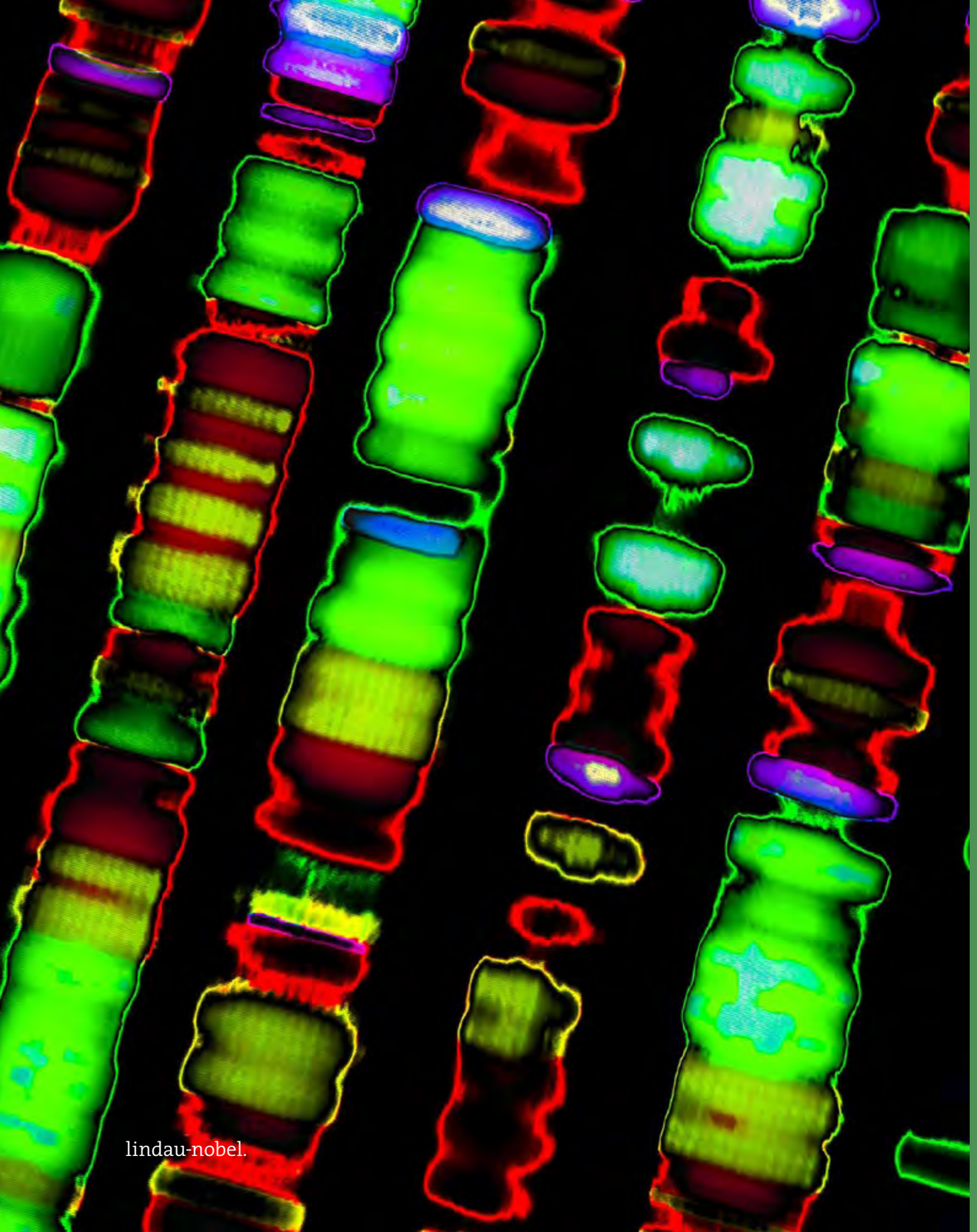

lindau-nobel.

72nd Lindau Nobel Laureate Meeting – Physiology/Medicine Annual Report 2023

LINDAU
NOBEL LAUREATE
MEETINGS

72nd Lindau Nobel Laureate Meeting Physiology/Medicine

Annual Report 2023

I had a terrific time meeting colleagues and interacting with the Young Scientists, who were inspiring. The organisation and execution of the meeting were flawless, totally professional, and
a pleasure from start to finish – amazing. Hats off to the Lindau Meeting team including the local hosts who housed Young Scientists.

Charles M. Rice
Nobel Laureate in
Physiology or Medicine 2020

Probably this is what the Lindau Spirit is: you connect and interact with fellow researchers during those five days only, but the bond that you make stays forever, such that you share happy endeavours as well as heartbreaking failures with them, knowing how easily they will relate to you, since they are on the same boat as you.

Shatarupa Bhattacharya
Lindau Alumna 2023

Annual Report 2023

72nd Lindau Nobel Laureate Meeting (Physiology/Medicine)

LINDAU
NOBEL LAUREATE
MEETINGS

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“Variety is Part of the Pleasure”

Gathering for the second time after the pandemic-enforced break and for the first time without major restrictions, one could feel the relief among Nobel Laureates and Young Scientists: a vibrant 72nd Lindau Nobel Laureate Meeting made re-entering the world of scientific networking a very real and palpable experience for every participant.

During the week, the pandemic was discussed as part of the International Day. Otherwise, the scientific programme included more than 60 sessions with topics such as gene analysis, immunology, and microbiology, often enough attesting to the close interconnectedness between chemistry, biology and medicine.

Alongside these more conventional conference topics, societal meta-topics were discussed, such as – to name but a few – gender balance, the importance of dealing with geographical disparities and national bias. Once again it became clear to all of us that science and research are just as affected by these social issues as all other areas of life – with different people from various generations and cultures discussing their distinct views and approaches.

As organisers of the Lindau Nobel Laureate Meetings, whose objective is dialogue, we see it as an ongoing task to provide space for the questions of the scientific community and to offer a good framework for fruitful exchange: what is the best way to ensure that ample time is set aside both for discussing science and research and for talking about the politics of science? Our aim is to find a good balance of topics, adhering to our enduring values as, for example, expressed in the Lindau Guidelines, and at the same time to continue to be a forum for excellent scientific exchange.

This core idea of connectivity is always about encounters between experienced Nobel Laureates and up-and-coming Young Scientists. As for the Nobel Laureates, we would like all those who have come to appreciate Lindau to participate in our meetings as often as possible. And, in inviting new Laureates to Lindau, we encourage them to engage in the dialogue of generations. The relevance of the meeting can be deduced from the answer of one of the Laureates to what the most popular programme format was: “Impossible question – the variety is part of the pleasure.”

Speaking of the Young Scientists, it is our goal to actively put their scientific work “on show” in the Next Gen Science Sessions and to ensure that scientific excellence from around the globe is comprehensively represented in Lindau. We are very pleased that 45 Young Scientists from 25 nations and all continents had the opportunity to showcase their work (there could always be more, but the meeting week is simply too short). And it makes us proud that, in a follow-up survey, more than 90 percent of the Young Scientists evaluated their involvement in the meeting as “good” or “very good”. This positive feedback is reflected by Nobel Laureates, one of whom praised “the most diverse scientific gathering I have ever attended” (see page 16).

2023 has also seen important changes among the persons closely involved with the organisation of the Lindau Meetings: we are looking forward to working more closely with Heiner Linke as our incoming Vice President of the Council and with Thomas Gruber who has been Director of the Executive Secretariat since September. At the same time, we would like to express our sincere thanks to, and great admiration for, the Council’s outgoing Vice President, Helga Nowotny (see page 112) as well as to Wolfgang Huang as the Executive Secretariat’s outgoing Director. His expertise was once again key to a successful 2023 meeting.

Looking ahead to the 73rd Lindau Meeting (Physics), we are anticipating once again hosting many Nobel Laureates and Young Scientists in Lindau next summer and discussing cutting-edge science. Concerning the ever hot topic of AI, physics is predestined not only to allow for discussions on the improvement of information processing but to provide fundamental new insights gained by actually using the technology.

As one year ends and another begins, however, we are also saddened by the thought that hopeful Young Scientists will not be able to come to Lindau because of upheavals in their home countries. The little we can do in this context is to reassure them that they are very welcome and to facilitate participation even at short notice by being flexible with nomination and selection deadlines. This global reality is very sad but also a reason for us to call to mind once again what the Lindau Nobel Laureate Meetings have stood for since 1951: dialogue, free speech, inclusion, and the promotion of global cooperation.

Countess Bettina Bernadotte af Wisborg
President
Council for the Lindau Nobel Laureate Meetings

Jürgen Kluge
Chairman of the Board of Directors
Foundation Lindau Nobel Laureate Meetings

Lindau is amazing, particularly on the island. I made valuable connections to young and older alike and was inspired by the vibrant structure of the meeting.

Morten Meldal

Opening Day

Traditionally, the opening day marks the festive start of the Lindau Meetings. After the opening ceremony, the first panel discussion took place, followed by the lectures of Frances H. Arnold and Morten Meldal. The day was rounded off by a dinner in the Inselhalle for the Young Scientists and the Foundation Dinner for Laureates and guests.

Countess Bettina Bernadotte during her opening speech

Bettina Stark-Watzinger, German Federal Minister of Education and Research

The reception with first personal encounters

Attending Laureates with Countess Bettina Bernadotte and Jürgen Kluge

Opening Ceremony

Opening Address
Countess Bettina Bernadotte, President of the Council

Greetings from Stockholm
Thomas Perlmann, Member of the Board of Directors, The Nobel Foundation, Secretary of the Nobel Assembly at Karolinska Institutet and of the Nobel Committee for Physiology or Medicine, Sweden

Welcome Speech
Bettina Stark-Watzinger, German Federal Minister of Education and Research

Greetings from the US
Al Gore, Former Vice-President, United States of America, Nobel Peace Prize 2007

Induction into the Honorary Senate of the Foundation
Marius Müller-Westernhagen
Laudatio: Jürgen Kluge, Chairman of the Foundation

Greetings from Munich
Markus Blume, Chairman of the Joint Science Conference (GWK), Bavarian State Minister of Science and the Arts, Germany

Programme Preview
Scientific Chairpersons of the 72nd Lindau Nobel Laureate Meeting: Klas Kärre, Stefan H.W. Kaufmann

Greetings from Austria
Martin Polaschek, Austrian Federal Minister of Education, Science and Research

Musical Accompaniment
Ensemble of the Vienna Philharmonic

Reception

hosted by the Republic of Austria

Scientific Programme

Diversity and Merits in Science
Panel Discussion, see page 44

Innovation by Evolution:
Bringing New Chemistry to Life
Frances H. Arnold, Nobel Laureate in Chemistry 2018

Molecular Click Adventures: A Leap from the Shoulders of Giants
Morten Meldal, Nobel Laureate in Chemistry 2022

Master of Ceremonies
Nkechi Madubuko, University of Giessen, Germany

Dinner

for Young Scientists

Foundation Dinner

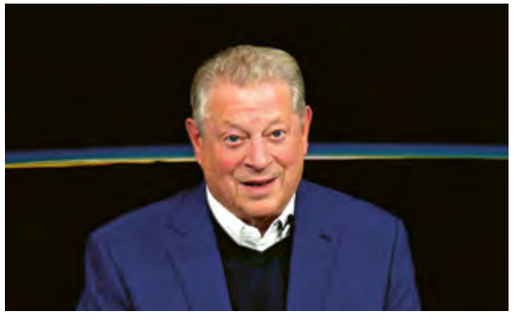
hosted by the Foundation Lindau Nobel Laureate Meetings

Welcome Address
Jürgen Kluge, Chairman of the Board of Directors, Foundation Lindau Nobel Laureate Meetings

Greetings From Sweden and the United States

Networks of Excellence – Most Trusted Voices in the World

Thomas Perlmann, Countess Bettina Bernadotte and Carl-Henrik Heldin, Chairman of the Nobel Foundation Board until May 2023



Al Gore, recipient of the Nobel Peace Prize 2007, delivered his greetings online.

"The Nobel Prize plays a unique and I would even dare to say essential role within the scientific ecosystem. It has evolved into an institution well-positioned to counteract the challenges to knowledge and truth that are so prevalent today. But let us also remember that the Nobel Prize values must be nurtured and safeguarded to ensure their continued influence. In Stockholm, we contribute by upholding the very long tradition of diligent and meticulous work within the committees to identify the most deserving laureates.

Through this work and our outreach activities, the lineage of Nobel Prizes in these categories serves as an essential historical record of the evolution of knowledge for more than 120 years. I think the Lindau Nobel Laureate Meetings also contribute in the best way possible. This forum for exchange has evolved into a unique institution supporting science. It strengthens, of course, the Nobel Prize, but it fosters also collaborative, robust networks of excellence. The presence of so many Nobel Laureates here today, as well as in previous years, is a true testament to the success of the Lindau Meetings in Stockholm." Thomas Perlmann, Member of the Board of Directors, The Nobel Foundation

"You're finding new ways to prevent and treat the conditions that the climate crisis is now exacerbating. But make no mistake, we simply have to stop burning fossil fuels. You see a depiction of our atmosphere behind me. That blue line is only 5 to 7 kilometers thick in most places, a very thin band of oxygen-enriched air encompassing our planet. And that's what we're using as an open sewer with all this heat-trapping pollution. Allow me to appeal to each and every one of you gathered in Lindau – you are among the most trusted voices in the world when it comes to the consequences of the climate crisis. Medical professionals and researchers have already provided some of the most compelling evidence that we must act with urgency.

I encourage all of you to not only continue your important research, but also to look for new avenues with which you could share that research with leaders and government, the private sector, business and civil society. Your voices and your work are more important than ever. And if you ever doubt whether or not we can muster the political will as human beings to solve the climate crisis, just remember that political will is itself a renewable resource."

Greetings From Berlin

Freedom Creates Scope to Think Beyond Today's Limitations

Bettina Stark-Watzinger, German Federal Minister of Education and Research

"It pays to also take what looks like the roads less travelled. You all know about that from your own experience. 'The Nobel Prize is important as the last stronghold of reverence for knowledge.' A quote by Christiane Nüsslein-Volhard from 2001. Thank goodness there is still reverence for knowledge.

But it has experienced some mighty ups and downs recently. ChatGPT and alike are now the ones unsettling the knowledge stronghold. How much is what we know still worth? What does artificial intelligence do with our knowledge and what are the consequences for learning, work and life?

I think it is important that we do not lapse into a state of collective fear and anxiety. We must keep an eye on the huge potential and the chances. Follow up on our curiosity. Do the research. You probably cannot even imagine it any other way. And that is what the special spirit of Lindau is all about. Artificial intelligence offers us enormous opportunities, which is why we cannot afford to lose pace. We best serve developments if we are part of shaping them.

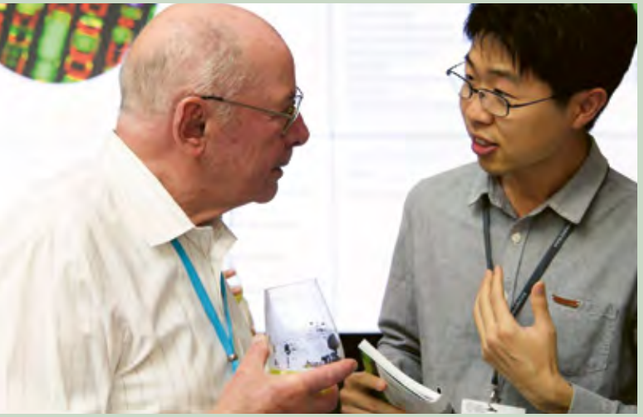
And that means moving ahead quickly. We must hold on to the necessary scope for action, especially for science and research. That means granting AI the necessary priority. I'm convinced if one wants to be part of shaping the AI revolution, we must invest in AI research now. And these efforts have already paid off in medicine.

Can and will AI one day take over from doctors? Forums such as this one in Lindau are exactly the right way to engage in informed discussion about ethics and to take the decision beyond this event. We see so much talk about setting limits nowadays. I would say that itself should have a limit.

That is the freedom of science and research. After all, free will, the free will of our scientists is what makes creative research possible in the first place. Freedom is our most important driver for innovation because freedom creates the scope to think beyond today's limitations. And my vote is clearly in favour of freedom of research, of freedom and innovation, of progress and development.

The Lindau Meetings thrive on their international character. The national perspective meets many others. Global cooperation is very important and valuable. Science is the answer, and so is the transfer of new findings. I thank each and every one of you for your contributions to finding these solutions."

Impressions



top right:
Countess Bettina Bernadotte and Jürgen Kluge welcoming our Honorary Senator HRH Princess Maha Chakri Sirindhorn from Thailand

bottom left:
Ensemble of the Vienna Philharmonic
Thomas Küblböck, Violin
Alexandr Sorokow, Violin
Sebastian Führlinger, Viola
Raffael Dolezal, Cello

Greetings From Bavaria and Austria

Fostering Innovation and Global Collaboration

Markus Blume, Bavarian State Minister for Science and the Arts, talking to Nobel Laureate in Chemistry 2022 and Lindau Alumnus from 1986 Morten Meldal

Martin Polaschek, Austrian Federal Minister for Education, Science and Research, in conversation with Rainer Blatt, Member of the Council

"Things are really emerging, developing in a way we've never seen before. It is the feeling of entering the age of exponentiality, of exponential progress, and not only in the field of what you can feel when you just use your smartphone, also in the field of science and research.

We have to come up with new solutions, with new answers. Especially in the field of physiology and medicine, I think we are building towards a paradigm shift. Big data analytics of health care allow us to significantly improve prevention, therapies, drug development, and things like this. Let's make this decade a decade – or even golden age – of medical progress.

I believe Lindau is the perfect place to come up with new ideas, to connect people, and to try to make our world a little bit better. Maybe this is special about Lindau, the idea of bringing together people, the brightest minds from all over the world, sharing their thoughts and being thought leaders for the challenges of tomorrow."

"The annual meeting offers a really unique opportunity for Young Scientists to interact with bright minds from around the world and to draw inspiration from the world's most distinguished researchers in their fields. And I strongly believe that open, free and trusting cooperation and exchange across borders are crucial for a vibrant, excellent and innovative research ecosystem. Because, however, illiberal regimes are increasingly challenging agreed international standards and common values, which is why we need to join our forces to strengthen and to defend free international exchange and cooperation among like-minded partners.

I am convinced of the Lindau Nobel Laureate Meeting's mission to promote scientific excellence, science education and international exchange. Lindau is not only about science, it's also about cooperation, it's about friendship, and it's about motivation, especially for the young researchers. And consequently, we will continue our close cooperation over the coming years."

Introduction to the Meeting Week

A Journey of Education With a "Fantastic Comeback"

As part of the opening ceremony, the scientific chairs Klas Kärre and Stefan H.E. Kaufmann talked about the meeting programme and their personal highlights for the upcoming week.

Both Council Members stressed the diversity of the 72nd Lindau Nobel Laureate Meeting in several respects. Professor Kaufmann emphasised that the week is a journey of education, be it through the lectures on ground-breaking research and its implications for health and disease, or in Agora Talks on a wide range of issues, or of course, the panel discussions on central themes as highlighted in Countess Bettina Bernadotte's opening remarks (see p. 8). This journey, combined with the Lindau Spirit, would give all young researchers a lot of input to digest, and hopefully a lot of inspiration. The output, Stefan Kaufmann said, "will be a different view on science for everybody."

Asked about key topics of the meeting, Professor Kärre explained that it is very difficult to plan narrow thematic sessions for a Lindau Meeting leading to many mixed sessions in the meeting programme. As a result, participants learn about issues outside of the scope of a single subject – which can lead to fantastic connections.

Professor Kaufmann pointed to a fairly new format as his highlight: The five Next Gen Science sessions, during which selected early-career researchers present their work to Nobel Laureates and fellow Young Scientists (see p. 50). For him, the excellent work presented by brilliant young researchers and the resulting discussions with innovative ideas across different backgrounds and subjects are "wonderful" additions to the talks by Nobel Laureates.

Professor Kärre's favourite parts of the week are sessions he is not supposed to attend: the particularly interactive sessions between just one Nobel Laureate and Young Scientists. They are at the core of the Lindau Spirit.

Professor Kaufmann stressed the eagerness of the young researchers to use the knowledge passed on by the Nobel Laureates to create something new: "That is the spirit of Lindau: Creativity and innovation that comes out of the different opinions and views on a topic." He was "extremely glad" that the 72nd Lindau Meeting was one of the most diverse in the history of the meetings, with excellent researchers from 89 countries and many different backgrounds, cultures and identities.

To close, Professor Kärre, who was a member of the Nobel Assembly for Physiology or Medicine, commented on a "fantastic comeback": 1986 Lindau Alumnus Morten Meldal had the unique opportunity to relive a once-in-a-lifetime experience and give a talk as a 2022 Nobel Laureate in Chemistry at #LINO23.

Programme preview of the scientific chairpersons

Klas Kärre, Professor in Molecular Immunology, Karolinska Institutet, Stockholm, Sweden with Nobel Laureate Morten Meldal

Stefan H.E. Kaufmann, Director Emeritus, Max Planck Institute for Infection Biology, Göttingen, Germany

Wonderful science, a gorgeous location, and above all the students! Lindau was the most diverse scientific gathering I have ever attended, and the energy of the young people filled the halls and rooms with excitement.

Frances H. Arnold

Participants in #LINO23

Nobel Laureates

Thirty-nine Nobel Laureates took part in the
72nd Lindau Nobel Laureate Meeting (Physiology/Medicine).

