



THE Crafoord PRIZE 

# The Crafoord Prize

1982-2022



Anna-Greta and  
Holger Crafoord Fund



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# The Anna-Greta and Holger Crafoord Fund



The Fund was established in 1980 by a donation to the Royal Swedish Academy of Sciences from Anna-Greta and Holger Crafoord. The Crafoord Prize was awarded for the first time in 1982. The purpose of the Fund is to promote basic scientific research worldwide in the following disciplines:



MATHEMATICS AND  
ASTRONOMY



GEOSCIENCES



BIOSCIENCES  
WITH EMPHASIS ON ECOLOGY



POLYARTHRITIS

Support to research takes the form of an international prize awarded annually to outstanding scientists, and of research grants to individuals or institutions in Sweden. Both awards and grants are made according to the following order:

- year 1: Mathematics and Astronomy
- year 2: Geosciences
- year 3: Biosciences
- year 4: Mathematics and Astronomy
- year 5: Geosciences
- year 6: Biosciences
- etc.

The prize in Polyarthritis is awarded only when an investigation by the Academy's Class for medical sciences has shown that scientific progress in this field has been such that an award is justified. Part of the Fund is reserved for appropriate research projects at the Academy's institutes.

The Crafoord Prize presently amounts to 6 million Swedish krona, the prizes in Mathematics and Astronomy are awarded with 6 million Swedish krona each. In addition to the prize, financial support is granted to other researchers in the same field in which the prize is awarded for that year. Announcement of the Laureate(s) is made in January each year.

## Nominations

The Academy invites scientists from all over the world to nominate candidates for the prize. The received nominations are then reviewed and assessed by a prize committee consisting of members from the appropriate Academy classes. The prize should be awarded to one recipient, but may, if necessary, be divided among up to three recipients. At the same time, grant allocations are announced, and may be applied for both by individuals and by institutions in Sweden. Grant applications can be made for scientific equipment and research, publication of scientific works, scientific conferences and symposia, studies outside of Sweden for Swedish researchers, and activities to further research within the field of research covered by the prize.

On the basis of reports from the prize committee and the appropriate Academy class, decisions concerning laureate(s) and grant discipline are made by the Academy in mid-January of the year in which the prize is to be awarded.

## Crafoord *Days*

The Crafoord Prize is presented at a ceremony held by the Royal Swedish Academy of Sciences during the Crafoord Days.

During the Crafoord Days the Academy organises an international scientific symposium on a subject from the chosen discipline of the year, and the Laureate(s) gives a public lecture, the Crafoord Prize Lecture.

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# The Crafoord *Prize* in Geosciences 2022

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PHOTO: THE ROYAL SOCIETY



**ANDREW H. KNOLL.**

HARVARD UNIVERSITY, CAMBRIDGE, MA, USA



**ANDREW H. KNOLL**, born 1951. Fisher Professor of Natural History at the Department of Earth and Planetary Sciences, Harvard University, Cambridge, MA, USA, “*for fundamental contributions to our understanding of the first three billion years of life on Earth and life’s interactions with the physical environment through time*”.



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# Prizes awarded

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## 2021 POLYARTHRITIS

**DANIEL L. KASTNER**, born 1951. M.D., Ph.D. Scientific director at the Division of Intramural Research, National Human Genome Research Institute, National Institutes of Health, Bethesda, MD, USA, *“for establishing the concept of autoinflammatory diseases”*.



DANIEL L. KASTNER

PHOTO: NHGRI

## 2020 MATHEMATICS

**ENRICO BOMBIERI**, born 1940. Professor Emeritus, School of Mathematics, Institute for Advanced Study, Princeton, NJ, USA, *“for outstanding and influential contributions in all the major areas of mathematics, particularly number theory, analysis and algebraic geometry”*.



