Boehringer Ingelheim Stiftung

2022

HEINRICH WIELAND PRIZE

AWARD SYMPOSIUM OF THE 2022 HEINRICH WIELAND PRIZE

Nymphenburg Palace, Munich, Germany
Thursday, 6 October 2022

HEINRICH WIELAND PRIZE

The international Heinrich Wieland Prize honours distinguished scientists for their outstanding research on biologically active molecules and systems in the fields of chemistry, biochemistry, and physiology as well as their clinical importance. The prize is endowed with 100,000 euros by the Boehringer Ingelheim Foundation and named after Heinrich Wieland (1877–1957), Nobel Laureate in Chemistry in 1927.

Every year, the Foundation invites scientists to make nominations in an open call. It entrusts the selection of the awardees to a scientific Board of Trustees, all of whom work in an honorary capacity (see page 7 for current members). Presented annually since 1964, the Heinrich Wieland Prize has four subsequent Nobel Laureates among its awardees.

www.heinrich-wieland-prize.de

PROGRAMME

AWARD SYMPOSIUM

3:30 p.m.	**Registration**
4:00 p.m.	**Welcome and opening remarks** Professor Dr F.-Ulrich Hartl, Chairman of the Board of Trustees of the Heinrich Wieland Prize, Max Planck Institute of Biochemistry, Martinsried, Germany
4:10 p.m.	**Molecular-scale resolution in fluorescence microscopy** Professor Dr Stefan W. Hell, Max Planck Institute for Multidisciplinary Sciences, Göttingen, and Max Planck Institute for Medical Research, Heidelberg, Germany
4:50 p.m.	**Imaging processes of cell division across scales** Dr Jan Ellenberg, European Molecular Biology Laboratory, Heidelberg, Germany
5:30 p.m.	**Coffee break** including **Meet the Speakers**
6:10 p.m.	**Inner workings of channelrhodopsins and brains** Professor Karl Deisseroth, MD, PhD, Stanford University and Howard Hughes Medical Institute, Stanford, CA, USA
6:50 p.m.	**Award ceremony** Presented by Kristina zur Mühlen, TV journalist and physicist, Hamburg, and Dr Stephan Formella, Managing Director Science & Research, Boehringer Ingelheim Foundation, Mainz, Germany ***Musical introduction*** Wolfgang Amadeus Mozart (1756–1791), Ouverture of The Marriage of Figaro, K492 **Laudation** Professor Karl Deisseroth, MD, PhD **Award presentation** to Professor Xiaowei Zhuang, PhD, Harvard University and Howard Hughes Medical Institute, Cambridge, MA, USA by Christoph Boehringer, Chairman of the Executive Committee of the Boehringer Ingelheim Foundation, Mainz, Germany, and by Professor Dr F.-Ulrich Hartl **Interview with Professor Xiaowei Zhuang, PhD** ***Musical interlude*** Johannes Brahms (1833–1897), Hungarian Dance No. 5 **Award lecture** **Illuminating biology at the nanoscale & genome-scale by imaging** Professor Xiaowei Zhuang, PhD ***Musical conclusion*** Alexander Borodin (1833–1887), String quartet No. 2 in D major II. Scherzo **Closing remarks:** Kristina zur Mühlen and Dr Stephan Formella
8:00–10:00 p.m.	**Get-together**

Music performed by Schumann Quartet Munich (members of the Bavarian State Orchestra): Barbara Burgdorf (violin), Traudi Pauer (violin), Stephan Finkentey (viola), Oliver Göske (cello)

Professor Xiaowei Zhuang, PhD
Harvard University and Howard Hughes Medical Institute, Cambridge, MA, USA