Peter Agre
Nobel Prize: Chemistry, 2003
Prize Motivation:
"for the discovery of water channels"

Frances H. Arnold
Chemistry, 2018
"for the directed evolution of enzymes"

Elizabeth H. Blackburn
Physiology or Medicine, 2009
"for the discovery of how chromosomes are protected by telomeres and the enzyme telomerase"

Mario R. Capecchi
Physiology or Medicine, 2007
"for their discoveries of principles for introducing specific gene modifications in mice by the use of embryonic stem cells"

Martin Chalfie
Chemistry, 2008
"for the discovery and development of the green fluorescent protein, GFP"

Emmanuelle Charpentier
Chemistry, 2020
"for the development of a method for genome editing"

Aaron Ciechanover
Chemistry, 2004
"for the discovery of ubiquitin-mediated protein degradation"

Johann Deisenhofer
Chemistry, 1988
"for the determination of the three-dimensional structure of a photosynthetic reaction centre"

Jacques Dubochet
Chemistry, 2017
"for developing cryo-electron microscopy for the high-resolution structure determination of biomolecules in solution"

Sir Martin J. Evans
Physiology or Medicine, 2007
"for their discoveries of principles for introducing specific gene modifications in mice by the use of embryonic stem cells"

Joachim Frank
Chemistry, 2017
"for developing cryo-electron microscopy for the high-resolution structure determination of biomolecules in solution"

Al A. Gore Jr.
Peace, 2007
"for their efforts to build up and disseminate greater knowledge about man-made climate change, and to lay the foundations for the measures that are needed to counteract such change"

Leland H. Hartwell
Physiology or Medicine, 2001
"for their discoveries of key regulators of the cell cycle"

Stefan W. Hell
Chemistry, 2014
"for the development of super-resolved fluorescence microscopy"

Avram Hershko
Chemistry, 2004
"for the discovery of ubiquitin-mediated protein degradation"

Jules A. Hoffmann
Physiology or Medicine, 2011
"for their discoveries concerning the activation of innate immunity"

Robert Huber
Chemistry, 1988
"for the determination of the three-dimensional structure of a photosynthetic reaction centre"

Tim Hunt
Physiology or Medicine, 2001
"for their discoveries of key regulators of the cell cycle"

William G. Kaelin Jr.
Physiology or Medicine, 2019
"for their discoveries of how cells sense and adapt to oxygen availability"

Jean-Marie Lehn
Chemistry, 1987
"for their development and use of molecules with structure-specific interactions of high selectivity"

Michael Levitt
Chemistry, 2013
"for the development of multiscale models for complex chemical systems"

Morten Meldal
Chemistry, 2022
"for the development of click chemistry and bioorthogonal chemistry"

Hartmut Michel
Chemistry, 1988
"for the determination of the three-dimensional structure of a photosynthetic reaction centre"

Edvard I. Moser
Physiology or Medicine, 2014
"for their discoveries of cells that constitute a positioning system in the brain"

Erwin Neher
Physiology or Medicine, 1991
"for their discoveries concerning the function of single ion channels in cells"

Christiane Nüsslein-Volhard
Physiology or Medicine, 1995
"for their discoveries concerning the genetic control of early embryonic development"

John O'Keefe
Physiology or Medicine, 2014
"for their discoveries of cells that constitute a positioning system in the brain"

Charles M. Rice
Physiology or Medicine, 2020
"for the discovery of Hepatitis C virus"

Sir Richard J. Roberts
Physiology or Medicine, 1993
"for their discovery of split genes"

Michael M. Rosbash
Physiology or Medicine, 2017
"for their discoveries of molecular mechanisms controlling the circadian rhythm"

Bert Sakmann
Physiology or Medicine, 1991
"for their discoveries concerning the function of single ion channels in cells"

Jean-Pierre Sauvage
Chemistry, 2016
"for the design and synthesis of molecular machines"

Randy W. Schekman
Physiology or Medicine, 2013
"for their discoveries of machinery regulating vesicle traffic, a major transport system in our cells"

Harold E. Varmus
Physiology or Medicine, 1989
"for their discovery of the cellular origin of retroviral oncogenes"

Sir John E. Walker
Chemistry, 1997
"for their elucidation of the enzymatic mechanism underlying the synthesis of adenosine triphosphate (ATP)"

Kurt Wüthrich
Chemistry, 2002
"for his development of nuclear magnetic resonance spectroscopy for determining the three-dimensional structure of biological macromolecules in solution"

Ada E. Yonath
Chemistry, 2009
"for studies of the structure and function of the ribosome"

Michael W. Young
Physiology or Medicine, 2017
"for their discoveries of molecular mechanisms controlling the circadian rhythm"

Rolf M. Zinkernagel
Physiology or Medicine, 1996
"for their discoveries concerning the specificity of the cell mediated immune defence"

Shwetak N. Patel
ACM Prize in Computing, 2018
"for his trailblazing work in ubiquitous computing"

Find more information on the Nobel Laureates in the Lindau Mediatheque.

Impressions

Laureates at #LINO23

The Council particularly appreciates the fact that some Nobel Laureates made their way to Lindau, having become acquainted with the meeting via online participation in previous years.

Disciplines

19
Physiology/Medicine

19
Chemistry

1
Peace

1
Computing

Age

Youngest
55

Oldest
86

Average
77

Records

First Participation
Frances H. Arnold
Mario R. Capecchi
Emmanuelle Charpentier
Jacques Dubochet (online)
Al A. Gore Jr.
Morten Meldal
John O'Keefe
Charles M. Rice

Most Participations: 26
Robert Huber

Earliest Award: 1987
Jean-Marie Lehn – Chemistry

Participation as Alumni: 2
Bert Sakmann 1963
Morten Meldal 1986

Nationalities

United States 14
Germany 8
United Kingdom 5
France 4
Israel 3
Switzerland 3
Australia 1
Denmark 1
Norway 1

Personal Impressions from #LINO23

Lindau is a Trademark

Morten Meldal was awarded one third of the Nobel Prize in Chemistry 2022 – and promptly made his way to Lindau in 2023. Here, he contemplates his first visit to Lindau as a Young Scientist in 1986 and describes his favourite part of this year's meeting.

Lindau first-time Laureates enjoy the variety of session formats: here during the Science Walk.

Lecture on the Opening Day

Mingling with the crowd of Young Scientists

It was a fantastic meeting and I truly enjoyed being there. And I very much enjoyed speaking with the other Nobel Laureates and experiencing these interactions which are unique to the Lindau Meeting. I'm still very active in research and in the laboratory, so I particularly appreciated being able to connect one-on-one with Young Scientists in the foyer of the hall. These contacts with Young Scientists where we can talk about the science itself truly provide inspiration for pursuing new questions in our work. In fact, one of these Young Scientists, a biologist who would like utilise our chemistry, has now reached out to suggest a collaboration, so we have to see if that will be possible. And in general, of course, it's a great way of expanding one's network of contacts in science. And I think that the young people also enjoyed it very much. What did make an impression on me: it is important to have a realistic view of the difference between the young people and their attitudes and experience of diversity and the gender issue and the Laureates like me who are older and have different attitudes. How can we communicate with each other in a productive way?

Regarding my fellow Laureates, there was a lot of exciting things to learn, particularly in areas outside my own domain of chemistry. If I would point out one topic in particular, then it would probably be the lectures on the brain. All of these insights into how neurons are activated and memories are stored. That was exciting, surprising, and genuinely eye-opening. I think it's great in general that the younger Laureates are also invited and do come to Lindau. They are more likely to still be active scientists themselves and thus are closer in several ways to the younger generation – sometimes it is the language and the attitudes that can make these interactions particularly fruitful for everyone involved.

I was there together with my wife Phaedria Marie St. Hilaire who is very active and engaged in matters pertaining to diversity and gender equality. She has founded an organisation in Denmark working on these issues. We had excellent discussions in the workshop sessions, and we were both involved in those discussions, which I think worked well and was very much appreciated. These were interactions that were really cherished by students. The lectures are, of course, wonderful, but these opportunities for one-on-one interactions are also an integral part of what makes the Lindau Meetings what they are. So, it is this combination that is great.

Of course, this wasn't my first time in Lindau. When I went as a Young Scientist in 1986, I didn't really know what I was getting into, but I was very happy to go. What was very memorable from this meeting was meeting Ilya Prigogine. He became a hero of mine and a great inspiration for my choices later on. He gave a lecture with a coil of paper and a glass of water to explain the irreversibility of the Universe. It was a fantastic experience – I was sitting on the edge of my chair for 45 minutes. Back then, the meetings were so small that there was ample opportunity for one-on-ones with the Laureates and I also took the chance to meet with him after his lecture and that was a unique experience. He was brilliant. Although the meetings are amazing today – Lindau is a trademark – opportunities for such intimate one-on-one exchanges are, owing to the size of the meetings, simply less. Maybe, it would be possible to select some Young Scientists for more of these kinds of exchanges. This intimacy I would think gives Young Scientists unique insights into what the Nobel Prize means – and maybe set them on their way to one day coming back themselves with a Nobel Prize.

Unfortunately, I didn't have the time to really enjoy the city of Lindau and its surroundings this time, as I had meetings and invited lectures just before and after #LINO23, but in this regard, I think it would be nice if some of the Laureates had the chance to share what they experienced in the Nobel year, that is the year after they received the prize, because that is what people want to hear about.

Impressions

Young Scientists at #LINO23

For the 72nd Lindau Nobel Laureate Meeting, all 575 Young Scientists participated on-site for the first time since 2019. This included 151 brilliant researchers who had to wait three years to finally make it to Lindau. Here are a few more interesting figures:

Representing 371 Institutions and 89 Countries

Gender Balance

Female 52% Male 47%

Age

Youngest 20

Oldest 40

Average 30

Research Across Disciplines

298 Medicine and Physiology

17 Chemistry

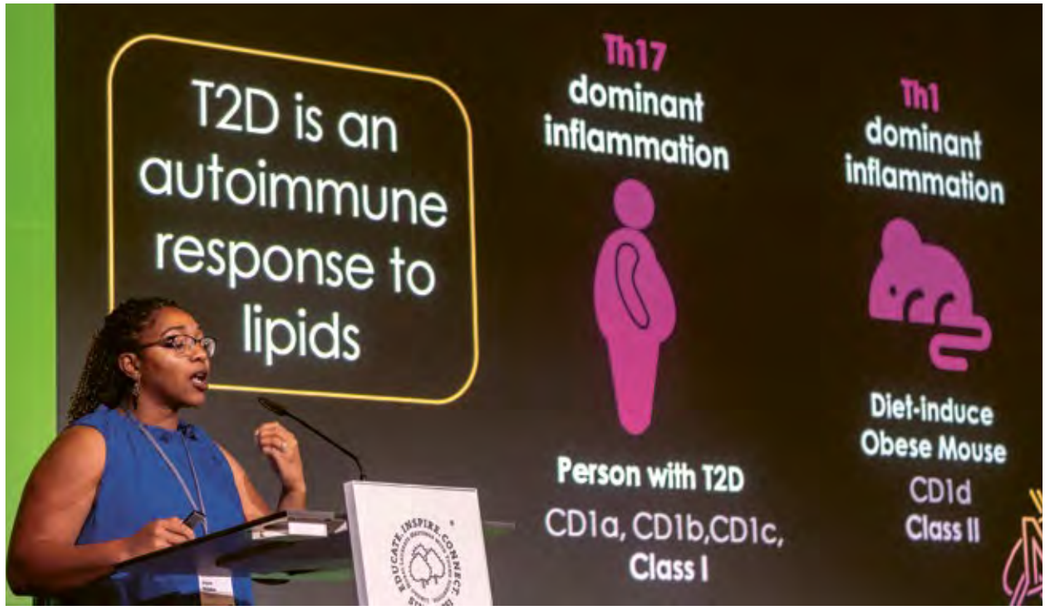
251 Biology

9 Physics

Dequina Nicholas' #LINO23 Story

An Odyssey Culminating in the Opportunity of a Lifetime

Lindau Alumna Dequina Nicholas is an Assistant Professor at the University of California Irvine in the Department of Molecular Biology and Biochemistry. At #LINO23, she presented her work during a Next Gen Science session.



Dequina Nicholas during her Next Gen Science presentation

For over a decade, I've dreamed of revolutionising the approach to understanding, researching and treating type 2 diabetes. Representing the University of California San Diego as a postdoctoral fellow at the Lindau Meeting in 2020 was the opportunity to launch my vision. Little did I know that a series of challenges stood between me and that opportunity. For months, my excitement was palpable. Then, just as quickly as the opportunity was given, it was taken away. The COVID-19 pandemic postponed the 70th Lindau Meeting. Months passed. I became a mom and I even started a faculty position. Just as I finally came to terms with having lost the opportunity to attend the Lindau Nobel Laurate Meeting in person, I received an invitation to attend #LINO23!

My first challenge was logistics. I was an academic mom living thousands of miles away from my family in Florida. My husband had a full-time job and was in school. I needed help that I didn't have. My solution was to book two separate itineraries – one for my two-year-old daughter to stay with my parents in Florida, and the other for me to continue to Lindau. The catch was that the combined cost had to match a direct California-to-Zurich itinerary. I made it work.

Leading-up to Lindau, my life became crazy with little time to prepare for the trip. Just two days before my departure, I realised that my phone carrier had no coverage in Germany. Late at night, after putting my toddler to bed, I rushed to the store, bought a new SIM card, and switched carriers.

I packed the same morning I went to the airport. My first flight was delayed, putting in jeopardy our connection to Florida and my non-refundable, separate flight booked from Florida to Europe. The gate agent managed to switch us to a different flight, which was also delayed. When we landed, we had a mere 15 minutes to catch our connection. I threw my sleeping toddler over my shoulder and ran through the airport. I caught my flight, but not without having an asthma attack.

Once in Florida, I took a brief nap at my parents' house before returning to the airport. Realising this would be my first time away from my child, I cried as I walked through TSA. I settled into my flight from Florida to Zurich, ready for an uneventful trip. It was nothing but: The flight was delayed several hours, again putting my connecting flight in jeopardy. Thankfully, the connecting flight was also delayed. Once I arrived in Zurich, I discovered my luggage was missing. I notified the airport but had to keep moving. Knowing I only had the clothes I was wearing, I quickly bought essentials in the airport.

Fortunately, I met other Lindau fellows facing delays and travelled with them to Lindau by train. The ordeal felt over, but the odyssey continued. We arrived late in Lindau. Stranded, I shared a taxi halfway to my hotel with a kind stranger. Alone, I walked the last 20 minutes to reach my destination.

That night, I hand washed my clothes in the sink and hoped they would dry. The next day, I felt embarrassed in semi-clean leggings and a T-shirt. Determined, I searched for an open store that Sunday. Eventually I found one and bought a blue dress and pink flats thinking, "this is not what I planned, but it'll have to do" because tomorrow was my Next Gen Science talk—a once-in-a-lifetime opportunity.

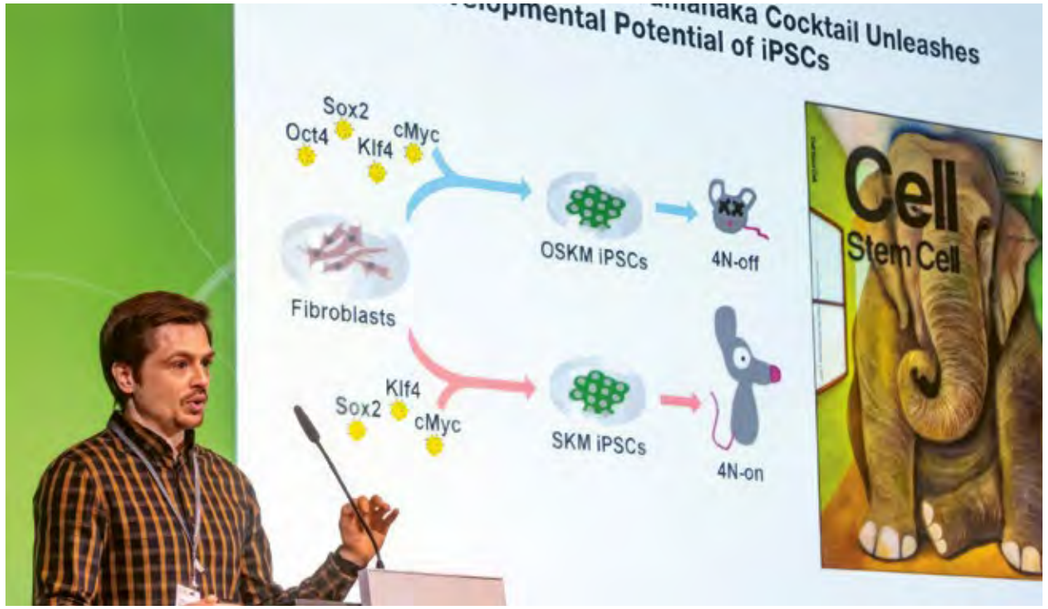
The morning of my talk, I borrowed makeup, I put on the blue dress and tried to calm my nerves as I rehearsed. That afternoon, I delivered the best talk of my life, sharing my research vision with Nobel Laureates. It was the highlight of my scientific career. I felt unstoppable. Despite the exhaustion, jet lag and separation from my child, my ideas, once laughed at over a decade ago, were validated by the very scientists who had pioneered their own fields. In that moment, I realised that every obstacle had been worth it. My odyssey had been worth it: this was the opportunity of a lifetime.

Find Dequina Nicholas' talk on lipid antigens in type 2 diabetes in our Mediatheque.

Sergiy Velychko's #LINO23 Experience

Revolutionary Research and Casual Conversations

Lindau Alumnus Sergiy Velychko is a research fellow in George Church's lab at Harvard Medical School. He presented his work during a Next Gen Science session at #LINO23.



Sergiy Velychko during his Next Gen Science presentation

Ever since middle school, I've been captivated by the brilliance of scientific minds and the Nobel Prize that celebrates their contributions. You can imagine my excitement when my PhD supervisor, Hans Schöler, nominated me to participate in the biggest Nobel Laureate event outside the Stockholm award ceremony: The Lindau Meetings.

I felt incredibly privileged to have the opportunity to present my work during the Next Gen Science session and in one-to-one exchanges with Nobel Laureates Martin Evans and Mario Capecchi. My research focuses on pluripotent stem cells, which naturally exist only in early embryos. These cells are exceptional because they can give rise to any cell type, tissue or organ. During natural development, pluripotent stem cells are responsible for building up whole animal bodies. Martin Evans derived the first pluripotent stem cells from mouse embryos in 1981. Evans' "culture-to-creature" paradigm, combined with precision DNA manipulation pioneered by Mario Capecchi, resulted in a "mouse knockout" revolution that uncovered the secrets of mammalian genetic makeup. The next big breakthrough came in 2006, when Nobel Laureate Shinya Yamanaka discovered how to generate induced pluripotent stem cells (iPSCs).

I was first introduced to iPSC technology during my bachelor's studies in Kyiv. The idea that a few molecules could rejuvenate old cells was astonishing. I went on to spend both my master's and PhD years learning how to culture both mouse and human pluripotent stem cells and understand their very different properties. Both induced and embryo-derived mouse pluripotent stem cells are highly potent; they could generate entire animals. Human cells, on the other hand, were finicky and much harder to culture or edit. Mouse cells represent an earlier stage in development, the so-called "naïve" state, while human stem cells can only be stabilized a later stage which we call the primed state. The properties of the stem cells in these two pluripotency states are dramatically different: only naïve cells can support the development of all animal tissues. Since Martin Evans generated the first culture-derived mouse more than 40 years ago, germline transmission has not yet been achieved for primates, livestock, or any other non-rodent species. Pluripotency remains a black box.

My work delves into the structural relationship between two Yamanaka factors, Oct4 and Sox2, and their almost magical power to reverse aging. I engineered a super-SOX protein that forms an extra-stable dimer with Oct4, thereby allowing generation of naïve pluripotent stem cells in multiple species of mammals, including humans. Using this powerful new tool, we have generated the first-ever cultured cells that could likely give rise to live human beings (which I do not suggest we should attempt!), but also allow us to grow organs for transplantation needs, etc. Most importantly, super-SOX became the key to unlocking the black box of naïve pluripotency, offering unprecedented access to the mammalian germline. Discovery of such a tool could become a milestone in the evolution of our species and life overall.

Excitingly, my Lindau journey began serendipitously soon after landing in Zurich. By chance my fellow traveller on the flight from Boston was Nobel Laureate Richard Roberts, who discovered gene splicing. We spent hours talking on the drive from Zurich to Lindau. He shared the story behind his groundbreaking discovery and the consequences of getting a Nobel prize for his life and career. We debated genetic engineering and Richard's advocacy for GMO plants in Europe, which I support, and recurring casual and work-related conversations later in the meeting – it felt like talking to a good friend.

Indeed, it is the personal encounters with Nobel Laureates and Young Scientists that left the biggest impression on me from Lindau. I already mentioned my discussions with Martin Evans and Mario Capecchi. I introduced my work and had engaging conversations with enzyme engineering pioneer, Francis Arnold and Emmanuelle Charpentier, who discovered CRISPR-Cas9. Emmanuelle's down-to-earth attitude and passion for science left an indelible mark on me. I joined her table for dinner, and we spent hours talking afterwards. I got to hear the story behind what might be the most impactful discovery of the 21st century. It was a truly unforgettable Lindau experience.

Find Sergiy Velychko's Next Gen Science talk on naïve pluripotency in our Mediatheque.

United by the Passion for Science

In the run-up to the 72nd Lindau Nobel Laureate Meeting, blogger and physicist Ulrike Böhm interviewed several female participants about their career paths, struggles and successes for the Lindau blog and the "Women in Research" blog – to increase the visibility of women in research. Here are some of the highlights:

What inspired you to pursue a career in science?
Birgül Akolpoglu, PhD student at the Max Planck Institute for Intelligent Systems, Stuttgart, Germany, and ETH Zürich, Switzerland: As a young child, I was always captivated by the natural world and had this desire to find out everything about it. I used to ask my parents many questions that they didn't know the answers to. [...] The thought of discovering things and the potential to positively impact society through scientific advancements inspired me to pursue a career in science.

