PREFACE

This latest supplement of *Nobel Prize Winners* is a biographical reference work containing profiles of the men, women, and institutions that have received the Nobel Prize between 2002 and 2018. It follows the publication of the 1987 foundational edition, and three supplements, in 1992, 1997, and 2002. Intended for students and the general reader, all of these editions introduce the lives and achievements of the laureates, placing special emphasis on the body of work for which they were awarded the Nobel Prize.

Praise for former editions:

"Nobel Prize Winners seems to me to meet its declared aim very well. That is, it gives students and general readers, in easy-to-understand form, brief but authoritative sketches of the lives and work of hundreds of men and women whose ideas helped transform our century."

—Gerald Holton, Professor of Physics and History of Science, Harvard University

Following this Preface are two extremely valuable introductory essays—the first, "Alfred Nobel" by author, journalist and historian Alden Whitman, provides a look at the character of the man who conceived and endowed the Nobel Prize, sketching Nobel's early years, the rise of his vast industrial empire, and the diverse, often contradictory facets of his personality. The essay concludes by relating the singular circumstances in which Nobel dissolved his corporate holdings and, in an un-witnessed, handwritten document, bequeathed the bulk of his fortune to the prize that bears his name.

How Nobel's controversial will was executed through the establishment of an administrative foundation and three prize-awarding institutions is the subject of the second introductory essay, "The Nobel Prizes and Nobel Institutions," by Carl Gustaf Bernhard, who was president emeritus of the Royal Swedish Academy of Sciences and a former professor at the Karolinska Institute. Dr. Bernhard, who also served on the Nobel committee for the physiology or medicine prize, describes the structure of the Nobel Foundation and the function of the organizations that nominate and select the laureates. He discusses the constraints Nobel placed on the awards as well as the controversies the prizes have provoked over the years. Together, these essays explain the origin of the Nobel Prize, the criteria governing the selection of laureates, and the significance of the awards.

The main body of this edition of *Nobel Prize Winners*, comprises the biographical profiles of all 201 winners from 2002 to 2018, arranged alphabetically. Each profile offers a narrative overview of the laureate's life and career, while focusing on his or her prizewinning work and its significance. Each laureate, even if part of a two or three person winning team, has been given a separate profile. Although resulting in a certain amount of repetition in descriptions of joint work, this permits the reader to find in one place a unified account of an individual laureate's work.

All laureate biographies begin with helpful details, like birth and death dates, the category of prize he or she was awarded, and the name of any other individuals sharing the prize. The profile itself is written chronologically, with the following subheads: Early Life and Education; Career; and Impact. Readers will get a strong sense of the experiences and actions that led to this prestigious award, as well as accomplishments,

both personally and professionally, following the win. In addition, all profiles include bibliographies or further reading to enable readers to pursue their interest in greater depth; these sections supplement titles cited in the profiles, and include only works available in English.

Following the laureate profiles, this edition of *Nobel Prize Winners* ends with three helpful lists, all including winners from 1901 to 2018:

- Nobel Prize Winners by Category & Year: 1901-2018
- Nobel Prize Winners by Country, Year & Category: 1901-2018
- Nobel Prize Winners by Year: 1901-2018