ENRICO BOMBIERI

PHOTO: CLIFF MORE, INSTITUTE FOR ADVANCED STUDY

## 2020 ASTRONOMY

**EUGENE N. PARKER**, born 1927. S. Chandrasekhar Distinguished Service Professor Emeritus, Department of Astronomy and Astrophysics, Enrico Fermi Institute, University of Chicago, IL, USA, *“for pioneering and fundamental studies of the solar wind and magnetic fields from stellar to galactic scales”*.



EUGENE N. PARKER

PHOTO: JOHN ZICH, CHICAGO UNIVERSITY

## 2019 BIOSCIENCES

**SALLIE W. CHISHOLM**, born 1947. Institute Professor, Massachusetts Institute of Technology, MIT, Cambridge, MA, USA, *“for the discovery and pioneering studies of the most abundant photosynthesising organism on Earth, Prochlorococcus”*.

## 2018 GEOSCIENCES

**SYUKURO MANABE**, born 1931. Senior meteorologist, Atmospheric and Oceanic Sciences Program (AOS), Princeton University, NJ, USA and **SUSAN SOLOMON**, born 1956. Lee and Geraldine Martin Professor of Environmental Studies, Department of Earth, Atmospheric and Planetary Sciences (EAPS), Massachusetts Institute of Technology, MIT, Cambridge, MA, USA, *“for fundamental contributions to understanding the role of atmospheric trace gases in Earth’s climate system”*.

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## 2017 POLYARTHRITIS

SHIMON SAKAGUCHI, born 1951. Professor, Osaka University, Japan.  
FRED RAMSDELL, born 1961. Head of Research, Parker Institute for Cancer Immunotherapy, San Francisco, CA, USA and ALEXANDER RUDENSKY, born 1956. Professor, Memorial Sloan Kettering Cancer Center, New York, NY, USA, “*for their discoveries relating to regulatory T cells, which counteract harmful immune reactions in arthritis and other autoimmune diseases*”.

## 2016 MATHEMATICS

YAKOV ELIASHBERG, born 1946 in St Petersburg, Russia, Ph.D. at Leningrad State University 1972. Herald L. and Caroline L. Ritch Professor of mathematics at Stanford University, CA, USA, “*for the development of contact and symplectic topology and groundbreaking discoveries of rigidity and flexibility phenomena*”.

## 2016 ASTRONOMY

ROY KERR, born 1934 in Kurow, New Zealand. Ph.D. 1959 at University of Cambridge, UK. Emeritus Professor at University of Canterbury, New Zealand and ROGER BLANDFORD, born 1949 in Grantham, UK. Ph.D. 1974 at University of Cambridge, UK. Luke Blossom Professor in the School of Humanities and Sciences, Stanford University, CA, USA, “*for fundamental work concerning rotating black holes and their astrophysical consequences*”.

## 2015 BIOSCIENCES

RICHARD LEWONTIN, US citizen. Born 1929 in New York, USA. Ph.D. 1954 from Columbia University, NY, USA. Emeritus Professor at Harvard University, MA, USA and TOMOKO OHTA, Japanese citizen. Born 1933 in Miyoshi, Japan. Ph.D. 1967 from North Carolina State University, NC, USA. Emeritus Professor at the National Institute of Genetics, Mishima, Japan, “*for their pioneering analyses and fundamental contributions to the understanding of genetic polymorphism*”.

## 2014 GEOSCIENCES

PETER MOLNAR, US citizen. Ph.D. 1970 from Columbia University, NY, USA. Professor in Geological Sciences at University of Colorado Boulder, CO, USA, “*for his ground-breaking contribution to the understanding of global tectonics, in particular the deformation of continents and the structure and evolution of mountain ranges, as well as the impact of tectonic processes on ocean-atmosphere circulation and climate*”.



### 2013 POLYARTHRITIS

PETER K. GREGERSEN, The Feinstein Institute for Medical Research, Manhasset, NY, USA, ROBERT J. WINCHESTER, Columbia University, New York, NY, USA and LARS KLARESKOG, Karolinska Institutet, Stockholm, Sweden, “*for their discoveries concerning the role of different genetic factors and their interactions with environmental factors in the pathogenesis, diagnosis and clinical management of rheumatoid arthritis*”.

