

FLYGPOST-PARAVION FLYGPOST-PARAVION

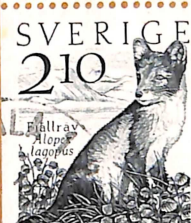
Professor M. Schenberg
Institute of Physics
University of Sao Paulo
CP 20516

SAO PAULO
- Brasilien -

*Permanently
Nobel*

NOBEL COMMITTEES
ROYAL ACADEMY OF SCIENCES
STUREGATAN 14
S-114 36 STOCKHOLM
SWEDEN

UPPSALA
1 10
84





Professor M. Schenberg
Sao Paulo

On behalf of the Swedish Royal Academy of Sciences we, as members of the Nobel Committee for Physics, have the honour of inviting you to submit proposals for the award of

The Nobel prize for Physics for 1985.

According to the Rules of the Nobel Foundation the discovery or invention should be indicated for which the award is proposed and full reasons given for the suggestion. Work done in the past may be selected for the award only on the supposition that its significance has until recently not been fully appreciated.

The person nominating a candidate is requested, neither to make known his nomination, nor to inform his nominee of the nomination.

A summary of the regulations governing awards is appended as well as a form which may be used for the proposal of candidate(s).

Proposals, which should be addressed to The Nobel Committee for Physics, Sturegatan 14, S-11436 Stockholm, Sweden, cannot be considered unless received by the Committee not later than 31 January 1985.

Stockholm, September 1984,

STIG LUNDQVIST
CHAIRMAN

GÖSTA EKSPÅNG

SVEN JOHANSSON

INGVAR LINDGREN

PER OLOV LÖWDIN

BENGT NAGEL
SECRETARY

**EXCERPTS FROM STATUTES
OF THE NOBEL FOUNDATION**

given at the Royal Palace of Stockholm on the 29th day of June 1900
with amendments

§ 1

The Nobel Foundation is established under the terms of the will of Dr. Alfred Bernhard Nobel, drawn up on the 27th of November, 1895, which in its relevant parts runs as follows:

"The whole of my remaining realizable estate shall be dealt with in the following way: the capital, invested in safe securities by my executors, 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 between 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 Swedish Academy of Sciences; that for physiological or medical works by the Caroline Institute in Stockholm; that for literature by the Academy in Stockholm, and that for champions of peace by a committee of five persons to be elected by the Norwegian Storting. It is my express wish that in awarding the prizes no consideration whatever shall be given to the nationality of the candidates, but that the most worthy shall receive the prize, whether he be a Scandinavian or not."

§ 2

The provision in the will that the annual award of prizes shall be intended for works "during the preceding year" shall be understood in the sense that the awards shall be made for the most recent achievements in the fields of culture referred to in the will and for older works only if their significance has not become apparent until recently.

§ 3

To be eligible for consideration for the award of a prize, a written work shall have been issued in print.

§ 4

A prize may be equally divided between two works each of which may be considered to merit a prize. Has a work, which is to be rewarded, been produced by two or three persons, the prize shall be awarded to them jointly. In no case may a prize be divided between more than three persons.

Work produced by a person since deceased shall not be considered for an award; if, however, a prize-winner dies before he has received the prize, then the prize may be presented.

§ 6

For each Swedish prize section the prize-awarding body shall appoint a "Nobel Committee", consisting of three, four or five persons, to give their opinion in the matter of the award of prizes.

§ 7

No person may be considered eligible for an award unless nominated in writing by a person competent to make such nominations. Personal applications for an award may not be considered.

§ 9

On the Festival Day of the Foundation, which is the 10th of December, the anniversary of the death of the testator, the prize-awarding bodies shall present to each prize-winner a cheque for the amount of the prize, a diploma, and a gold medal bearing the image of the testator and an appropriate inscription.

§ 10

No appeal may be made against the decision of a prize-awarding body with regard to the award of a prize.

Proposals received for the award of a prize, and investigations and opinions concerning the award of a prize may not be divulged. Should divergent opinions have been expressed in connection with the decision of a prize-awarding body concerning the award of a prize, these may not be included in the record or otherwise divulged.

A prize-awarding body may, however, after due consideration in each individual case, permit access to material which formed the basis for evaluation and decision concerning a prize, for purposes of historical research. Such permission may not be granted until at least 50 years have elapsed after the date on which the decision in question was taken.

