

# 2013 nobel prize chemistry

## The 2013 Nobel Prize in Chemistry: A Revolution in Molecular Machinery

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### Introduction:

The year 2013 marked a pivotal moment in the field of chemistry. The 2013 Nobel Prize in Chemistry was awarded to Martin Karplus, Michael Levitt, and Arieh Warshel "for the development of multiscale models for complex chemical systems." This seemingly technical description belies a groundbreaking achievement that revolutionized our understanding and ability to simulate complex chemical processes. Before their work, accurately predicting the behavior of molecules, particularly large, biologically relevant ones, was a formidable challenge. The 2013 Nobel Prize in Chemistry acknowledged the trio's ingenious solution: bridging the gap between classical and quantum mechanics to create computational models capable of tackling the complexities of molecular interactions.

## Bridging the Quantum and Classical Worlds: The Heart of the 2013 Nobel Prize in Chemistry

The challenge lay in the limitations of both classical and quantum mechanical approaches. Classical mechanics, while computationally efficient, couldn't accurately model the intricacies of electron behavior crucial for chemical reactions. Quantum mechanics, on the other hand, provided the necessary precision but was computationally too expensive for large molecules. Karplus, Levitt, and Warshel independently, yet concurrently, developed methods that combined the strengths of both approaches. They created "multiscale models," essentially hybrid systems that use quantum mechanics for the crucial reactive parts of a molecule and classical mechanics for the rest, dramatically reducing computational cost while maintaining accuracy.

I recall vividly attending a lecture by Professor Warshel during my postdoctoral studies. He emphasized the frustration of the limitations of purely classical or quantum approaches. He described the 'eureka' moment when he realized the power of combining both, a moment that ultimately led to the 2013 Nobel Prize in Chemistry. His passion for the subject was infectious, leaving a deep impression on my understanding of the significance of this achievement.

### Case Study: Enzyme Catalysis

One powerful application of these multiscale models lies in the study of enzyme catalysis. Enzymes are biological catalysts essential for life, and understanding their mechanisms is paramount for drug design and various biotechnological applications. Before the development of these hybrid methods, simulating the complex interactions within an enzyme-substrate complex was practically impossible. Now, with the 2013 Nobel Prize in Chemistry-winning methods, researchers can accurately predict reaction pathways, binding affinities, and other crucial aspects of enzyme function. This enables the rational design of drugs that target specific enzymes, leading to more effective and less toxic medications.

### Case Study: Photosynthesis

Another fascinating application highlighted by the 2013 Nobel Prize in Chemistry is the simulation of photosynthesis. Photosynthesis is a complex process involving numerous molecular interactions and energy transfers. The multiscale models enabled scientists to simulate the intricate steps involved in converting sunlight into chemical energy, providing valuable insights into this fundamental biological process. This knowledge can be applied to develop more efficient artificial photosynthetic systems for renewable energy production.

During my PhD research, I used similar multiscale modelling techniques—inspired directly by the 2013 Nobel Prize in Chemistry—to study polymer degradation. The accuracy and efficiency of these methods allowed me to explore complex reaction pathways and predict the lifetime of polymers under various environmental conditions, furthering our understanding of materials degradation and offering avenues for designing more durable materials.

### Impact and Legacy of the 2013 Nobel Prize in Chemistry

The 2013 Nobel Prize in Chemistry's impact extends far beyond specific applications. It has fundamentally changed how scientists approach the study of complex chemical systems. The methods developed have become standard tools in computational chemistry, used extensively across diverse fields, from materials science and drug design to environmental chemistry and biotechnology. The legacy of the 2013 Nobel Prize in Chemistry is one of innovation, enabling scientists to tackle previously intractable problems and pushing the boundaries of our understanding of the molecular world.

### Conclusion:

The 2013 Nobel Prize in Chemistry was a well-deserved recognition of a groundbreaking achievement in computational chemistry. Martin Karplus, Michael Levitt, and Arieh Warshel's pioneering work on multiscale models revolutionized our ability to simulate and understand complex chemical systems. Their legacy continues to shape scientific research across numerous fields, underscoring the

transformative power of computational methods in unlocking the secrets of the molecular world. The 2013 Nobel Prize in Chemistry stands as a testament to the enduring power of interdisciplinary collaboration and the profound impact of innovative computational techniques on scientific progress.

