber Physiology or Medicine, 1978

In the past 30 years I attended many Nobel Laureate Meetings in Lindau. This week of scientific debates, both with colleagues and with highly motivated young scientists is, and remains, a highlight of my activities as an emeritus University teacher and engaged researcher in the fields of molecular genetics and of molecular evolution.



Founders' Assembly of the Foundation with 244 Nobel Laureates

The Founders' Assembly of the Foundation Lindau Nobelprizewinners Meetings at Lake Constance can currently count more than 240 Laureate among its members. They all share the common ideals of the Lindau 'Mission Education', to educate, inspire and connect. More Laureates have joined the assembly in the past few months: Ei-ichi Negishi, Akira Suzuki, Christopher A. Pissarides, Thomas A. Steitz, Elizabeth H. Blackburn, Peter A. Diamond and Dale T. Mortensen.

A	Stanley Cohen	Donald Glaser
Alexei Abrikosov	Claude Cohen-Tannoudji	Sheldon L. Glashow
Peter C. Agre	Leon Cooper	Roy J. Glauber
Martti Ahtisaari	Elias J. Corey	Joseph L. Goldstein
George A. Akerlof	John Warcup Cornforth	Mikhail Gorbachev
Zhores Alferov	James W. Cronin	Clive Granger
Maurice Allais	Paul J. Crutzen	Paul Greengard
Sidney Altman	Robert F. Curl jr.	David J. Gross
Philip W. Anderson	D	Robert H. Grubbs
Werner Arber	Hans G. Dehmelt	Peter Grünberg
Kenneth J. Arrow	Johann Deisenhofer	H
Robert J. Aumann	Peter A. Diamond	Theodor W. Hänsch
Richard Axel	Peter C. Doherty	John L. Hall
Julius Axelrod	Renato Dulbecco	Lee Hartwell
B	Christian de Duve	Herbert A. Hauptman
David Baltimore	E	Harald zur Hausen
Francoise Barré-Sinoussi	Gerald Edelman	Richard Heck
Gary S. Becker	Manfred Eigen	Alan C. Heeger
Johannes Georg Bednorz	Robert Engle	Dudley R. Herschbach
Baruj Benacerraf	Richard R. Ernst	Avram Hershko
Paul Berg	Gerhard Ertl	Antony Hewish
Hans A. Bethe	Leo Esaki	Roald Hoffmann
J. Michael Bishop	Sir Martin J. Evans	Gerardus 't Hooft
Sir James Black	F	Robert H. Horvitz
Elizabeth H. Blackburn	John B. Fenn	David H. Hubel
Günter Blobel	Albert Fert	Robert Huber
Nicolaas Bloembergen	Edmond H. Fischer	Russel Hulse
Baruch S. Blumberg	Ernst Otto Fischer	Tim Hunt
Paul D. Boyer	Robert W. Fogel	Leonid Hurwicz
James M. Buchanan	Jerome Friedman	Andrew F. Huxley
Linda Buck	Milton Friedman	I
C	Robert F. Furchgott	Louis Ignarro
Mario R. Capecchi	G	J
Jimmy Carter	D. Caletton Gajdusek	Brian D. Josephson
Thomas R. Cech	Andre Geim	K
Martin Chalfie	Murray Gell-Mann	Eric R. Kandel
Georges Charpak	Riccardo Giacconi	Charles K. Kao
Yves Chauvin	Ivar Giaever	Jerome Karle
Steven Chu	Walter Gilbert	Wolfgang Ketterle
Aaron Ciechanover	Alfred G. Gilman	Har Gobind Khorana
Ronald H. Coase	Vitaly L. Ginzburg	Lawrence R. Klein

Klaus von Klitzing	Joseph E. Murray	William F. Sharpe
Aaron Klug	Roger B. Myerson	K. Barry Sharpless
Makato Kobayashi	N	Osamu Shimomura
Walter Kohn	Yoichiro Nambu	Kai M. Siegbahn
Arthur Kornberg	John F. Nash jr.	Jens C. Skou
Roger D. Kornberg	Ei-ichi Negishi	Richard Smalley
Masatoshi Koshiha	Erwin Neher	Hamilton O. Smith
Edwin Krebs	Marshall Nirenberg	Michael Smith
Herbert Kroemer	Douglass C. North	Oliver Smithies
Sir Harold W. Kroto	Konstantin Novoselov	George F. Smoot
Finn Kydland	Ryoji Noyori	Robert M. Solow
L	Christiane Nüsslein-Volhard	Jack Steinberger
Willis E. Lamb	Paul M. Nurse	Thomas A. Steitz
Robert Laughlin	O	Joseph E. Stiglitz
Paul C. Lauterbur	George A. Olah	John Sulston
Leon M. Lederman	Douglas Osheroff	Akira Suzuki
David M. Lee	P	Jack W. Szostak
Tsung-Dao Lee	Arno Allen Penzias	T
Yuan Tseh Lee	Edmund S. Phelps	Henry Taube
Jean-Marie Lehn	William D. Phillips	Joseph Taylor
Rita Levi-Montalcini	Christopher A. Pissarides	Samuel C. C. Ting
Edward B. Lewis	John Polanyi	Susumu Tonegawa
William N. Lipscomb	John Pople	Charles H. Townes
Robert E. Lucas Jr.	Lord George Porter	Roger Y. Tsien
M	Edward C. Prescott	Daniel C. Tsui
Alan G. MacDiarmid	Ilya Prigogine	V
Roderick MacKinnon	R	Simon van der Meer
Peter Mansfield	José Ramos-Horta	Harold E. Varmus
Rudolph A. Marcus	Norman F. Ramsey	Martinus J. G. Veltman
Harry M. Markowitz	Robert Richardson	W
Barry Marshall	Richard J. Roberts	Sir John E. Walker
Toshihide Maskawa	Heinrich Rohrer	Robin Warren
Eric S. Maskin	Joseph Rotblat	James D. Watson
John C. Mather	F. Sherwood Rowland	Thomas H. Weller
Daniel L. McFadden	Carlo Rubbia	Eric F. Wieschaus
Craig C. Mello	S	Torsten N. Wiesel
Bruce Merrifield	Bert Sakmann	Frank Wilczek
Robert C. Merton	Paul A. Samuelson	Maurice H.F. Wilkens
Hartmut Michel	Bengt Samuelsson	Robert W. Wilson
James A. Mirrlees	Frederick Sanger	Kurt Wüthrich
Rudolf Mößbauer	Andrew V. Schally	Y
Mario Molina	Thomas C. Schelling	Rosalyn Yalow
Luc Montagnier	Myron S. Scholes	Ada E. Yonath
Dale T. Mortensen	John Robert Schrieffer	Chen Ning Yang
Karl Alexander Müller	Richard R. Schrock	Muhammad Yunus
Kary B. Mullis	Melvin Schwartz	Z
Robert A. Mundell	Reinhard Selten	Ahmed Zewail
Ferid Murad	Amartya Sen	Rolf Zinkernagel