**EXCERPTS FROM STATUTES CONTAINING
SPECIAL REGULATIONS FOR THE AWARD OF
PRIZES FROM THE NOBEL FOUNDATION BY THE
ROYAL ACADEMY OF SCIENCES, etc.**

given at the Royal Palace of Stockholm on the 29th day of June 1900
with amendments

§ 1

Competence to submit proposals for the award of prizes, as laid down in § 7 of the Statutes of the Nobel Foundation, shall be enjoyed by:

1. Swedish and foreign members of the Academy of Sciences;
2. Members of the Nobel Committees for Physics and Chemistry;
3. Scientists who have been awarded the Nobel Prize by the Academy of Sciences;
4. Permanent and acting professors in the sciences of Physics and Chemistry at the universities and institutes of technology of Sweden, Denmark, Finland, Iceland and Norway, and at the Caroline Institute;
5. Holders of corresponding chairs in at least six universities or university colleges selected by the Academy of Sciences with a view to ensuring the appropriate distribution of the commission over the different countries and their seats of learning; and
6. Other scientists from whom the Academy may see fit to invite proposals.

Decisions as to the selection of the teachers and scientists referred to in paragraphs 5 and 6 above shall be taken each year before the end of the month of September.

§ 7

Before the end of September, the Nobel Committee shall submit to the Academy its opinion and proposals for the award of prizes.

Subsequently, and before the end of October at the latest, that class of the Academy which is concerned shall submit to the Academy its comments and observations in the matter. If the class in

question deems it necessary for that purpose, it may co-opt a specially qualified member from another class of the Academy.

The Academy shall take up the matter for a final decision before the middle of the following November.

§ 8

The deliberations, opinions and proposals of the Nobel Committees and classes in connection with the award of prizes may not be made public or otherwise revealed other than in accordance with the provi-

sions of article 10, paragraph 3 of the Statutes of the Nobel Foundation.

In considering an application under article 10, paragraph 3 of the Statutes of the Nobel Foundation, the rule shall be that material relating to the research work of a named person may not be released during that persons's lifetime. If an application is made for the release of material which includes a special investigation or opinion by a named person who is still alive, the material may not be released without the consent of the person concerned.

NOMINATION FOR THE AWARD OF THE 1985 NOBEL PRIZE FOR PHYSICS

Candidate(s):

Name

Position or title

Address (Institution)

Name

Position or title

Address (Institution)

Name

Position or title

Address (Institution)

The nomination concerns the discovery (invention) of

Grounds for nomination. (Detailed specification of grounds, bibliography, curriculum vitae and other relevant documents may be appended.)

Nominator

Position or title

Address (Institution)

Signature of nominator

Date

SWEDISH ROYAL ACADEMY OF SCIENCES
THE NOBEL COMMITTEES
STOCKHOLM · SWEDEN

List of
the Nobel Prize Winners

Printed in Sweden
ALMQVIST & WIKSELL
UPPSALA 1984

The Nobel Prize for Physics has been awarded as follows:

- In 1901: to Professor *W. C. Röntgen*, Munich, for the discovery of the remarkable rays subsequently named after him.
- In 1902: half each to Professor *H. A. Lorentz*, Leiden, and Professor *P. Zeeman*, Amsterdam, for their researches into the influence of magnetism upon radiation phenomena.
- In 1903: half to *H. A. Becquerel*, Professor at the École Polytechnique, Paris, for his discovery of spontaneous radioactivity, and the other half to Professor *P. Curie* and Mme *Marie Curie*, Paris, for their joint researches on the radiation phenomena discovered by Professor Henri Becquerel.
- In 1904: to Lord *Rayleigh*, London, for his investigations of the densities of the most important gases and for his discovery of argon in connection with these studies.
- In 1905: to Professor *P. Lenard*, Kiel, for his work on cathode rays.
- In 1906: to Professor *J. J. Thomson*, Cambridge, England, for his theoretical and experimental investigations on the conduction of electricity by gases.
- In 1907: to Professor *A. A. Michelson*, Chicago, Ill., for his optical precision instruments and the spectroscopic and metrological investigations carried out with their aid.
- In 1908: to Professor *G. Lippmann*, Paris, for his method of reproducing colours photographically based on the phenomenon of interference.
- In 1909: half each to Mr *G. Marconi*, London, and Professor *F. Braun*, Strasbourg, for their contributions to the development of wireless telegraphy.
- In 1910: to *J. D. van der Waals*, Professor Emeritus, Amsterdam, for his work on the equation of state for gases and liquids.
- In 1911: to Professor *W. Wien*, Würzburg, for his discoveries regarding the laws governing the radiation of heat.
- In 1912: to Mr *G. Dalén*, Stockholm, for his invention of automatic regulators for use in conjunction with gas accumulators for illuminating lighthouses and buoys.
- In 1913: to Professor *H. Kamerlingh Onnes*, Leiden, for his investigations on the properties of matter at low temperatures which led, *inter alia*, to the production of liquid helium.
- In 1914: to Professor *M. von Laue*, Frankfort o/M., for his discovery of the diffraction of X-rays by crystals.
- In 1915: half each to Professor *W. H. Bragg*, London, and *W. L. Bragg*, Manchester, for their analysis of crystal structure by means of X-rays.
- In 1916: the prize was not awarded.
- The prize for 1917: awarded in 1918 to Professor *C. G. Barkla*, Edinburgh, for his discovery of the characteristic Röntgen radiation of the elements.
- The prize for 1918: awarded in 1919 to Professor *M. Planck*, Berlin, in recognition of the services he rendered to the advancement of Physics by his discovery of energy quanta.