ALFRED NOBEL

by Alden Whitman

Alfred Nobel, the Swedish chemical experimenter and businessman who invented dynamite and other explosive compounds and whose will established the prizes that have brought him lasting fame, was a person of many paradoxes and contradictions. His contemporaries in the last half of the nineteenth century often found him perplexing because he did not quite fit the mold of the successful capitalist of his expansionist era. For one thing, Nobel was fonder of seclusion and tranquility than of ostentation and urban life, although he lived in cities most of his life and traveled widely. Unlike many contemporary barons of business, Nobel was spartan in his habits; he neither smoked nor drank, and he eschewed cards and other games. While his heritage was Swedish, he was a cosmopolitan European, comfortable with the French, German, Russian, and English languages as well as with his native tongue. Despite the heavy demands of his business and industrial affairs, he managed to build a well-stocked library and was well acquainted with the works of such authors as Herbert Spencer, the British philosopher and exponent of social Darwinism; Voltaire; and Shakespeare. Of nineteenth-century men of letters, he most admired a number of French writers: the Romantic novelist and poet Victor Hugo; Guy de Maupassant, the short story craftsman; Honoré de Balzac, the novelist whose keen eye pierced the human comedy; and the poet Alphonse de Lamartine. He also liked to read the works of the Russian novelist Ivan Turgenev and the Norwegian playwright and poet Henrik Ibsen. The naturalism of the French novelist Émile Zola, however, left him cold. Above all, he loved the poetry of Percy Bysshe Shelley, whose works inspired in him an early resolve to embark on a literary career. To that end, he wrote a considerable number of plays, novels, and poems, only one of which was published. He then turned instead to a career in chemistry.

Likewise puzzling to his fellow entrepreneurs was Nobel's reputation for holding advanced social views. The notion that he was a socialist was,

in fact, quite undeserved, for he was actually an economic and political conservative who opposed suffrage for women and expressed grave doubts about democracy. Nevertheless, as much as Nobel lacked confidence in the political wisdom of the masses, he despised despotism. As an employer of many hundreds of workers, he took a paternalistic interest in their welfare, without wishing to establish any personal contact. Shrewdly, he realized that a work force with high morale is more productive than a crudely exploited one, which may well have been the basis for Nobel's reputation as a socialist.

Nobel was quite unassuming and even reticent about himself. He had few confidants and never kept a diary. Yet at dinner parties and among friends, he was an attentive listener, always courteous and considerate. The dinners given at his home in one of the most fashionable neighborhoods of Paris were convivial and elegant, for he was a well-informed host able to call upon a fund of small talk. He could strike off words of incisive wit when the occasion arose, for instance once remarking, "All Frenchmen are under the

THE NOBEL PRIZES AND NOBEL INSTITUTIONS

by Carl Gustaf Bernhard

Alfred Nobel died on December 10, 1896. In his remarkable will, written in Paris on November 27, 1895, Nobel stated:

> *The whole of my remaining realizable estate shall be dealt with in the following way:*
>
> *The capital shall be invested by my executors in safe securities and shall constitute a fund, the interest on which shall be annually distributed in the form of prizes to those who, during the preceding year, shall have conferred the greatest benefit on mankind. The said interest shall be divided into five equal parts, which shall be apportioned as follows: one part to the person who shall have made the most important discovery or invention within the field of physics; one part to the person who shall have made the most important chemical discovery or improvement; one part to the person who shall have made the most important discovery within the domain of physiology or medicine; one part to the person who shall have produced in the field of literature the most outstanding work of an idealistic tendency; and one part to the person who shall have done the most or the best work for fraternity among nations, for the abolition or reduction of standing armies, and for the holding and promotion of peace congresses.*
>
> *The prizes for physics and chemistry shall be awarded by the [Royal] Swedish Academy of Sciences; that for physiological or medical works by the Karolinska Institute in Stockholm; that for literature by the [Swedish] Academy in Stockholm; and that for champions of peace by a committee of five persons to be elected by the Norwegian Storting [Parliament]. It is my express wish that in awarding the prizes no consideration whatever shall be given to the nationality of the candidates, so that the most worthy shall receive the prize, whether he be a Scandinavian or not.*

The invitation to assume the responsibility of selecting laureates was accepted by the awarding bodies designated in Nobel's will only after considerable discussion. Several members of these organizations were doubtful and, referring to the vague formulation of the will, claimed that it would be difficult to implement. In spite of these reservations, in 1900 the Nobel Foundation was established and statutes were worked out by a special committee on the basis of the will's stipulations.