Who are your role models?
Mari Carmen Romero-Mulero, PhD student at the Max Planck Institute of Immunobiology and Epigenetics and the Faculty of Biology, University of Freiburg, Germany: I, fortunately, have many role models. To start with, the women in my family and my hometown are very important figures for me, as they were and are extremely hard-working women who constantly fight to make life better and easier for all of us. Teachers and professors along my path were also important figures, as they transmitted their passion for science to me. Professionally, I am lucky to pursue my project in a lab with amazing women who not only help you improve your scientific skills but also your confidence and your personal life. I continuously meet new role models, highly-skilled and knowledgeable researchers who share my fascination for science.

What advice do you have for other women interested in your discipline?
Trishla Sinha, MD/PhD student at the University Medical Center Groningen, Netherlands: In the research environment, especially when working with bioinformatics, it can sometimes be challenging to be taken seriously by the men around me. My advice is not to be afraid to voice your opinion and to keep asking questions, even though it may feel like a battle every day. In my experience, relentless determination, continuous asking of critical questions, dedication, and perseverance eventually earned me the respect of the people around me. Another important thing is to love what you are doing and be enthusiastic. In my experience, enthusiasm is infectious. If you are enthusiastic, people around you will be too, and that is a wonderful environment to be in!

Birgül Akolpoglu enjoyed participating in the Hidroist project, which aimed to design and construct a futuristic mini car powered by hydrogen.

Mari Carmen Romero-Mulero assesses the effect of aging on the physiology of the hematopoietic compartment via computational and experimental approaches.

Liyana Binti Azmi conducts research on antimicrobial resistance (AMR) through studying protein structure and functions.

In her research, Trishla Sinha aims to identify factors that shape the maternal and infant gut microbiomes and viromes.

What should be done to increase the number of female scientists and professors?
Liyana Binti Azmi, Lecturer at Universiti Sains Islam Malaysia: I think science education and research must be inclusive for all, regardless of gender, race, ethnicity, or socioeconomic status. On that note, I believe there are cases where women are limited by their responsibilities or expectations to care for their families. This is one of the reasons why many women hold back from doing science or pursuing higher positions in the workforce. Personally, I've seen what women can achieve if their families support them – I am lucky to be in one.

On the other hand, if working organisations or academia could support families or even increase awareness against patriarchy, women would have more support and the encouragement they need to pursue science. Finally, I think science should be encouraged for girls at a young age, and female scientists must be highlighted to help inspire them to pursue science as a career.

After the meeting, several of the young women in science shared their #LINO23 experiences with us.

Academic Partners

Vital Nodes in a World-Spanning Network

To ensure the scientific excellence of the attending Young Scientists, the Lindau Nobel Laureate Meetings maintain a strong global network of more than 200 Academic Partner institutions.

Signing a Memorandum of Understanding with Texas A&M University, United States

Reception for Academic Partner representatives during the 72nd Lindau Meeting

World-renowned entities in science and research both from the public and private sectors are entitled to nominate Young Scientists for participation in the Lindau Meetings. These institutions include academies of sciences, leading universities, research institutions, foundations and innovative enterprises throughout the world. Without this support, the Lindau Nobel Laureate Meetings would not be able to identify and invite the most gifted scientific talents worldwide.

For the 72nd Lindau Nobel Laureate Meeting (Physiology/Medicine) about 150 institutions from around the globe nominated their most talented Young Scientists. Generally, Young Scientists apply to and are nominated by our Academic Partner institutions. In exceptional cases, applications can be submitted directly to the Council via Open Application, for example, when an applicant studies or works in a country where the Lindau Meetings do not yet have an Academic Partner.

The partner network is continuously being expanded, partly by memoranda of understanding. In these, both the Lindau Meetings and their partners commit themselves to the interconnection and promotion of aspiring Young Scientists and thus to spreading Lindau's "Mission Education" worldwide. By engaging in a symbiotic relationship, Academic Partners become vital nodes in a world-spanning network of progressive young minds for which the Lindau Meetings function as a hub. They are the trustees of a constant pursuit of excellence and enablers of intergenerational and intercultural dialogue.

Application Process

Requirements

Undergraduates, Master or PhD Students, or Post-Docs
Top 5% of Their Class

Application for the 74th Lindau Meeting dedicated to Chemistry (29 June – 4 July 2025)

Application

Application for the 8th Lindau Meeting on Economic Sciences (26 – 30 August 2025)

Regular:
Nomination by Academic Partners (Internal Selection)

Exception:
Open Application (If No Academic Partner is Responsible)

Evaluation and Selection

Review Panel of the Council
400 – 600 Participants
(Depending on Meeting Type)

Pre-evaluation

Participation

One-Time Only

Lindau Alumni Community

About 35,000 Former Participants
Since 1951

The application process for the 74th Lindau Nobel Laureate Meeting (Chemistry) in 2025 starts in September 2024 and for the 8th Lindau Meeting on Economic Sciences in October 2024.

Accepted Young Scientists at #LINO23

Nominating Institutions

Academia Sinica, Taiwan
Académie Nationale des Sciences et Techniques du Sénégal (ANSTS)
Academy of Science of South Africa (ASSAf)
Academy of Sciences Malaysia
acatech – National Academy of Science and Engineering, Germany
Alexander von Humboldt Foundation, Germany
American University of Beirut, Lebanon
Australian Academy of Science
Austrian Academy of Sciences
Bangladesh Academy of Sciences (BAS)
Bavarian Academy of Sciences and Humanities, Germany
Boehringer Ingelheim International GmbH
Brazilian Academy of Sciences (BAS)
Calouste Gulbenkian Foundation, Portugal
Canadian Institutes of Health Research (CIHR)
Canadian Student Health Research Forum
Carl von Ossietzky University of Oldenburg, Germany
Carl Zeiss Stiftung, Germany
Charité – Universitätsmedizin Berlin, Germany
Chilean Academy of Sciences
China-Singapore Guangzhou Knowledge City Investment and Development Co., Ltd
Columbus Association
Constructor University, Germany
Croucher Foundation, Hong Kong
Czech Academy of Sciences
Democratic Republic of Timor-Leste
Department of Science & Technology, India
Eberhard Karls University of Tübingen, Germany
Elite Network of Bavaria, Germany
Else Kröner-Fresenius-Stiftung
Estonian Academy of Sciences
European Commission
European Molecular Biology Laboratory (EMBL)
Forschungszentrum Jülich GmbH, Germany
Foundation for Innovation and Technological Transfer (FITT), Bulgaria
Foundation for Polish Science
Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V., Germany
Friedrich Schiller University Jena, Germany
Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), Germany
Fund for Scientific Research – FNRS, Belgium
German Academic Exchange Service
German Academic Scholarship Foundation
German National Academy of Sciences Leopoldina
Global Young Academy
Goethe University Frankfurt, Germany
Göttingen Graduate Center for Neurosciences, Biophysics, and Molecular Biosciences (GGNB), Germany
Hannover Medical School, Germany
Heidelberg University – Medical Faculty Mannheim, Germany
Heidelberg University, Germany
Heinrich Heine University Düsseldorf, Germany
Helmholtz Association of German Research Centres, Germany
Honoris United Universities
Human Frontier Science Program
Hungarian Academy of Sciences
ICREA – Catalan Institution for Research and Advanced Studies, Spain
Independent Research Fund Denmark
Industrie-Club e.V. Düsseldorf, Germany
Irish Research Council
Japan Society for the Promotion of Science (JSPS)
Johannes Gutenberg University Mainz, Germany
Jordan University of Science and Technology
Julius-Maximilians-Universität Würzburg, Germany
Karlsruhe Institute of Technology, Germany
King Abdullah University of Science and Technology, Saudi Arabia
Klaus Tschira Stiftung gGmbH, Germany
Körber Foundation, Germany
Korea Foundation for Advanced Studies (KFAS)
Leibniz Association, Germany
Leipzig University, Germany
Ludwig-Maximilians-Universität Munich, Germany
Luxembourg National Research Fund
Martin Luther University Halle-Wittenberg, Germany
Max Planck Society, Germany
Medizinische Hochschule Brandenburg Theodor Fontane, Germany
Mexican Academy of Sciences
Ministry of Education, Tertiary Education, Science and Technology, Mauritius
Ministry of Higher Education, Research and Innovation, Oman
Ministry of Research, Technology and Higher Education of the Republic of Indonesia
Mongolian Academy of Sciences
National Academy of Sciences of the Republic of Armenia
National Academy of Sciences of Uruguay
National Biomedical Foundation, Hungary
National Research Foundation, Singapore
National Science and Technology Development Agency, Thailand
Oak Ridge Associated Universities (ORAU), USA
Pakistan Institute of Engineering & Applied Sciences (PIEAS)
Philipps-Universität Marburg, Germany
The Royal Swedish Academy of Sciences, Sweden
Research Foundation – Flanders (FWO), Belgium
Royal Netherlands Academy of Arts and Sciences
Ruhr-Universität Bochum, Germany
RWTH Aachen University, Germany
Saarland University, Germany
Sino-German Center for Research Promotion, China
Swiss Academy of Sciences (SCNAT)
Technical University of Darmstadt, Germany
Technical University of Munich, Germany
Technische Universität Dresden, Germany
Texas A&M University, USA
The African Academy of Sciences (AAS)
The Council of Finnish Academies
The European Molecular Biology Organization (EMBO)
The Korean Academy of Science and Technology
The Lithuanian Academy of Sciences
The Norwegian Academy of Science and Letters
The Royal Society, UK
TÜBİTAK, Turkey
TWAS – The World Academy of Sciences
Ulm University, Germany
Universidad de los Andes, Colombia
Universität Heidelberg – Medizinische Fakultät Mannheim, Germany
Universität zu Lübeck, Germany
University Medical Center Hamburg-Eppendorf, Germany
University Medicine Greifswald, Germany
University of Bonn, Germany
University of California (UC), USA
University of Cologne, Germany
University of Duisburg-Essen (UDE), Germany
University of Freiburg, Germany
University of Greifswald, Germany
University of Hohenheim, Germany
University of Iceland
University of Liechtenstein
University of Malta
University of Münster, Germany
University of Nicosia, Cyprus
University of Regensburg, Germany
University of Rostock, Germany
Volkswagen Foundation, Germany
Weizmann Institute of Science, Israel
Wilhelm Sander-Stiftung, Germany

I very much enjoyed my interactions with the Young Scientists, as well as the scientific and social programme of the meeting.

Emmanuelle Charpentier

Programme Structure

	Sunday, 25 June	Monday, 26 June	Tuesday, 27 June	Wednesday, 28 June	Thursday, 29 June	Friday, 30 June
07		*Partner Events* • Austrian Federal Ministry of Education • Republic of Indonesia *Break* **Morning Workout**	*Partner Events* • Mars, Incorporated • Rolex SA *Break* **Morning Workout**	*Partner Event* • vfa *Break* **Morning Workout**	*Break* **Morning Workout**	
08						*Social Event* **Baden-Württemberg Boat Trip to Mainau Island** hosted by the State of Baden-Württemberg
09		*Lecture* **O'Keefe**	*Lecture* **Nüsslein-Volhard**	*Next Gen Science* *presentations by Young Scientists*	*Agora Talks* • Blackburn & Hartwell (online) • Lehn & Sauvage	
10		*Lecture* **Capecchi** *Lecture* **Charpentier**	*Lecture* **Hell** *Lecture* **Levitt**		*Lecture* **Evans** *Lecture* **Moser**	
11		*Agora Talks* • Ciechanover & Hunt • Varmus	*Agora Talk* • Roberts	*Agora Talks* • Chalfie & Schekman • Yonath		*Panel Discussion* **Climate Change and Implications on Health** *Agre, Campbell-Lendrum, Huisman, Rocklöv, Saktiawati, Schmitt*
12					*Lecture* **Kaelin**	
13		*Agora Talks* • Walker • Zinkernagel	*Agora Talks* • Deisenhofer, Frank, Michel, Wüthrich • Dubochet (online)	*Agora Talks* • Neher • Rosbash & Young	*Lecture* **Rice**	*Closing Ceremony*
14	*Opening Ceremony* Gore (online) *Ensemble of the Vienna Philharmonic Orchestra*	*Break* **Lunch Break** **City Reception**	*Break* **Lunch Break** **Laureate Lunches**	*Break* **Lunch Break** **Laureate Lunches**	*Break* **Lunch Break** **Laureate Lunches**	*Social Event* **Science Picnic on the Castle Meadow** hosted by the Ministry of Science, Education and the Arts, State of Baden-Württemberg
15		*Next Gen Science* *presentations by Young Scientists*	*Panel Discussion* **Artificial Intelligence and Medicine** *Ciechanover, Cui, Hershko, Levitt, Patel, Sakpere*	*Next Gen Science* *presentations by Young Scientists*	*Open Exchanges* *Evans, Hoffmann, Kaelin, Lehn, Moser, Rice* *Science Walks*	
16	*Reception* hosted by the Republic of Austria					
17	*Panel Discussion* **Diversity and Merits in Science** *Chalfie, Charpentier, Nüsslein-Volhard, Shraim, Shumo, Varmus*	*Open Exchanges* *Capecchi, Charpentier, Ciechanover, Hershko, Hunt, O'Keefe, Varmus, Walker, Zinkernagel* *Science Walks*	*Open Exchanges* *Deisenhofer, Hell, Huber, Levitt, Meldal, Michel, Nüsslein-Volhard, Roberts, Wüthrich*	*Open Exchanges* *Agre, Arnold, Chalfie, Frank, Neher, Rosbash, Schekman, Yonath, Young*	*Workshops* • Lindau Guidelines: Merits • Lindau Guidelines: Diversity • Climate Change & Global Health	*Social Event* **Baden-Württemberg Boat Trip to Lindau** hosted by the State of Baden-Württemberg
18	*Lecture* **Arnold** *Lecture* **Meldal**					
19	*Social Programme* **Dinner** *for Young Scientists*	*Social Programme* **International Get-Together** hosted by the Republic of Indonesia	*Social Programme* **Academic Partner Dinners** hosted by Academic Partners	*Heidelberg Lecture* **Patel**	*Social Programme* **Bavarian Evening** hosted by the Free State of Bavaria	
20	**Foundation Dinner** hosted by the Foundation Lindau Nobel Laureate Meetings		**Grill & Chill** hosted by the Lindau Nobel Laureate Meetings and supported by the City of Lindau	*Social Programme* **Dinner** *for Young Scientists*		
21						

Browse the programme booklet.

Impressions

Lectures

Frances H. Arnold	Innovation by Evolution: Bringing New Chemistry to Life
Mario R. Capecchi	Defective Hoxb8 Microglia are Causative for both Chronic Anxiety and OCSD-like Behavior in Mice
Emmanuelle Charpentier	A Research Journey Towards the CRISPR-Cas Genome Engineering Technology
Sir Martin J. Evans	Embryonal Carcinoma/Stem Cell Story
Stefan W. Hell	Molecular-Scale Resolution and Dynamics in Fluorescence Microscopy
William G. Kaelin Jr.	The von Hippel-Lindau Hereditary Cancer Syndrome: Insights into Oxygen Sensing and Cancer
Morten Meldal	Molecular Click Adventures: A Leap from the Shoulders of Giants
Edvard I. Moser	Neural Networks for Navigation
Christiane Nüsslein-Volhard	Animal Beauty: Function and Evolution of Biological Aesthetics
John O'Keefe	Navigation System of the Brain
Charles M. Rice	Hepatitis C Cure and Beyond: Challenges Ahead

Heidelberg Lecture

To emphasise the close links and the outstanding partnership between the Lindau Nobel Laureate Meetings and the Heidelberg Laureate Forum (HLF), Lindau hosts Heidelberg Lectures every year, and Lindau Lectures are part of every HLF programme.

In this year's Heidelberg Lecture, Shwetak N. Patel, recipient of the 2018 ACM Prize in Computing, discussed the emergence of mobile phones and wearables for health – and answered questions also from very young scientists, as in this case from his daughter.

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1 Christiane Nüsslein-Volhard
2 Stefan W. Hell
3 Mario R. Capecchi
4 Frances H. Arnold
5 Edvard I. Moser
6 John O'Keefe

Find recordings of all lectures from the 72nd Lindau Nobel Laureate Meeting in the Lindau Mediatheque.

Panel Discussions

Diversity and Merits in Science

- Emmanuelle Charpentier, Max Planck Unit for the Science of Pathogens, Germany
- Harold E. Varmus, Weill Cornell Medical College, United States of America
- Christiane Nüsslein-Volhard, Max Planck Institute for Developmental Biology, Germany
- Martin Chalfie, Columbia University, United States of America
- Rasha Shraim, Trinity College Dublin, Ireland
- Marwa Shumo, University of Bonn, Germany
- Nkechi Madubuko, Kassel University, Germany (Moderator)

Artificial Intelligence in Medicine

- Aderonke Sakpere, University of Ibadan, Nigeria
- Ang Cui, Harvard University, United States of America
- Shwetak N. Patel, University of Washington, United States of America
- Aaron Ciechanover, Israel Institute of Technology
- Michael Levitt, Stanford University, United States of America
- Avram Hershko, Israel Institute of Technology
- Bart de Witte, HIPPO AI Foundation gUG, Germany (Moderator)

Aderonke Sakpere

Michael Levitt

Climate Change and Implications on Health

- Adam Smith, Nobel Prize Outreach, Sweden (Moderator)
- Peter Agre, Johns Hopkins Malaria Research Institute, United States of America
- Jana S. Huisman, Massachusetts Institute of Technology (MIT), United States of America
- Joacim Rocklöv, Heidelberg University, Germany
- Antonia M. I. Saktiawati, Universitas Gadjah Mada, Indonesia
- Diarmid Campbell-Lendrum, World Health Organization, Switzerland
- Leonard Schmitt, Technical University of Munich, Germany

Nkechi Madubuko also moderated the Opening Ceremony.

Bart de Witte moderated the AI panel on his birthday, with Avram Hershko (left).

Adam Smith was not only in demand for moderating.

Agora Talks

Elizabeth H. Blackburn, Leland H. Hartwell (online)	Science and Education
Aaron Ciechanover, Tim Hunt	Mentoring and Role Models
Martin Chalfie, Randy W. Schekman	Advice for Next Generation Scientists
Johann Deisenhofer, Joachim Frank, Hartmut Michel, Kurt Wüthrich	The Future of Structural Biology
Jacques Dubochet (online)	Responsible Scientist
Jean-Marie Lehn, Jean-Pierre Sauvage	Molecular Structure and Function
Michael Levitt	Impact of Biological Intelligence (BI), Human Intelligence (HI) & Machine Intelligence (AI) on Innovation in Science & Technology
Erwin Neher	Short-Term Synaptic Plasticity: Electrophysiology and Molecular Mechanisms
Sir Richard J. Roberts	Why Europe Should Embrace GMOs
Michael M. Rosbash, Michael W. Young	Circadian Rhythms
Harold E. Varmus	Ten Axioms for a Life in Science
Sir John E. Walker	Citrin Deficiency: A Defect in the Urea Cycle
Ada E. Yonath	From Origin of Life to Genetic Diseases
Rolf M. Zinkernagel	Acquired Immunity and Immunological Memory

The Agora Talks were moderated by
Rainer Blatt, University of Innsbruck, Austria
Stefan H. E. Kaufmann, Max Planck Institute for Infection Biology, Germany
Klas Kärre, Karolinska Institutet, Sweden
Heiner Linke, Lund University, Sweden
Wolfgang Lubitz, Max Planck Institute for Chemical Energy Conversion, Germany
Adam Smith, Nobel Prize Outreach, Sweden
Pernilla Wittung-Stafshede, Chalmers University of Technology, Sweden

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1 Tim Hunt and Aaron Ciechanover with Pernilla WIttung-Stafshede and a Young Scientst
2 Jean-Pierre Sauvage, Jean-Marie Lehn and Rainer Blatt
3 Elizabeth H. Blackburn and Leland H. Hartwell on screen with Adam Smith
4 Jacques Dubochet on screen with Heiner Linke
5 Rolf M. Zinkernagel
6 Ada E. Yonath

Recordings of all #LINO23 Agora Talks can be found in the Lindau Mediatheque.

Open Exchanges

Peter Agre	Jules A. Hoffmann	John O'Keefe
Frances H. Arnold	Robert Huber	Charles M. Rice
Mario R. Capecchi	Tim Hunt	Sir Richard J. Roberts
Martin Chalfie	William G. Kaelin Jr.	Michael M. Rosbash
Emmanuelle Charpentier	Jean-Marie Lehn	Randy W. Schekman
Aaron Ciechanover	Michael Levitt	Harold E. Varmus
Johann Deisenhofer	Morten Meldal	Sir John E. Walker
Sir Martin J. Evans	Hartmut Michel	Kurt Wüthrich
Joachim Frank	Edvard I. Moser	Ada E. Yonath
Stefan W. Hell	Erwin Neher	Michael W. Young
Avram Hershko	Christiane Nüsslein-Volhard	Rolf M. Zinkernagel

At each Lindau Meeting, most Nobel Laureates also chair an Open Exchange session – open exclusively to the Young Scientists. The intimacy, informality, and frankness of these discussions allow for personal questions, controversial reflections and profound specialist insights. This year, 33 Nobel Laureates took the time for in-depth conversations with the young meeting participants about science, research as well as topics outside of their work.

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1 Michael W. Young
2 Jules A. Hoffmann
3 Robert Huber
4 Michael M. Rosbash
5 Sir Martin J. Evans
6 Hartmut Michel

Next Gen Science

The Future of Physiology and Medicine

In five sessions, more than 40 selected Young Scientists presented their current work to our community – and answered questions from Nobel Laureates and their peers.

