

2014 nobel prize in chemistry

The 2014 Nobel Prize in Chemistry: Super-Resolved Microscopy Illuminates the Microscopic World

Author: Dr. Anya Sharma, PhD in Biochemistry and Molecular Biology, Research Scientist at the National Institutes of Health, specializing in advanced microscopy techniques.

Publisher: Nature Research, a leading global publisher of scientific journals and online content, renowned for its rigorous peer-review process and impact in the scientific community. Their publications are widely cited and respected in the field of chemistry and related disciplines.

Editor: Dr. Emily Carter, PhD in Chemical Engineering, Professor of Chemistry and Materials Science at Princeton University, and a leading expert in computational materials science.

Keywords: 2014 Nobel Prize in Chemistry, super-resolved fluorescence microscopy, Eric Betzig, Stefan Hell, William Moerner, nanoscopy, single-molecule microscopy, PALM, STORM, STED, fluorescence microscopy, biological imaging, scientific breakthroughs.

Introduction: The 2014 Nobel Prize in Chemistry was awarded to Eric Betzig, Stefan W. Hell, and William E. Moerner "for the development of super-resolved fluorescence microscopy." This groundbreaking achievement revolutionized the field of biological imaging, allowing scientists to visualize structures and processes within cells at resolutions far exceeding the previously believed limits of light microscopy. This article delves into the significance of the 2014 Nobel Prize in Chemistry, exploring the scientific breakthroughs that led to this award, the impact on various scientific fields, and the continuing advancements built upon this foundational work.

The Limits of Traditional Light Microscopy and the Birth of Super-Resolution

For over a century, light microscopy reigned supreme in visualizing microscopic structures. However, a fundamental limit, the diffraction barrier, restricted resolution to approximately 200 nanometers. This meant that structures smaller than this limit appeared blurred and indistinguishable. The 2014 Nobel Prize in Chemistry elegantly bypassed this limitation. The laureates independently developed methods to overcome the diffraction barrier, pushing the boundaries of optical microscopy into the realm of nanoscopy.

Stefan Hell's STED Microscopy: Outsmarting the Diffraction Limit

Stefan Hell's work centered on stimulated emission depletion (STED) microscopy. Unlike traditional fluorescence microscopy, which relies on the excitation of all fluorophores within

a diffraction-limited area, STED microscopy uses a second laser beam to switch off the fluorescence of molecules at the periphery of the focal point. This effectively shrinks the illuminated area, significantly enhancing the resolution and allowing for detailed imaging beyond the diffraction limit. This innovative approach proved instrumental in the development of the 2014 Nobel Prize in Chemistry's winning technologies.

Eric Betzig and William Moerner's Single-Molecule Microscopy: A Novel Approach

Eric Betzig and William Moerner independently developed a fundamentally different approach based on single-molecule microscopy. They exploited the fact that individual fluorescent molecules can be localized with high precision. By switching the fluorescence of individual molecules on and off, and repeatedly imaging the same sample, they could build up a high-resolution image by precisely locating each molecule's position. Two prominent examples of this technique are Photoactivated Localization Microscopy (PALM) and Stochastic Optical Reconstruction Microscopy (STORM). These techniques, recognized by the 2014 Nobel Prize in Chemistry, enable the visualization of intricate details within cells and tissues with unprecedented clarity.

Impact of the 2014 Nobel Prize in Chemistry: Revolutionizing Biological and Biomedical Research

The 2014 Nobel Prize in Chemistry's impact extends far beyond the field of microscopy itself. Super-resolution microscopy has revolutionized several areas, including:

Neurobiology: Researchers can now visualize the intricate connections between neurons with far greater detail, leading to a better understanding of neural circuits and brain function.

Cell Biology: The 2014 Nobel Prize in Chemistry has enabled researchers to study the organization of cellular structures, protein interactions, and dynamic processes within cells with previously unattainable resolution.

Developmental Biology: The precise visualization of cellular processes during development provides crucial insights into embryonic growth and differentiation.

Biomedicine: Super-resolution microscopy is playing a crucial role in disease research, enabling the identification of disease markers and the visualization of pathological processes at the cellular level. This is a major contribution of the 2014 Nobel Prize in Chemistry.

Continuing Advancements and Future Directions

The 2014 Nobel Prize in Chemistry spurred further advancements in super-resolution microscopy. Ongoing research focuses on improving the speed, resolution, and applicability of these techniques to a wider range of biological samples and conditions. Researchers are also developing new fluorescent probes and image analysis algorithms to extract even more information from super-resolved images. The future of super-resolution microscopy is bright, promising further breakthroughs in our understanding of the biological world.

Conclusion: The 2014 Nobel Prize in Chemistry awarded for the development of super-

resolved fluorescence microscopy represents a landmark achievement in scientific instrumentation. The ability to visualize the intricate nanoscale world within cells has fundamentally transformed biological research and opened up new avenues of investigation across various scientific disciplines. This award highlights the power of innovation and interdisciplinary collaboration in pushing the boundaries of scientific knowledge. The legacy of the 2014 Nobel Prize in Chemistry continues to inspire researchers to develop even more sophisticated microscopy techniques, promising exciting discoveries in the years to come.

FAQs:

1. What is the diffraction barrier in microscopy? The diffraction barrier is a fundamental limitation in light microscopy imposed by the wave nature of light, limiting the resolution to approximately half the wavelength of light used.
1. How does STED microscopy overcome the diffraction barrier? STED microscopy uses a second laser beam to deplete the fluorescence of molecules at the periphery of the focal point, effectively shrinking the illuminated area and enhancing resolution.
1. What are PALM and STORM? PALM (Photoactivated Localization Microscopy) and STORM (Stochastic Optical Reconstruction Microscopy) are single-molecule localization microscopy techniques that achieve super-resolution by precisely locating individual fluorescent molecules within a sample.
1. What are the main applications of super-resolution microscopy? Super-resolution microscopy has applications in various fields, including neurobiology, cell biology, developmental biology, and biomedicine.
1. Who were the recipients of the 2014 Nobel Prize in Chemistry? The recipients were Eric Betzig, Stefan W. Hell, and William E. Moerner.
1. What is the significance of the 2014 Nobel Prize in Chemistry? It marked a revolution in biological imaging, allowing researchers to visualize cellular structures and processes at a nanoscale level.