Xiaowei Zhuang is awarded the 2022 Heinrich Wieland Prize for developing ground-breaking single-molecule and super-resolution imaging methods and applying these to make seminal discoveries in cell biology and neurobiology. She invented STochastic Optical Reconstruction Microscopy (STORM), one of the first and most widely used methods of super-resolution imaging technologies that overcome the diffraction limit of resolution in light microscopy. STORM is based on her discovery of dyes that can be switched between dark and fluorescent states by light. With their help, she was able to separate spatially unresolvable molecules in time and thus determine their precise locations. She visualized individual molecules set apart by only ~10 nm in three dimensions in cells and demonstrated live-cell super-resolution imaging with a temporal resolution of one second. Applying STORM to neurons, Xiaowei Zhuang unveiled a periodic membrane skeleton structure in neurons. This structure is conserved from worms to humans and organizes the periodic distribution of membrane proteins such as ion channels and signalling molecules. It is important for signal transduction in neurons and for axon stability. In another body of work, Xiaowei Zhuang took high resolution imaging to the genome scale. She invented Multiplexed Error-Robust Fluorescence In Situ Hybridization (MERFISH), which allowed her to visualize more than 10,000 genes in parallel in single cells. Studying the brain with MERFISH, she revealed novel cell types, determined their spatial organizations and functions, and thereby helped to elucidate neural circuits controlling behaviours. She also applied MERFISH and STORM to probe how chromatin physically folds in the nucleus. Her findings advanced our understanding of how chromatin folds into a 3D structure that regulates gene expression.

Xiaowei Zhuang studied physics at the University of Science and Technology of China and obtained her PhD from the University of California at Berkeley in 1996. After postdoctoral research in biophysics at Stanford, she joined the faculty at Harvard University in 2001. She became associate professor and HHMI investigator in 2005, and was promoted to full professor in 2006. In 2014, she was appointed the David B. Arnold Professor of Science. She is a member of the National Academy of Sciences, the National Academy of Medicine, the American Academy of Arts and Sciences, a fellow of the American Philosophical Society, and foreign member of EMBO and the Chinese Academy of Sciences. She received numerous awards, including a MacArthur Fellowship, the Heineken Prize for Biochemistry and Biophysics of the Royal Netherlands Academy of Arts and Sciences, the Breakthrough Prize in Life Sciences, the National Academy of Sciences Award for Scientific Discovery, the Vilcek Prize in Biomedical Science, and the FNIH Lurie Prize in Biomedical Sciences.

SPEAKERS

Professor Karl Deisseroth, MD, PhD

Stanford University and Howard Hughes Medical Institute, Stanford, CA, USA

Karl Deisseroth pioneered high-resolution methods, including optogenetics and hydrogel-tissue chemistry, for controlling and mapping intact biological systems. Deisseroth developed optogenetics as a method to explore how function arises from the activity of cells, using light-activated microbial proteins (including channelrhodopsins, for which he resolved the high-resolution structures of the three major types, and redesigned them for new types of function). To fully enable precise, fast gain- or loss-of-function in cellular activity, he also developed advanced optical strategies to guide light to many individually-specified cells in behaving animals, and using optogenetics along with neurophysiology, he elucidated cellular circuits underlying thirst, hunger, anxiety, motivation, and perception.

Karl Deisseroth studied biochemistry at Harvard and earned his PhD (1998) and MD (2000) from Stanford. He launched his independent laboratory in 2004, was appointed the D.H. Chen Professor of Bioengineering and Psychiatry in 2012, and was named HHMI investigator in 2014. He is a member of the National Academy of Medicine, the National Academy of Sciences, the National Academy of Engineering, and the German National Academy of Sciences Leopoldina. He has received, among other awards, the Lounsbery Prize (from NAS), the Brain Prize, the Breakthrough Prize in Life Sciences, the Else Kröner Fresenius Prize in Medicine, the Dickson Prize, the Kyoto Prize, the Heineken Prize, and the Lasker Award.

Dr Jan Ellenberg

European Molecular Biology Laboratory, Heidelberg, Germany

Jan Ellenberg is a worldwide leader in fluorescence imaging technologies. He combines them with computational data analysis and machine learning and develops corresponding modelling approaches to decipher basic biological processes non-invasively and quantitatively. He compiled a comprehensive map of the genes involved in cell division in humans and recently found a way to systematically measure the absolute abundance, subcellular distribution, and interactions of proteins in dividing cells, painting an in-depth picture of mitosis. He also demonstrated that imaging can solve the variable structure and assembly of large protein assemblies in situ by studying the molecular organization of the nuclear pore complex, the central trafficking route between a cell's nucleus and cytoplasm.