Nobel Laureates following Next Gen Science sessions: Sir John E. Walker, Tim Hunt, Michael M. Rosbash

The majority of Young Scientists invited to the 72nd Lindau Nobel Laureate Meeting submitted abstracts as applications. Continuing the successful cooperation of the past few years, Lindau Alumni once again contributed their time and expertise during the peer review process.

Based on their rankings, the scientific chairpersons put together five fascinating sessions that represented the diversity of the Lindau Meetings' global community in several ways. The presenters represent more than 25 countries and work at 17 internationally renowned institutions, with an even gender balance.

Most importantly, the seven-minute presentations were great snapshots of the breadth of cutting-edge research done by excellent early-career researchers. Nobel Laureates and Young Scientists alike attended the sessions in Lindau's Inselhalle and City Theatre, and many fruitful discussions started in the brief questions-and-answer rounds.

Find a recording of all five Next Gen Science sessions in our Mediatheque.

Amanda Oliver during her engaging presentation

Immunology

Session I moderated by Council Member Klas Kärre, Karolinska Institutet, Sweden

Engineering Principles of T Cell Proliferation Control: Computational Design of Circuits That Counteract Tumor Suppression
Hersh Bhargava, University of California, San Francisco, United States of America

Vitreous Macrophages in Proliferative Diabetic Retinopathy
Stefaniya Boneva, University of Freiburg, Germany

Redefining Human Bone Marrow Lymphoid Development by Integrating Computational and Experimental Methods
YeEun Kim, Stanford University, United States of America

Leveraging Inflammation as a Common Immunologic Language in T Cells
Nicholas Maurice, University of Minnesota, United States of America

How an Evolutionary Perspective Can Expose Gaps in Our Immunological Knowledge
Magdalena Migalska, Jagiellonian University, Poland

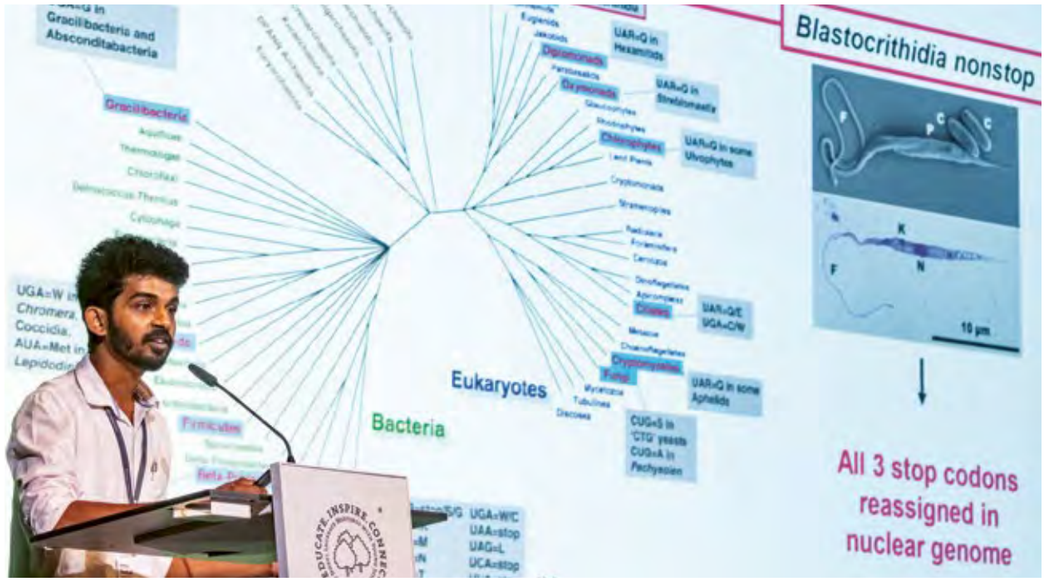
Lipid Antigen Presentation on CD1a Redefines Type 2 Diabetes as an Autoimmune Response to Lipids
Dequina Nicholas, University of California, Irvine, United States of America

Using Single Cell and Spatial Transcriptomics to Decode Mucosal Immunity
Amanda Oliver, Wellcome Sanger Institute, United Kingdom

Single-Cell Spatial Landscape of NSCLC Reveals Prognostic Immune Features and Mechanisms of Enhanced Anti-Tumor Immunity
Mark Sorin, McGill University, Canada

Mapping COVID-19 Initiation in the Human Lung: Noncanonical Macrophages, Receptors, and Host Response
Timothy Wu, Stanford University, United States of America

Stefan H.E. Kaufmann and Nabila Ismail in conversation



Ambar Kachale speaking about nonstop tRNAs

Microbiology in Health and Disease

Session II moderated by scientific chairperson Stefan H.E. Kaufmann, Max Planck Institute for Infection Biology, Germany

Sputum Bacterial Load and Bacterial Composition Correlate With Lung Function and Are Altered by Long-Term Azithromycin Treatment in Children With HIV-Associated Chronic Lung Disease
Regina Esinam Abotsi, University of Cape Town, South Africa

Distribution and Tropism of Tick-Borne Flavivirus in the Brain Shaped by Interferon Response: Looking Through Different Lenses
Nunya Chotiwan, Umeå University, Sweden

Microbial Exposure Synchronises Cellular Circadian Rhythmicity
Priya Crosby, University of California, Santa Cruz, United States of America

Investigating the Overlap in Drug Target Pathways in Mycobacterium Tuberculosis for the Nitroimidazole Drug Class and the Repurposed Riminophenazine Drug; Clofazimine
Nabila Ismail, Stellenbosch University, South Africa

Lung Spatial Transcriptomic Analysis Reveals the Potential of a Novel SARS-CoV-2 Live Attenuated Vaccine in Inhibiting Virus Replication
Etori Aguiar Moreira, University of Bern, Switzerland

Use of Shigella-Septin Interactions to Explore Biophysical Determinants in Cell-Autonomous Immunity
Gizem Ozbaykal-Guler, London School of Hygiene and Tropical Medicine, United Kingdom

Asymptomatic Sexually Transmitted Infections Are Associated With the Presence of Inflammatory Cells, Dermatopathology and Changes in Tight Junction Gene Expression in the Human Foreskin From South African Males
Cosnet Lerato Rametse, University Of Cape Town, South Africa

Microbial Co-Cultures for the Discovery of Novel Antibiotics
Maria Stroe, Karlsruhe Institute of Technology (KIT), Germany

Intestinal Toll-like Receptor 5 Contributes to Gut Permeability After Stroke via Microbiota Modulation
Huidi Wang, Southern Medical University, China

Genetics, Biochemistry and Cell Biology

Session III moderated by Council Member Pernilla Wittung-Stafshede, Chalmers University of Technology, Sweden

Chromatin Reorganization to Totipotency
Johanna Gassler, IMBA – Institute of Molecular Biotechnology of the Austrian Academy of Sciences, Austria

Chronic Viral Infection Drives Three Gene Expression States in Cardiomyocytes
Cameron Griffiths, University of Virginia, United States of America

Short tRNA Anticodon Stem and Mutant eRF1 Allow Stop Codon Reassignment
Ambar Kachale, Biology Centre CAS, Czech Republic

BACH1 Proline Hydroxylation Regulates the Hypoxia Response and Metastasis in Triple Negative Breast Cancer
Long Nguyen, University of Chicago, United States of America

Uncovering Activity-Dependent Ion Channel Splicing Patterns at Cellular Resolution Using in Situ Sequencing
Yu-Chi Sun, New York University, United States of America

How Does the Spliceosome Bind Introns?
Jonas Tholen, EMBL Grenoble & Genentech, United States of America

Highly Efficient Synthetic Reprogramming Factor Unravels the Core Mechanism of Naïve Pluripotency
Sergiy Velychko, Harvard University, USA

Keren Jia on stage in Inselhalle

Laura Pritchett during her presentation on women's brain health

Emerging Technologies/Cancer

Session IV moderated by Council Member Heiner Linke, Lund University, Sweden

Single-Cell Transcriptomic Atlas-Guided Development of CAR-T Cells for the Treatment of Acute Myeloid Leukemia
Adrian Gottschlich, University Hospital of the LMU Munich, Germany

A Multiscale, Systems-Level Approach Highlights the Spatiotemporal Regulatory Growth Mechanisms of a Complex Mini Organ
Christian Guerrero-Juarez, University of California, Irvine, United States of America

Predicting Response to Immunotherapy in Gastric Cancer via Multi-Dimensional Analyses
Keren Jia, Peking University, China

Self-Supervised Learning Resolves Subcellular Protein Localization and More
Hirofumi Kobayashi, Pictor Labs, United States of America

Multivalent Vaccine Candidates and Novel Adjuvants Enabled by Multicomponent Reactions
Yanira Méndez Gómez, University of Cambridge, United Kingdom

Engineered Enzymes for Programmable Genome Manipulation
Beverly Y. Mok, Agency for Science, Technology and Research (A*STAR), Singapore

CAR T Cells Produced in Vivo to Treat Cardiac Disease
Joel Rurik, Karolinska Institutet, Sweden

The Potential of an Electronic Nose as a Screening Tool for Tuberculosis (TB)
Antonia Morita I. Saktiawati, Universitas Gadjah Mada, Indonesia

Multicellular Phenotypic Programs Defining Colorectal Cancer Liver Metastases
Thomas Walle, German Cancer Research Center, Germany

Neurobiology

Session V moderated by Thomas Perlmann, Karolinska Institutet, Sweden

Mining the Non-Coding Human Genome for Novel Risk Factors of Neurodegenerative Disease
Frederick Arnold, University of California, Irvine, United States of America

Exploring Brain Evolution With Comparative Transcriptomics
David Hain, Max Planck Institute for Brain Research, Germany

Early Brain Changes in a Mouse Model of Alzheimer's Disease Detected With Advanced Diffusion MRI
Andrada Ianus, Champalimaud Foundation, Portugal

Creation of Forebrain Assembloids to Recapitulate the Dynamic Cellular Interactions During the Development of the Human Schizophrenia Brain
Eunjee Kim, Seoul National University, South Korea

Adenosine A2A Receptor Signaling in Astrocytes Contributes to Multiple Sclerosis Progression
Chih Hung Lo, Nanyang Technological University, Singapore

Single-Photon Captures Drive the Pupillary Light Response at Visual Threshold
Gabriel Peinado, Aalto University, Finland

Endocrine Modulation of the Nervous System as Revealed by Precision Imaging – Implications for Women's Brain Health
Laura Pritschet, University of California, Santa Barbara, United States of America

Simultaneous Trimodal (MR/PET/EEG) Approach to Study the Functional Integration within the Brain
Ravichandran Rajkumar, RWTH Aachen University, Germany

Dynamic Value and Decision Codes in the Prefrontal Cortex
Xulu Sun, University of California, San Francisco, United States of America

Without doubt the best organised and most interesting science conference I have ever attended. This week has been immensely inspiring and will be absolutely unforgettable.

Nathalie Conrad

Active Brainstorming by Young Scientists

Designed to pick up on the opening panel discussion on "Diversity and Merits in Science", two workshops were held later during the week in Lindau. A third workshop took place with the reverse logic: preparing the closing panel on "Climate Change and Implications on Health".

One of the workshops referring to the opening panel was dedicated to merits in the academic system and was thus closely related to the Lindau Guidelines' Goal #7: Change Reward Systems, while the other focused on DEI topics, relating to Goal #8: Support All Talent. During the workshops, the about 50 participants in each session split into several smaller groups and worked on spontaneous ideas for improvement. The results were presented in 2-minute talks and are summarised on the next pages. Some ideas target a global, governmental or institutional level, some are suggestions on how to improve the Lindau Meetings themselves.

In an additional seminar on the opening day, Tobias Maier, National Institute for Science Communication (NaWik), Germany, advised the Young Scientists on how best to present at the Next Gen Science sessions.

Change Reward Systems

Group 1
- Acknowledge negative results in research papers in a dedicated section of papers/journals – to avoid repetitive research mistakes and increase research quality.
- Increase author visibility and teamwork efforts.
- Address bias towards prestigious journals like Nature.
- Create a free, inclusive journal, possibly called the "Lindau Journal".

Group 2
- Create a universal database to integrate publications, work results, grants, CVs, and other related data. Can then be used for job applications, grant writing, etc. and will give a better picture of a researcher's work.
- AI should be used to help remove bias, especially during recruitment.

Group 3
- Differentiate impactful science from prestigious journals.
- Establish an open access journal with peer review and non-profit orientation.
- Reviewers should be non-anonymous.
- Emphasis on the quality of the work, not the reputation of the journal.

Group 4
- Create different career systems, e.g., for tenure track and staff scientists.
- Encourage more choice for labs/research groups, i.e., not only go for high-profile publications, but rather also emphasise open access work, science outreach, educational activities, etc.

Group 5
- Lower barriers for publishing negative data to reward the research process.
- Create a composite metric for scientists that includes data reproducibility, teaching hours, review contributions, data accessibility, and transparency. This would complement other metrics such as the h-score.

Moderator Leonhard Möckl, Lindau Alumnus 2022, Max Planck Institute for the Science of Light, Germany

Morten Meldal as advisor during the workshop

Group 6
- Shift focus from publications and journal impact factors to top five scientific contributions when job seeking or presenting.
- Replace journal names with PubMed IDs when referencing papers for critical analysis.
- Clearly state individual contributions to published papers in CVs, similar to current practices in some journals.
- Utilise ORCID ID for centralised documentation of scientific contributions.

Group 7
- Increase transparency in authorship selection, with tentative decisions made early in the research process.
- Evaluate the mentor-mentee relationship bi-directionally, even including those who don't complete their degrees.
- Ensure all levels of staff are represented in hiring committees, particularly for new faculty.

Group 8
- All facets of scientific work, including database preparation and method optimisation, should be recognised and considered in annual reports and grant applications.

Initial fact finding

Martin Chalfie sharing his experience with the Young Scientists

Support All Talent

Group 1

- Inequalities that result in mechanisms like (gender) quotas should be addressed on a more fundamental level, as they actually generate a lot of pressure and negative side-effects.
- For example, quotas for women should eventually be made obsolete by reaching a far more balanced distribution of duties between parents, equal offers addressing both parents (e.g., childcare, maternity leave, leadership support). Thereby, men and women will have equal opportunities from the start.
- Similar approaches apply to other groups of society.

Group 2

- Advocate for supporting individuals from disadvantaged socioeconomic backgrounds and first-generation academics, to make temporary positive discrimination obsolete in the long run.
- Equal funding for childcare for both genders, with added benefits for women.
- Importance of broad qualification criteria without undue emphasis on prestigious publications.

Group 3

- Introduce equipment grants to empower better research.
- Improve science outreach to children, showcasing diverse scientist profiles.
- Assist scientists when relocating to new countries, especially concerning legal issues.
- Offer interest-free loans for relocating scientists.
- Fostering a sense of community/family within academic institutions.

Group 4

Suggestions to implement at the Lindau Meetings:

- Conduct surveys on Young Scientists' experiences, especially concerning discrimination and micro-aggressions.
- Develop clear diversity goals.
- Make the selection process completely anonymous (double-blind).
- Provide childcare facilities with professional caregivers during the meeting.

Group 5

- Individual responsibility: Everyone should undergo training to become aware of unconscious biases, encompassing all professional levels (PhD, PI, students).
- Institutional role: Blinded reviews of manuscripts, funding, and job applications should be enforced.
- Lindau's part: Standardising the nomination process to ensure everyone is aware and has an equal opportunity to participate.

Group 6

- Conferences should advertise early to accommodate visa processing times.
- Talks and content should be made available online.
- Account for food restrictions, provide spaces for breastfeeding and praying, and offer childcare.
- Scholarships should be available for global participation, and more conferences should be hosted in the Global South.
- Institutions should practice blinded CV reviews during hiring and utilise intermediaries.
- Mandatory workshops should be conducted on topics like unconscious bias, gender equality, diversity, and mental health.
- Offer workshops on skills such as grant writing, especially for those in the Global North.
- Institutions should appoint a diversity officer, establish a code of conduct, and set consequences for violations.

Plenary discussion at the beginning

Groups further developing their arguments

Prioritising all the raised topics

Climate Change and Global Health

The third Workshop on the afternoon before the closing panel was not only supposed to discuss arguments relating to the topic of the session. The approximately 50 participants also managed to select spokespersons for those issues that were ranked top throughout the workshop. They brought up the groups' arguments during the panel – both from the stage as well as by contributions from the audience. Thanks to this preparatory stage, the closing session discussed the following topics (among others):

- Direct and indirect effects of climate change on health and diseases.
- Preparedness for future outbreaks of diseases.
- One Health concept.
- How can we make our laboratories, hospitals and science sustainable in everyday life?
- Scientific responsibility in shaping societal awareness and trust in science.
- Green computing and AI as part of medical research.

In conclusion, the #LINO23 workshops really lived up to the expectations and this or a similar format will be part of the programme in 2024.

Arguments around climate & health in the Lindau Mediatheque:

New Ideas and a Dynamic Format

3rd Lindau Online Sciathon

Over 48 hours in April 2023, 27 teams comprised of Lindau Alumni and Young Scientists worked on fascinating ideas for tackling key challenges of our time. The five best teams presented their concepts during the Sciathon workshop at the 72nd Lindau Meeting.

The 3rd Lindau Online Sciathon (28–30 April 2023) built on the successful hackathon-style events in 2020 and 2021. Lindau Alumni and the newly selected Young Scientists for the 72nd Lindau Nobel Laureate Meeting were invited to participate. This way, Lindau Alumni had the opportunity to meet and welcome the "newcomers", and newly admitted Young Scientists could get involved in a Lindau project right away. Most importantly, the adapted format of the Lindau Online Sciathon seeks to develop novel and ingenious solutions to some of the key challenges of our time.

The topic this year was "Innovative Applications of Medical Research". In February 2023, almost 30 Lindau Alumni from 12 Lindau Meetings and representing 18 countries submitted their project ideas. Starting in March, Lindau Alumni and Young Scientists registered for the accepted groups through the Lindau Alumni Network.

More than 200 scientists from all over the world worked intensively in 27 groups. An opening and closing session moderated by Brian Malow bookended the weekend. After 48 hours, all groups successfully handed in a brief report summarizing their ideas. Together with a short video submitted after 72 hours, these materials were the basis for the evaluation by an expert jury chaired by Council Member Stefan H.E. Kaufmann.

The five best groups proposing novel scientific solutions received the unique opportunity to present their work during the Sciathon workshop at the 72nd Lindau Meeting. The projects received positive feedback and encouraging comments by the esteemed panel and audience of the afternoon session. Two particularly promising teams, 'Biosheets' and 'Cancer Detection', are receiving further advice, guidance and support from venture capital experts. These mentors will help them to turn the ideas into reality. Find out more on sciathon.org.

Innovative Application of Medical Research

Expert Jury

- Stefan H.E. Kaufmann, Scientific Co-Chair 72nd Lindau Meeting (Chair)
- Renata Gomes, Lindau Alumna 2014, Bravo Victor
- Jürgen Kluge, Chairman, Foundation Lindau Nobel Laureate Meetings
- Enrique Lin Shiao, Lindau Alumnus 2018, Cystic Fibrosis Foundation
- Pia Michel, PrimaMateria AB

Sciathon Workshop

Monday, 26 June 2023

Moderated by Ulrich Schmitz, Axel Springer Digital Ventures

Pia Michel with Jürgen Kluge and Stefan H.E. Kaufmann

Tilmann Herberger and Vanessa Restrepo-Schild

Quang Trung Tran and Stephanos Yerolatsitis

Thomas Oehl and Jagdeep Bachher

Groups

Antimalarial PROTACs to Combat Artemisinin Resistance
Group Adié À Moumbock

Artificial Intelligence (AI) Based Molecular Simulation for the Prognosis of Adverse Drug Reactions
Group Kandaswamy

Phototherapy for the Treatment of Endometriosis
Group Arnau del Valle

Revolutionizing Cancer Detection With Optical Fibers and Artificial Intelligence
Group Yerolatsitis

Revolutionizing Wound Care: Smart Biosheets With Early Infection Detection and Antimicrobial Properties
Group Herberger & Restrepo-Schild

Workshop Panel

- Stefan H.E. Kaufmann, Scientific Co-Chair 72nd Lindau Meeting (Chair)
- Jagdeep Bachher, University of California
- Jürgen Kluge, Chairman, Foundation Lindau Nobel Laureate Meetings
- Pia Michel, PrimaMateria AB
- Thomas Oehl, VSquared Ventures

4th Lindau Online Sciathon
Physics as a Driver for a Sustainable Future
19–21 April 2024
Lindau Alumni will be invited to submit their project idea for the next event in early 2024.

For Curious Early Birds

Partner Events

The Lindau Meetings offer a variety of options for Partner Events, such as the Partner Breakfasts. Despite the fact that these take place early in the morning before the scientific programme starts, they are well attended and play host to insightful discussions.