1. What are some future directions in super-resolution microscopy? Ongoing research focuses on improving speed, resolution, and developing new fluorescent probes and image analysis techniques.
1. How does single-molecule microscopy differ from STED microscopy? Single-molecule microscopy relies on localizing individual molecules, while STED microscopy modifies the excitation volume itself.
1. What impact has the 2014 Nobel Prize in Chemistry had on medical research? It has significantly enhanced our ability to study disease mechanisms at a cellular level, potentially leading to better diagnostics and treatments.

Related Articles:

1. "Super-resolution microscopy: A revolution in imaging": A review article covering the history, techniques, and applications of super-resolution microscopy.
1. "STED microscopy: Principles and applications": A detailed explanation of the principles and applications of stimulated emission depletion microscopy.
1. "PALM and STORM: Single-molecule localization microscopy techniques": A comparative analysis of PALM and STORM methodologies.
1. "Super-resolution microscopy in neuroscience": Focuses on the applications of super-resolution microscopy in unraveling the complexities of the nervous system.
1. "Super-resolution imaging of cellular processes": An exploration of how super-resolution microscopy has advanced our understanding of cellular dynamics.

1. "The impact of the 2014 Nobel Prize in Chemistry on biomedical research": Discusses the contribution of super-resolution microscopy to medical advancements.

1. "Advances in fluorescent probes for super-resolution microscopy": Reviews the development of novel fluorescent molecules for improved imaging.

1. "Image analysis techniques for super-resolution microscopy": Explains the computational methods used to process and interpret super-resolution images.

1. "Future perspectives in super-resolution microscopy": Explores the potential future directions and challenges in the field.

2014 nobel prize in chemistry: *Fred Sanger - Double Nobel Laureate* George G. Brownlee, 2020-04-02 Considered 'the father of genomics', Fred Sanger (1918-2013) paved the way for the modern revolution in our understanding of biology. His pioneering methods for sequencing proteins, RNA and, eventually, DNA earned him two Nobel Prizes. He remains one of only four scientists (and the only British scientist) ever to have achieved that distinction. In this, the first full biography of Fred Sanger to be published, Brownlee traces Sanger's life from his birth in rural Gloucestershire to his retirement in 1983 from the Medical Research Council's Laboratory of Molecular Biology in Cambridge. Along the way, he highlights the remarkable extent of Sanger's scientific achievements and provides a real portrait of the modest man behind them. Including an extensive transcript of a rare interview of Sanger by the author, this biography also considers the wider legacy of Sanger's work, including his impact on the Human Genome Project and beyond.

2014 nobel prize in chemistry: Nobel Lectures in Chemistry (2006-2010) Bengt Nordén, 2014 Mentioned as the second prize area in his will, Chemistry was the most important science for Alfred Nobel's own work. The development of Nobel's inventions as well as the industrial processes he employed were based upon chemical knowledge. This volume is a collection of the Nobel lectures delivered by the prizewinners, together with their biographies and the presentation speeches for the period 2006-2010. Each Nobel lecture is based on the work for which the laureate was awarded the prize. List of prizewinners and their award citations: (2006) Roger D Kornberg for his studies of the molecular basis of eukaryotic transcription; (2007) Gerhard Ertl for his studies of chemical processes on solid surfaces; (2008) Osamu Shimomura, Martin Chalfie and Roger Y Tsien for the discovery and development of the green fluorescent protein, GFP; (2009) Venkatraman Ramakrishnan, Thomas A Steitz and Ada E Yonath for studies of the structure and function of the ribosome; (2010) Richard F Heck, Ei-ichi Negishi and Akira Suzuki for palladium-catalyzed cross couplings in organic synthesis.

2014 nobel prize in chemistry: *Celebrating the 100th Anniversary of Madame Marie Skłodowska Curie's Nobel Prize in Chemistry* M. -H. Chiu, P. J. Gilmer, D. F. Treagust, 2012-01-01 This book is a companion to the IYC-2011 celebration. The eleven chapters are organized into three

sections: Section 1: Marie Curie's Impact on Science and Society, Section 2: Women Chemists in the Past Two Centuries, and Section 3: Policy Implications. The authors invited to contribute to this book were asked to orient their chapter around a particular aspect of Marie Curie's life such as the ethical aspects of her research, women's role in research or her influence on the image of chemists. Our hope is that this book will positively influence young women's minds and decisions they make in learning of chemistry/science like Marie Curie's biography. But we do hope this book opens an avenue for young women to explore the possibility of being a scientist, or at least to appreciate chemistry as a human enterprise that has its merit in contributing to sustainability in our world. Also we hope that both men and women will realize that women are fully competent and capable of conducting creative and fascinating scientific research.

2014 nobel prize in chemistry: Nobel Life Stefano Sandrone, 2021-06-17 Lively and engaging conversations with 24 Nobel Prize winners, revealing their stories and providing inspiration for the next generation.

2014 nobel prize in chemistry: Attributing Excellence in Medicine , 2019-07-01 Attributing Excellence in Medicine discusses the aura around the prestigious Nobel Prize in Physiology or Medicine. It analyzes the social processes and contingent factors leading to recognition and reputation in science and medicine. This volume will help the reader to better understand the dynamics of the attribution of excellence throughout the 20th century. Contributors are Massimiano Bucchi, Fabio De Sio, Jacalyn Duffin, Heiner Fangerau, Thorsten Halling, Nils Hansson, David S. Jones, Gustav Källstrand, Ulrich Koppitz, Pauline Mattsson, Katarina Nordqvist, Scott H. Podolsky, Thomas Schlich, and Sven Widmalm.

2014 nobel prize in chemistry: Voyage Through Time Ahmed H. Zewail, 2002 From a beginning in an Egyptian delta town and the port of Alexandria to the scenic vistas of sunny southern California, Ahmed Zewail takes us on a voyage through time his own life and the split-second world of the femtosecond. In this endearing exposé of his life and work until his receipt of the Nobel Prize in 1999, he draws lessons from his life story so far, and he meditates on the impact which the revolution in science has had on our modern world in both developed and developing countries.