The foundation, an independent, nongovernment organization has the responsibility of administering the funds in a manner "destined to safeguard the financial basis for the prizes, and for the activities associated with the selection of prizewinners." The foundation also protects the common interests of the prize-awarding institutions and represents the Nobel institutions externally. In this capacity the foundation arranges the annual Nobel Prize ceremonies on behalf of the awarding institutions. The Nobel Foundation itself is not involved in proposing candidates, in the evaluation process, or in the final selections. These functions are all performed independently by the prize-awarding assemblies. Today, the Nobel Foundation also administers the Nobel Symposia, which since 1966 have been supported mainly through grants to the foundation from the Bank of Sweden's Tercentenary Foundation.

The statutes for the Nobel Foundation and the special regulations of the awarding institutions were promulgated by the King in Council on June 29, 1900. The first Nobel Prizes were awarded on December 10, 1901. The political union between Norway and Sweden came to a peaceful end in 1905. As a result, the current special regulations for the body awarding the peace prize, the Norwegian Nobel Committee, are dated April 10, 1905.

In 1968 the Bank of Sweden at its tercentenary made a donation for a prize in the economic sciences. After some hesitation, the Royal Swedish Academy of Sciences accepted the role of

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Alexei A. Abrikosov

Nobel Prize in Physics, 2003

Shared with: Vitaly Ginzburg, Anthony James Leggett

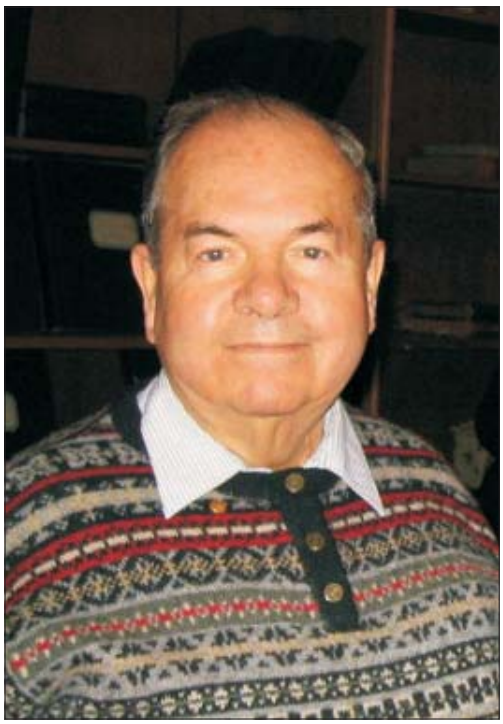
Born: June 25, 1928
Died: March 29, 2017
Birthplace: Moscow, U.S.S.R. (now Russia)

Early Life and Education

Alexei Alexeyevich Abrikosov was born on June 25, 1928, in Moscow in the Soviet Union (now Russia). After graduating from Moscow State University in 1948, Abrikosov was admitted to the Kapitza Institute for Physical Problems in Moscow. In 1951 he earned a doctorate in physics from the institute based on his dissertation, which explored the theory of thermal diffusion in plasma. Four years later, Abrikosov received his second doctorate in physics from the institute for his dissertation on quantum electrodynamics at high energies.

Career

As a research associate with the Kapitza Institute, Abrikosov began conducting research into the phenomenon of superconductivity. Superconductivity was discovered in 1911 by the Dutch physicist Heike Kamerlingh Onnes (1853-1926), who observed that electrical resistance disappeared in mercury when it was cooled to just a few degrees above absolute zero. Kamerlingh Onnes's discovery earned him the Nobel Prize in Physics in 1913. In 1950 two Russian physicists, Vitaly Ginzburg and Lev Landau, published a scientific paper



Alexei Abrikosov in 2003.

that offered a theory of how superconductivity worked. Ginzburg and Landau devised mathematical equations that explained why superconductivity and magnetism could coexist in some superconducting materials but not others. (Landau won the Nobel Prize in Physics in 1962. Ginzburg shared the Nobel Prize in Physics in 2003 with Abrikosov and Anthony Leggett, a British physicist.) Abrikosov's colleague and roommate at the institute, Nikolay Zavaritskii, began measuring the critical magnetic field of thin superconducting films to see if Ginzburg and Landau were correct in predicting their behavior. "[Ginzburg's and Landau's theory] and experiment fitted perfectly, including the change of the nature of the transition: first order at larger thickness and second order at smaller ones," Abrikosov recalled in his Nobel lecture, as posted on the Nobel e-Museum website.