Indonesia in Overcoming COVID-19 Pandemic and Domestic Vaccine

hosted by the Republic of Indonesia as host of the International Day 2023

- Ismunandar, Lindau Alumnus 2005; Ambassador/Alt. Permanent Delegate of the Republic of Indonesia for UNESCO; Ministry of Education, Culture, Research and Technology, Republic of Indonesia (Moderator)
- Fedik Abdul Rantam, Universitas Airlangga, Republic of Indonesia
- Antonia Morita Iswari Saktiawati, Gadjah Mada University, Republic of Indonesia

Genetic Analyses for Prediction and Prevention of Diseases, a Promising and Challenging Medical Tool

hosted by the Austrian Federal Ministry of Education, Science and Research

- Elisabeth Puchhammer-Stöckl, Center for Virology, Medical University of Vienna, Austria (Moderator)
- Harold E. Varmus, Weill Cornell Medical College, United States of America
- Katharina Kohl, CeMM, Research Center for Molecular Medicine of the Austrian Academy of Sciences, Austria

Adding Life to Our Years: Healthy Aging, Longevity, and the Potential for Nutrition Science

hosted by Mars, Incorporated

- Adam Smith, Nobel Prize Outreach, Sweden (Moderator)
- Ninadini Sharma, Max Planck Institute for Multidisciplinary Sciences, Germany
- Michael W. Young, The Rockefeller University, United States of America
- Hagen Schroeter, Mars Edge, United States of America

Excellence in Science for Society: Harnessing Innovative Science, Medicine, Engineering and Ingenuity to Improve People's Lives

hosted by Rolex SA

- Faith McLellan, World Health Organization, Switzerland (Moderator)
- Grégoire Courtine, Swiss Federal Institute of Technology Lausanne and University of Lausanne, Switzerland
- Jocelyne Bloch, Lausanne University Hospital and Swiss Federal Institute of Technology, Lausanne, Switzerland
- Randy W. Schekman, University of California, Berkeley, United States of America

CRISPR-Cas9: From Lab to Therapeutic Tool

hosted by the German Association of Research-based Pharmaceutical Companies (vfa)

- Rolf Hömke, Science Communicator of the German Association of Research-based Pharmaceutical Companies (vfa) (Moderator)
- Emmanuelle Charpentier, Max Planck Unit for the Science of Pathogens, Berlin, Germany
- André Cohnen, VP, Head of Genomic Medicine at Bayer Pharmaceuticals, Germany
- Julia Jansing, Maastricht University, The Netherlands

Klaus Tschira Stiftung Supports the Lindau Meetings

Promoting Science for Everyone

Gero von der Stein, Head of Communications, representing the Klaus Tschira Stiftung

Young Scientists during the entertaining Pub Quiz

How many nationalities are represented at the Heidelberg Institute for Theoretical Studies (HITS)? Which category is not part of the NaWik Arrow? And what is Hilbert's Hotel all about? Questions like these were encountered by the participants in an entertaining Pub Quiz organised by the Klaus Tschira Stiftung at their informal get-together. The Klaus Tschira Stiftung promotes natural sciences, mathematics and computer science through its own projects as well as via support for other initiatives, organisations and events – like the Lindau Meetings.

While enjoying antipasti and prosecco, German-speaking Young Scientists learned about funding opportunities, research projects and science communication. For example, the KlarText Award for science communication recognises postdocs who have done a particularly impressive job in explaining their doctoral thesis to non-scientists.

The National Institute for Science Communication (NaWik) provides another opportunity for scientists to improve their skills in explaining their research. NaWik trains scientists to communicate their intentions, findings and motivations to a wider audience and engage in societal dialogue.

Based on the belief that evidence-based journalism can counterbalance disinformation, populism and lobbying, the Science Media Center aims to strengthen science journalism by delivering authoritative expertise from proven experts and evidence-based knowledge to journalists. The Young Scientists could become accredited experts and in this way join the public discourse.

Finally, the Klaus Tschira Stiftung talked about the Heidelberg Laureate Forum – developed on the model of Lindau –, which brings together world-leading mathematicians and computer scientists. After all, there are maths-affine scientists at every Lindau Meeting. Each year the recipients of the Abel Prize, ACM A.M. Turing Award, ACM Prize in Computing, Fields Medal, IMU Abacus Medal and the Nevanlinna Prize meet 200 selected young researchers from all over the world.

In case, you are still wondering: 40 nationalities gather at the HITS and Hilbert's paradox of the Grand Hotel is a mathematical thought experiment, which illustrates a counterintuitive property of infinite sets. Many Young Scientists succeeded in solving the riddle and the three best teams were awarded with prizes. The quizzing will surely continue in 2024.

Scientific Programme

Session Formats

11
Lectures
By Nobel Laureates
Free Choice of Topic

14
Agora Talks
Laureates Interact During Presentation
Moderator Leads Q&A from the Audience
Flexible and Interactive

3
Panel Discussions
Topical and Relevant Issues
High Profile Panelists: Laureates, Young Scientists, Civil Society Attendees
Broadcasted via Livestream

43
Next Gen Science Presentations
Research by Selected Young Scientists
Opportunity for Q&A
Nobel Laureates in the Audience

33
Open Exchanges
Informal Discussions
Between a Laurate and Young Scientists Only
Time for Q&A

5
Partner Events
Discussions Hosted by Partners of the Lindau Meetings

Where Science Meets Culture and Politics

Summer Festival of Science

hosted by the German Federal Minister of Education and Research Bettina Stark-Watzinger

Reception and dinner at the Eilguthalle, Lindau

Addresses
- Federal Minister Bettina Stark-Watzinger
- Jürgen Kluge, Chairman of the Board of Directors, Foundation Lindau Nobel Laureate Meetings

Austrian Federal Minister Martin Polaschek and German Federal Minister Stark-Watzinger with Young Scientist Steve Doo

Federal Minister Stark-Watzinger with Nobel Laureates Richard Roberts (left) and Stefan Hell (right)

Nobel Laureate Charles M. Rice and Honorary Senator Klaus Kleinfeld

International Day

hosted by Indonesia

Partner Breakfast

see page 64

International Get-Together

Welcome
- Countess Bettina Bernadotte, President of the Council
- Arif Havas Oegroseno, Ambassador of the Republic of Indonesia to the Federal Republic of Germany

Presentation
- Nizam, Director General for Higher Education, Research and Technology, Ministry of Education, Culture, Research and Technology, Republic of Indonesia
- Budi Annisa Sidi, The Embassy of the Republic of Indonesia in Berlin (Master of Ceremonies)

Indonesian Cultural Performance
- Anggur Jaya – Freiburger Gamelan Ensemble
- Pesona Indonesia and Friends

Indonesian Dinner

Pesona Indonesia and Friends during the cultural performance

Director General Nizam introducing Indonesia and its biodiversity

Barbara Schretter greeting the participants on behalf of the Free State of Bavaria

Bavarian Evening

hosted by the Free State of Bavaria

Welcome
- Countess Bettina Bernadotte, President of the Council

Greetings on Behalf of the Free State of Bavaria
- Barbara Schretter, President of the Government of Swabia, Germany

Sketches of Science
- Photographer Volker Steger and Adam Smith, Nobel Prize Outreach

Bavarian Music & Folk Dance
- Trachtenverein "Koppachtaler" Altusried
- ScheinEilig

Bavarian Dinner

Social Events

Numerous Occasions for Personal Encounters

Grill & Chill

Upon invitation of the Lindau Nobel Laureate Meetings in cooperation with the City of Lindau

Welcome Addresses
- Countess Bettina Bernadotte, President of the Council
- Claudia Alfons, Lord Mayor of Lindau

Donations of Our Guests
The proceeds and donations benefit the Lindau city museum "Cavazzen", projects with young people in Lindau and the surrounding area run by the Mentor Foundation Germany as well as marshland renaturation projects.

Support
- City of Lindau
- Mineralbrunnen Krumbach GmbH
- TV Reutin 1905

Grill & Chill in the Toskanapark

John O'Keefe enjoying the atmosphere at the shore of Lake Constance

Several Academic Dinners took place in the Eilguthalle.

Academic Partner and Supporter Dinners

Hosts
- Austrian Federal Ministry of Education, Science and Research
- Bayer Foundation
- Boehringer Ingelheim Stiftung
- Carl-Zeiss Foundation
- Dieter Schwarz Stiftung
- Else Kröner-Fresenius-Stiftung
- German Research Foundation (DFG)
- Helmholtz Association of German Research Centres
- Mars, Inc.
- Max Planck Society

Young Scientists during an Academic Dinner

Baden-Württemberg Boat Trip to Mainau Island

hosted by the State of Baden-Württemberg

Welcome Addresses
- Petra Olschowski, State Minister for Research and the Arts, State of Baden-Württemberg
- Countess Bettina Bernadotte

Closing Panel Discussion
"Climate Change and Implications on Health"

Conclusion & Farewell
- Hadeer Elhabashy, Young Scientist, Max Planck Institute for Developmental Biology, Germany
- William G. Kaelin Jr., Nobel Laureate in Physiology or Medicine 2019, Harvard Cancer Center, USA

Science Picnic

hosted by the Baden-Württemberg Science Ministry

Alumni Party

Music by Tamara Wirth

Petra Olschowski, State Minister for Research and the Arts, State of Baden-Württemberg (right)

The Science Picnic – time to chat or rest after an eventful week

It was a pleasure to participate (even just online), as always, and I hope to return in person to another great Lindau Meeting.

Elizabeth H. Blackburn

Artificial Intelligence and Medicine

Potential and Danger for Science, Technology and Medical Practice

Two #LINO23 sessions dug deep into the capabilities, dangers and even the existential questions that the large language model ChatGPT has raised since version 3.5 was released to the world in November 2022: an Agora Talk by Michael Levitt and the "Artificial Intelligence and Medicine" Panel Discussion hosted by Bart de Witte.

Michael Levitt on AI and medicine

Young Scientist Aderonke Sakpere

Panelists Ang Cui, Shwetak Patel and Aaron Ciechanover

Moderator Bart de Witte

Michael Levitt, 2013 Nobel Laureate in Chemistry, began by summarising his thoughts on intelligence: "There really is a triad of intelligences: biological intelligence, which I think is by far the greatest intelligence; the intelligence that we humans have; and then finally, machine intelligence or AI," he said. "And these intelligences interact: biology made humans, humans have made machines, machines will feed back both into new biology and into changing how human beings are."

After an all-too-brief presentation on each of these types of intelligences, skirting past Levitt's own contributions to understanding biological and human intelligence, the large majority of the time was left open to what became an AI-focused Q&A with the audience.

Can we use large language models like ChatGPT and AlphaFold to really probe into the mechanisms of protein folding? "I would love an addition to AlphaFold where you could actually ask it, why? At least then you could see where the differences are between the best model and the second-best model," he replied. "I think we need to learn this because we do need the understanding."

What are your thoughts on the impact of general usage of AI tools for society? "I think it's going to have an impact on the stock market. I think it's going to have an impact on the legal system," Levitt replied. "Where I really want to see ChatGPT have an impact is risk assessment. In a crisis, it's difficult to do a risk assessment because you've got to say, what is the cost of doing this versus the cost of doing that? Computers could be very good at that."

Does the rapid evolution of AI mean we need to redefine the meaning of what is alive? "The current models are not alive because they don't control their own energy source. So, in some ways, they are maybe as alive as a virus," responded Levitt. "Should we be worried? I believe that a human being plus AI will always be better than a human being by themself, or AI by itself."

Given the enthusiasm expressed at Levitt's Agora Talk, it was little surprise that #LINO23 attendees flocked to the "Artificial Intelligence and Medicine" Panel Discussion. They were greeted by moderator Bart de Witte, who discussed the current opportunities and risks of AI in medicine with an esteemed panel and audience.

On stage, he was joined by Young Scientists Ang Cui (Harvard University, USA) and Aderonke Sakpere (University of Ibadan, Nigeria), as well as Shwetak Patel (Google) and Nobel Laureates Aaron Ciechanover (2004 Nobel Prize in Chemistry), Avram Hershko (2004 Nobel Prize in Chemistry) and Michael Levitt.

AI and machine learning tools are already making serious inroads into medical practice, assisting in a host of areas including breast cancer screening, skin cancer classification and in predicting the progression of diabetes. What's more, ChatGPT and its peers are widely seen as key tools in future medical care.

This view was confirmed by the panellists, who had all used and benefitted from machine learning and AI in their research, with Cui going even further: "Machine learning has really penetrated into every field. We have all been using it knowingly or unknowingly for every facet of our research."

Patel was similarly positive. "These new models are what I call label-efficient, and what that means is that you can have lots of data, but very few labels, and it can be just as performant as large, labelled datasets," he explained. "What does that mean for us in health? Well, it means that we may be able to solve the longtail problem, all those rare diseases."

Of course, as with any revolutionary technology, benefits need to be weighed against risks. "One problem that I can see is overreliance on artificial intelligence; so, when a doctor will get used to using artificial intelligence for diagnosis, for example, he can become over-reliant on it and may not use his own judgement," opined Hershko. "Then there is the problem of accountability – if there is a mistake, then what do you do? Do you sue your computer? Do you sue the company?"

Sakpere, meanwhile, argued that open data is key to equitable AI: "As long as we have openness, it enables us to contribute to global health data, so when global data has been trained, there won't be any form of bias, with certain groups of people not being represented."

To ensure medical AI avoids these and other dangers, and is put to use for the good of humanity, all panellists agreed that regulation is critical, with Levitt even coming up with a three-point plan for its introduction: explainability, transparency and steerability. "Let's say you have a tool for medical diagnosis," he said. "It should lay out why it came to its conclusion, it should basically be transparent about where the conclusion came from, and you should be able to say 'well, now try something different'."

We Should Look for Language That's Not Inflammatory

The question of how science and scientists should respond to the global societal challenge of climate change dominated two #LINO23 sessions: the Agora Talk "Why Europe Should Embrace GMOs" by Sir Richard J. Roberts and the final Panel Discussion "Climate Change and Implications on Health" held on Mainau Island.

We are all aware of the impact climate change can have (and is having) on the health of our global population. Extreme weather increases heat- and cold-related illness and deaths, and leads to more frequent and intense natural disasters, like hurricanes, floods, wildfires and storms. Air pollution causes respiratory problems. And knock-on disruptions to water supplies and agricultural systems contribute to food insecurity, malnutrition and outbreaks of various diseases. What's worse is that these impacts disproportionately affect the most vulnerable members of society – the elderly, the young, people with pre-existing health conditions and communities in developing countries most lacking the resources needed to respond to these threats.

Sir Richard J. Roberts' Agora Talk (1993 Nobel Prize in Physiology or Medicine) was a forthright argument for Europe to embrace genetically modified crops to feed a growing global population on a warming Earth. "In Europe, you're not allowed to buy GMO food, you can't grow GMO foods, but the animals in Europe are fed millions of tonnes of GMO soybean. Apparently, GMOs are perfectly safe for animals but deadly for people – and I find this hypocrisy to be just too much."

Roberts contended that the science says GMOs are safe, but political and financial vested interests continue to fuel a pan-European anti-GMO movement that bars the planting of GMO crops. Not only did he argue that this is deleterious to Europe, but it is also a critical roadblock to the rest of the world embracing GMOs. His argument concluded with a call to arms for Young Scientists to support GMOs.

Three days later, on the idyllic Mainau Island, moderator Adam Smith and panellists Peter Agre (2003 Nobel Prize in Chemistry), Diarmid Campbell-Lendrum (World Health Organization), epidemiological researcher Joacim Rocklöv (Heidelberg University), and Young Scientists Leonard Schmitt (Technical University of Munich), Jana Sanne Huisman (Massachusetts Institute of Technology) and Antonia Morita Saktiawati (Universitas Gadjah Mada) picked up the baton from Roberts.

Many Young Scientists had met the day before in a workshop to hash out six important topics related to climate change and its implications for health.
The six topics chosen were:

- talking about direct and indirect consequences of climate change for health
- ensuring preparedness for future pandemics
- interdisciplinary collaboration to attain optimal health for the environment, animals and humanity
- actions to make our laboratories, hospitals and science in general more sustainable
- improving trust in science and influencing policymakers to implement changes
- utilising AI to address climate change and health

Leonard Schmitt emphasised the need to educate all young people on how climate change will impact their fields, particularly those in health-related disciplines. "Given that climate change is the biggest health threat to humanity, you would think that that should be part of the curriculum, right?"

Antonia Morita Saktiawati highlighted how we can no longer think of a global North-South divide when it comes to public health. This applies to COVID-19 and is also due to climate change shifting where diseases like malaria and dengue, for example, thrive. "As long as there is still infection in the global South, it can come to the global North – no one is safe until everyone is safe."

Final Panel Discussion at #LINO23: Moderator Adam Smith, Peter Agre, Jana Sanne Huisman, Joacim Rocklöv, Antonia Morita Saktiawati, Diarmid Campbell-Lendrum, Leonard Schmitt

Jana Sanne Huisman extended this argument into the political sphere, arguing for better political engagement from scientists on societal issues connected with climate change and health. "What can we do to convince our politicians right now? Part of that should be making the arguments of how our actions have a global reach, but sometimes saying 'what you think is a far-away problem is actually a problem right at home' might be the more convincing communication strategy."

Peter Agre has been active in communicating and exploring solutions to the climate crisis in terms of public health and equity. When asked about how to build trust in science on climate change and its impact on health, he had sage advice, "We have to be convincing and… we should look for language that's not inflammatory."

Diarmid Campbell-Lendrum had more to add on this topic. "Positive framing of the health and environmental benefits of climate action elicits the most support across boundaries," he explained. "And that's been tested in quite a few countries – the only exception is Germany."

Sir Richard J. Roberts

Joacim Rocklöv stated, "Another thing that is really promising and important is to engage normal people because it increases awareness and support for policies."

Though many of the topics, arguments and examples will have been familiar to attendees, the sense at the end of the discussion was that they were leaving with a renewed determination to play their part. In the words of Schmitt: "We know the solution, we just need to implement it."

Evolution, Editing and Clicks

Nobel Laureates Unpack the Biochemistry Revolution

#LINO23 offered an intriguing series of lectures about biochemistry and how we can harvest its power for the benefit of mankind.

Frances H. Arnold on directed evolution

Emmanuelle Charpentier during her presentation on CRISPR/Cas9

Morten Meldal, awarded for his work on click-chemistry

Stefan W. Hell about the development of fluorescence microscopy

This series was kicked off by Frances H. Arnold on the opening day of this year's meeting. Proteins and enzymes are remarkable in their abilities to adapt and optimise their functions, explained the Nobel Laureate in Chemistry 2018 in a thoroughly engaging lecture. Arnold wanted to create enzymes that did not exist in human chemistry. Like many scientists, she was experiencing frustration because her work wasn't progressing the way she was hoping. Then she realised there was one excellent chemist who could help her: evolution by nature.

"How do enzymes create new chemistry? It comes out of diversity. Novelty is already there because there's massive diversity in the natural world. You may not know where it is, but nature will find it and it will appear in natural selection." So, Arnold got started with creating new proteins through the process of directed evolution. This method used in biochemical engineering mimics natural evolution to create new and improved enzyme proteins. The process involves iterative rounds of genetic mutation, selection or screening and amplification.

When you're creating new enzymes through evolution, you're not exactly understanding all the genetic mechanisms at play. But then again, this isn't new. Just look at the many different and specialised breeds of dogs, Arnold mentions. They were selected through breeding, without the breeders truly understanding the process. More recently, the process has been used in various products, including hair gels and detergents.

"Directed evolution worked incredibly well for many years and you might be surprised to know that laundry detergents were made by natural evolution. After all, what natural enzyme wants to work in your laundry machine?," Arnold quipped.

At one point in her talk, Arnold mentioned our ability to read and edit DNA, after which she emphatically said "Thanks, Emmanuelle!" She was of course referring to Emmanuelle Charpentier, who was awarded the Nobel Prize in Chemistry in 2020 for the development of CRISPR/Cas9, along with Jennifer Doudna.

The story of this genome editing tool starts with an unlikely character: Streptococcus pyogenes – a human pathogen that infects up to 5% of all humans and up to 17% of all children. S. pyogenes is itself vulnerable to infections – viral infections, that is. Several researchers have looked at how bacteria react to viral infections, explained Charpentier. This was the groundwork for understanding CRISPR. CRISPR, which stands for "clustered regularly interspaced short palindromic repeats", is an accessory system in some bacteria and archaea that provides immunity against viruses and harmful plasmids.

First, explains Charpentier, you have a recognition of the invasion by the phage. The CRISPR system will recognise the invading DNA, will take a portion of it and will insert this portion into an array that allows the memorisation of the infection. Basically, CRISPR-Cas immunity integrates sequences of invading DNA to recognise, to remember and to destroy the invasive element.

In order to do this, the system has to be very good at cutting and pasting DNA, and this is what Charpentier and Doudna were most interested in. It wasn't straightforward or simple. The journey of CRISPR/CAS9 started with Darwin and the understanding of the laws of inheritance, and progressed with the understanding that DNA was a carrier of genetic information, the isolation of DNA and the understanding that there was a genetic code involved. Nowadays, applications for CRISPR/Cas9 are aplenty, which is striking for such a new technology.

It's definitely rewarding when your research clicks together, but sometimes, it's the molecules themselves that do the clicking. Up next was Morten Meldal, whose lecture presented the advantages of click chemistry. Meldal, the 2022 Nobel Laureate in Chemistry, is also a Lindau Alumnus (1986).

The term "click chemistry" was inspired by the metaphor of clicking together two pieces of a puzzle. In the metaphor, these pieces are two chemical components coming together to form a new compound. But in order for something to be a click reaction, it has to fulfil specific characteristics: click reactions occur in one pot, don't react with water and generate minimal and harmless byproducts. Essentially, the molecular building blocks "click" together seamlessly and efficiently.

The classic click reaction is the copper-catalysed reaction of an azide with an alkyne (CuAAC). Now, although the click chemistry toolbox is still small, there are several important reactions that use this mechanism. Meldal ended his talk with a call to action, saying we should teach more science to children, and this can help the betterment of our society.

A programme session on another way of using chemistry for examining cell structures was given during the meeting by Nobel Laureate Stefan W. Hell – recording available in the Lindau Mediatheque.

Health and Diseases

From Complex Disorders to Revolutionary Cures

"Scientific research works, it is the only way to get at the underlying mechanisms of disease, and the only way to learn what to do about them." – Lewis Thomas

Throughout the entire week, the concepts of health and diseases played a central role at the 72nd Lindau Nobel Laureate Meeting. Thus, many sessions were dedicated to this topic area: from well-known diseases, which often make the headlines, to those that are less common.

In a compelling presentation, Nobel Laureate Sir John E. Walker graced the stage to unravel the complexities of a relatively unknown ailment: citrin deficiency. Recognised for his groundbreaking work on the structure of the enzyme ATP synthase, which produces adenosine triphosphate, Walker called attention to the pivotal role of the protein citrin in transporting energy to liver cells. Beyond its energy-regulating function, citrin also plays a crucial role in carbohydrate breakdown and the clearance of ammonia from the body through the urea system.