- In 1919: to Professor *J. Stark*, Greifswald, for his discovery of the Doppler effect in canal rays and of the splitting of spectral lines in electric fields.
- In 1920: to Director *Ch. E. Guillaume*, Sèvres, in recognition of the service he has rendered to precise measurements in Physics by his discovery of anomalies in nickel steel alloys.
- The prize for 1921: awarded in 1922 to Professor *A. Einstein*, Berlin, for services to Theoretical Physics, and especially for his discovery of the law of the photo-electric effect.
- In 1922: to Professor *N. Bohr*, Copenhagen, for his investigations of the structure of atoms, and of the radiation emanating from them.
- In 1923: to Professor *R. A. Millikan*, Pasadena, Cal., for his work on the elementary charge of electricity and on the photo-electric effect.
- The prize for 1924: awarded in 1925 to Professor *M. Siegbahn*, Upsala, for his discoveries and researches in the field of X-ray spectroscopy.
- The prize for 1925: awarded in 1926 one half each to Professor *J. Franck*, Göttingen, and Professor *G. Hertz*, Halle a. S., for their discovery of the laws governing the impact of an electron upon an atom.
- In 1926: to Professor *J. Perrin*, Paris, for his work on the discontinuous structure of matter, and especially for his discovery of sedimentation equilibrium.
- In 1927: half each to Professor *A. H. Compton*, Chicago, Ill., for his discovery of the effect named after him, and to Professor *C. T. R. Wilson*, Cambridge, England, for his method of making the paths of electrically charged particles visible by condensation of vapour.
- The prize for 1928: awarded in 1929 to Professor *O. W. Richardson*, London, for his work on the thermionic phenomenon and especially for his discovery of the law named after him.
- In 1929: to Prince *L. V. de Broglie*, Paris, for his discovery of the wave nature of electrons.
- In 1930: to Sir *Venkata Raman*, Calcutta, for his work on the scattering of light and for the discovery of the effect named after him.
- In 1931: the prize was not awarded.
- The prize for 1932: awarded in 1933 to Professor *W. Heisenberg*, Leipzig, for the creation of quantum mechanics, the application of which has, *inter alia*, led to the discovery of the allotropic forms of hydrogen.
- In 1933: half each to Professor *E. Schrödinger*, Berlin, and Professor *P. A. M. Dirac*, Cambridge, England, for the discovery of new productive forms of atomic theory.
- In 1934: the prize was not awarded.
- In 1935: to Professor *J. Chadwick*, Liverpool, for his discovery of the neutron.
- In 1936: half each to Professor *V. F. Hess*, Innsbruck, for his discovery of cosmic radiation, and to Dr. *C. D. Anderson*, Pasadena, Cal., for his discovery of the positron.
- In 1937: half each to Dr. *C. J. Davisson*, New York, N.Y., and Professor *G. P. Thomson*, London, for their experimental discovery of the diffraction of electrons by crystals.