Jan Ellenberg studied biology at Universität Hamburg and received his PhD in biochemistry from Freie Universität Berlin, during which time he primarily trained at the National Institutes of Health (NIH) in Bethesda, USA. He started his own laboratory at EMBL in 1999, became Senior Scientist and coordinator of EMBL's Gene Expression Unit in 2006, and head of the Cell Biology and Biophysics Unit in 2010. He also directs the EMBL Imaging Centre, which opened in 2021. Jan Ellenberg is a member of EMBO, the Academia Europaea, and the German National Academy of Sciences Leopoldina. He was awarded an ERC Advanced Grant as well as an Allen Distinguished Investigatorship by the Paul Allen Foundation.

Professor Dr Stefan W. Hell

Max Planck Institute for Multidisciplinary Sciences, Göttingen, and
Max Planck Institute for Medical Research, Heidelberg, Germany

Stefan Hell revolutionized light microscopy when he invented Stimulated Emission Depletion microscopy (STED). With this new concept, he was the first to surpass the diffraction barrier and laid the foundation for super-resolution microscopy. He later combined STED with the random switch of fluorescent labels between on and off states in MINFLUX microscopy and achieved a resolution of 1–3 nm – the size of single molecules. He also invented 4Pi microscopy which, when joined with MINFLUX, allows imaging of cellular structures down to the nanometer scale in all spatial dimensions. Stefan Hell also pioneers the chemical synthesis and application of fluorescent labels to improve their performance in super-resolution microscopy.

Stefan Hell earned a PhD in physics from the University of Heidelberg in 1990. After research stays in Heidelberg and Turku, Finland, he became group leader at the MPI for Multidisciplinary Sciences in Göttingen in 1997 and Director in 2002. He is also Director at the MPI for Medical Research in Heidelberg since 2016 and honorary professor at the Universities in Göttingen and Heidelberg. From 2003 to 2017, he also led a group at DKFZ Heidelberg. He is a member of the National Academy of Sciences, the German National Academy of Sciences Leopoldina, and the German Academy of Science and Engineering. His awards include the Gottfried Wilhelm Leibniz Prize of DFG, the Otto Hahn Award, the Körber European Science Prize, the German Future Prize, the Kavli Prize in Neurosciences, and the Nobel Prize in Chemistry.

THE PRIZE

Heinrich Otto Wieland was born on 4 July 1877, in Pforzheim, Germany. Wieland studied chemistry at the Ludwig-Maximilians-Universität München (LMU) in Munich, Germany, where he received his doctorate in 1901 and was appointed "außerordentlicher Professor" in 1909. At this time, he was already interested in oxidation processes in the living cell, one of the foundation stones of the field of bio-chemistry. He worked at the Technische Universität München (TUM), also in Munich, and LMU until 1921 as well as at the Kaiser Wilhelm Institute in Berlin-Dahlem, Germany. Wieland then accepted a call to the University of Freiburg, Germany, but returned to LMU in 1925 to succeed Richard Willstätter as Chair of Chemistry. He retired in 1952 and died in Munich on 5 August 1957.

Heinrich Wieland received numerous awards, among them the 1927 Nobel Prize in Chemistry for his pioneering investigations of bile acids and related substances.

Heinrich Wieland was a cousin of Albert Boehringer, the founder of the company Boehringer Ingelheim. As early as 1903, Wieland worked with the company and, in 1917, his advice led to the company establishing its first scientific department dedicated to innovative research. His scientific findings made it possible, for example, to produce drugs for cardiovascular and respiratory diseases.

The Board of Trustees of the Heinrich Wieland Prize
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BOEHRINGER INGELHEIM FOUNDATION

The Boehringer Ingelheim Foundation is an independent, non-profit organization committed to the promotion of the medical, biological, chemical, and pharmaceutical sciences. It was established in 1977 by Hubertus Liebrecht (1931–1991), a member of the shareholder family of the Boehringer Ingelheim company. Through its funding programmes Plus 3, Exploration Grants, and Rise up!, the Foundation supports excellent scientists during critical stages of their careers. It also endows awards for junior scientists in Germany.
In addition, the Foundation funds institutional projects in Germany, such as the Institute of Molecular Biology (IMB), the department of life sciences at the University of Mainz, and the European Molecular Biology Laboratory (EMBL) in Heidelberg.

Boehringer Ingelheim Stiftung

CONTACT

Boehringer Ingelheim Foundation
Schusterstr. 46–48
55116 Mainz
Germany
Phone +49 (0) 6131 27 508-12
Email hwp@bistiftung.de
www.heinrich-wieland-prize.de
www.boehringer-ingelheim-stiftung.de