Zavaritskii's supervisor, Alexander Salnikov, was not satisfied with the results, however, because the young physicist had used films that were prepared at room temperature. "The atoms of the metal, evaporated on a glass substrate, could agglomerate, and there the film actually consisted of small droplets," Abrikosov recalled in his lecture. "In order to avoid that, Salnikov recommended to maintain the glass substrate at helium temperature during evaporation and until the measurements were finished. Then every metal atom hitting the surface would stick to its place, and the film would be homogeneous." When he tried the experiment again, following Salnikov's instructions, Zavaritskii found that the results did not confirm Ginzburg's and Landau's predictions. "Discussing these results with Zavaritskii, we couldn't believe that the theory was wrong: it was so beautiful, and fitted so well [with] the previous data," Abrikosov said in his lecture. "Therefore, we tried to find some solution in the framework of the theory itself."

Abrikosov found that the Ginzburg-Landau parameter, which formed the basis of the two physicists' equations, had small values because they were calculated from the surface energy between the normal and superconducting phases of the superconductor. When the value of the parameter was increased, the surface energy between the normal and superconducting phases became negative. Ginzburg and Landau kept the value of their parameter small because the existence of negative surface energy contradicted the existence of the intermediate state in a superconductor. Abrikosov experimented with negative surface energy and discovered that the transition was of the second order for superconducting films of any thickness. He concluded that a special type of superconductors existed, which he and his colleagues called superconductors of the second group. These eventually became known as Type-II superconductors. Ginzburg and Landau had used Type-I superconductors, which expel magnetic fields, in their experiments. By contrast, Type-II superconductors allow superconductivity and magnetism to co-exist. In 1952 Abrikosov published his findings in a Russian scientific journal.

Next, Abrikosov devoted his attention to examining the magnetic properties of Type-II superconductors. "The solution of the Ginzburg-Landau equation in the form of an infinitesimal superconducting layer in a normal sea of electrons was already contained in their paper," Abrikosov wrote in an article for *Physics Today* (January 1973). "Starting from this solution I found that below the limiting critical field, which is the stability limit of every superconducting nucleation, a new and very popular phase arose, with a periodic distribution of the [wave] function, magnetic field and current. I called it the 'mixed state.'" Abrikosov devised mathematical equations that explained how a magnetic field successfully penetrated Type-II superconductors and was able to coexist with superconductivity. "By an insightful analysis of the Ginzburg- Landau equations he was able to show vortices may form in the spatial distribution of the order parameter and how a magnetic field through these can penetrate the superconductor," Professor Mats Jonsson said in his presentation speech to the Nobel laure-

ates, as posted on the Nobel e-Museum website. "The vortices are essentially of the same type as those we can see form in the water when we empty a bath tub." In 1953 Abrikosov shared his theory with Landau. Although he was initially intrigued by Abrikosov's research, Landau strongly rejected the idea that vortices allowed magnetism to penetrate the superconductor. Abrikosov decided to postpone publishing his paper. "I put it in a drawer, but I did not put it in the wastepaper basket because I believed in it," he recalled to Jeremy Manier and James Janega for the *Chicago Tribune* (8 Oct. 2003). In 1957 Abrikosov finally published his paper in a Russian scientific journal. The same year, Abrikosov's paper was translated into English and published in the *Journal of Physics and Chemistry of Solids.* Unfortunately, the translated article contained numerous errors in the equations and the text.