- In 1938: to Professor *E. Fermi*, Rome, for his demonstrations of the existence of new radioactive elements produced by neutron irradiation, and for his related discovery of nuclear reactions brought about by slow neutrons.
- In 1939: to Professor *E. O. Lawrence*, Berkeley, Cal., for the invention and development of the cyclotron and for results obtained with it, especially with regard to artificial radioactive elements.
- In 1940: the prize was not awarded.
- In 1941: the prize was not awarded.
- In 1942: the prize was not awarded.
- The prize for 1943: awarded in 1944 to Professor *O. Stern*, Pittsburgh, Pa., for his contributions to the development of the molecular ray method and his discovery of the magnetic moment of the proton.
- In 1944: to Professor *J. J. Rabi*, New York, N.Y., for his resonance method for recording the magnetic properties of atomic nuclei.
- In 1945: to Professor *W. Pauli*, Zurich, for the discovery of the Exclusion Principle, also called the Pauli Principle.
- In 1946: to Professor *P. W. Bridgman*, Harvard University, Mass., for the invention of an apparatus to produce extremely high pressures and for the discoveries he made in the field of high pressure physics.
- In 1947: to Sir *E. V. Appleton*, London, for his investigations of the physics of the upper atmosphere, especially for the discovery of the so-called Appleton layer.
- In 1948: to Professor *P. M. S. Blackett*, Manchester, for his development of the Wilson cloud chamber method and his discoveries therewith in the field of nuclear physics and cosmic radiation.
- In 1949: to Professor *H. Yukawa*, Kyoto, for his prediction of the existence of mesons on the basis of theoretical work on nuclear forces.
- In 1950: to Professor *C. F. Powell*, Bristol, for his development of the photographic method of studying nuclear processes and his discoveries regarding mesons made with this method.
- In 1951: half each to Sir *J. D. Cockcroft*, Harwell, and Professor *E. T. S. Walton*, Dublin, for their pioneer work on the transmutation of atomic nuclei by artificially accelerated atomic particles.
- In 1952: half each to Professor *F. Bloch*, Stanford University, Cal., and Professor *E. M. Purcell*, Harvard University, Mass., for the development of new methods for nuclear magnetic precision measurements and the discoveries in connection therewith.
- In 1953: to Professor *F. Zernike*, Groningen, for his demonstration of the phase contrast method, especially for his invention of the phase contrast microscope.
- In 1954: half each to Professor *Max Born*, Edinburgh, for his fundamental research in quantum mechanics, especially for his statistical interpretation of the wavefunction, and to Professor *W. Bothe*, Heidelberg, for the coincidence method and his discoveries made therewith.
- In 1955: half each to Professor *W. E. Lamb*, Stanford University, Cal., for his discoveries concerning the fine structure of the hydrogen spectrum, and Professor *P. Kusch*, New York, N.Y., for his precision determination of the magnetic moment of the electron.

- In 1956: one third each to Professor *W. Shockley*, Pasadena, Cal., Professor *J. Bardeen*, Urbana, Ill., and Dr. *W. H. Brattain*, Murray Hill, N.J., for their investigations on semiconductors and their discovery of the transistor effect.
- In 1957: half each to Professor *Tsung Dao Lee*, Columbia University, New York, N.Y., and Professor *Chen Ning Yang*, Princeton, N.J., for their penetrating investigation of the so-called parity laws, which has led to important discoveries regarding the elementary particles.
- In 1958: one third each to Professor *P. A. Cherenkov*, Professor *I. M. Frank* and Academician *I. E. Tamm*, Moscow, for the discovery and the interpretation of the Cherenkov effect.
- In 1959: half each to Professor *Emilio Segrè* and Professor *O. Chamberlain*, Berkeley, Cal., for their discovery of the antiproton.
- In 1960: to Professor *D. A. Glaser*, Berkeley, Cal., for the invention of the bubble chamber.
- In 1961: half each to Professor *R. Hofstadter*, Stanford University, Cal., for his pioneering studies of electron scattering in atomic nuclei and for his thereby achieved discoveries concerning the structure of the nucleons, and Dr *R. L. Mössbauer*, Munich, for his researches concerning the resonance absorption of gamma radiation and his discovery in this connection of the effect which bears his name.
- In 1962: to Academician *L. D. Landau*, Moscow, for his pioneering theories for condensed matter, especially liquid helium.
- In 1963: half to Professor *E. P. Wigner*, Princeton University, N.J., for his contributions to the theory of the atomic nucleus and the elementary particles, particularly through the discovery and application of fundamental symmetry principles, and the other half jointly to Professor *Maria Goeppert-Mayer*, La Jolla, Cal., and Professor *J. H. D. Jensen*, Heidelberg, for their discoveries concerning nuclear shell structure.
- In 1964: half to Professor *Ch. H. Townes*, Massachusetts Institute of Technology, Cambridge, Mass., and the other half jointly to Professor *N. G. Basov* and Professor *A. M. Prokhorov*, Moscow, for fundamental work in the field of quantum electronics, which has led to the construction of oscillators and amplifiers based on the maser-laser-principle.
- In 1965: one third each to Professor *Sin-itiro Tomonaga*, Tokyo, Professor *Julian Schwinger*, Cambridge, Mass., and Professor *Richard P. Feynman*, Pasadena, Cal., for their fundamental work in quantum electrodynamics, with deep-ploughing consequences for the physics of elementary particles.
- In 1966: to Professor *A. Kastler*, Paris, for the discovery and development of optical methods for studying hertzian resonances in atoms.
- In 1967: to Professor *Hans A. Bethe*, Cornell University, Ithaca, N.Y., for his contributions to the theory of nuclear reactions, especially his discoveries concerning the energy production in stars.
- In 1968: to Professor *Luis W. Alvarez*, Berkeley, Cal., for his decisive contributions to elementary particle physics, in particular the discovery of a large number of resonance states, made possible through his development of the hydrogen bubble chamber technique and data analysis.
- In 1969: to Professor *Murray Gell-Mann*, California Institute of Technology, Pasadena, Cal., for his contributions and discoveries concerning the classification of elementary particles and their interactions.