Citrin deficiency, resulting from a rare mutation in the SLC25A13 gene, is an autosomal recessive metabolic disorder. Walker highlighted the challenge of diagnosing this condition early in life, which often leads to its silent presence during childhood. The disease manifests through dietary preferences, hypoglycaemia, short stature, and dyslipidaemia. Ammonia buildup triggers hyperammonaemia symptoms in adolescence and adulthood, progressing to liver failure. Regrettably, the sole remedy is liver transplantation.

The diagnosis process currently relies on whole-genome sequencing, a tool not universally accessible. Walker stressed the need for comprehensive research and infrastructure to comprehend citrin deficiency better. This condition stands as a poignant example of a rare disease that could potentially benefit from gene therapy breakthroughs in the future.

A Next Gen Science session on the topic of "Microbiology in Health and Disease" featured the research endeavours of nine Young Scientists, each unveiling valuable insights. Regina Esinam Abotsi, hailing from the University of Cape Town, South Africa, illuminated the oft-overlooked area of chronic lung disease among HIV-positive children. Her study showcased promising improvements in patient conditions with the use of the antibiotic azithromycin.

Meanwhile, Nabila Ismail from Stellenbosch University, also South Africa, addressed the formidable challenge of drug resistance in tuberculosis control. Despite tuberculosis being a well-known disease, treatment efficacy remains at 50–60% and is limited to orally administered drugs. Ismail's research delved into the genetic variants of Mycobacterium tuberculosis that display resistance to specific drugs, offering new avenues for treatment development.

Etori Aguiar Moreira, representing the University of Bern, Switzerland, ventured into the realm of viral illnesses. Her groundbreaking work on a live-attenuated vaccine for SARS-CoV-2, delivered intranasally, shows remarkable potential. In comparison to mRNA vaccines, the live-attenuated version not only cleared the virus from infected lung tissue more rapidly but also accelerated the resolution of inflammatory responses.

Sir John E. Walker

Charles M. Rice

Regina Esinam Abotsi

Nabila Ismail

The closing lecture on Thursday was delivered by Nobel Laureate Charles M. Rice, awarded in 2020 for his contributions to the discovery of the hepatitis C virus. Collaborating with Harvey J. Alter and Michael Houghton, Rice's journey involved decades of persistent effort to piece together the puzzle of hepatitis C. The virus, a silent yet devastating blood-borne pathogen, which ultimately causes cirrhosis or liver damage, previously led to millions of infections annually.

The journey toward understanding hepatitis C was arduous, with Harvey Alter and Michael Houghton piecing together crucial fragments. Despite setbacks due to the virus's genetic variability and replication challenges, the efforts of Rice's team were eventually met with success, and they could unveil the complete RNA replication system for hepatitis C. This achievement marked a turning point in therapeutic development, leading to revolutionary antiviral treatments with significantly improved cure rates.

However, Rice candidly acknowledged the absence of a hepatitis C vaccine, highlighting the ongoing work required to tackle this virus effectively. The journey toward understanding, treating and preventing hepatitis C encapsulates the essence of scientific research and its vital role in addressing complex medical challenges. He concluded his lecture with a quote from medical researcher Lewis Thomas: "Scientific research works, it is the only way to get at the underlying mechanisms of disease, and the only way to learn what to do about them."

Etori Aguiar Moreira and moderator Stefan H.E. Kaufmann

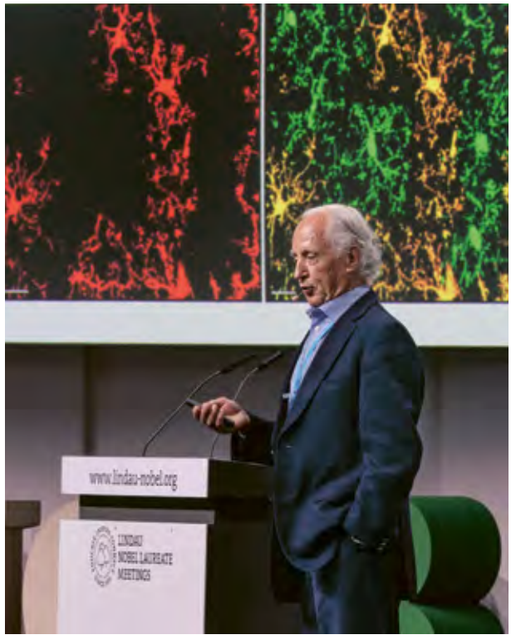
All in all, the 72nd Lindau Nobel Laureate Meeting cast a brilliant spotlight on the intricacies of health and diseases, from the exploration of different genetic anomalies to innovative approaches in disease treatment and prevention.

Neurobiology

Much More to Explore at the Brain's Cellular Level

For anyone with an interest in how the inner workings of the cells of the brain manifest themselves in our experience of the world, lectures by John O'Keefe and Mario Capecchi were the ideal #LINO23 sessions.

John O'Keefe



Mario R. Capecchi

O'Keefe's work in the late 1960s tested individual neurons in rat brains to see how they reacted to environmental stimuli. To his peers at the time, the method went against the grain: "We said, 'let's forget what we're interested in, see what the cells are interested in, and follow the cells as the animal goes about its normal daily living'," he recalled. "Everybody in physiology said, 'this is completely crazy, it'll ruin your career'."

However, the naysayers were completely wrong. The 2014 Laureate in Physiology and his collaborators were the first researchers to successfully transfer the philosophical question of how we perceive our sense of place into the rigorous world of 20th century neurophysiological experimentation. He identified a set of individual nerve cells in a part of the brain called the hippocampus that became activated when the lab rat assumed a particular place in its environment. Moreover, he discovered that these "place cells" worked in concert to build a memory of different environments.

But this did not fully satisfy O'Keefe – something more was needed: "You need to connect all the parts of the map together," he explained. "And the simplest way of doing that is by creating vectors, mathematical entities which connect in space, the distance and direction between two points." The question of whether place cells form a vector-based representation of space sat idle until very recently, when O'Keefe's team at University College London, UK, used modern technology to record hundreds of rat place cells at the same time while cajoling the rat through a unique "honeycomb maze" consisting of 61 individually raisable platforms. The idea behind the experiment was that a rat is given a goal and placed on a single raised platform a distance away from that goal, and then two adjacent platforms are raised for the rat to choose from. Once the rat has made its choice, the other platforms sink down and two new adjacent platforms pop up. This continues until the rat reaches its goal.

The team discovered that activity forms a vector field concentrated at the goal location. Moreover, cell firing provides information about other directions and ranks them in terms of how good each would be in getting the rat to its goal if the direct approach is blocked. O'Keefe sees this new discovery, published open access in Nature in 2022, as a major boost to our understanding of how the hippocampus enables flexible navigation and good news for those wanting to take this research even further.

Continuing the theme of focusing on new, exciting research, next up was Mario Capecchi, who received the 2007 Nobel Prize in Physiology or Medicine. Though still embracing mouse gene modification, Capecchi's research today centres on uncovering the roots of anxiety-related conditions. A few years ago, Capecchi's team discovered that a mutation in certain subset of microglia caused mice to exhibit such behaviours. This result was highly unexpected. Neurons were traditionally thought to be the cells that regulate behaviours. In contrast, microglia had a different role, clearing cellular debris and mounting the immune response to pathogens and infections.

But in addition to this, the team concluded that Hoxb8 microglia are important for controlling behaviour by communicating with specific neuronal circuits. Yet how this worked was a mystery. Capecchi's team turned to optogenetics, using a laser to stimulate specific populations of microglia in the mouse brain. "People said, 'you're insane to try to do optogenetics, these aren't neurons, they can't fire,' and so on", Capecchi recalled. "So why did we do this experiment? Because it works."

In work published open access in April 2023 in the journal Molecular Biology, Capecchi's team from the University of Utah, USA, showed how they can manipulate anxiety-related behaviours by specifically stimulating Hoxb8 microglia, allowing them to control these behaviours like flipping a switch on and off. "Hoxb8 microglia actually function as brakes, they reduce sensitivity. And non-Hoxb8 microglia, they act as an accelerant, increasing the level of grooming and anxiety," explained Capecchi. "So together, they can tune to find the exact level that you should have." Further research and a deeper understanding of this relationship in mice could eventually lead to new approaches for targeted therapies for anxiety-related conditions.

Programme sessions on similar topics were held during the meeting with Nobel Laureates Edvard I. Moser, Erwin Neher, Michael M. Rosbash, Michael W. Young and during Next Gen Science on Neurobiology – all available in the Lindau Mediatheque.

Stem Cells, CAR-T and an Electric Nose

From Myths to Molecules: Emerging Technologies

At #LINO23, we got a chance to witness how the pioneering work of Nobel Laureates is continued by young researchers and how all this work hints at a tantalizing new future where we can improve our longevity and wellbeing.

The fountain of youth is probably one of the oldest and most popular myths in human culture, and who hasn't dreamed of it at least once? The fountain itself may be a myth, but thanks to research in stem cells and other emerging technologies, some forms of rejuvenation may not be all that far away. "Embryonic stem cells have had and are having a considerable impact on understanding development, cell differentiation and genetic function. They have also opened prospects for cellular therapies," said Nobel Laureate Sir Martin Evans during his lecture in Lindau.

It's hard to overstate just how impactful Sir Martin's work (2007 Nobel Prize in Physiology/Medicine with Mario R. Capecchi and Oliver Smithies) has been. Evans and collaborators were the first to culture mice embryonic stem cells and cultivate them in a lab. Ultimately, they demonstrated that they could insert a novel gene into embryonic stem cells that were being cultured. They then utilised these genetically modified cells to create chimeric embryos. Sir Martin discussed the importance of keeping this technology accessible to all, something which would go on to greatly accelerate research in the field of stem cells: "We didn't want this patented! We wanted it in the public domain."

Sir Martin's discoveries are now being applied in virtually all fields of bioscience, and his work is advanced by some of the young researchers present at LINO23. For instance, at the Next Gen Science session on genetics, biochemistry and cell biology, Sergiy Velychko (Harvard University, USA) presented a way to induce naive pluripotency across different species. Velychko and Evans had a compelling exchange following Velychko's presentation, their back and forth a prime example of meaningful scientific communication.

The relentless fight against disease is another aspect of utmost importance – this is where medical research meets the frontlines of healthcare, merging cutting-edge biotechnology with clinical relevance. At the Emerging Technologies/Cancer Next Gen session, Adrian Gottschlich (LMU Munich, Germany) discussed how CAR-T cell therapy can be used for treating acute myeloid leukaemia (AML), the most common type of leukaemia in adults. CAR-T cells (Chimeric Antigen Receptor T cells) are a type of immune cell that have been engineered in the laboratory to produce a specific protein on their surface. However, AML cannot currently be treated this way. This is where Gottschlich's work comes in. He and his colleagues used bioinformatic analyses to find two candidates out of 25,000 potential cell surface molecules. The resulting cells only destroy tumours, while leaving the healthy tissue around them virtually unscathed. Now, the researcher is working on developing cells to be used for clinical trials.

Adrian Gottschlich

Sir Martin J. Evans

Antonia Morita I. Saktiawati

Joel Rurik

Joel Rurik (Karolinska Institutet, Sweden) used CAR-T cells for something very different: treating cardiac disease. CAR-T cells pose a problem for dealing with heart problems: the fibroblast response is critical, especially with regard to acute injury. So, Rurik wanted to see whether he could construct RNA with CAR-T instructions against fibroblasts. Essentially, he and his colleagues created CAR-T cells in vivo using mRNA. "With a single vaccine-like therapeutic RNA, we get a recovery of the function and corresponding fibrosis readouts. I think this is a really incredible result," enthused Rurik .

Clinical advancements come in multiple forms. Antonia Morita I. Saktiawati (Universitas Gadjah Mada, Indonesia) works on an "electric nose" to diagnose tuberculosis: "The chemical sensors in the e-nose will catch the airborne molecules from a sample and will then change it into signal that will be recognized by a pattern recognition done by AI. This is similar to what happens in our brain."

While we have yet to find the mythical fountain of youth, we're already seeing how modern science can profoundly improve our ability to stay healthier for longer. However, the future won't just be about new technological advancements. It will also be about ensuring these advancements are accessible and beneficial for all. Sir Martin's commitment to keeping his embryonic stem cell technology in the public domain served as a potent reminder of the importance of public access to scientific advancements. Perhaps, in this altruism lies something even more valuable than the Fountain of Youth.

A longer version of this article can be found on our blog, and the lecture by Sir Martin Evans as well as the Next Gen Science sessions can be found in the Lindau Mediatheque.

The Language of the Universe

A Journey Into Atomic Structures

Understanding atomic structures is a cornerstone of chemistry and biology, from medicine and materials science to environmental studies and energy production. Unsurprisingly, the #LINO23 Agora Talk about the future of biotechnology, which focused on imaging, was packed.

Nobel Laureates Johann Deisenhofer, Joachim Frank, Hartmut Michel and Kurt Wüthrich took the stage of the Agora Talk, all of whom with links between their Nobel Prize research and the topic of chemical imaging. Understanding atomic structure is a prerequisite for understanding mechanisms of action, drug design and virtual screening, Michel explained. There are five main methods though which this is done:

X-ray crystallography is well established but requires crystals and an X-ray source, which can be very expensive. Similarly, neutron crystallography requires huge crystals and is even more expensive. With electron crystallography, you need 2D crystals, and it often causes strong radiation damage. But Michel specifically emphasised the latter method: "We have the single particle electron cryomicroscopy which seems to revolutionise the field. If you have a look at the atomic structures deposited in the protein bank, it's clear that it used to be all X-ray, but now, single-particle electron cryomicroscopy is coming up," he noted.

Cryo-EM is particularly exciting because it doesn't require the crystallisation of molecules and you only need tiny amounts of materials. In this method, samples are rapidly cooled at extreme temperatures to prevent the formation of ice crystals and preserve their natural shape. The samples are then visualised with an electron microscope. "I think cryo-EM has been so successful because it enables the visualisation of molecules in their native states, and that is very different from those methods in which the molecules are essentially forced into a crystal arrangement," added Joachim Frank.

Between 1970 and now, the intensity of X-rays one can generate with synchrotons or free electron lasers has increased by 11 orders of magnitude, noted Johann Deisenhofer. "That generates a very, very different situation from what we lived through in the early 1980s, with months of data collection. Now, they are talking about seconds of data collection. In the old days, we needed big crystals, so big that you can see them with your eyes, but nowadays, the talk is about 10 microns or so," the Laureate told the audience. After just one single exposure of X-rays, these crystals will be destroyed but with enough time to diffract the X-rays and give a diffraction pattern.

The topic of nuclear magnetic resonance (NMR) spectroscopy was saved by the other Laureates for Kurt Wüthrich, who developed NMR methods to study biological macromolecules. Wüthrich emphasised not just NMR and its applicability, but also the importance of using these methods in conjunction. "We have now talked about different disciplines in structural biology. But what's important is that we all work together," the Laureate added, recalling a paper published alongside Deisenhofer in 1976. "These were not unimportant papers at the time, and they combined crystallography results and NMR results, as well as results from molecular dynamics."

At the Next Gen Science Session on Genetics, Biochemistry and Cell Biology, Young Scientists presented impressive insights into the strategies they are using to visualise chemical structures. For example, Johanna Gassler discussed the role of NFIB in pluripotency. While it was known to play an important role during this process, its role in earlier stages of embryonic development was not clear. Now, the work of Gassler and colleagues demonstrated that NFIB is a pilot transcription factor and showed that it plays a major role in totipotency – the ability of an isolated cell to produce a healthy individual.

Cameron Griffiths focused on heart infections. The challenge here is that their symptoms are similar to other viral infections and heart biopsies are risky and infrequently performed. So, Griffiths gathered data from RNA-seek, a comprehensive, open-source RNA-sequence pipeline. He found data from around 1,000 patients and found that the presence of a virus in the heart does not necessarily result in a uniform response but could instead lead to different adaptations in different patients. Using a clustering algorithm, Griffiths and his colleagues identified three distinct clusters in hearts infected with viruses. Yu-Chi Sun talked about ion channels, pore-forming proteins that help control the small voltage gradient across the membrane of all living cells. Much of physiology is about maintaining homeostasis through negative feedback regulation, similar to a thermostat controlling temperature. Sun and her colleagues analysed changes in ion channel splicing under varying activity levels. They found widespread splicing changes in ion channels involved in physiological processes. These insights were possible thanks to BARseq, a method she worked on developing that can detect short RNA sequences, making it ideal for splice variants.

Lively debate after the Agora Talk "The Future of Structural Biology"

Johanna Gassler

Cameron Griffiths

Yu-Chi Sun

For a fuller documentation of the session including Kurt Wüthrich's statement that he felt "discriminated against as a man" and the discussion that arose from it, please see:

Advice From Nobel Laureates

Life as a Scientist

Several Nobel Laureates shared their thoughts on being a good scientist who contributes responsibly to society without neglecting individual interests and needs. While Harold E. Varmus spoke onsite in Lindau, Elizabeth H. Blackburn, Jacques Dubochet and Leland H. Hartwell participated online.

Harald E. Varmus shared "Ten Axioms for a Life in Science".

Jacques Dubochet spoke to moderator Heiner Linke about the "Responsible Scientist".

Elizabeth H. Blackburn and Hartwell H. Leland held an online conversation with moderator Adam Smith – and the audience in Lindau.

There is no such thing as universal advice for every scientist, as everyone is different, and everyone has unique life trajectories. This was emphasised by Nobel Laureate Harold E. Varmus, "Everybody gets different pleasures, rewards and disappointments from science." But there are some tips that most Nobel Laureates would agree with. At #LINO23, Nobel Laureate Jacques Dubochet spoke about what it means to be a responsible scientist, while Harold Varmus presented his "Ten Axioms for a Life in Science." Both spoke to crowds of eager listeners.

Varmus' first axiom was the one that particularly generated a lot of questions: "I have a strong belief in a prolonged adolescence," said Varmus, who has undergraduate and graduate degrees in English literature, before he switched to medical school. He doesn't regret that it took him longer than many people to find out what he would like to do in life. "My life is full of things that happened to me as a student of English literature," he said. "I don't think we should be viewing an educational process to just one that should strictly determine your career prospects." Dubochet expressed his view that narrow-mindedness and not pursuing interests outside research isn't the way of the successful scientist. When choosing a graduate student or postdoc, Dubochet viewed their hobbies, such as being a theatre enthusiast, as a good sign.

The second axiom presented by Varmus: choosing scientific questions that are interesting, long-term, technically feasible, and which may even someday have some societal benefit. This was echoed by Dubochet in his lecture; he encouraged Young Scientists to "find a hot topic," but to make sure it wasn't too crowded a field. There should be room for new discoveries, as well as for making mistakes. "Making mistakes is normal! It should be the essence of research."

"The future of science is, I hope, open science," said Dubochet, also stating that he would like to see data being shared among scientists in real time. This is parallel to Varmus' fourth and fifth axioms: "Science is best practised as a team sport, not a solitary activity," and "make your work accessible to others, both to colleagues and the public, as soon and as freely as possible."

Both Nobel Laureates insisted that a love of science and a will to succeed is not enough to stand out. "Science depends on societal support: find a way to serve," says axiom no. 7. Dubochet stressed the need for individual scientists to contribute to using knowledge for the greater good, and to fight for a cause, such as climate change. "You will be brilliant scientists, but also citizens," he said. In his Nobel biography, Dubochet explained what his "4S" are: The first S stands for Self, "taking good care of oneself." The second S is for Social, living together (here, Dubochet writes that he teaches young migrants basic mathematics). The third S is Science, "because I love it." The fourth S stands for Service.

It was evident that the Young Scientists responded warmly to all this advice. "That's what I like about Lindau," said Varmus, "You always get a good round of applause!"

Another session focussed on considering science itself. Although the Agora Talk "Science and Education" was conducted at about midnight for Elizabeth H. Blackburn and Leland H. Hartwell, as both were located in another time zone at the Pacific coast and participating online, the session was an inspiring one.

Elizabeth H. Blackburn, Nobel Laureate in Physiology/Medicine 2009, recommended to think about the process of growing into a scientist. One aspect is the interaction with the scientific environment. "So much of our work will involve working with our colleagues and trainees." Both agreed on the importance of treating research as a playground, although this is difficult in the current system with one-year-contracts. "The system forces people to follow a certain trail," worried Leland H. Hartwell. It is always helpful to trust the process and to trust your own ideas. In their opinion scientists must learn to be comfortable with uncertainty.

Regarding the scientific process, Blackburn emphasised that you should be your own worst critic. "You have to be comfortable with being wrong."

Many questions were asked during the following Q&A – for example about teaching which is an important aspect for her research as Blackburn underlined. "My students taught me a lot." Hartwell agreed: "I like to explore things that I don't understand either." Further topics were – among others – handling data and education in schools.

Additionally, Martin Chalfie and Randy W. Schekman shared their "Advice for Next Generation Scientists" in an Agora Talk moderated by Stefan H.W. Kaufmann. Altogether, four sessions can be found in the Lindau Mediatheque, conveying a lot of smart ideas about how to do science.

Just this morning I spoke with a senior staff member of my Parkinson's network who told me she attended the Lindau Meeting in 2008 and for years after that she met annually with one of the other postdocs she met at the conference.

Randy W. Schekman

Lindau Alumni and Friends

Connecting With Our Community

From peer reviews to workshops, during the 72nd Lindau Nobel Laureate Meeting Lindau Alumni had more opportunities to get involved than ever before.

Alumni Peer Review
For both the 72nd Lindau Meeting and in preparation of the 73rd Lindau Meeting on Physics, selected Lindau Alumni from around the world supported our scientific chairs as reviewers in the nomination and application process for new Young Scientists, ensuring that the community has a meaningful impact on the composition of the meeting.

