

## MEETING REPORT

## Lessons on good science from great scientists\*

*To my surprise, those who achieved the unexpected and invented the possible were not simply men of learning and method. More than anything else, they were creatures of amazing vision. Those in the front ranks displayed exotic blends of passion and indifference, of rigor and whimsy, of naivete and the will power, in a triumph of individuality – The Statue Within; Francois Jacob.*

I have only begun to appreciate Francois Jacob's words after setting out on a journey to try and put together a personal 'formula' for becoming a good scientist, in order to understand the meaning of and behind good science – to learn, so to say, from the Masters themselves. What follows is an account of that journey. Through 1–6 July 2007 wherein 17 Nobel laureates and 563 students came together to participate in the Lindau Meetings. It was here that I started my quest.

Lindau is a small island town on Lake Constance in the southwestern part of Germany. Every year this island comes alive to host the Meeting of Nobel laureates – providing a scenic interface for the interaction among Nobel laureates, young scientists and students who aspire to be scientists, from all over the world.

The meetings were initiated by two bold physicians: Gustav Parade and Franz Karl Hein, with the hope of integrating the scientific community of Germany devastated and isolated after the Second World War. In the 56 years since 1951, this meeting has stood the test of time and has adapted to the changing global climate to grow beyond anything that its first organizers could have ever imagined – an international forum of scientific discussion. This year for instance, 62 countries sent their representatives to the gathering.

The meetings from their very conception have had the support of Count Lennart Bernadotte of the Mainau Island and consequently the Bernadotte family. Count Lennart played an instrumental role in attracting Nobel laureates to the meeting and shaped its character into becoming a

'window to the world' for young researchers.

The annual Lindau Meeting alternatively dedicated to physiology and medicine, physics and chemistry, traditionally takes off in the last week of June and through the week, the students (who have mostly replaced the physicians of 1951) enjoy the morning lectures, informal afternoon discussions, a dinner and dance on the first evening and the traditional final-day boat trip to Mainau Island as guests of the Bernadotte family. This year a novel theme was introduced into the gathering by the organization of a 'science bazaar', a mobile exchange between the laureates and students.

*I think it is wonderful opportunity for you to get into contact with the Nobel laureates, to learn how they earned their Prize, what kind of science they did and how they are doing their science...*  
Wolfgang Lubitz, Member of the Lindau Council since 2004.

Countess Sonja Bernadotte inaugurated the meeting on the evening of 1 July. In her inaugural address, she encouraged the participants to make the most of the opportunity.

The first day's lecture session was spread out among three speakers. Craig C. Mello (Physiology or Medicine, 2006)

presented the first lecture on RNAi, emphasizing the worm's claim to fame. Mello stressed on the fact that RNAi cures will be tailor-made medicine and he expressed doubt on whether it would become a common form of therapy in the near future. He used the platform to encourage young researchers to share their ideas, admitting that such collaborative efforts had benefitted him greatly and also that young scientists need to get over their fear of being 'scooped'.

The second of the morning's lecture was delivered by Ferid Murad (Physiology or Medicine, 1998) who recounted his journey to and from the Prize, which was in many ways the story of nitric oxide research and went on to show how nitric oxide, the unique signalling molecule – has been implicated in almost everything – angiogenesis, inflammation, neural degeneration, stem-cell differentiation and proliferation, tumour growth – to mention a few. Hartmut Michel (Chemistry, 1988) then presented a controversial talk on 'Biofuels – sense or nonsense?' In his opinion, focus should be on photovoltaic energy and not on biofuels.

In the afternoon, all young researchers were invited to parallel discussions and I joined Murad – in the course of answering the many questions that were posed to him, he voiced concerns about the reluctance of drug companies to bring out



Round table: Medical sciences and society (Thursday, 5 July 2007). Prof. Fischer, Prof. Hershko, Prof. Murad, Prof. Neher and Prof. Roberts.

\*A report on 57th Meeting of Nobel Prize Winners in Lindau, 2007.

cheap drugs for diseases prevalent in poor countries and the increasing tendency of students to believe in technology. I asked him about what he thought of the Lindau Meetings and what a student should take back from it. His reply was as follows:

*'I think the students have an opportunity to see a broad area of research of very high quality, how people have approached it and done a good job with it. You also end up meeting a lot of other students, make some colleagues and friends for the future, perhaps for collaborating and see some other opportunities. An important issue is to see how enthusiastic all the Nobel laureates are about their research. How much they love research and how excited they are and that's the way it should be.'*

Timothy Hunt (Physiology or Medicine, 2001) was the first to deliver his lecture on the second day. He spoke on cell cycle in cancer, pointing out that although we know a lot about cell cycle control, we still know very little about cell growth and even less about nutrition in tumours. Edmond Fischer (Physiology or Medicine, 1992) delivered the second lecture of the day on protein crosstalk in cell signalling. He was the oldest (born in 1920) laureate present at the meeting; however, his infectious enthusiasm was timeless.

There were five lectures lined up for the third day of the meeting. Bert Sakmann (Physiology or Medicine, 1991) gave the first talk on grey matter(s), in which he described his experiments with rats in order to identify the pathway that leads to the motor behaviour of jumping a gap to obtain food placed beyond the gap – tracing the circuit involved starting out from a single whisker.