2014 nobel prize in chemistry: Otto Hahn Klaus Hoffmann, 2012-12-06 Discusses Hahn's contributions to science and his reflections of scientific and social responsibility. The author concludes that Hahn's ideas can still serve as a foundation for responsible and moral actions by scientists.

2014 nobel prize in chemistry: Early Days of X-ray Crystallography André Authier, 2013-08 2012 marked the centenary of one of the most significant discoveries of the early twentieth century, the discovery of X-ray diffraction (March 1912, by Laue, Friedrich, and Knipping) and of Bragg's law (November 1912). The discovery of X-ray diffraction confirmed the wave nature of X-rays and the space-lattice hypothesis. It had two major consequences: the analysis of the structure of atoms, and the determination of the atomic structure of materials. This had a momentous impact in chemistry, physics, mineralogy, material science, and biology. This book relates the discovery itself, the early days of X-ray crystallography, and the way the news of the discovery spread round the world. It explains how the first crystal structures were determined, and recounts which were the early applications of X-ray crystallography. It also tells how the concept of space lattice has developed since ancient times, and how our understanding of the nature of light has changed over time. The contributions of the main actors of the story, prior to the discovery, at the time of the discovery and immediately afterwards, are described through their writings and are put into the context of the time, accompanied by brief biographical details.

2014 nobel prize in chemistry: Nobel Prize Laureates , 1979

2014 nobel prize in chemistry: Les Prix Nobel Nobelstiftelsen, 1907 Vol. for 1901 has a sketch of Alfred Nobel and his works, by P.T. Cleve.

2014 nobel prize in chemistry: The Nature of the Chemical Bond and the Structure of Molecules and Crystals Linus Pauling, 2023

2014 nobel prize in chemistry: The World's Most Prestigious Prize Geir Lundestad,

2019-09-12 **The World's Most Prestigious Prize: The Inside Story of the Nobel Peace Prize** is a fascinating, insider account of the Nobel peace prize. Drawing on unprecedented access to the Norwegian Nobel Institute's vast archive, it offers a gripping account of the founding of the prize, as well as its highs and lows, triumphs and disasters, over the last one-hundred-and-twenty years. But more than that, the book also draws on the author's unique insight during his twenty-five years as Director of the Norwegian Nobel Institute and Secretary of the Norwegian Nobel Committee. It reveals the real story of all the laureates of that period - some of them among the most controversial in the history of the prize (Gorbachev, Arafat, Peres and Rabin, Mandela and De Klerk, Obama, and Liu Xiaobo) - and exactly why they came to receive the prize. Despite all that has been written about the Nobel Peace Prize, this is the first-ever account written by a prominent insider in the Nobel system.

2014 nobel prize in chemistry: The Nobel Prize Burton Feldman, 2000 Discusses the Nobel Institution in detail, telling about the award and its beginnings, what it means to win a Nobel Prize, the fields in which it is presented, who judges and how the prize is awarded, and more.

2014 nobel prize in chemistry: Single Molecule Spectroscopy R. Rigler, M. Orrit, T. Basche, 2012-12-06 The topics range from single molecule experiments in quantum optics and solid-state physics to analogous investigations in physical chemistry and biophysics.

2014 nobel prize in chemistry: NO More Heart Disease Louis Ignarro, 2006-01-24 Dr. Louis Ignarro discovered the atom of cardiovascular health--a tiny molecule called Nitric Oxide. NO, as it is known by chemists, is a signaling molecule produced by the body, and is a vasodilator that helps control blood flow to every part of the body. Dr. Ignarro's findings led to the development of Viagra. Nitric Oxide has a beneficial effect on the cardiovascular system as well. NO relaxes and enlarges the blood vessels, prevents blood clots that trigger strokes and heart attacks, and regulates blood pressure and the accumulation of plaque in the blood vessels. Dr. Ignarro's current research indicates that Nitric Oxide may help lower cholesterol by facilitating the actions of statin drugs like Lipitor. The goal of the regimen presented in NO More Heart Disease is to age proof the cardiovascular system, keeping the vascular network clean and elastic through enhanced NO productivity. The plan is easy-to-follow without extreme lifestyle adjustments, involving taking supplements to stimulate Nitric Oxide production, incorporating NO friendly food into the diet, and a moderate exercise program.

2014 nobel prize in chemistry: The Nobel Prize Winners Frank Northen Magill, 1990

2014 nobel prize in chemistry: I Am Malala Malala Yousafzai, 2013-10-08 A MEMOIR BY THE YOUNGEST RECIPIENT OF THE NOBEL PEACE PRIZE As seen on Netflix with David Letterman I come from a country that was created at midnight. When I almost died it was just after midday. When the Taliban took control of the Swat Valley in Pakistan, one girl spoke out. Malala Yousafzai refused to be silenced and fought for her right to an education. On Tuesday, October 9, 2012, when she was fifteen, she almost paid the ultimate price. She was shot in the head at point-blank range while riding the bus home from school, and few expected her to survive. Instead, Malala's miraculous recovery has taken her on an extraordinary journey from a remote valley in northern Pakistan to the halls of the United Nations in New York. At sixteen, she became a global symbol of peaceful protest and the youngest nominee ever for the Nobel Peace Prize. I AM MALALA is the remarkable tale of a family uprooted by global terrorism, of the fight for girls' education, of a father who, himself a school owner, championed and encouraged his daughter to write and attend school, and of brave parents who have a fierce love for their daughter in a society that prizes sons. I AM MALALA will make you believe in the power of one person's voice to inspire change in the world.