Upcoming Lindau Meetings

62nd Meeting of Nobel Laureates
(dedicated to Physics) from 1st July—6th July 2012

63rd Meeting of Nobel Laureates
(dedicated to Chemistry) from 30th June—5th July 2013

64th Meeting of Nobel Laureates
(dedicated to Physiology or Medicine) from 29th June—4th July 2014

5th Lindau Meeting on Economic Sciences
from 19th August—23rd August 2014

65th Meeting of Nobel Laureates
(4th Interdisciplinary Meeting with Nobel Laureates from the fields of Physics, Physiology or Medicine and Chemistry) from 28th June—3rd July 2015

Join Us on

facebook facebook.com/LindauNobelLaureatesMeeting

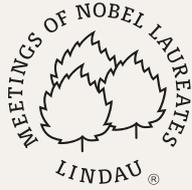
twitter twitter.com/lindaunobel

You Tube youtube.com/user/NobelLaureateMeeting

ResearchGATE researchgate.net/community/lindaunobel

566 highly talented Young Researchers from 78 countries came together at the shores of Lake Constance for a week of personal encounters and scientific exchange.

Kuratorium für
die Tagungen
der Nobelpreisträger
in Lindau
Council for the Lindau
Nobel Laureate Meetings



Stiftung Lindauer
Nobelpreisträgertreffen
am Bodensee
Foundation Lindau
Nobelprizewinners Meetings
at Lake Constance

Council for the Lindau Nobel Laureate Meetings
Foundation Lindau Nobelprizewinners Meetings at Lake Constance

Executive Secretariat
Alfred-Nobel-Platz 1
Lennart-Bernadotte-Haus
88131 Lindau, Germany

Phone + 49 (0) 8382-277 31-0
Fax + 49 (0) 8382-277 31-13

info@lindau-nobel.org

For more information, please visit our website www.lindau-nobel.org

Realisation & Texts

Jan Keese, Christian Rapp, Christian Schumacher with Hans Jörnvall, Helmut Sies and further contributors.

Layout & Production

Andreas Mayer, Stuttgart

Photos

Peter Badge/typos 1 (portraits), Berlin; Christian Flemming & Rolf Schultes, Lindau; Andreas Mayer, Stuttgart (p. 104); Reiner Roither/Lindauer Zeitung (p. 110); Nikolaus Turner, Lindau (p. 115, top); Liesa Johannsen/DAAD España (p. 115, centre); Volker Steger, Munich (p. 115, bottom)

Printed by

Vorarlberger Verlagsanstalt GmbH, Dornbirn, Austria

MEETING OF NOBEL LAUREATES AT LINDAU (2011)

“RETROSPECTS AND PROSPECTS” ISSN 1869-3741

I have to say that this meeting gave me not only the amazing experience of getting to know the laureates, getting pictures and videos of with them and a huge signed by them but also the inspiration to continue studying, working and researching, and the desire to create more connections between my country and groups and institutions around the world, to increase investigation and enhance academic excellence, that's why I already started to invite some Laureates to visit us in Colombia as a way to inspire other Young Researchers to continue on the path of science on behalf of our community and humanity itself.

But one of the most important lessons was the one given by Laureate Ferid Murad, on the question I asked him, "what's the worst thing about being a Nobel Laureate?" He replied popularity and the lack of time for family, which made me realise that happiness is as simple as spending time with the ones you love, instead of searching for illusions like fame.

William Omar Contreras Lopez

Colombia





MEETING OF NOBEL LAUREATES AT LINDAU (2011)
"RETROSPECTS AND PROSPECTS" ISSN 1869-3741

PUBLISHED BY
COUNCIL FOR THE LINDAU NOBEL LAUREATE MEETINGS
FOUNDATION LINDAU NOBELPRIZEWINNERS MEETINGS AT LAKE CONSTANCE