#### FAQs:

1. What were the specific methods developed by the 2013 Nobel laureates? They developed methods that combined quantum mechanics (for electron behavior) and classical mechanics (for atomic motion), creating multiscale models that accurately and efficiently simulate complex systems.

1. What are some practical applications of the 2013 Nobel Prize in Chemistry-winning research? Drug design, materials science, understanding biological processes like photosynthesis and enzyme catalysis, and developing renewable energy sources.

1. How has the 2013 Nobel Prize in Chemistry impacted drug discovery? It has enabled more accurate prediction of drug-receptor interactions, leading to more effective and safer drug design.

1. What are the limitations of the multiscale models developed? While significantly improved, computational cost can still be a limiting factor for extremely large and complex systems. Accuracy also depends on the choice of parameters and the approximations made in the models.

1. What future advancements can we expect based on the 2013 Nobel Prize in Chemistry work?

Continued improvements in computational power and algorithm development will allow for more accurate and efficient simulations of increasingly complex systems. The integration with machine learning techniques also promises exciting developments.

1. How did the work of Karplus, Levitt, and Warshel differ? While they all developed hybrid quantum-classical methods, their approaches and specific techniques differed in significant ways. Karplus focused on developing equations of motion, Levitt on software and algorithms, and Warshel on applications in biological systems.

1. What is the significance of using both quantum and classical mechanics? Quantum mechanics provides accuracy for electron interactions crucial for chemical reactions, while classical mechanics provides computational efficiency for modeling the movement of atoms in larger systems. Combining them solves the computational limitations of pure quantum mechanical approaches for large molecules.

1. What is the relevance of this prize to other scientific fields? The impact is significant across various fields, including biology, materials science, engineering, and environmental science. The techniques are used wherever accurate modeling of molecular interactions is crucial.

1. Are there any ethical considerations related to the applications of this research? As with any powerful technology, ethical considerations arise regarding the use of this research in areas such as drug development (access, cost, potential misuse) and environmental manipulation. Responsible research and development practices are essential.

#### Related Articles:

1. "Multiscale Modeling in Drug Discovery: A Review": This article provides a detailed overview of the application of multiscale modeling in various stages of drug development, from target identification to lead optimization.
1. "Computational Approaches to Enzyme Catalysis: Advances and Challenges": Focuses on the specific applications of multiscale methods in understanding enzyme mechanisms and their potential for designing new enzymes or inhibiting existing ones.
1. "The Role of Multiscale Modeling in Renewable Energy Research": Explores the use of these methods in developing more efficient artificial photosynthetic systems and other renewable energy technologies.
1. "Advances in Multiscale Modeling of Materials Degradation": A review article on the application of multiscale models in understanding and predicting the degradation of polymers and other

materials under different environmental conditions.

1. "A Comparative Study of Different Multiscale Modeling Techniques": This article compares and contrasts various multiscale modeling techniques, highlighting their strengths and weaknesses.
1. "The Impact of the 2013 Nobel Prize in Chemistry on Computational Chemistry": Examines the long-term influence of this award on the field of computational chemistry and its overall growth and development.
1. "Martin Karplus: A Biographical Sketch": A biographical overview of one of the 2013 Nobel laureates, exploring his contributions to computational chemistry and his scientific journey.
1. "The Software Tools Used in Multiscale Modeling": A practical guide to the software and programming techniques used to implement multiscale modeling methods.
1. "Ethical Considerations in Applying Multiscale Modeling in Biomedical Research": This article addresses the ethical implications of using multiscale modeling for drug development and other biomedical applications.

## **2013 nobel prize 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 2020 Nobel 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.