Continuing the outstanding collaboration of the past years, Lindau Alumni volunteered their time and expertise as part of the review process for the Next Gen Science sessions, evaluating a huge number of abstracts submitted by #LINO23 Young Scientists across all fields of medicine, physiology and bioscience. We would like to thank all Lindau Alumni reviewers for being actively involved this way and are looking forward to continuing this well-established, cooperative effort.

Lindau Mentoring Hub
The goal of the Lindau Mentoring Hub is to make sure that Lindau Alumni, Young Scientists and Young Economists have access to support and guidance. The platform was developed with Team Mentoring Hub, a group of Lindau Alumni who initiated the idea during the first Lindau Online Sciathon. A strength of the Lindau Mentoring Hub is the dual role for mentors: Lindau Alumni can sign up for the platform to seek advice as a mentee, to share advice as a mentor – or to do both. The Lindau Mentoring Hub is committed to the Lindau Guidelines and is ready for a future open-source release and expansion.

Throughout 2023, the Lindau Meetings organised online seminars for members of the Lindau Mentoring Hub with science career consultant Alaina Levine. Numerous members of the new platform joined live, asked questions or made comments. All Mentoring Hub members have access to the recordings in the growing resource library of the platform.

The Lindau Nobel Laureate Meetings and Team Mentoring Hub gratefully acknowledge the support of the Dieter Schwarz Foundation for the development of the platform. All Lindau Alumni are encouraged to join the platform at lindau.mentoringhub.org.

Lindau Alumni Network
The Lindau Alumni Network has been the digital space for our alumni community since 2017. The platform includes tools that help users to find fellow alumni, share their work, swap stories, register for Lindau Alumni events and stay connected to our growing global community.

In 2024, the Executive Secretariat will continue to organise a variety of events to extend the "Lindau Spirit" beyond the confines of a weeklong meeting. Members of the Lindau Alumni Network will always hear about these opportunities first – including invitations to submit projects to the 4th Lindau Online Sciathon (see p. 62).

Lindau Alumni during the Sciathon workshop

Nobel Laureate Peter Agre at the AAAS expo booth

Art Molella with Lindau Alumni in the Smithsonian

Nobel Laureate Bill Phillips engaging with the audience

The Lindau Meetings express their sincere gratitude to the German Federal Ministry of Education and Research for initially supporting the project. All former participants are invited to enrich the Lindau Alumni Network with their own ideas and perspectives on how to educate, inspire and connect.

Lindau in Washington, D.C.
As part of our alumni and outreach strategy, the Lindau Nobel Laureate Meetings were present at the American Association for the Advancement of Science's Annual Meeting 2–5 March 2023 in Washington, D.C., USA. At a joint booth with our friends from the Heidelberg Laureate Foundation, we connected with potential new Young Scientists and partners and reconnected with Lindau Alumni and friends.

Upon invitation of the Embassy of the Federal Republic of Germany, alumni, friends and partners of the Lindau Nobel Laureate Meetings spent an afternoon at the German Historical Institute (GHI) in Washington, D.C., on 4 March 2023. During a conversation at GHI moderated by alumni manager Christoph Schumacher, Nobel Laureates Peter Agre, John Mather and William D. Phillips as well as Lindau Alumni Eliad Peretz (NASA) and Ludmila Prokunina-Olsson (National Cancer Institute) discussed the role of mentoring and intergenerational exchange in science and research. The event was a good opportunity to connect with partners and friends, including Vidar Helgesen, Executive Director of the Nobel Foundation.

The Lindau Meetings' time in Washington included the first in-person event for former participants of the Lindau Meetings since 2019: A small group of alumni received a fascinating tour of the Lemelson Center for the Study of Invention and Innovation by Art Molella, founding director of the center in the Smithsonian National Museum of American History. This alumni event concluded with a lovely, informal get-together for the alumni with Nobel Laureate Peter Agre.

All Lindau Alumni are invited to join the online community at lindau-alumni-network.org.

Photo Sessions With Nobel Laureates

Even though the second edition of the art book "Sketches of Science" was published together with the Nobel Prize Museum only last year, science photographer Volker Steger is far from idle. At #LINO23, eight Nobel Laureates agreed to take part in the photo project – the result: lots of smiling faces and of course quite creative drawing.

"What the photographs mainly seem to radiate is the fun of doing science", Nobel Laureate Tim Hunt once said about the long-term photo project which started about 13 years ago. Steger had the idea during a bike-ride while his mind had the liberty to wander: Why not ask Nobel Laureates to make a sketch of the research for which they won their Nobel Prizes? And then ask them to present their artwork to the camera? Such portraits could show the Laureates and their discoveries in a very personal way.

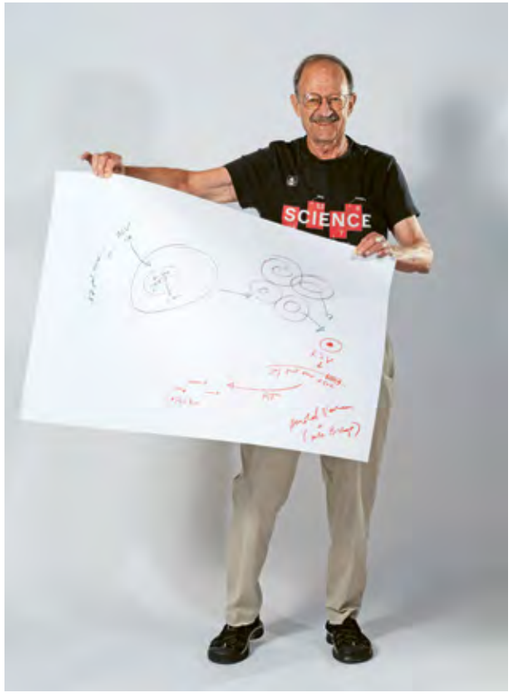
So it happens that when Nobel Laureates come to Lindau, Volker Steger addresses them with a surprise task. They are invited into a room with a desk, a chair, a blank sheet of paper and wax crayons. Each Laureate sketches his or her discovery, following the only guidelines to make the sketch big and use multiple colours. After finishing and signing the work, Steger photographs each Laureate with his or her drawing. Some stand, some sit, there are even those who lie on the floor. One laureate was so baffled by the request for a sketch that his page is blank. Steger calls this mode of portraiture "engaging" because the subject has so much control, yet the frame and the style of portrait is in practice rather consistent.

The first edition of the art book was issued in 2012 together with an exhibition of about 40 photos of the series which was launched at the Nobel Prize Museum in Stockholm. About 11 years later and after many exhibitions in different countries, a new and much enlarged version of the art book was published, featuring 120 Nobel Laureates on 536 pages. It comes with accompanying texts by Adam Smith, Chief Scientific Officer of Nobel Prize Outreach AB, describing the diverse discoveries depicted.

Project Partner
Nobel Prize Museum, Stockholm

Principal Funder
Klaus Tschira Stiftung, Heidelberg

Publisher
Berliner Wissenschafts-Verlag
ISBN 978-3-8305-5176-8



Harold E. Varmus

Countess Bettina Bernadotte moderated the talk about the concept and realisation of the project.

Sketch by Morten Meldal

Edvard I. Moser

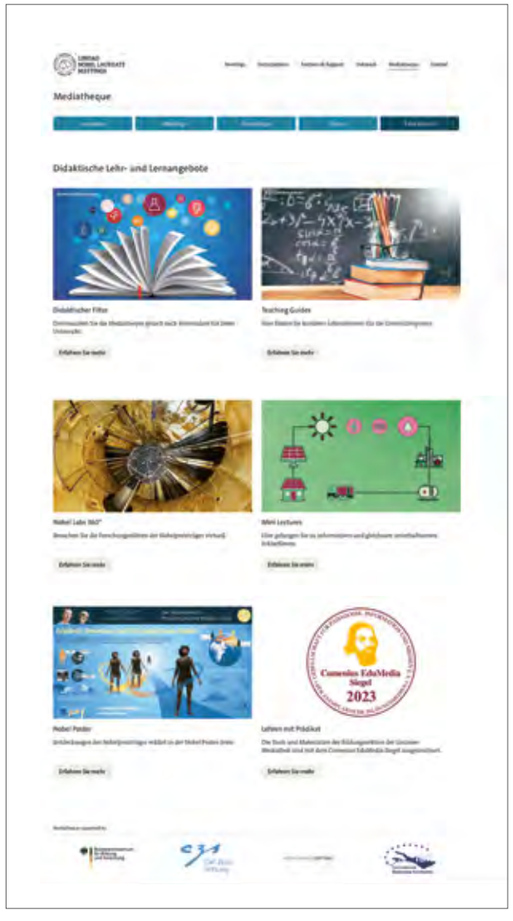
Complex Science – Modern Guise

The Lindau Mediatheque provides a smooth and engaging user experience that showcases, in its extensive range of scientific content, the more than seven-decade history of the Lindau Nobel Laureate Meetings.

The Lindau Mediatheque shares archived knowledge going back more than seventy years, thus fostering public engagement with science as one of the core goals of the Lindau Meetings' "Mission Education". Currently boasting almost 1,000 recorded lectures, panel discussions and talks by Nobel Laureates, the Lindau Mediatheque's comprehensive research archive contributes greatly to anchoring science and cutting-edge research in the centre of society.

The Lindau Mediatheque's extensive range of video lectures is supplemented by didactically prepared, digital educational offerings aimed specifically at teachers. The educational section provides high-quality teaching and lesson materials based on the discoveries of Nobel Laureates. Every year, first-hand scientific content is added in various media formats for different audiences: animated educational films, interactive lab tours and pedagogically prepared teaching units that provide helpful ideas and suggestions for teaching and learning. In recognition of their high pedagogic quality and innovative functionality, the tools and materials from the Lindau Mediatheque's educational section were awarded the Comenius EduMedia Award in 2023.

A recent revision of the mediatheque's layout allows teachers, students, scientists or the general public interested in science to smoothly navigate through the archive's extensive collections. Its captivating, easy-to-understand design, which combines clearly structured content pages with targeted, rapid search options, turns the complex world of cutting-edge research into a unique user experience.



Teaching Material for Schools

The continuous development of the Lindau Mediatheque's educational material is aimed at increasing interest in science in schools and other educational institutions.

The Lindau Mediatheque features almost 1,000 original lectures and discussions by Nobel Laureates, including the programme sessions of #LINO23. New productions in the following formats have been added to the mediatheque's extensive offerings.

Topic Cluster: Click Chemistry
The concept of click chemistry was coined in 2001 by K. Barry Sharpless and describes a way to synthesise target molecules from smaller units quickly and in a directed manner, as it is done in nature. The latest Topic Cluster addition provides a comprehensive introduction to the historical development and current applications of click chemistry with lecture excerpts by, among others, Nobel Laureates Sir Derek H. R. Barton, Aaron Ciechanover, Morten Meldal and Ryoji Noyori.

Teaching Guide: From Early Man to Homo Sapiens
In 1997, Svante Pääbo succeeded in sequencing parts of the mitochondrial DNA of a Neanderthal. However, the study of the DNA of extinct life forms is extremely challenging, as only traces of it can be found after thousands of years. Further, even the slightest contamination is enough to affect the analysis and lead to false conclusions. This teaching guide introduces the field of palaeogenetics, which focuses on the genetic analysis of historical and prehistoric genetic material from fossils, mummified organisms, archaeological remains and other samples. This ancient DNA, also known as aDNA, provides important insights into the world as it once was and the evolution of life.

Nobel Posters
Every year, the Royal Swedish Academy of Sciences and the Karolinska Institutet publish posters explaining the discoveries of the recent Nobel Laureates in Swedish and English. The Lindau Nobel Laureate Meetings with the support of the Christa und Hermann Laur-Stiftung translated the posters for the 2022 Nobel Prizes into German and distributed more than 7,000 copies among secondary schools in Germany and the region of the International Lake Constance Conference (IBK). The 2023 edition is in progress.

Mini Lectures: CRISPR/Cas9, mRNA Technology
One of the most recent additions to the Mini Lectures series focuses on the CRISPR/Cas9 method of targeted genetic modification developed by Emmanuelle Charpentier and Jennifer Doudna. Two chapters explain how the genetic scissors work, point out its advantages and applications compared to modern genetic engineering and discuss the legal and ethical issues the technology raises.

The second topic is mRNA technology, which has been brought into the spotlight by the COVID-19 pandemic. Complementing the broader theme of vaccination, this chapter elaborates on the function of mRNA vaccines, the difficulties in curing cancer and how this key technology could help in the fight against this disease.

Teaching Spirit

Rewarding Excellent Teachers of Future Scientists

Twenty-one teachers from Germany, Austria and Switzerland took part in the two-day “Teaching Spirit 2.0” programme at #LINO23. With this outreach project, the Lindau Nobel Laureate Meetings make an important contribution to school education in science subjects.

Participation in the Teaching Spirit programme, taking place for the first time since 2019 recognises and rewards teachers who have made an outstanding contribution to the teaching of science at their schools – for example, by establishing or supervising project groups and similar measures beyond their general teaching obligations and over a longer period of time.

In accordance with this year’s focus on the disciplines of physiology and medicine, mainly teachers in the subjects of biology and/or chemistry were selected. Candidates were nominated by the education ministries of the federal states, the EWE Foundation, the German Philologists Association, the International Lake Constance Conference (IBK), the MNU, the Technical University of Munich, the German Life Sciences Association (VBIO), the German Chemicals Industry Association (VCI), Jugend forscht Foundation and Teach First Germany.

As part of the programme, the teachers had the opportunity to attend the lectures held by Nobel Laureates in the Inselhalle, to mingle with Young Scientists and experience the Bavarian Evening as well as the final day on Mainau Island. A lunch with Nobel Laureates who gladly devoted their time was another highlight of the programme.

However, the teachers not only gained an insight into the Lindau Meeting’s programme, but also received valuable input for lesson planning. The didactical core content of the programme “Teaching Spirit 2.0” was developed in a collaborative project incorporating chemistry didactics at the University of Tübingen (Professor Stefan Schwarzer) and biology didactics at the University of Giessen (Professor Kerstin Kremer). Funding was provided by Vector Stiftung and Siemens Stiftung.

Numerous hands-on experiment stations could be explored in detail by the curious participants. The work units’ main topics were nanotechnology and modern materials, antibiotic resistance and evidence-based medicine. Another station was devoted specifically to the use of virtual reality. Here, selected online laboratories of Nobel Laureates, which are also offered as online tours in the Lindau Mediatheque, could be tested using virtual reality headsets.

The afternoon session was enriched with a lecture by Nobel Laureate Bert Sakmann, who spoke in an informal atmosphere about his research journey that led to the development of the patch clamp technique. For this method, Sakmann and Erwin Neher were awarded the Nobel Prize in Physiology or Medicine 1991.

Teachers having lunch with Nobel Laureate Johann Deisenhofer

Nobel Laureate Bert Sakmann giving his presentation

Stefan Schwarzer introducing the programme “Teaching Spirit 2.0”

Testing a Nobel Lab 360° with virtual reality headsets

Teachers at the hands-on experiment stations

Theory and mostly practice during a whole afternoon

Didactic background for the experiments

Hands-on experiments for the classroom

Nobel Laureates @ School

Inspiring the Younger Generation

"Be interested and curious! There are still many open questions and problems to be solved." – Erwin Neher

A Nobel Laureate at the lectern ...

... highly appreciated by the high school students

During #LINO23, Nobel Laureate Erwin Neher gave an inspiring talk at the Valentin-Heider-Gymnasium Lindau for high school students from the Lake Constance region. Neher received the Nobel Prize in Physiology or Medicine in 1991 together with Bert Sakmann "for their discoveries concerning the function of single ion channels in cells." They developed the so-called patch-clamp technique, a method for studying signal transmission within and between cells. Their discoveries enabled the development of specific drug therapies for diseases such as diabetes, cystic fibrosis, epilepsy and cardiovascular and neuromuscular disorders.

Following his talk titled "Ion Channels: Their Discovery and Role in Biomedicine and Pharmacology", Neher vividly explained how ion channels work and what role they play in the detection and treatment of diseases. His explanatory lecture was followed by a lively exchange with the students, who were curious to learn more and didn't hesitate to ask many questions about his research and scientific career. Besides answering them, he also shared his experiences and insights on the path that led to the Nobel Prize – with coincidences coming to the biophysicist's aid here and there.

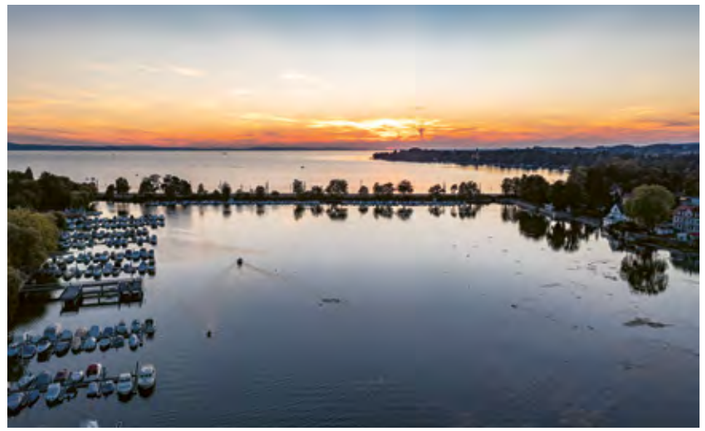
Concluding the afternoon, Neher had some advice for his audience: "Be interested and curious! There are still many open questions and problems to be solved." Extensive school education is certainly important for a subsequent scientific career. To inspire the younger generation and to actively involve regional students in the Lindau Meetings, the Council organises a visit to a local school for one of the participating Nobel Laureates every year. Once again, the event was greatly appreciated by all participants.

Lindau Nobel Laureate Pier

A Popular Location for Our Science Communication

The Lindau Nobel Laureate Pier honours all Laureates who have ever been in Lindau. In 2023, six new entries were added to the pier, which provides information about the Laureates in a beautiful setting at the shore of Lindau Island.

New bar dedicated to Charles M. Rice



The pier is located near Lindau's Inselhalle, the event venue of the meetings.

With the newly added Laureates Frances H. Arnold, Mario R. Capecchi, Emmanuelle Charpentier, Morten Meldal, John O'Keefe and Charles M. Rice, 410 names can now be found on the Lindau Nobel Laureate Pier. Each Laureate's premiere in Lindau is reflected by another bar that displays the name, the discipline as well as the year of the prize and the first meeting participation.

The Lindau Nobel Laureate Pier is an integral part of the Lindau Science Trail that offers information on scientific topics by means of 21 pylons displayed in Lindau and on Mainau Island. An additional app and a website expand the trail to the digital world – users can search for comprehensive information on the Laureates in an online app.

Besides its scientific relevance, the pier has also become a popular location for Lindau citizens and tourists – especially on Wednesday evenings during the summer when visitors can enjoy a glass of wine and a snack at a food market on the shore. Lindau is curious to see which Nobel Laureates will be immortalised on the pier in 2024, when it will celebrate its fifth birthday.

The recently added bars were marked with a green loop.

Lindau Matinee

Explaining the Nobel Prizes

The year began with the traditional matinee, which, after two online editions, was once again held in person – and for the first time in the Inselhalle, the venue for the annual Lindau Meetings.

Council and Foundation invited Lindau citizens to a programme of lectures followed by a reception to further discuss the science behind the latest Nobel Prizes. Two members of the Council and Lindau Alumni explained the complexities of the individual scientific disciplines in insightful presentations, which also highlighted the relevance of the research to society. Hendrik Groth, Editor-at-Large of the Schwäbische Zeitung, moderated the event.

The Nobel Prize in Chemistry:
Carolyn R. Bertozzi, Morten Meldal and **K. Barry Sharpless** for the development of click chemistry and bioorthogonal chemistry

Background by **Heiner Linke**, Member of the Nobel Committee for Chemistry, Royal Swedish Academy of Sciences, Professor of Nanophysics and deputy dean of the Faculty of Engineering (LTH) at Lund University, Sweden, Member of the Council and scientific co-chairperson of the Lindau Meetings dedicated to physics

Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel:
Ben S. Bernanke, Douglas W. Diamond and **Philip H. Dybvig** for research on banks and financial crises

Explanation by **Alexander Gruber**, Lindau Alumnus of the 5th Lindau Meeting on Economic Sciences 2014, Head of Economic Research and Advisory at Finreon AG, Lecturer at the University of St. Gallen (HSG)

The Nobel posters were an opportunity for the audience to delve deeper into the science.

The Nobel Prize in Physics:
Alain Aspect, John F. Clauser and **Anton Zeilinger** for experiments with entangled photons, establishing the violation of Bell inequalities and pioneering quantum information science

Introduction to the topic by **Rainer Blatt**, Member of the Council and scientific co-chairperson of the Lindau Meetings dedicated to physics

The Nobel Prize in Physiology or Medicine:
Svante Pääbo for his discoveries concerning the genomes of extinct hominins and human evolution

Presentation by **Lara Urban**, Lindau Alumna of the 68th Lindau Nobel Laureate Meeting (Physiology/Medicine) 2018, Principal Investigator at Helmholtz Pioneer Campus (HPC), Technical University of Munich

Back With Travel Grants

Journalists sharing their recording of an interview with a Nobel Laureate with colleagues and others helping with the translation of an article from English into Spanish – the Lindau Spirit of cooperation was not confined to Laureates and Young Scientists.

For the first time since 2019, media representatives were able to participate in the meeting as usual in Lindau, thus strengthening the relationship of the meetings with international media bodies. More than 50 journalists from all over the world applied for travel grants, of which a dozen were selected (from Egypt, Bosnia and Herzegovina, Bulgaria, Canada, Denmark/Ecuador, Indonesia, Israel, Latvia, Uruguay, United Kingdom), some of them thanks to our long-standing cooperation with IJP (International Journalists' Programmes).