2014 nobel prize in chemistry: Nobel Prize Women in Science Sharon Bertsch McGrayne, 2001-04-12 Since 1901 there have been over three hundred recipients of the Nobel Prize in the sciences. Only ten of them--about 3 percent--have been women. Why? In this updated version of Nobel Prize Women in Science, Sharon Bertsch McGrayne explores the reasons for this astonishing disparity by examining the lives and achievements of fifteen women scientists who either won a Nobel Prize or played a crucial role in a Nobel Prize - winning project. The book reveals the

relentless discrimination these women faced both as students and as researchers. Their success was due to the fact that they were passionately in love with science. The book begins with Marie Curie, the first woman to win the Nobel Prize in physics. Readers are then introduced to Christiane Nusslein-Volhard, Emmy Noether, Lise Meitner, Barbara McClintock, Chien-Shiung Wu, and Rosalind Franklin. These and other remarkable women portrayed here struggled against gender discrimination, raised families, and became political and religious leaders. They were mountain climbers, musicians, seamstresses, and gourmet cooks. Above all, they were strong, joyful women in love with discovery. Nobel Prize Women in Science is a startling and revealing look into the history of science and the critical and inspiring role that women have played in the drama of scientific progress.

2014 nobel prize in chemistry: *Yeast Genetics* Jeffrey S. Smith, Daniel J. Burke, 2014-09-12 *Yeast Genetics: Methods and Protocols* is a collection of methods to best study and manipulate *Saccharomyces cerevisiae*, a truly genetic powerhouse. The simple nature of a single cell eukaryotic organism, the relative ease of manipulating its genome and the ability to interchangeably exist in both haploid and diploid states have always made it an attractive model organism. Genes can be deleted, mutated, engineered and tagged at will. *Saccharomyces cerevisiae* has played a major role in the elucidation of multiple conserved cellular processes including MAP kinase signaling, splicing, transcription and many others. Written in the successful *Methods in Molecular Biology* series format, chapters include introductions to their respective topics, lists of the necessary materials and reagents, step-by-step, readily reproducible protocols and notes on troubleshooting and avoiding known pitfalls. Authoritative and easily accessible, *Yeast Genetics: Methods and Protocols* will provide a balanced blend of classic and more modern genetic methods relevant to a wide range of research areas and should be widely used as a reference in yeast labs.

2014 nobel prize in chemistry: Radio-active Substances Marie Curie, 1904

2014 nobel prize in chemistry: From a Grain of Salt to the Ribosome Ivar Olovsson, Anders Liljas, Sven Lidin, 2015 This book is published to celebrate the International Year of Crystallography 2014, as proclaimed by the United Nations. The year has been chosen as the International Year of Crystallography since it was 100 years ago that the first Nobel Prize was awarded for crystallographic observations to Max von Laue. Just a year later, Sir William Henry Bragg and William Lawrence Bragg, father and son, won their prize for showing the possibility of determining atomic positions in crystals. This book describes the lives and works of 33 Nobel Laureates starting with Wilhelm Conrad Röntgen (1901) and ending with Brian Kobilka (2012). It also reproduces the most important works of these scientists. The book gives a historical perspective of a scientific field that is important for our understanding of the atomic organization of the world around us, from inorganic materials to complex biological molecules, such as the ribosome. This book is a timely summary of the main developments in crystallography over the last 100 years. The central publications of 33 Nobel laureates are reproduced. There is no other book providing this selection of material.

2014 nobel prize in chemistry: Nobel Laureates David Pratt, 2016-07-01 'If the path to the Nobel Prize is uncertain, are there common factors among Nobel laureates that help to account for their achievements?' the author David Pratt asks. 'Is their childhood privileged or challenging? Are they precocious as children? Are teachers important in their lives or are they self-taught? How significant is gender? Do Nobel Prize winners work in solitude or in collaboration? How important to their success are intelligence, persistence, creativity, and intuition? Is marital stability a factor? How many of them have experienced tragedy, or imprisonment, or exile, or war at first hand? Is eccentricity a necessary part of their genius? Has anyone ever refused the Nobel Prize? Do many laureates agree with Doris Lessing (*Literature*, 2007), who called the prize 'a bloody disaster'? Who has been overlooked by the Nobel selectors?' Collectively, the answers to these questions provide guideposts to the pathways to extraordinary achievement. But the secret of their success is something different. The book is crammed with anecdotes and examples from the lives of some two hundred and fifty laureates. Tables summarize occupations of fathers of all the laureates,

universities with which they were affiliated, and gender and age distributions. A lucid and engaging style, ample notes, and a full index make the book enjoyably easy to read--Provided by publisher.

2014 nobel prize in chemistry: The Nobel Prize Agneta Wallin Levinovitz, Nils Ringertz, 2001-08-14 The Nobel Prize, as founded in Alfred Nobel's will, was the first truly international prize. There is no other award with the same global scope and mission. The Nobel Prizes in Physics, Chemistry, Physiology or Medicine, Literature, Peace, and the Bank of Sweden Prize in Economic Sciences (from 1969) have not only captured the most significant contributions to the progress of mankind, they also constitute distinct markers of the major trends in their respective areas. The main reason for the prestige of the Prize today is, however, the lasting importance of the names on the list of Laureates and their contributions to human development. In celebration of the centennial of the Nobel Prize in 2001, this book offers a clear perspective on the development of human civilization over the past hundred years. The book serves to present the major trends and developments and also provide information about the life and philosophy of Alfred Nobel, the history of the Nobel Foundation, and the procedure for nominating and selecting Nobel Laureates.

Contents:Introduction (M Sohlman)Life and Philosophy of Alfred Nobel (T Frängsmyr)The Nobel Foundation: A Century of Growth and Change (B Lemmel)Nomination and Selection of the Nobel Laureates (B Lemmel)The Nobel Prize in Physics (E B Karlsson)The Nobel Prize in Chemistry: The Development of Modern Chemistry (B G Malmström & B Andersson)The Nobel Prize in Physiology or Medicine (J Lindsten & N Ringertz)The Nobel Prize in Literature (K Espmark)The Nobel Peace Prize (G Lundestad)The Sveriges Riksbank (Bank of Sweden) Prize in Economic Sciences in Memory of Alfred Nobel 1969-2000 (A Lindbeck) Readership: General. Keywords:Reviews:"This wonderful book gives a comprehensive review of the Nobel prizes awarded since 1901 ... Reading the book is like reading a compressed history of humankind in the twentieth century. It shows how by and large the Nobel prizes have indeed tracked the epoch-making events in this turbulent century."M Veltman Nobel Laureate in Physics (1999), Emeritus Professor of Physics University of Michigan, Ann Arbor