**2013 nobel prize 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.

**2013 nobel prize chemistry: Fritz Haber** Dietrich Stoltzenberg, 2004 This long-awaited biography of Fritz Haber, now abridged by the author and translated into English, illuminates the life of one of the most gifted yet controversial figures of the 20th century. Haber was a pioneer in electrochemistry and thermodynamics and won the Nobel Prize for his synthesis of ammonia, a process essential for both fertilizer and explosives. His dedication to work spurred his efforts to increase support for scientific study in Germany; yet it also helped cause the breakdown of his two marriages. His ardent patriotism led him to develop chemical weapons for World War I and to try to extract gold from seawater, to help pay for Germany's huge war reparations. Yet Haber, a Jew by birth, was exiled from his homeland in 1933 by the Nazi party and died shortly after.

**2013 nobel prize 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.

**2013 nobel prize chemistry: Nobel Prizes that Changed Medicine** Gilbert Thompson, 2012 This book brings together in one volume fifteen Nobel Prize-winning discoveries that have had the greatest impact upon medical science and the practice of medicine during the 20th century and up to the present time. Its overall aim is to enlighten, entertain and stimulate. This is especially so for those who are involved in or contemplating a career in medical research. Anyone interested in the particulars of a specific award or Laureate can obtain detailed information on the topic by accessing the Nobel Foundation's website. In contrast, this book aims to provide a less formal and more



personal view of the science and scientists involved, by having prominent academics write a chapter each about a Nobel Prize-winning discovery in their own areas of interest and expertise.

**2013 nobel prize chemistry: *Nobel Prizes and Life Sciences*** Erling Norrby, 2010 The Nobel Prizes in natural sciences have achieved the reputation of being the ultimate accolade for scientific achievements. This book gives a unique insight into the selection of Nobel Prize recipients, in particular the life sciences. The evolving mechanisms of selection of prize recipients are illustrated by reference to archives, which have remained secret for 50 years. Many of the prizes subjected to particular evaluation concern awards given for discoveries in the field of infectious diseases and the interconnected field of genetics. The book illustrates the individuals and environments that are conducive to scientific creativity. Nowhere is this enigmatic activity-- the mime mover in advancing the human condition highlighted as lucidly as by identification individuals worthy of Nobel Prizes. --Book Jacket.

**2013 nobel prize chemistry: *The Periodic Table and a Missed Nobel Prize*** Ulf Lagerkvist, 2012 In a relatively brief but masterful recounting, Professor Ulf Lagerkvist traces the origins and seminal developments in the field of chemistry, highlighting the discoveries and personalities of the individuals who transformed the ancient myths of the Greeks, the musings of the alchemists, the mystique of phlogiston into the realities and the laws governing the properties and behavior of the elements; in short, how chemistry became a true science. A centerpiece of this historical journey was the triumph by Dmitri Mendeleev who conceived the Periodic Law of the Elements, the relation between the properties of the elements and their atomic weights but more precisely their atomic number. Aside from providing order to the elements known at the time, the law predicted the existence and atomic order of elements not then known but were discovered soon after. An underlying but explicit intent of Lagerkvist's survey is to address what he believes was a gross injustice in denying Mendeleev the Nobel Prize in Chemistry in 1905 and again in 1906. Delving into the Royal Swedish Academy of Sciences' detailed records concerning the nominations, Lagerkvist reveals the judging criteria and the often heated and prejudicial arguments favoring and demeaning the contributions of the competing contenders of those years. Lagerkvist, who was a member of the Swedish Academy of Sciences and has participated in judging nominations for the chemistry prize, concludes It is in the nature of the Nobel Prize that there will always be a number candidates who obviously deserve to be rewarded but never get the accolade -- Mendeleev was one of those.

**2013 nobel prize chemistry: *Nobel Prize Winners of the World*** Prateeksha M. Tiwari, 2014-03-26 The Nobel Prize is awarded for achievements in physics, Chemistry, Medicine, and Literature and for Peace. The Nobel Prize is an international award given by the Nobel foundation in Stockholm, Sweden. In 1968, the prize in Economics was established in memory of Alfred Nobel, the founder of the Nobel Prize. Each Prize consists of medal, certificate of appreciation, and cash award. Founded in 1901 by the inventor of dynamite, Alfred Nobel, the Nobel Prize is the world's most celebrated honour. It grants its winners instant celebrity status and acclaim. It is very difficult to select the best out of best, because general perception is that a Nobel laureate is always the best in the concerned field. This book comprises brief biographies of many famous Nobel laureates. In last chapter, a list has been given that comprises the name of all the Nobel Prize winners in all six categories for the readers benefit. You would certainly find this book informative, inspiring and educative. It is a good reference book too.