Overall, there was broad global media coverage, starting with the announcement of the invited Young Scientists at the end of March, with numerous portraits of participants in the run-up. From the opening day through the entire week and beyond, the meeting was reported on widely in various media outlets. In addition to the scientific topics, diversity was also taken up on a meta-level. Frankfurter Allgemeine and the Süddeutsche Zeitung published an extensive supplement on #LINO23.

The host country for International Day 2023 was the Republic of Indonesia, which led to a gratifying response in the media there – in addition to Deutsche Welle, also Kompas TV covered the meeting. Many of the Nobel Laureates were in high demand for interviews during the 72nd Lindau Meeting. In order to grant as many interview requests as possible and despite the Laureates' limited time, group interviews were organized in some cases. The format led to a lively exchange, which was also well received by the participating media representatives and ensured exciting coverage.

In between the meetings, we also take the time to further develop our media partnerships. In the autumn, for example, Katja Wildermuth, Director-General of Bayerischer Rundfunk was a guest at the executive office in Lindau where she met with Countess Bettina Bernadotte.

Nikolaus Turner, Katja Wildermuth and Countess Bettina Bernadotte

Media reception at the end of the opening day

Manifold Reasons to Browse

The website of the Lindau Nobel Laureate Meetings is a rich source of information about the meetings in general and the since 1951 participating Nobel Laureates in particular. Lindau Alumni as well as Young Scientists share their expectations before coming to Lake Constance, their Lindau experiences and the learnings on their career path so far.

After the meeting, Amreen Khan (third from right), participating in #LINO23 as Young Scientist, shared her Lindau memories on the blog.

lindau-nobel.org gathers together all information for the different Lindau stakeholders in English and German. Potential Young Scientists can find information about the nomination and application process. Further events and initiatives organised by the Lindau Nobel Laureate Meetings are also presented online.

During the meetings, lindau-nobel.org offers public livestreams of selected sessions as well as blog posts that cover the programme and daily recaps that summarise the course of each day, curated by the communications department. This summer, the blog team, consisting of Hanna Kurlanda-Witek, Ben Skuse and Andrei Mihai, could finally attend on-site in Lindau after a break due to COVID-19.

On the blog, posts are usually published on a weekly basis throughout the year. Interviews and portraits of former and future participants, explanations about new Nobel Prizes or pieces on current scientific topics can all be found on the blog. For instance, Bart de Witte who moderated the AI panel discussion gave an interview in the run-up to the meeting.

The website serves as a gateway to all online platforms of the Lindau Nobel Laureate Meetings such as social media channels, the Lindau Mediatheque, project subsites or to online communities like the Lindau Alumni Network and Mentoring Hub.

lindau-nobel.org can be easily accessed and read on mobile devices.

Social Media

Digital Connections

The core of the Lindau Meetings' mission is to connect people and share ideas. In 2023, connecting with our community through social media continued to be crucial.

The meeting hashtag next to @Stefan_W_Hell

Despite significant changes to the platform including a rebranding, X (formerly Twitter) was a key social media platform for the Meetings in 2023. More than 14,000 Lindau Alumni, Young Scientists, partners and other interested users connected with @lindaunobel. Using the hashtag #LINO23, 'science twitter' engaged with us to offer praise, criticism and more.

LinkedIn is an increasingly important part of the Lindau Meetings' social media strategy. Our presence on the networking site for professionals is a great way to create and uphold relationships with Lindau Alumni, potential Young Scientists, partners and other friends.

We share videos, visual highlights and other digital content from the Lindau Meetings on Instagram. Young Scientists and Lindau Alumni engage with us, sharing snapshots and stories during #LINO23 and throughout the year. We're looking forward to more stories in the lead-up to #LINO24 next year.

The Lindau Nobel Laureate Meetings' official Facebook page has been liked by over 17,000 users from around the world. We update our community on news from Lindau year-round. During this summer's meeting, Brian Malow went live on the platform with interviews with our community from Lindau.

The live interviews were also broadcast on YouTube. Our channel is a growing resource of short-form interviews, additional material from Lindau and the Sciathon. Mini Lectures supplement our educational content on a platform widely used by a younger audience.

Images from the Lindau Meetings are available to everyone on Flickr, be it to relive memories or to find high-quality pictures for reports on the Lindau Meetings. The images are free for editorial use, but the copyrights must be acknowledged accordingly.

Video Productions

Moving Images From Lindau

From a short film at the beginning to extensive live interviews at the end, the Lindau Spirit was comprehensively captured on video during the 72nd Lindau Nobel Laureate Meeting.

Lindau Spirit: Eau des Sciences

Behind the scenes of the opening film

Young Scientists live on camera after the Mainau Boat Trip

Laureate Shwetak Patel and Young Scientist Ravichandran Rajkumar

This year, the Lindau Nobel Laureate Meetings commissioned the Filmakademie Baden-Württemberg and Cherry Tales Filmatelier to create a short movie that captured the essence of the Lindau Spirit in an engaging way. This movie set the mood in Lindau during the opening ceremony.

Interested viewers at home could also see the Lindau Spirit at work: short clips featuring Nobel Laureates and Young Scientists produced by London-based Econ Films delivered insights into the conversations between participants. Longer, spontaneous interviews between Young Scientists, Sciathon groups and science comedian Brian Malow once again were streamed live on social media and on YouTube. Regional videographer Theresia Keck captured the action during the International Get-Together. All videos are available on the Lindau Meetings' YouTube channel or the Lindau Mediatheque.

Productions by international journalists and content creators from South America (Ciencia Sí) to Indonesia (Deutsche Welle Indonesia and Kompas TV) were great additions to the content produced by the Lindau Nobel Laureate Meetings and our media partners this year (also see p. 104).

There is something in the air at the meeting that encourages one to be brave and vulnerable, and I think it comes from the feeling of safety and home that you all provide.

Prakriti Gupta

Council and Foundation

The Council

The non-profit Council for the Lindau Nobel Laureate Meetings was founded in 1954 to run the Lindau Meetings inaugurated in 1951. To organise the annual Lindau Meetings, the Council today maintains an executive secretariat based in the Lennart-Bernadotte-Haus on Lindau Island.

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Count Lennart Bernadotte af Wisborg †

Board
Countess Bettina Bernadotte af Wisborg
President

Wolfgang Lubitz
Vice-President

Heiner Linke
Vice-President
(as of 1 January 2024)

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Hartmut Michel
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Reinhard Pöllath
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Pernilla Wittung-Stafshede

Corresponding Members
Astrid Gräslund
Hans Jörnvall
Thomas Perlmann
(as of 1 January 2024)
Christoph Philipp
(as of 1 January 2024)

Permanent Guests
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Christof Widmer

Executive Secretariat of the Council
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Director (since 09/2023)
Wolfgang Huang
Director (until 08/2023)

Conference Management
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Sabrina Lummer
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Diana Hagg
(since 02/2023)

Young Scientist Support and Academic Partner Relations
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Head
Kai Lohbeck
Nora Dávila Flores
Saskia Flegler
(since 09/2023)
Sina Heer
(until 07/2023)

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(03–08/2023)

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Lisiane Clossmann
Marion Möstel
Evelyn Weishaupt

Data Projects
Wolfgang Huang
Director (09–12/2023)

The Foundation

The non-profit Foundation Lindau Nobel Laureate Meetings was established under German law in the year 2000 by 50 Nobel Laureates. Its main purpose is to ensure the continuance and further development of the Lindau Meetings. As of December 2023, more than 375 Nobel Laureates have agreed to serve as advocates for the Lindau Spirit in the Founders' Assembly (see page 116).

Honorary Presidents
Count Lennart Bernadotte af Wisborg †
Roman Herzog †

Honorary Chairman
Wolfgang Schürer

Board of Directors
Jürgen Kluge
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Nikolaus Turner
Managing Director
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Thomas Ellerbeck
Christoph Philipp
(as of 1 January 2024)
Reinhard Pöllath

Foundation Office
Nikolaus Turner
Managing Director
Franziska Castell
Director International Benefactor Relations
Diana Grenz
Office

In March 2023, Council and Foundation met in Vienna, finally again in person. On this occasion, the participants were guests of the Austrian Federal Ministry of Education, Science and Research. Federal Minister Martin Polaschek warmly welcomed the guests.

A Role Model of Science Diplomacy

Farewell to Helga Nowotny

Towards the end of 2023, Professor Helga Nowotny's Council membership and tenure as vice president will come to an end. All members of the Council are grateful for her support and will miss her tremendous experience in international science diplomacy.

Helga Nowotny is Professor emerita of Science and Technology Studies, ETH Zurich, and a founding member of the European Research Council whose presidency she held from 2010 until 2015. Countless awards from universities around the world adorn her CV. For eight years, since 2015, she has been vice president of the Council together with Professor Wolfgang Lubitz.

Right at the beginning of her term of office, she provided key impetus for the creation of an interdisciplinary programme in 2015, which at the same time marked the 65th anniversary of the Lindau Meetings and was attended by the same number of Nobel Laureates. Thereafter, one of her Lindau initiatives was the idea of a joint and interdisciplinary fellowship programme for European innovation together with the European Forum Alpbach, Austria, and the Falling Walls Conference, Berlin.

When in 2017 science found itself challenged or questioned by populist politicians, Nowotny was the first signatory of the Vienna March for Science. Her thoughts at the time echo even louder in light of the experiences of the pandemic: "For a long time it has been said that science has facts and society deals with values. It is finally time to abolish this separation – it no longer applies. Because science is also based on values. One of these values is the freedom to ask questions and to step into the unknown. At the same time, facts don't fall from the sky, but are the result of a long process of scientific investigation. As scientists, we need to better convey how we arrive at facts. We should have more confidence in people's power of judgement, whilst also helping them to acquire this power. This is necessary if we want to transform information into knowledge."

Helga Nowotny at her first Lindau Meeting in a senior capacity and during the 71st edition in 2022

In the years since 2020, Nowotny brought her considerable experience from numerous other committees to bear on the organisational challenges facing the Lindau Meetings. In the course of the further development of the Meetings during Covid-19, she was involved in the Lindau Online Sciathon, among other things. In its 2021 edition she was a member of the scientific jury and chaired the project category on the question "How Can Open Science Improve the Public's Trust in Science?".

In spring 2023, Vienna-born Nowotny did not miss the opportunity to host a Council meeting in the Austrian capital before the end of her term of office. In this context, Countess Bettina Bernadotte acknowledged her commitment for the Lindau cause: "As a member and vice president of the Council, Helga Nowotny is and will remain an important link for the Lindau Meetings between the world of science, society and politics. Her ideas and advice reflect her approach of actively embodying the role model of science diplomacy. It goes without saying that we look forward to welcoming her at upcoming meetings even without an official role and function in Lindau – and we count on receiving helpful advice and support in making contacts and opening doors also in the future."

Most recently, Helga Nowotny dealt with artificial intelligence and the effects of algorithms on our society, again with a plea to bridge the gap between technocratic expertise and the socio-political perspective – valuable food for thought, not only for the Lindau Council.

Impressions

A New Director for the Executive Secretariat

Welcoming Thomas Gruber

As of September 2023, Dr Thomas Gruber has taken over the management of the Executive Secretariat of the Lindau Nobel Laureate Meetings.

Amidst Young Scientists during the International Get-Together

Having obtained his D. Phil. at Oxford, Thomas Gruber worked as a staff member in the German Bundestag as well as a public-sector consultant for BCG and McKinsey. In 2017, he returned to the world of academia and moved to Florence, Italy, where he was responsible for international events and the various publication series at Villa I Tatti, Harvard University's Italian research center. For Dr Gruber, his new position in Lindau is a return to his roots: "It is a privilege to live again in a region that has been so close to me since my youth. At the same time, I am extremely looking forward to collaborating with the team and to being responsible for this unique event – unique in the way it has brought the global world of science to the region, and unique in the degree of exchange it offers between the most eminent scholars and ever-new generations of Young Scientists."

Countess Bettina Bernadotte, President of the Council, found warm words of welcome: "The entire Council is looking forward to working with Dr Gruber. I am convinced that we will see a good take-over of the office that Wolfgang Huang so successfully managed and shaped over the last thirteen years, and that Dr Gruber, in turn, will significantly contribute to the ongoing evolution of the meetings." Nikolaus Turner, Member of the Boards of both the Council and Foundation for the Lindau Nobel Laureate Meetings, added: "I am delighted that Dr Thomas Gruber has completed our team as early as possible in the run-up to the 73rd Lindau Meeting in 2024. His participation as a guest at the last meeting gave him a good impression of what Lindau is all about and was the ideal preparation for his new task."

Founders' Assembly

The Foundation Lindau Nobel Laureate Meetings was established in the year 2000 by 50 Nobel Laureates. Through their membership in the Founders' Assembly, Nobel Laureates demonstrate their strong support for the Lindau Meetings. As of November 2023, more than 375 members constitute the assembly – these are the newest additions to this body:

Alain Aspect
Nobel Laureate in Physics
2022

Emmanuelle Charpentier
Nobel Laureate in Chemistry
2020

William G. Kaelin Jr.
Nobel Laureate in Physiology or Medicine
2019

Anne L'Huillier
Nobel Laureate in Physics
2023

Charles M. Rice
Nobel Laureate in Physiology or Medicine
2020

Richard H. Thaler
Laureate in Economic Sciences
2017

Find all members of the Founders' Assembly on our website.

Honorary Senate

During the opening of the 72nd Lindau Meeting, German singer and songwriter Marius Müller-Westernhagen was inducted into the Honorary Senate of the Foundation Lindau Nobel Laureate Meetings.

Marius Müller-Westernhagen: very grateful for the invitation

The Certificate of Induction signed by the members of the board of the Foundation

In his laudation, the Chairman of the Board of the Foundation, Jürgen Kluge, emphasised: "Not only with his lyrics, but also with his personal commitment, the artist who has been influential in the German-speaking world for decades stands up for diversity, humanity, freedom and against racism. It is this attitude of Marius Müller-Westernhagen that fits perfectly with the objectives of the Lindau Meetings. With his vision, we are able to increase the number of Young Scientists coming from the Global South as brokers of knowledge and agents of positive change to participate in the Lindau Meetings.

As members of the most prestigious committee of the Foundation, the Honorary Senators function as advisors to the board and distinguished ambassadors for the cause of the Lindau Meetings. They bring their formidable experience, expertise and dedication to bear on the goal of advancing the values and aims of Lindau's "Mission Education".

Müller-Westernhagen, who was unable at short notice to attend the opening in Lindau, accepted his appointment and conveyed his gratitude by video message: "I support with all my heart your vision and your hard work for a better and fairer world. Keep up the good work and thank you!"

Presentation of the certificate of induction in November in Berlin:

Many thanks for a wonderful week – I really think the best ever in Lindau.

Tim Hunt

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as of October 2023

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Preliminary Accounts 2023: Revenues

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Total Revenues	€ 3,359,222

Preliminary Accounts 2023: Expected Expenditures

	(€)
Travel	
Nobel Laureates	213,521
Young Scientists	42,528
Media	10,389
Others	31,775
Lodging	
Nobel Laureates	71,477
Young Scientists	376,139
Media	10,875
Others	76,547
Boarding	
Nobel Laureates	48,443
Young Scientists	229,202
Media	2,779
Others	17,785
Meeting Organisation	
Scientific Programme & Selection of Young Scientists	20,270
Venue Rental Costs	141,428
Technical Equipment	335,595
Utilities & Services	20,022
Onsite Staff	89,310
Transfers	207,254
Supporting Programme	41,955
Printed Matter	59,707
Expendable Items	12,542
Audio & Video Productions	82,431
Science & Media Services	31,985
Website	18,316
Telecommunications, Postage	24,811
IT Services, Hardware, Software	69,320
Accounting, Legal Advice, Insurances	49,358
Other Costs	7,528
Ongoing Outreach Activities	
Digital Archives (Mediatheque)	50,587
Alumni Activities	18,425
Events and Exhibitions	15,026
Further Outreach Activities	4,310
Executive Secretariat	
Staff	830,364
Office Operating Costs	74,868
Office Supplies & Equipment	22,348
Expected Total Expenditures	3,359,222

Please note: The budget includes cost projections for Oct–Dec 2023.

Fellowships

Endowments Enable Participation

Special funds of the Foundation Lindau Nobel Laureate Meetings award fellowships for the participation of Young Scientists in the meetings.

Countess Sonja Bernadotte in 2004 with Lars Bergström, then Secretary of the Nobel Committee for Physics

Lou Ignarro with Young Scientists at Lindau harbour

The Foundation Lindau Nobel Laureate Meetings was established in 2000 upon the initiative of 50 Nobel Laureates. Since then, more than 375 Laureates have joined the Founders' Assembly. To support the continuation of the Lindau Meetings in the long term and to safeguard their independence, the Foundation continues to pursue the goal of significantly increasing its assets.

To help generous donors achieve this, the Lindau Foundation has set up Fellowship Funds to enable Young Scientists to participate in the Lindau Meetings. This year, we want to draw special attention to the fellowship named after Countess Sonja Bernadotte, whose passing in October 2008 we commemorate for the 15th time. This funding enables female Young Scientists to participate in the meetings.

Another fellowship, called the "Lindau Spirit", describes the special atmosphere at the Lindau Meetings when Nobel Laureates and Young Scientists meet in person. The "Lindau Spirit Fellowship" was initiated by supporters during the pandemic and was awarded for the first time in 2022. In the meantime, several such fellowships have been created, including the "Sharon and Lou Ignarro Fellowship" which is funded from the proceeds of the German edition of the book "Dr. NO: The Discovery That Led to a Nobel Prize and Viagra".

In grateful and loving memory of Edmond H. Fischer, recipient of the Nobel Prize in Medicine 1992, the Vallee Foundation has also endowed an Eddy Fischer/Vallee Foundation Fellowship Fund. With this fellowship, every year a Young Scientist is invited in his name to the meetings in Lindau.

Förderstiftung für die Lindau Nobel Laureate Meetings
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You Can Make This Happen

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William D. Phillips, Nobel Laureate in Physics 1997

We would be delighted to welcome you into this circle.
All donations are tax-deductible according to German law.

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As your contact information is not forwarded, please send us a short notice to donations@lindau-nobel.org to ensure your gift is properly designated.

lindau-nobel.org/funding-opportunities

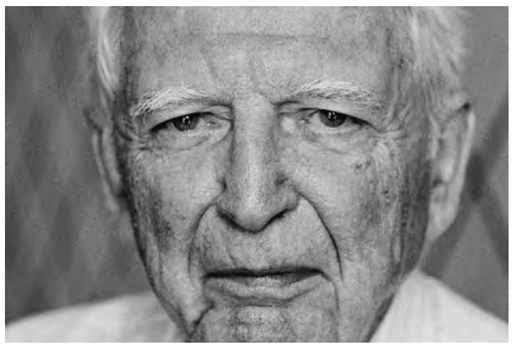
In Memoriam – Dearly Missed

The Council was particularly saddened to hear the news of Harald zur Hausen's passing, which reached us only three weeks before the 72nd Lindau Meeting. Professor zur Hausen was very close to the meetings, often assisted with advice as a frequent participant – and we had expected him to give the #LINO23 life lecture.

Martti Ahtisaari
1937 – 2023
Nobel Laureate in Peace 2008

Paul Berg
1926 – 2023
Nobel Laureate in Chemistry 1980

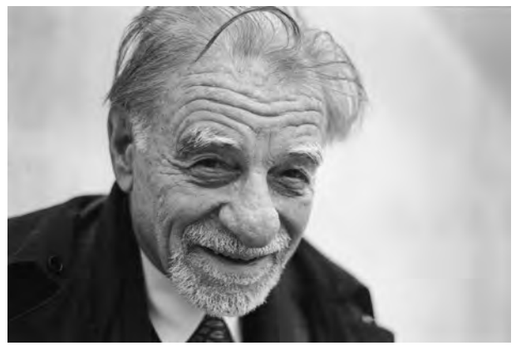
John B. Goodenough
1922 – 2023
Nobel Laureate in Chemistry 2019



Harald zur Hausen
1936 – 2023
Nobel Laureate in Physiology or Medicine 2008

Robert E. Lucas Jr.
1937 – 2023
Laureate in Economic Sciences 1995

Harry M. Markowitz
1927 – 2023
Laureate in Economic Sciences 1990



K. Alex Müller
1927 – 2023
Nobel Laureate in Physics 1987

Ferid Murad
1936 – 2023
Nobel Laureate in Physiology or Medicine 1998


73rd Lindau Nobel Laureate Meeting (Physics) 30 June – 5 July 2024
74th Lindau Nobel Laureate Meeting (Chemistry) 29 June – 4 July 2025
75th Lindau Nobel Laureate Meeting (Interdisciplinary) 28 June – 3 July 2026
8th Lindau Meeting on Economic Sciences 26 – 30 August 2025

72nd Lindau Nobel Laureate Meeting (Physiology/Medicine)

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Cover Art
Illustration of DNA sequencing. Genome analysis has been awarded several times with the Nobel Prize, including in Chemistry in 1962, 2015 and 2020, and in Physiology or Medicine in 2009 and in 2022.
Credit: Gio_tto/iStockphoto

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I had a terrific time meeting colleagues and interacting with the Young Scientists, who were inspiring. The organisation and execution of the meeting were flawless, totally professional, and a pleasure from start to finish – amazing. Hats off to the Lindau Meeting team including the local hosts who housed Young Scientists.

Charles M. Rice
Nobel Laureate in Physiology or Medicine 2020

Probably this is what the Lindau Spirit is: you connect and interact with fellow researchers during those five days only, but the bond that you make stays forever, such that you share happy endeavours as well as heart-breaking failures with them, knowing how easily they will relate to you, since they are on the same boat as you.

Shatarupa Bhattacharya
Lindau Alumna 2023