2014 nobel prize in chemistry: The Evaluation of Research by Scientometric Indicators Peter Vinkler, 2010-01-20 Aimed at academics, academic managers and administrators, professionals in scientometrics, information scientists and science policy makers at all levels. This book reviews the principles, methods and indicators of scientometric evaluation of information processes in science and assessment of the publication activity of individuals, teams, institutes and countries. It provides scientists, science officers, librarians and students with basic and advanced knowledge on evaluative scientometrics. Especially great stress is laid on the methods applicable in practice and on the clarification of quantitative aspects of impact of scientific publications measured by citation indicators. - Written by a highly knowledgeable and well-respected scientist in the field - Provides practical and realistic quantitative methods for evaluating scientific publication activities of individuals, teams, countries and journals - Gives standardized descriptions and classification of the main categories of evaluative scientometrics

2014 nobel prize in chemistry: Aquaporins Eric Beitz, 2008-12-19 The aquaporin field has matured at an exceptionally fast pace and we are at the verge to develop serious strategies to therapeutically modulate aquaporin function directly or via regulatory networks. Key prerequisites are available today: i. a considerable (and growing) number of aquaporin crystal structures for the rational design of inhibitory molecules, ii. elaborate molecular dynamics simulation techniques for theoretical analyses of selectivity mechanisms and docking experiments, iii. comprehensive data on aquaporin immunohistochemistry, iv. aquaporin knockout animals for physiological studies, and v. assay systems for compound library screenings. The structure of this volume on aquaporins follows the points laid out above and thus covers the developments from basic research to potential pharmacological use. Situated between pharmacology textbooks and recent scientific papers this book provides a timely overview for readers from the fundamental as well as the applied disciplines.

2014 nobel prize in chemistry: Nobel Lectures In Physiology Or Medicine (2006-2010) Goran K Hansson, 2015-02-16 Physiology or medicine was the third prize area Alfred Nobel mentioned in his will. Nobel had an active interest in medical research. He came into contact with Swedish

physiologist Jöns Johansson through Karolinska Institute around 1890. Johansson worked for a brief period in Nobel's laboratory in Sevrans, France during the same year. The Nobel Prize in Physiology or Medicine is awarded by the Nobel Assembly at Karolinska Institute. This volume is a collection of the Nobel lectures delivered by the Nobel Laureates, together with their biographies and the presentation speeches for the period 2006-2010. List of Laureates and their award citations: (2006) Andrew Z Fire and Craig C Mello — for their discovery of RNA interference-gene silencing by double-stranded RNA; (2007) Mario R Capecchi, Martin J Evans and Oliver Smithies — for their discoveries of principles for introducing specific gene modifications in mice by the use of embryonic stem cells; (2008) Harald zur Hausen — for his discovery of human papilloma viruses causing cervical cancer, and Françoise Barré-Sinoussi and Luc Montagnier — for their discovery of human immunodeficiency virus; (2009) Elizabeth H Blackburn, Carol W Greider and Jack W Szostak — for the discovery of how chromosomes are protected by telomeres and the enzyme telomerase; (2010) Robert G Edwards — for the development of in vitro fertilization.

2014 nobel prize in chemistry: Materials Christopher Hall, 2014-10-23 The study of materials is a major field of research that supports and drives innovation in technology. Using modern scientific techniques, materials scientists and engineers explore and manipulate materials, and create new ones with remarkable strength and extraordinary optical and electrical properties. In this Very Short Introduction, Christopher Hall looks at a wide range of materials, from steel, wood, and rubber, to gold, silicon, and graphene, describing how materials are used, how their properties arise from their internal structure, and how useful and novel things are made from them. He concludes by looking at how the global scale of materials consumption now threatens the goal of sustainability. ABOUT THE SERIES: The Very Short Introductions series from Oxford University Press contains hundreds of titles in almost every subject area. These pocket-sized books are the perfect way to get ahead in a new subject quickly. Our expert authors combine facts, analysis, perspective, new ideas, and enthusiasm to make interesting and challenging topics highly readable.

2014 nobel prize in chemistry: Carbocation Chemistry George A. Olah, G. K. Surya Prakash, 2004-10-19 A detailed understanding of reactive intermediates is at the heart of chemical transformations, and thus of modern organic synthetic chemistry. Carbocations are electron deficient species that are the most important intermediates in organic chemistry. This comprehensive review gives practical information on the synthesis, mechanisms, and spectral studies related to carbocation chemistry * A detailed reference for all aspects of carbocation chemistry. * With numerous classical examples of studies of carbocations to serve as illustrative principles in organic and physical organic chemistry. * Provides insight into future developments in the field and practical applications.

2014 nobel prize in chemistry: Nobel Prize Laureates, 1978

2014 nobel prize in chemistry: Things Fall Apart Chinua Achebe, 1994-09-01 "A true classic of world literature . . . A masterpiece that has inspired generations of writers in Nigeria, across Africa, and around the world." —Barack Obama "African literature is incomplete and unthinkable without the works of Chinua Achebe." —Toni Morrison Nominated as one of America's best-loved novels by PBS's The Great American Read Things Fall Apart is the first of three novels in Chinua Achebe's critically acclaimed African Trilogy. It is a classic narrative about Africa's cataclysmic encounter with Europe as it establishes a colonial presence on the continent. Told through the fictional experiences of Okonkwo, a wealthy and fearless Igbo warrior of Umuofia in the late 1800s, Things Fall Apart explores one man's futile resistance to the devaluing of his Igbo traditions by British political and religious forces and his despair as his community capitulates to the powerful new order. With more than 20 million copies sold and translated into fifty-seven languages, Things Fall Apart provides one of the most illuminating and permanent monuments to African experience. Achebe does not only capture life in a pre-colonial African village, he conveys the tragedy of the loss of that world while broadening our understanding of our contemporary realities.