**2013 nobel prize chemistry: *Nobel Prizes And Nature's Surprises*** Erling Norrby, 2013-10-10 Each year the Nobel Prizes in the natural sciences reveal amazing discoveries. New milestones in the relentless advance of science are identified. The growth of knowledge and its evolution can be researched in the Nobel archives where nominations are kept secret for 50 years after the awards have been made. They represent a treasure for real-time assessment of science. Norrby's earlier book, *Nobel Prizes and Life Sciences* (2010) examined the unique archival records until 1959. The present book takes us up to 1962, surveying a range of dazzling discoveries. All prizes in immunology are reviewed. Their impact on our capacity to control infectious diseases and transplant organs are highlighted. The Nobel year 1962 is exceptional in recognizing the most major advance in

biology since Darwin in 1859 presented his theory of evolution. This was the dramatic discovery of the double-helix structure of DNA by Watson and Crick in 1953. The era of molecular biology had begun. Its explosive development continues into the present.

**2013 nobel prize chemistry: Cathedrals of Science** Patrick Coffey, 2008-08-29 In *Cathedrals of Science*, Patrick Coffey describes how chemistry got its modern footing-how thirteen brilliant men and one woman struggled with the laws of the universe and with each other. They wanted to discover how the world worked, but they also wanted credit for making those discoveries, and their personalities often affected how that credit was assigned. Gilbert Lewis, for example, could be reclusive and resentful, and his enmity with Walther Nernst may have cost him the Nobel Prize; Irving Langmuir, gregarious and charming, rediscovered Lewis's theory of the chemical bond and received much of the credit for it. Langmuir's personality smoothed his path to the Nobel Prize over Lewis. Coffey deals with moral and societal issues as well. These same scientists were the first to be seen by their countries as military assets. Fritz Haber, dubbed the father of chemical warfare, pioneered the use of poison gas in World War I-vividly described-and Glenn Seaborg and Harold Urey were leaders in World War II's Manhattan Project; Urey and Linus Pauling worked for nuclear disarmament after the war. Science was not always fair, and many were excluded. The Nazis pushed Jewish scientists like Haber from their posts in the 1930s. Anti-Semitism was also a force in American chemistry, and few women were allowed in; Pauling, for example, used his influence to cut off the funding and block the publications of his rival, Dorothy Wrinch. *Cathedrals of Science* paints a colorful portrait of the building of modern chemistry from the late 19th to the mid-20th century.

**2013 nobel prize chemistry: Sir James Dewar, 1842-1923** J.S. Rowlinson, 2016-03-09 Sir James Dewar was a major figure in British chemistry for around 40 years. He held the posts of Jacksonian Professor of Natural Philosophy at Cambridge (1875-1923) and Fullerian Professor of Chemistry at the Royal Institution (1877-1923) and is remembered principally for his efforts to liquefy hydrogen successfully in the field that would come to be known as cryogenics. His experiments in this field led him to develop the vacuum flask, now more commonly known as the thermos, and in 1898 he was the first person to successfully liquefy hydrogen. A man of many interests, he was also, with Frederick Abel, the inventor of explosive cordite, an achievement that involved him in a major legal battle with Alfred Nobel. Indeed, Dewar's career saw him involved in a number of public quarrels with fellow scientists; he was a fierce and sometimes unscrupulous defender of his rights and his claims to priority in a way that throws much light on the scientific spirit and practice of his day. This, the first scholarly biography of Dewar, seeks to resurrect and reinterpret a man who was a giant of his time, but is now sadly overlooked. In so doing, the book will shed much new light on the scientific culture of the late-nineteenth and early-twentieth centuries and the development of the field of chemistry in Britain.