- In 1970: half each to Professor *Hannes Alfvén*, Stockholm, for fundamental work and discoveries in magneto-hydrodynamics with fruitful applications in different parts of plasma physics, and Professor *Louis Néel*, Grenoble, for fundamental work and discoveries concerning antiferromagnetism and ferrimagnetism which have led to important applications in solid state physics.
- In 1971: to Professor *Dennis Gabor*, London, for his invention and development of the holographic method.
- In 1972: on third each to Professor *John Bardeen*, Urbana, Ill., Professor *Leon N. Cooper*, Providence, R.I., and Professor *John R. Schrieffer*, Philadelphia, Penn., for their theory of superconductivity, usually called the BCS-theory.
- In 1973: for discoveries regarding tunneling phenomena in solids with one half to be equally shared between Dr. *Leo Esaki*, Yorktown Heights, N.Y., and Dr. *Ivar Giaever*, Schenectady, N.Y., for their experimental discoveries regarding tunneling phenomena in semiconductors and superconductors, respectively, and with the other half to Dr. *Brian D. Josephson*, Cambridge, for his theoretical predictions of the properties of a supercurrent through a tunnel barrier, in particular those phenomena which are generally known as the Josephson effects.
- In 1974: in equal shares to Sir *Martin Ryle*, Cambridge, and Professor *Antony Hewish*, Cambridge, for their pioneering research in radioastrophysics: Ryle for his observations and inventions, in particular of the aperture-synthesis technique, and Hewish for his decisive role in the discovery of pulsars.
- In 1975: in equal shares to Professor *Aage Bohr*, Copenhagen, to Professor *Ben Mottelson*, Copenhagen, and to Professor *James Rainwater*, New York, N.Y., for the discovery of the connection between collective motion and particle motion in atomic nuclei and the development of the theory of the structure of the atomic nucleus based on this connection.
- In 1976: in equal shares to Professor *Burton Richter*, Stanford, Cal., and to Professor *Samuel C. C. Ting*, Cambridge, Mass., for their pioneering work in the discovery of a heavy elementary particle of a new kind.
- In 1977: in equal shares to Dr. *Philip W. Anderson*, Murray Hill, N.J., Sir *Nevill F. Mott*, Cambridge, U.K., and Professor *John H. Van Vleck*, Cambridge, Mass., for their fundamental theoretical investigations of the electronic structure of magnetic and disordered systems.
- In 1978: half to Professor *Pjotr L. Kapitsa*, Moscow, for his basic inventions and discoveries in the area of low-temperature physics, and the other half jointly to Dr. *Arno A. Penzias* and Dr. *Robert W. Wilson*, Holmdel, N.J., for their discovery of cosmic microwave background radiation.
- In 1979: in equal shares to Professor *Sheldon L. Glashow*, Harvard University, Professor *Abdus Salam*, International Centre for Theoretical Physics, Trieste, and Imperial College, London, and Professor *Steven Weinberg*, Harvard University, for their contributions to the theory of the unified weak and electromagnetic interaction between elementary particles, including inter alia the prediction of the weak neutral current.
- In 1980: in equal shares to Professor *James W. Cronin*, Chicago, Ill., and Professor *Val L. Fitch*, Princeton, N.J., for the discovery of violations of fundamental symmetry principles in the decay of neutral K-mesons.

- In 1981: half jointly to Professor *Nicolaas Bloembergen*, Harvard University, and Professor *Arthur L. Schawlow*, Stanford University, for their contributions to the development of laser spectroscopy, and the other half to Professor *Kai M. Siegbahn*, Uppsala University, for his contribution to the development of high-resolution electron spectroscopy.
- In 1982: to Professor *Kenneth G. Wilson*, Cornell University, for his theory for critical phenomena in connection with phase transitions.
- In 1983: by one half to Professor *Subrahmanyan Chandrasekhar*, University of Chicago, for his theoretical studies of the physical processes of importance to the structure and evolution of the stars, and by the other half to Professor *William H. Fowler*, California Institute of Technology, for his theoretical and experimental studies of the nuclear reactions of importance in the formation of the chemical elements in the universe.