Avram Hershko (Chemistry, 2004) presented 'The ubiquitin system and its roles in the control of cell division'. He began with the 'biochemical analysis of complex systems' and went on to discuss his most recent work on protein degradation. He concluded his speech with his message to all the young researchers:

*'And the take-home message I would like you, the young students to learn from this story is: when you choose a research subject, try to choose a subject*

*that you believe is important, but is not yet interesting to the others, because if it's interesting to the mainstream, you can be sure that the big laboratories will get there before you. And the second lesson that I would like to tell you is that biochemistry, good old fashioned biochemistry, is still very much needed.'*

Werner Arber (Physiology or Medicine, 1978) then continued on 'Darwinian evolution as understood by scientists of the 21st century'. 'Nucleo-cytoplasmic traffic' was the topic chosen by Gunter Blobel (Physiology or Medicine, 1999). He gave an animated discourse on the structure and function of the nuclear pore complex. Robert Huber (Chemistry, 1988) delivered the final lecture for the day entitled 'proteolysis and its regulation'. He offered an introduction to the transforming field of protein crystallography and discussed the use of structures for novel drug development strategies.

The afternoon was dedicated to parallel discussions by the laureates again and I joined Hershko as he continued on the theme of the morning's lecture – advising young scientists to choose research topics carefully and to take biochemistry seriously – for without it, he explained, a system like one protein tagging another for degradation would never have been discovered.

The first speaker on the last day was Richard Roberts (Physiology or Medicine, 1993). He took the audience on an absorbing journey through microbiology (greatly aided by Brock's amazing book on the subject) in a lecture entitled 'Why I love microbes'. He encouraged students to work on microbes, emphasizing that we are close to understanding how a simple microbe works, but still very far from understanding complex animal systems such as humans.

Aaron Ciechanover (Chemistry, 2004) delivered the penultimate talk, 'On the dynamics of our proteins: From basic mechanisms onto the patient bed'. He discussed some aspects of his work on protein degradation and built on Hershko's lecture of the previous day. He focused on drugs that have targeted the ubiquitin system like Geldanamycin, which is in drug trials, and the future of research in the area of proteasome inhibition, which according to him lies in a very specific missile targeted treatment of the ubiquitin ligase.

Rolf Zinkernagel (Physiology or Medicine, 1996) delivered the last lecture for this year's meeting. In his talk, 'Why do we not have a vaccine against TB or HIV (yet)?', he illustrated why we have not been able to develop vaccines against many infectious diseases. All the vaccines that have been successful protect via antibodies; for those cases in which protective antibodies play a small or minor role in control (such as TB, HIV, Schistosomiasis, etc.) we have not been able to make vaccines. It was clear from his explanation that it is the very nature of the immune response rather than the pathogen alone that prevents vaccines against those pathogens that invoke a predominant cell-mediated immunity rather than humoral one.

The lectures on Tuesday (3 July 2007) and Thursday (5 July 2007) were followed by a round-table discussion on 'Basic sciences in molecular medicine' among Blobel, Hartwell, Hunt and Mello, moderated by Anders Zetterberg and Helmut Sies. Strong points were made in this discussion about who actually benefits from the research (the 2–3% who can afford it), and regarding the importance of communicating with the public – all the laureates were unanimous that the new generation of scientists must 'inform the public of the progress that has been made in science' and also that scientists must connect and collaborate rather than command and control.

The second round-table conference was on 'medical sciences and society', with Fischer, Hershko, Murad, Neher and Roberts chaired by Hans Jornvall and Sies. There were many questions sent up to the table from the house, including those concerning gender equality in science, stem-cell research and world hunger. Being a part of this meeting made me realize that these heroes in science are human beings too – they have been recognized for the paradigm shifts they brought about in their fields and have been honoured by their peers – but they are human beings nonetheless, they have their limitations; be it funding for their research or say in policy making for science and scientists. However, many of the Nobel laureates we met inspired us much like a brilliant teacher in school or college, who first made one decide to raise questions and were instrumental in changing the way one thought – it was a warm welcome to the world of science and for the many medical students who

were also a part of the meeting, it was an interesting window to the world of research, imploring them to ask themselves whether they heard Emergency Room or Endoplasmic Reticulum when they heard the abbreviation ER. As for the 21 students from India, sent to this meeting by the Department of Science and Technology (DST), we came back after the meeting and the subsequent one week tour of German research institutes organized by the DFG (German Research Foundation), with dreams of creating links between medical practice and research, future collaborations to take projects from the laboratory into the clinics – this is undoubtedly the need of the hour.

Tuesday (3 July) afternoon was dedicated to the ‘science bazaar’ and the venue was converted to a ‘market place of science’, as students gathered around the laureates who shared various instances and choices from their personal life to their failures and moments of inspiration. We heard about the numerous rejections (blessings in disguise!), the skepticism many of them had to face, time and again before acceptance. As I walked from one group to the next, sometimes catching snippets of an excit-

ing, animated conversation, I realized how different the laureates were from one another. They have little similarity, except the love of science and a huge moral courage for truth. I began to see that the ‘formula’ I was seeking probably did not exist – there were far too many variables! Far too many ways to do good science if you had the will (a certain doggedness) to do it!

On Friday (6 July), we went to the ‘Flower Island’ of Mainau by boat, for the formal closing of the meeting by Countess Sonja Bernadotte. On this trip I asked Fischer why he came to the Lindau Meetings and what it was meant to achieve. He replied:

*‘You are the people who will continue what we have been doing. You are the people who will carry the ball after us. So it’s important that we go and speak with you. Science advances so fast now that it is inconceivable that people will work alone by themselves – so this kind of collaboration, this kind of interaction is indispensable if one wants science to progress and this is where the students come into the picture. We need you to work with us, work in the lab, inspire us*

*with your ideas, which are different than ours; to think outside of the way we think and continue after us, that’s what is important.’*

1. [www.lindau-nobel.de](http://www.lindau-nobel.de)
2. [www.eurovision.net](http://www.eurovision.net)
3. [www.nobelprize.org](http://www.nobelprize.org)

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