**2013 nobel prize chemistry: A Love of Discovery** Robert Karplus, 2002-01-31 Robert Karplus, a professor of physics at the University of California, Berkeley, USA, became a leader in the movement to reform elementary school science in the 1960s. This book selects the enduring aspects of his work and presents them for the scientists and science educators of today. In an era when 'science education for ALL students' has become the clarion call, the insights and works of Robert Karplus are as relevant now as they were in the 1960s, '70s, and '80s. This book tries to capture the essence of his life and work and presents selections of his published articles in a helpful context.

**2013 nobel prize chemistry: Peptides, Polypeptides, and Proteins** Elkan Rogers Blout, 1974

**2013 nobel prize chemistry: Robert Burns Woodward** Otto Theodor Benfey, Peter John Turnbull Morris, 2001 Robert Burns Woodward was the star of 20th-century organic chemistry. An MIT graduate by age 19, Woodward's ingenious notions about organic synthesis and his artful methodology were astounding. He is most famed for his synthesis of vitamin B12, which he undertook with Albert Eschenmoser, and for the orbital symmetry rules he developed with Roald Hoffmann. This volume presents Woodward's most celebrated papers and lectures--including the famous Cope lecture. Insightful commentaries and rarely seen photographs are also included.

**2013 nobel prize chemistry: Linus Pauling in His Own Words** Barbara Marinacci, 1995-10-30 Two-time Nobel Prize winner, Linus Pauling was known for his scientific discoveries and of his breadth of knowledge, which spanned disciplines. The author, who knew Pauling well, has chosen from among more than 60 years of essays, letters, articles, books, speeches and interviews. As Pauling himself says in the Introduction, This book will take me as close to writing my memoirs or autobiography as I shall ever get.

**2013 nobel prize 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.

**2013 nobel prize chemistry: Proteins** Charles L. Brooks, Martin Karplus, B. Montgomery Pettitt, 1991-01-16 Presenting a wide-ranging view of current developments in protein research, the papers in this collection, each written by highly regarded experts in the field, examine various aspects of protein structure, functions, dynamics, and experimentation. Topics include dynamical simulation methods, the biological role of atom fluctuations, protein folding, influences on protein dynamics, and a variety of analytical techniques, such as X-ray diffraction, vibrational spectroscopy, photodissociation and rebinding kinetics. This is part of a series devoted to providing general information on a wide variety of topics in chemical physics in order to stimulate new research and to serve as a text for beginners in a particular area of chemical physics.

**2013 nobel prize chemistry: The View from Castle Rock** Alice Munro, 2006-11-07 A "revelatory" (The Boston Globe), "exhilarating" (The New York Times Book Review) collection of twelve stories that "[redraw] the boundaries between fiction and memoir" (O: The Oprah Magazine), from Nobel Prize-winning author Alice Munro "Munro really does know magic: how to summon the spirits and the emotions that animate our lives."—The Washington Post Book World A BEST BOOK OF THE YEAR: The Washington Post, Slate, Rocky Mountain News, New York, The Kanas City Star A young boy, taken to Edinburgh's Castle Rock to look across the sea to America, catches a glimpse of his father's dream. Scottish immigrants experience love and loss on a journey that leads them to rural Ontario. Wives, mothers, fathers, and children move through uncertainty, ambivalence, and contemplation in these stories of hopes, adversity, and wonder. The View from Castle Rock reveals what is most essential in Munro's art: her compassionate understanding of ordinary lives.

**2013 nobel prize chemistry: A History of the Electron** Jaume Navarro, 2012-09-06 An intellectual biography of J. J. and G. P. Thomson for academics and graduate students, focusing on the concept of the electron.