The Nobel Prize for Chemistry has been awarded as follows:

- In 1901: to Professor *J. H. van't Hoff*, Berlin, for the discovery of the laws of chemical dynamics and osmotic pressure in solutions.
- In 1902: to Professor *E. Fischer*, Berlin, for his work on sugar and purine syntheses.
- In 1903: to Professor *S. Arrhenius*, Stockholm, for the services he has rendered to the advancement of chemistry by his electrolytic theory of dissociation.
- In 1904: to Sir *William Ramsay*, London, for his discovery of the inert gaseous elements in air, and his determination of their place in the periodic system.
- In 1905: to Professor *A. von Baeyer*, Munich, for his services in the advancement of organic chemistry and the chemical industry, through his work on organic dyes and hydroaromatic compounds.
- In 1906: to Professor *H. Moissan*, Paris, for his investigation and isolation of the element fluorine, and for the adoption in the service of science of the electric furnace called after him.
- In 1907: to Professor *E. Buchner*, Berlin, for his biochemical researches and his discovery of cell-free fermentation.
- In 1908: to Professor *E. Rutherford*, Manchester, for his investigations into the disintegration of the elements, and the chemistry of radioactive substances.
- In 1909: to Professor *W. Ostwald*, Gross-Bothen, for his work on catalysis, and for his investigations into the fundamental principles governing chemical equilibria and rates of reaction.
- In 1910: to Professor *O. Wallach*, Göttingen, for his services to organic chemistry and the chemical industry by his pioneer work in the field of alicyclic compounds.
- In 1911: to Professor *Marie Curie*, Paris, for her services to the advancement of chemistry by the discovery of the elements radium and polonium, by the isolation of radium and the study of the nature and compounds of this remarkable element.
- In 1912: half each to Professor *V. Grignard*, Nancy, for the discovery of the Grignard reagent, and to Professor *P. Sabatier*, Toulouse, for his method of hydrogenating organic compounds in the presence of finely disintegrated metals whereby the progress of organic chemistry has been greatly advanced in recent years.
- In 1913: to Professor *A. Werner*, Zurich, for his work on the linkage of atoms in molecules by which he has thrown new light on earlier investigations and opened up new fields of research especially in inorganic chemistry.
- In 1914: to Professor *Th. W. Richards*, Cambridge, Mass., for his accurate determinations of the atomic weight of a large number of chemical elements.
- In 1915: to Professor *R. Willstätter*, Munich, for his researches on plant pigments, especially chlorophyll.
- In 1916: the prize was not awarded.
- In 1917: the prize was not awarded.
- The prize for 1918: awarded in 1919 to Professor *F. Haber*, Berlin-Dahlem, for the synthesis of ammonia from its elements.
- In 1919: the prize was not awarded.

- The prize for 1920: awarded in 1921 to Professor *W. Nernst*, Berlin, in recognition of his work in thermochemistry.
- The prize for 1921: awarded in 1922 to Professor *F. Soddy*, Oxford, for his contributions to our knowledge of the chemistry of radioactive substances, and his investigations into the origin and nature of isotopes.
- In 1922: to Dr. *F. W. Aston*, Cambridge, England, for his discovery, by means of his mass spectrograph, of isotopes in a large number of non-radioactive elements, and for his enunciation of the whole-number rule.
- In 1923: to Professor *F. Pregl*, Graz, for his invention of the method of microanalysis of organic substances.
- In 1924: the prize was not awarded.
- The prize for 1925: awarded in 1926 to Professor *R. Zsigmondy*, Göttingen, for his demonstration of the heterogeneous nature of colloid solutions and for the methods he used, which have since become fundamental in modern colloid chemistry.
- In 1926: to Professor *T. Svedberg*, Upsala, for his work on disperse systems.
- The prize for 1927: awarded in 1928 to Professor *H. Wieland*, Munich, for his investigations of the constitution of the bile acids and related substances.
- In 1928: to Professor *A. Windaus*, Göttingen, for his researches into the constitution of the sterols and their connection with the vitamins.
- In 1929: half each to Professor *A. Harden*, London, and to Professor *H. von Euler-Chelpin*, Stockholm, for their investigations on the fermentation of sugars and fermentative enzymes.
- In 1930: to Professor *H. Fischer*, Munich, for his researches into the constitution of hæmin and chlorophyll and especially for his synthesis of hæmin.
- In 1931: half each to Professor *C. Bosch*, Heidelberg, and Dr. *F. Bergius*, Heidelberg, in recognition of their contributions to the invention and development of chemical high pressure methods.
- In 1932: to Dr. *J. Langmuir*, Schenectady, N.Y., for his discoveries and investigations in surface chemistry.
- In 1933: the prize was not awarded.
- In 1934: to Professor *H. C. Urey*, New York, N.Y., for his discovery of heavy hydrogen.
- In 1935: half each to Professor *F. Joliot* and Dr. *Irène Joliot-Curie*, Paris, in recognition of their synthesis of new radioactive elements.
- In 1936: to Professor *P. Debye*, Berlin-Dahlem, for his contributions to our knowledge of molecular structure through his investigations on dipole moments and on the diffraction of X-rays and electrons in gases.
- In 1937: half each to Professor *W. N. Haworth*, Birmingham, for his investigations on carbohydrates and vitamin C, and Professor *P. Karrer*, Zurich, for his investigations of carotenoids, flavins and vitamins A and B₂.
- The prize for 1938: awarded in 1939 to Professor *R. Kulm*, Heidelberg, for his work on carotenoids and vitamins.