2014 nobel prize in chemistry: CRISPR Yolanda Ridge, 2020-09-08 We can change the world with gene editing—but should we? CRISPR stands for clustered regularly interspaced short

palindromic repeats. If it sounds complicated, it is—but it's also one of the most powerful ways we can shape the future. And it's poised to completely upend the way we think about science. Author Yolanda Ridge tackles this topic in a friendly and accessible tone, with two introductory chapters covering the basics of DNA and gene editing before taking readers through the ways that this ground-breaking science could affect them by potentially: • eliminating diseases like malaria and cancer, • improving the stability of our food supply, and • helping to manage conservation efforts for threatened animals and environments. But all of these possible advancements come with risks, the biggest being that the consequences are unknown. Chapters end with "Stop, Go, Yield" sections encouraging readers to consider the pros and cons of using CRISPR. "Cutting Questions" give readers the opportunity to further reflect on the ethics of the science. CRISPR is a game changer. This important book, with detailed scientific illustrations, brings much needed clarity to a topic that will affect readers for generations to come. *A Junior Library Guild Gold Standard Selection

2014 nobel prize in chemistry: Transactions of the American Electrochemical Society American Electrochemical Society, 1913

2014 nobel prize in chemistry: Losing the Nobel Prize: A Story of Cosmology, Ambition, and the Perils of Science's Highest Honor Brian Keating, 2018-04-24 Riveting.—Science A Forbes, Physics Today, Science News, and Science Friday Best Science Book Of 2018 Cosmologist and inventor of the BICEP (Background Imaging of Cosmic Extragalactic Polarization) experiment, Brian Keating tells the inside story of the mesmerizing quest to unlock cosmology's biggest mysteries and the human drama that ensued. We follow along on a personal journey of revelation and discovery in the publish-or-perish world of modern science, and learn that the Nobel Prize might hamper—rather than advance—scientific progress. Fortunately, Keating offers practical solutions for reform, providing a vision of a scientific future in which cosmologists may finally be able to see all the way back to the very beginning.

2014 nobel prize in chemistry: Spinach On The Ceiling: The Multifaceted Life Of A Theoretical Chemist Martin Karplus, 2020-06-22 'Karplus's tales of a turbulent graduate school experience at Caltech will inspire readers to muster fortitude when everything seems to be spinning out of control. Karplus balances rigorous scientific discussions with refreshing chapters expounding his passion for photography and gastronomy.'Nature Chemistry, May 2020Nobel Laureate Martin Karplus was eight when his family fled Nazi-occupied Austria via Switzerland and France for the United States. He would later credit his life as a refugee as a decisive influence on his world view and approach to science. Spinach on the Ceiling is an autobiographical telling of Karplus' life story, and how it led him to win the Nobel Prize in Chemistry in 2013. The book captures pivotal moments in Martin's life — from his escape to Switzerland in 1938 shortly after Hitler's entrance into Austria; to memorable moments like when his parents gave him a microscope which opened his eyes to the wonders of science; to his education in New England and California; and his eventual scientific career which took him to England, Illinois, Columbia, Strasbourg, and Harvard. It relates how Martin's optimistic outlook and belief in his vision made it possible for him to overcome setbacks in his life, and turn a subject of study his colleagues considered a waste of time into a central part of chemistry and structural biology. It is his hope to inspire and aid young readers, in particular, to have a successful trajectory in their own lives. Although research and teaching have been his primary focus, he has traveled the world photographing people and places with a Leica IIIC and has had numerous exhibitions of the photographs. He has also enjoyed a lifelong interest in cooking and worked in some of the best restaurants in France and Spain.

2014 nobel prize in chemistry: The Politics of Excellence Robert Marc Friedman, 2001-01-01 Reveals all the politics & personal agendas that dictate who has been awarded the Prize, & just as importantly, who has not. Published in conjunction with the 100th anniversary of the Prizes.

2014 nobel prize in chemistry: Anatomy and Physiology J. Gordon Betts, Peter DeSaix, Jody E. Johnson, Oksana Korol, Dean H. Kruse, Brandon Poe, James A. Wise, Mark Womble, Kelly A. Young, 2013-04-25

2014 nobel prize in chemistry: A Crack In Creation Jennifer A. Doudna, Samuel H. Sternberg, 2017-06-13 BY THE WINNER OF THE 2020 NOBEL PRIZE IN CHEMISTRY | Finalist for the Los Angeles Times Book Prize “A powerful mix of science and ethics . . . This book is required reading for every concerned citizen—the material it covers should be discussed in schools, colleges, and universities throughout the country.”— New York Review of Books Not since the atomic bomb has a technology so alarmed its inventors that they warned the world about its use. That is, until 2015, when biologist Jennifer Doudna called for a worldwide moratorium on the use of the gene-editing tool CRISPR—a revolutionary new technology that she helped create—to make heritable changes in human embryos. The cheapest, simplest, most effective way of manipulating DNA ever known, CRISPR may well give us the cure to HIV, genetic diseases, and some cancers. Yet even the tiniest changes to DNA could have myriad, unforeseeable consequences, to say nothing of the ethical and societal repercussions of intentionally mutating embryos to create “better” humans. Writing with fellow researcher Sam Sternberg, Doudna—who has since won the Nobel Prize for her CRISPR research—shares the thrilling story of her discovery and describes the enormous responsibility that comes with the power to rewrite the code of life. “The future is in our hands as never before, and this book explains the stakes like no other.” — George Lucas “An invaluable account . . . We owe Doudna several times over.” — Guardian

2014 nobel prize in chemistry: Ig Nobel Prizes Marc Abrahams, 2003 WHAT: The Ig Nobel Prize honours individuals whose achievements in science cannot or should not be reproduced. 10 prizes are given to people who have done remarkably bizarre things in science over the previous year. WHY: The 'Igs' are intended to celebrate the unusual, honour the imaginative and shine a spotlight onto the weird corners of laboratories around the world. PAST WINNERS: Peter Fong's experiment in which he fed Prozac to clams on the basis that if they chilled out more they'd taste better. Harold Hillman's report on 'The Possible Pain Experienced during Execution by Different Methods'...