Abrikosov's work, however, was gradually vindicated, as more Type-II superconducting metals, which can carry more electricity than Type-I materials, were discovered during the 1960s. Abrikosov was eventually named a senior scientist at the Institute of Physical Problems. In 1965 he became the head of the L.D. Landau Institute of Theoretical Physics of the USSR Academy of Sciences in Moscow. Abrikosov has also taught at Moscow State University, Gorky University, and the Moscow Physical English Institute. In 1988 Abrikosov became the head of the Institute of High Pressure Physics in Moscow.

Disillusioned by life in the Soviet Union, Abrikosov came to the United States in the spring of 1991, months before the collapse of the USSR. In the United States he joined the Argonne National Laboratory in Illinois, as the Argonne Distinguished Scientist at the Condensed Matter Theory Group of the Materials Science Division. Explaining his decision to emigrate to the United States, Abrikosov told Margaret Shapiro for *The Washington Post* (23 Nov. 1991), "If you spend all day trying to get a car fixed and trying to find food, it doesn't stimulate theoretical research." He became a citizen of the United States in 1999. At the Argonne National Laboratory, Abrikosov pursued research in the fields of high-temperature superconductors and colossal magnetoresistance (CMR) manganates.

On October 8, 2003, Alexei A. Abrikosov, along with Vitaly L. Ginzburg and Anthony J. Leggett, was awarded the Nobel Prize in Physics "for pioneering contributions to the theory of superconductors and superfluids." He earned the award because he had explained how "type-II superconductors allow superconductivity and magnetism to exist at the same time and remain superconductive in high magnetic fields," according to the press release from the Nobel committee.

Abrikosov published several books on physics and numerous scientific papers. He died on March 29, 2017, at his home in Sunnyvale, California. He was eighty-eight years old.

Impact

Alexei Abrikosov's work in theoretical physics helped to explain how certain metals could conduct electricity without resistance, a property called superconductivity. Abrikosov theorized what are now called "Abrikosov vortices" (sometimes also called fluxons). An Abrikosov vortex is a vortex of supercurrent in a Type-II superconductor. Superconductivity was first observed in 1911, and the emergence of a coherent explanation for the unusual property is widely considered to have been one of the great achievements in physics in the twentieth century. Newer research into superconductivity has focused on the discovery of superconductors that work at higher temperatures. Many challenges continue to exist in exploiting superconductivity for practical purposes, and it still remains an exciting field for scientific discovery.

Bibliography

Abrikosov, A. A. "My Years with Landau." *Physics Today,* vol. 26, no. 1, 1 Jan. 1973, pp. 6-60, doi.org/10.1063/1.3127896. Accessed 5 Nov. 2018.