- In 1939: half each to Professor *A. F. J. Butenandt*, Berlin, for his work on sex hormones, and to Professor *L. Ruzicka*, Zurich, for his work on polymethylenes and higher terpenes.
- In 1940: the prize was not awarded.
- In 1941: the prize was not awarded.
- In 1942: the prize was not awarded.
- The prize for 1943: awarded in 1944 to Professor *G. Hevesy*, Stockholm, for his work on the use of isotopes as tracers in the study of chemical processes.
- The prize for 1944: awarded in 1945 to Professor *O. Hahn*, Berlin-Dahlem, for his discovery of the fission of heavy nuclei.
- In 1945: to Professor *A. J. Virtanen*, Helsingfors, for his research and inventions in agricultural and nutrition chemistry, especially for his fodder preservation method.
- In 1946: half to Professor *J. B. Sumner*, Ithaca, N.Y., for his discovery that enzymes can be crystallized, and the other half to Dr. *J. H. Northrop* and Dr. *W. M. Stanley*, Princeton, N.J., for their preparation of enzymes and virus proteins in a pure form.
- In 1947: to Sir *Robert Robinson*, Oxford, for his investigations on plant products of biological importance, especially the alkaloids.
- In 1948: to Professor *A. W. K. Tiselius*, Uppsala, for his research on electrophoresis and adsorption analysis, especially for his discoveries concerning the complex nature of the serum proteins.
- In 1949: to Professor *W. F. Giauque*, Berkeley, Cal., for his contributions in the field of chemical thermodynamics, particularly concerning the behaviour of substances at extremely low temperatures.
- In 1950: half each to Professor *O. Diels*, Kiel, and Professor *K. Alder*, Cologne, for their discovery and development of the diene synthesis.
- In 1951: half each to Professor *E. M. McMillan* and Professor *G. T. Seaborg*, Berkeley, Cal., for their discoveries in the chemistry of the transuranium elements.
- In 1952: half each to Dr. *A. J. P. Martin*, London, and Dr. *R. L. M. Synge*, Bucksburn, Scotland, for their invention of the partition chromatography.
- In 1953: to Professor *H. Staudinger*, Freiburg i. Br., for his discoveries in the field of macromolecular chemistry.
- In 1954: to Professor *L. Pauling*, Pasadena, Cal., for his research into the nature of the chemical bond and its application to the elucidation of the structure of complex substances.
- In 1955: to Professor *V. du Vigneaud*, New York, N.Y., for his work on biochemically important sulphur compounds, especially for the first synthesis of a polypeptide hormone.
- In 1956: half each to Sir *C. N. Hinshelwood*, Oxford, and Academician *N. N. Semenov*, Moscow, for their researches into the mechanism of chemical reactions.
- In 1957: to Sir *Alexander Todd*, Cambridge, for his work on nucleotides and nucleotide co-enzymes.
- In 1958: to Dr. *F. Sanger*, Cambridge, for his work on the structure of proteins, especially that of insulin.