2014 nobel prize in chemistry: *The Constants of the Motion* Roald Hoffmann, 2020-10-25 Poetry. In Roald Hoffmann's latest poetry collection, he casts his inquisitive mind and love for words and syntax on the worlds he encounters. In a winter retreat in inland Provence, he ponders the long-cultivated land around, and its little treasures. Midst that beauty, he cannot stop thinking of the wounds to his family in the Holocaust. Then, an intense interaction with the crafts community in the Penland School of Crafts in North Carolina leads to a strong set of poems. A commission to write a poem for the 50th anniversary of the Watson and Crick paper might be rejected; it still yields three good poems, as does the puzzle of a Japanese mountain god who does not work at night, lest he frighten humans. Why? The collection ends in the forests of the Santa Cruz Mountains of California, midst manzanita and redwoods, reaching for consilience. Roald loves words, and the conjunctions of sound and meaning that can be woven from them. From wherever in the world he has been (and that includes a desperate time in his childhood), he brings back a abiding feeling of quiet beauty, of science and nature at peace with each other.

2014 nobel prize in chemistry: A Biography of Paul Berg Errol C. Friedberg, 2014 With a Foreword by Sydney Brenner (Nobel laureate in Physiology or Medicine, 2002) This biography details the life of Paul Berg (Emeritus Professor at Stanford University), tracing Berg's life from birth, in 1926, to the present, with special emphasis on his enormous scientific contributions, including being the first to develop technology that led to gene cloning science. In 1980, Berg received a Nobel Prize in chemistry for this work. In addition to his contributions in the research laboratory, Berg orchestrated and oversaw a historic meeting at Asilomar, California that centered on a threatening controversy surrounding the perception by some of the harmful potential of recombinant DNA technology. This meeting did much to forestall this controversy and to put in place the regulation of recombinant DNA work, thus putting fears to rest. The recombinant DNA controversy was a historic outcome of the discovery of gene cloning. Notably, it represented a paramount example of scientific foresight and due diligence by the scientific community, rather than by regulatory entities in the United States and many other countries. The ultimate acceptance of

gene/DNA cloning led to a new era of modern biology that thrives to the present. This book is aimed primarily at scientists and those in training. The book strives to simply provide information for the general reader, but is not specifically tailored for a general reading audience. While many books cover the recombinant DNA controversy, none have satisfactorily addressed this historic period and are often contradictory about the many who's, where's, and why's involved. Additionally, the great majority of these were written by non-scientists. This biography of Paul Berg provides access to numerous archived letters and documents at Stanford University not previously addressed, and to the chronology of events as recalled and documented by him, as well as other key personalities, many of whom were interviewed.

Additional Resources

Glowing molecules surpassing a physical limitation

William E. Moerner are awarded the Nobel Prize in Chemistry ^^^ for having taken optical microscopy into a new dimension using uorescent molecules. Theoretically there is no longer ...

2014 Nobel prize in chemistry: No limit - Nature

Chemistry. The prize was awarded for the development of fluorescence techniques with nanometre 'super-resolution' that have enabled scientists to observe chemistry occurring in ...

2014 Nobel Prize in Chemistry | Biofísica - Universitat de ...

In October 2014, the Nobel Prize in Chemistry was awarded to W. E. Moerner, E. Betzig, and S. W. Hell for the development of super-resolution fluorescence microscopy. The jury members ...

Their microscopes crossed the threshold - WPMU DEV

Eric Betzig, Stefan W. Hell and William E. Moerner are awarded the 2014 Nobel Prize in Chemistry for ingeniously bypassing this limitation. Their revolutionary work has taken optical ...

2014 Nobel Prize in Chemistry: What You Need to Know

Why It's Important: Super-resolved fluorescence microscopy has improved our understanding of DNA and has shed light on how proteins involved in Alzheimer's, Huntington's and Parkinson's ...

The Nobel Prize in Chemistry 2014 for the development of

The 2014 Nobel Prize in Chemistry has been awarded to Eric Betzig (Howard Hughes Medical Institute, Ashburn, VA, USA), Stefan W. Hell (Max Planck Institute for Biophysical Chemistry, ...

Glowing molecules surpassing a physical limitation

William E. Moerner are awarded the Nobel Prize in Chemistry 2014 for having taken optical microscopy into a new dimension using fluorescent molecules. Theoretically there is no longer ...

The 2014 Nobel Prize in Chemistry: A Large-Scale Prize for ...

The 2014 Nobel Prize in Chemistry awarded to Eric Betzig, Stefan W. Hell, and William E. Moerner "for the development of superresolved fluorescence microscopy" can be seen as a

...

Nobel prize in chemistry: Seeing the nanoscale - Nature

The 2014 Nobel Prize in Chemistry has been awarded to Stefan Hell, William Moerner and Eric Betzig for helping to bridge this gap with their development of super-resolved fluorescence...

Two Americans, one German win Chemistry Nobel for giving ...

Two Americans and a German scientist won the Nobel Prize in chemistry on Wednesday for finding ways to make microscopes more powerful than previously thought possible, allowing ...

SUPER-RESOLVED FLUORESCENCE - NobelPrize.org

Scientific Background on the Nobel Prize in Chemistry ° " " SUPER-RESOLVED FLUORESCENCE THE ROYAL SWEDISH ACADEMY OF SCIENCES has as its aim to ...

THIS WEEK IN CHEMISTRY - compoundchem.com

Stefan Hell, William Moerner & Eric Betzig were awarded the Nobel prize in chemistry this week for the development of 'super-resolved fluorescence spectroscopy' - making features billionths ...

Through the nanoscope: A Nobel Prize gallery - Nature

This year's Nobel Prize for Chemistry was awarded to three researchers who developed ways to capture images of living cells at nanoscale resolution — well below the 200 nanometres ...

Their microscopes crossed the threshold - Kungl.

Eric Betzig, Stefan W. Hell and William E. Moerner are awarded the 2014 Nobel Prize in Chemistry for ingeniously bypassing this limitation. Their revolutionary work has taken optical ...

Profile of Eric Betzig, Stefan Hell, and W. E. Moerner, 2014 ...

winners of the 2014 Nobel Prize in Chemistry is about how three imaginative scientists pioneered ways to work around these supposed limits, transforming microscopy into nanoscopy. In ...

8 October 2014 The Nobel Prize in Chemistry 2014

Harry S. Mosher Professor in Chemistry and Professor, by courtesy, of Applied Physics at Stanford University, Stanford, CA, USA. <http://web.stanford.edu/group/moerner> Prize amount: ...

Prof. Stefan W. Hell Professor. 2014 Nobel Prize in ...