NOBEL PRIZE WINNERS BY CATEGORY & YEAR: 1901-2018

Nobel Prize in Chemistry

1901 Jacobus van't Hoff
1902 Emil Fischer
1903 Svante Arrhenius
1904 William Ramsay
1905 Adolf von Baeyer
1906 Henri Moissan
1907 Eduard Buchner
1908 Ernest Rutherford
1909 Wilhelm Ostwald
1910 Otto Wallach
1911 Marie Curie
1912 Victor Grignard
Paul Sabatier
1913 Alfred Werner
1914 Theodore W. Richards
1915 Richard Willstätter
1918 Fritz Haber
1920 Walther Nernst
1921 Frederick Soddy
1922 Francis W. Aston
1923 Fritz Pregl
1925 Richard Zsigmondy
1926 Teodor Svedberg
1927 Heinrich Wieland
1928 Adolf Windaus
1929 Hans von Euler-Chelpin
Arthur Harden
1930 Hans Fischer
1931 Friedrich Bergius
Carl Bosch
1932 Irving Langmuir
1934 Harold C. Urey
1935 Frédéric Joliot
Irène Joliot-Curie
1936 Peter Debye
1937 Walter N. Haworth
Paul Karrer
1938 Richard Kuhn
1939 Adolf Butenandt
Leopold Ružička
1943 George de Hevesy
1944 Otto Hahn
1945 Artturi Virtanen
1946 John H. Northrop
Wendell M. Stanley
James B. Sumner
1947 Robert Robinson
1948 Arne Tiselius
1949 William F. Giauque
1950 Kurt Alder
Otto Diels
1951 Edwin M. McMillan
Glenn T. Seaborg
1952 Archer Martin
Richard Synge
1953 Hermann Staudinger
1954 Linus C. Pauling
1955 Vincent du Vigneaud
1956 Cyril N. Hinshelwood
Nikolay N. Semenov
1957 Alexander Todd
1958 Frederick Sanger
1959 Jaroslav Heyrovský
1960 Willard F. Libby
1961 Melvin Calvin
1962 John C. Kendrew
Max Perutz
1963 Giulio Natta
Karl Ziegler
1964 Dorothy C. Hodgkin
1965 R. B. Woodward
1966 Robert S. Mulliken
1967 Manfred Eigen
Ronald Norrish
George Porter
1968 Lars Onsager
1969 Derek Barton
Odd Hassel
1970 Luis F. Leloir
1971 Gerhard Herzberg
1972 Christian Anfinsen
Stanford Moore
William H. Stein
1973 Ernst Fischer
Geoffrey Wilkinson
1974 Paul J. Flory
1975 John W. Cornforth
Vladimir Prelog
1976 William N. Lipscomb
1977 Ilya Prigogine
1978 Peter D. Mitchell
1979 Herbert C. Brown
Georg Wittig
1980 Paul Berg
Walter Gilbert
Frederick Sanger
1981 Kenichi Fukui
Roald Hoffmann
1982 Aaron Klug
1983 Henry Taube
1984 R. Bruce Merrifield
1985 Herbert A. Hauptman
Jerome Karle
1986 Dudley R. Herschbach
Yuan T. Lee
John C. Polanyi
1987 Donald J. Cram
Jean-Marie Lehn
Charles J. Pedersen
1988 Johann Deisenhofer

NOBEL PRIZE WINNERS BY COUNTRY, CATEGORY & YEAR: 1901-2018

Countries listed are based on data supplied by the Nobel Foundation.
Where multiple countries are attributed to one winner, each country is listed.
Where a prize has multiple winners, the country of each winner is credited.

Algeria

1957	Literature	Albert Camus

Argentina

1936	Peace	Carlos Saavedra Lamas
1947	Physiology or Medicine	Bernardo Houssay
1970	Chemistry	Luis F. Leloir
1980	Peace	Adolfo Pérez Esquivel
1984	Physiology or Medicine	César Milstein

Australia

1915	Physics	William Lawrence Bragg
1945	Physiology or Medicine	Howard W. Florey
1960	Physiology or Medicine	Macfarlane Burnet
1963	Physiology or Medicine	John C. Eccles
1973	Literature	Patrick White
1975	Chemistry	John W. Cornforth
1996	Physiology or Medicine	Peter Doherty
2003	Literature	John M. Coetzee
2005	Physiology or Medicine	Barry J. Marshall
		J. Robin Warren
2009	Physiology or Medicine	Elizabeth H. Blackburn
2011	Physics	Brian P. Schmidt
2013	Chemistry	Martin Karplus

Austria

1911	Peace	Alfred Fried (then Austria-Hungary)
1914	Physiology or Medicine	Robert Bárány (then Austria-Hungary)
1927	Physiology or Medicine	Julius Wagner von Jauregg
1930	Physiology or Medicine	Karl Landsteiner
1933	Physics	Erwin Schrödinger
1936	Physics	Victor Francis Hess
	Physiology or Medicine	Otto Loewi
1945	Physics	Wolfgang Pauli
1973	Physiology or Medicine	Konrad Lenz
1974	Economic Sciences	Friedrich A. von Hayek
1923	Chemistry	Fritz Pregl
2004	Literature	Elfriede Jelinek
2013	Chemistry	Martin Karplus

Bangladesh

2006	Peace	Grameen Bank
		Muhammad Yunus