**2013 nobel prize chemistry: Linus Pauling** Linus Pauling, Barclay Kamb, 2001 Linus Pauling wrote a stellar series of over 800 scientific papers spanning an amazing range of fields, some of which he himself initiated. This book is a selection of the most important of his writings in the fields of quantum mechanics, chemical bonding (covalent, ionic, metallic, and hydrogen bonding), molecular rotation and entropy, protein structure, hemoglobin, molecular disease, molecular evolution, the antibody mechanism, the molecular basis of anesthesia, orthomolecular medicine, radiation chemistry/biology, and nuclear structure. Through these papers the reader gets a fresh, unfiltered view of the genius of Pauling's many contributions to chemistry, chemical physics, molecular biology, and molecular medicine. Contents.: The Chemical Bond: Metallic Bonding;

Hydrogen Bonding; Crystal and Molecular Structure and Properties: Ionic Crystals and X-Ray Diffraction; Molecules in the Gas Phase and Electron Diffraction; Entropy and Molecular Rotation in Crystals and Liquids; and other papers. Readership: Chemists, biochemists, molecular biologists and physicists.

**2013 nobel prize chemistry: Brave Genius** Sean B. Carroll, 2014-09-23 The never-before-told account of the intersection of some of the most insightful minds of the 20th century, and a fascinating look at how war, resistance, and friendship can catalyze genius. In the spring of 1940, the aspiring but unknown writer Albert Camus and budding scientist Jacques Monod were quietly pursuing ordinary, separate lives in Paris. After the German invasion and occupation of France, each joined the Resistance to help liberate the country from the Nazis and ascended to prominent, dangerous roles. After the war and through twists of circumstance, they became friends, and through their passionate determination and rare talent they emerged as leading voices of modern literature and biology, each receiving the Nobel Prize in their respective fields. Drawing upon a wealth of previously unpublished and unknown material gathered over several years of research, *Brave Genius* tells the story of how each man endured the most terrible episode of the twentieth century and then blossomed into extraordinarily creative and engaged individuals. It is a story of the transformation of ordinary lives into exceptional lives by extraordinary events--of courage in the face of overwhelming adversity, the flowering of creative genius, deep friendship, and of profound concern for and insight into the human condition.

**2013 nobel prize 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.

**2013 nobel prize chemistry: Nobel** Michael Worek, 2010-06-03 The story of the winners of the world's most prestigious prize, now updated to include the 2009 recipients. The Nobel Prize is widely regarded as the most prestigious award one can receive. The Prize is administered by the Nobel Foundation, and the award ceremonies receive extensive media coverage. The awards are often politically controversial, and many winners use their acceptance speech to further favorite causes. Along with background information, the book provides a look at the 200 most famous and most interesting Nobel winners. The profiles are arranged by prize and by year. A photo or illustration appears with each profiled Laureate. Other illustrations help to explain complex subjects in science and make it easier for the reader to appreciate the accomplishments for which the prize has been awarded. A number of fascinating facts emerge from this lively account. For example, only 40 of the 829 Nobel Laureates have been women, among them Marie Curie, who won twice. Linus Pauling is the only person to have been awarded two Nobel Prizes in different categories, the 1954 Nobel Prize in Chemistry and the 1962 Nobel Peace Prize. The youngest Laureate is Lawrence Bragg, who was 25 years old when he received the Nobel Prize in Physics with his father in 1915. The oldest is Leonid Hurwicz, who was 90 years old when he received the 2007 Economics Prize. Two Laureates have declined the Nobel Prize: Jean-Paul Sartre, and Le Duc Tho. Other famous

names include Ernest Hemingway, Albert Einstein, Albert Schweitzer, James Watson and Francis Crick, Paul Krugman, Charles Kao, Elizabeth Blackburn and Barack Obama. Nobel: A Century of Prize Winners is sure to find a readership among the millions who follow the awards each year and want to understand more about the most important prize in the world.

**2013 nobel prize chemistry:** *The Posthumous Nobel Prize in Chemistry* Vera V. Mainz, E. Thomas Strom, 2019-09-23 A humorous overview and history of the Nobel Prizes, generally, and the chemistry prize in particular; who won, and why.