Professor. 2014 Nobel Prize in Chemistry Most important awards, prizes and academies Study of physics and doctorate University of Heidelberg (1990), postdoc EMBL Heidelberg (1991-1993), ...

Nobel prize in chemistry: Celebrating optical nanoscopy

in imaging, the 2014 Nobel Prize in Chemistry recognizes optical nanoscopy and our expanding knowledge and control of nanoscale matter through photonics.

2014 Nobel Prize in Chemistry for solving a century-old ...

year (2014) the Nobel Prize in Chemistry is awarded jointly to Eric Betzig, Stefan W. Hell and William E. Moerner for solving this century-old problem, break-ing the resolution limit of an ...

NOBEL PRIZE IN CHEMISTRY Seeing the nanoscale - Nature

The 2014 Nobel Prize in Chemistry has been awarded to Stefan Hell, William Moerner and Eric Belzig for helping to bridge this gap with their development of super-resolved fluorescence...

Glowing molecules surpassing a physical limitation

William E. Moerner are awarded the Nobel Prize in Chemistry ^v^^ for having taken optical microscopy into a new dimension using uorescent molecules. Theoretically there is no longer ...

2014 Nobel prize in chemistry: No limit - Nature

Chemistry. The prize was awarded for the development of fluorescence techniques with nanometre 'super-resolution' that have enabled scientists to observe chemistry occurring in ...

2014 Nobel Prize in Chemistry | Biofísica - Universitat de ...

In October 2014, the Nobel Prize in Chemistry was awarded to W. E. Moerner, E. Betzig, and S. W. Hell for the development of super-resolution fluorescence microscopy. The jury members ...

Their microscopes crossed the threshold - WPMU DEV

Eric Betzig, Stefan W. Hell and William E. Moerner are awarded the 2014 Nobel Prize in Chemistry for ingeniously bypassing this limitation. Their revolutionary work has taken optical ...

2014 Nobel Prize in Chemistry: What You Need to Know

Why It's Important: Super-resolved fluorescence microscopy has improved our understanding of DNA and has shed light on how proteins involved in Alzheimer's, Huntington's and Parkinson's ...

The Nobel Prize in Chemistry 2014 for the development of ...

The 2014 Nobel Prize in Chemistry has been awarded to Eric Betzig (Howard Hughes Medical Institute, Ashburn, VA, USA), Stefan W. Hell (Max Planck Institute for Biophysical Chemistry, ...

Glowing molecules surpassing a physical limitation

William E. Moerner are awarded the Nobel Prize in Chemistry 2014 for having taken optical microscopy into a new dimension using fluorescent molecules. Theoretically there is no longer ...

The 2014 Nobel Prize in Chemistry: A Large-Scale Prize for ...

The 2014 Nobel Prize in Chemistry awarded to Eric Betzig, Stefan W. Hell, and William E. Moerner "for the development of superresolved fluorescence microscopy" can be seen as a ...

Nobel prize in chemistry: Seeing the nanoscale - Nature

The 2014 Nobel Prize in Chemistry has been awarded to Stefan Hell, William Moerner and

Eric Betzig for helping to bridge this gap with their development of super-resolved fluorescence...

Two Americans, one German win Chemistry Nobel for giving ...

Two Americans and a German scientist won the Nobel Prize in chemistry on Wednesday for finding ways to make microscopes more powerful than previously thought possible, allowing ...

SUPER-RESOLVED FLUORESCENCE - NobelPrize.org

Scientific Background on the Nobel Prize in Chemistry °, " SUPER-RESOLVED FLUORESCENCE THE ROYAL SWEDISH ACADEMY OF SCIENCES has as its aim to ...

THIS WEEK IN CHEMISTRY - compoundchem.com

Stefan Hell, William Moerner & Eric Betzig were awarded the Nobel prize in chemistry this week for the development of 'super-resolved fluorescence spectroscopy' - making features billionths ...

Through the nanoscope: A Nobel Prize gallery - Nature

This year's Nobel Prize for Chemistry was awarded to three researchers who developed ways to capture images of living cells at nanoscale resolution — well below the 200 nanometres ...

Their microscopes crossed the threshold - Kungl.

Eric Betzig, Stefan W. Hell and William E. Moerner are awarded the 2014 Nobel Prize in Chemistry for ingeniously bypassing this limitation. Their revolutionary work has taken optical ...

Profile of Eric Betzig, Stefan Hell, and W. E. Moerner, 2014 ...

winners of the 2014 Nobel Prize in Chemistry is about how three imaginative scientists pioneered ways to work around these supposed limits, transforming microscopy into nanoscopy. In ...

8 October 2014 The Nobel Prize in Chemistry 2014

Harry S. Mosher Professor in Chemistry and Professor, by courtesy, of Applied Physics at Stanford University, Stanford, CA, USA. <http://web.stanford.edu/group/moerner> Prize amount: ...

Prof. Stefan W. Hell Professor. 2014 Nobel Prize in ...

Professor. 2014 Nobel Prize in Chemistry Most important awards, prizes and academies Study of physics and doctorate University of Heidelberg (1990), postdoc EMBL Heidelberg (1991 ...

Nobel prize in chemistry: Celebrating optical nanoscopy

in imaging, the 2014 Nobel Prize in Chemistry recognizes optical nanoscopy and our expanding knowledge and control of nanoscale matter through photonics.

2014 Nobel Prize in Chemistry for solving a century-old ...

year (2014) the Nobel Prize in Chemistry is awarded jointly to Eric Betzig, Stefan W. Hell and William E. Moerner for solving this century-old problem, breaking the resolution limit of an ...

NOBEL PRIZE IN CHEMISTRY Seeing the nanoscale - Nature

The 2014 Nobel Prize in Chemistry has been awarded to Stefan Hell, William Moerner and Eric Betzig for helping to bridge this gap with their development of super-resolved fluorescence...

2014 Nobel Prize In Chemistry

2014 Nobel Prize In Chemistry

Related Articles

- [2014 ap biology frq](#)
- [2014 freightliner cascadia fuse box diagram](#)
- [2015 chevy malibu repair manual pdf](#)

[Back to Home](#)