- In 1959: to Professor *J. Heyrovský*, Prague, for his discovery and development of the polarographic method of analysis.
- In 1960: to Professor *W. F. Libby*, Los Angeles, Cal., for his method to use carbon-14 for age determination in archaeology, geology, geophysics, and other branches of science.
- In 1961: to Professor *M. Calvin*, Berkeley, Cal., for his research on the carbon dioxide assimilation in plants.
- In 1962: half each to Dr. *J. C. Kendrew* and Dr. *M. F. Perutz*, Cambridge, for their studies of the structures of globular proteins.
- In 1963: half each to Professor *K. Ziegler*, Mülheim/Ruhr, and Professor *G. Natta*, Milan, for their discoveries in the field of the chemistry and technology of high polymers.
- In 1964: to Professor *Dorothy Crowfoot Hodgkin*, Oxford, for her determinations by X-ray techniques of the structures of important biochemical substances.
- In 1965: to Professor *Robert Burns Woodward*, Cambridge, Mass., for his outstanding achievements in the art of organic synthesis.
- In 1966: to Professor *R. S. Mulliken*, Chicago, Ill., for his fundamental work concerning chemical bonds and the electronic structure of molecules by the molecular orbital method.
- In 1967: half to Professor *Manfred Eigen*, Göttingen, and the other half jointly to Professor *R. G. W. Norrish*, Cambridge, and Professor *George Porter*, London, for their studies of extremely fast chemical reactions, effected by disturbing the equilibrium by means of very short pulses of energy.
- In 1968: to Professor *Lars Onsager*, New Haven, Conn., for the discovery of the reciprocity relations bearing his name, which are fundamental for the thermodynamics of irreversible processes.
- In 1969: half each to Professor *Derek H. R. Barton*, Imperial College of Science and Technology, London, and Professor *Odd Hassel*, Oslo, for their contributions to the development of the concept of conformation and its application in chemistry.
- In 1970: to Professor *Luis F. Leloir*, Buenos Aires, for his discovery of sugar nucleotides and their role in the biosynthesis of carbohydrates.
- In 1971: to Dr. *Gerhard Herzberg*, Ottawa; for his contributions to the knowledge of electronic structure and geometry of molecules, particularly free radicals.
- In 1972: half to Dr. *Christian B. Anfinsen*, Bethesda, Md., for his work on ribonuclease, especially concerning the connection between the amino acid sequence and the biologically active conformation and the other half jointly to Dr. *Stanford Moore* and Dr. *William H. Stein*, New York, N.Y., for their contribution to the understanding of the connection between chemical structure and catalytic activity of the active centre of the ribonuclease molecule.
- In 1973: half each to Professor *Ernst Otto Fischer*, Munich, and Professor *Geoffrey Wilkinson*, London, for their pioneering work, performed independently, on the chemistry of the organometallic so called sandwich compounds.
- In 1974: to Professor *Paul J. Flory*, Stanford, Cal., for his fundamental achievements, both theoretical and experimental, in the physical chemistry of macromolecules.

- In 1975: half each to Professor *John Warcup Cornforth*, Brighton, for his work on the stereochemistry of enzyme-catalyzed reactions, and to Professor *Vladimir Prelog*, Zurich, for his work on the stereochemistry of organic molecules and reactions.
- In 1976: to Professor *William N. Lipscomb, Jr.*, Cambridge, Mass., for his studies on the structure of boranes illuminating problems of chemical bonding.
- In 1977: to Professor *Ilya Prigogine*, Brussels, for his contributions to non-equilibrium thermodynamics, particularly the theory of dissipative structures.
- In 1978: to Dr. *Peter Mitchell*, Bodmin, Cornwall, for his contribution to the understanding of biological energy transfer through the formulation of the chemiosmotic theory.
- In 1979: half each to Professor *Herbert C. Brown*, West Lafayette, Ind., and Professor *Georg Wittig*, Heidelberg, for their development of boron and phosphorus compounds, respectively, into important reagents in organic synthesis.
- In 1980: half to Professor *Paul Berg*, Stanford University, for his fundamental studies of the biochemistry of nucleic acids, with particular regard to recombinant-DNA, and the other half jointly to Professor *Walter Gilbert*, Harvard University, and Professor *Frederick Sanger*, Cambridge University, for their contributions concerning the determination of base sequences in nucleic acids.
- In 1981: half each to Professor *Kenichi Fukui*, Kyoto University, and Professor *Roald Hoffmann*, Cornell University, for their theories, developed independently, concerning the course of chemical reactions.
- In 1982: to Dr. *Aaron Klug*, Cambridge, for his development of crystallographic electron microscopy and his structural elucidation of biologically important nucleic acid-protein complexes.
- In 1983: to Professor *Henry Taube*, Stanford University, for his work on the mechanisms of electron transfer reactions, especially in metal complexes.