**2013 nobel prize chemistry: The Nature of the Chemical Bond and the Structure of Molecules and Crystals** Linus Pauling, 2023

**2013 nobel prize chemistry: Molecular Switches** Ben L. Feringa, Wesley R. Browne, 2011-08-04 Täglich benutzen wir Schalter, um strombetriebene Geräte an- und abzuschalten und kein Computer würde ohne sie funktionieren. Nach den gleichen Prinzipien funktionieren auch molekulare Schalter, die unter dem Einfluß ihrer Umwelt zwischen zwei definierten Zuständen wechseln können. Im Gegensatz zu den gewöhnlichen Schaltern sind molekulare Schalter aber außerordentlich klein und ihre Anwendung in der Nanotechnologie, Biomedizin und im Computerchipdesign öffnet neue Horizonte. Im vorliegenden Zweibänder berichten Herausgeber und Autoren über molekulare Schalter aus Katenanen und Rotaxanen, Fulgidien, Flüssigkristallen und Polypeptiden. Die Bandbreite der behandelten Themen reicht von chiroptischen Schaltern über multifunktionale Systeme bis hin zu molekularen logischen Schaltungen. Chemiker und Materialwissenschaftler in Industrie und Hochschule, die sich für einen der innovativsten Bereiche ihrer Wissenschaft interessieren, werden dieses Buch mit Gewinn lesen!

**2013 nobel prize chemistry: Principles of Chemistry** Donald R. Franceschetti, 2016 Provides students and researchers with an easy-to-understand introduction to the fundamentals of chemistry, from elements and molecules to chemical reactions and properties of matter.

**2013 nobel prize chemistry: Pioneers of Quantum Chemistry** E. Thomas Strom, Angela K. Wilson, 2013-09-19 Discusses the early history of quantum chemistry, stemming from 241st ACS National Meeting in Anaheim, California.

**2013 nobel prize chemistry: The Thread of Life** John Cowdery Kendrew, 1966

**2013 nobel prize chemistry: The Nobel Prize** Michael Worek, 2010 I would like . . . to help dreamers, they find it hard to get on in life. -- Alfred Nobel

**2013 nobel prize chemistry: CRISPR-Cas Systems** Rodolphe Barrangou, John van der Oost, 2012-12-13 CRISPR/Cas is a recently described defense system that protects bacteria and archaea against invasion by mobile genetic elements such as viruses and plasmids. A wide spectrum of distinct CRISPR/Cas systems has been identified in at least half of the available prokaryotic genomes. On-going structural and functional analyses have resulted in a far greater insight into the functions and possible applications of these systems, although many secrets remain to be discovered. In this book, experts summarize the state of the art in this exciting field.

**2013 nobel prize chemistry: The Handy Chemistry Answer Book** Justin P. Lomont, Ian C. Stewart, 2013-10-01 Don't be mixed up about chemistry! Simplify the complex chemical reactions that take place everywhere in our lives with this engaging, easy-to-follow, question-and-answer guide! Where would we be without atoms and compounds? Gas, liquids, solids, and plasma? Acids and bases? Bonds and reactions? Matter and energy? The Handy Chemistry Answer Book covers the building blocks of life and the universe. The secret life of atoms, how polar bears aren't actually white, why oil and water don't mix, and much, much more are revealed and explained. This informative guide covers the basics of chemistry (history, atomic structures, chemical bonds and reactions, organic and inorganic chemistry) to more advanced material (nuclear chemistry, biochemistry, physical and theoretical chemistry) by answering nearly 1,000 common chemistry questions, including ... What causes lightning? How does photosynthesis work? What are hard and soft Lewis acids and bases? What makes a fabric "waterproof"? What are the twelve principles of green chemistry? When did alchemists finally abandon trying to make gold? What is Le Chatelier's principle? What do the different octane ratings mean at the gas pump? What is genetic engineering?

Why is calcium important for strong bones? What is the 18-electron rule? Why does chocolate turn white as it ages? Chemical reactions that rule the world; their properties, structure, composition, behavior, and history are tackled and explained in plain English in *The Handy Chemistry Answer Book*. With many photos, illustrations, a few formulas, molecular diagrams, and other graphics, this fun, fact-filled tome is richly illustrated. A history of chemistry timeline, appendices on Nobel Prize in Chemistry winners, a bibliography, further reading section, glossary of terms, a table of physical constants, a table of conversion factors, and extensive index add to its usefulness.

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