### 2012 MATHEMATICS

JEAN BOURGAIN, Institute for Advanced Study, Princeton, NJ, USA and TERENCE TAO, University of California, Los Angeles, CA, USA, “*for their brilliant and groundbreaking work in harmonic analysis, partial differential equations, ergodic theory, number theory, combinatorics, functional analysis and theoretical computer science*”.

### 2012 ASTRONOMY

REINHARD GENZEL, Max-Planck-Institut für extraterrestrische Physik, Garching, Germany and ANDREA GHEZ, University of California, Los Angeles, CA, USA, “*for their observations of the stars orbiting the galactic centre, indicating the presence of a supermassive black hole*”.

### 2011 BIOSCIENCES

ILKKA HANSKI, University of Helsinki, Finland, “*for his pioneering studies on how spatial variation affects the dynamics of animal and plant populations*”.

### 2010 GEOSCIENCES

WALTER MUNK, Scripps Institution of Oceanography, University of California, San Diego, La Jolla, CA, USA, “*for his pioneering and fundamental contributions to our understanding of ocean circulation, tides and waves, and their role in the Earth's dynamics*”.

### 2009 POLYARTHRITIS

CHARLES DINARELLO, University of Colorado School of Medicine, Denver, CO, USA, TADAMITSU KISHIMOTO, Osaka University, Japan and TOSHIO HIRANO, Osaka University, Japan, “*for their pioneering work to isolate interleukins, determine their properties and explore their role in the onset of inflammatory diseases*”.

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## 2008 MATHEMATICS AND ASTRONOMY

MAXIM KONTSEVICH, IHÉS, France, and EDWARD WITTEN, Institute for Advanced Study, Princeton, NJ, USA, “*for their important contributions to mathematics inspired by modern theoretical physics*”, and RASHID ALIEVICH SUNYAEV, Max-Planck-Institute for Astrophysics, Garching, Germany, “*for his decisive contributions to highenergy astrophysics and cosmology, in particular processes and dynamics around black holes and neutron stars and demonstration of the diagnostic power of structures in the background radiation*”.

## 2007 BIOSCIENCES

ROBERT L. TRIVERS, Rutgers University, New Brunswick, NJ, USA, “*for his fundamental analysis of social evolution, conflict and cooperation*”.

## 2006 GEOSCIENCES

WALLACE S. BROECKER, Lamont-Doherty Earth Observatory, Columbia University, Palisades, NY, USA, “*for his innovative and pioneering research on the operation of the global carbon cycle within the ocean atmosphere-biosphere system, and its interaction with climate*”.

## 2005 MATHEMATICS AND ASTRONOMY

JAMES E. GUNN and P. JAMES E. PEEBLES, Princeton University, NJ, USA, and SIR MARTIN J. REES, Cambridge University, UK, “*for contributions towards understanding the large-scale structure of the Universe*”.

## 2004 POLYARTHRITIS

EUGENE C. BUTCHER, Stanford University, CA, USA, and TIMOTHY A. SPRINGER, Harvard Medical School, Boston, MA, USA, “*for their studies on the molecular mechanisms involved in migration of white blood cells in health and disease*”.

## 2003 BIOSCIENCES

CARL R. WOESE, University of Illinois (UIUC), IL, USA, “*for his discovery of a third domain of life*”.

## 2002 GEOSCIENCES

DAN P. MCKENZIE, University of Cambridge, UK, “*for fundamental contributions to the understanding of the dynamics of the lithosphere, particularly plate tectonics, sedimentary basin formation and mantle melting*”.

**2001 MATHEMATICS AND ASTRONOMY**

ALAIN CONNES, IHÉS and Collège de France, France, *“for his penetrating work on the theory of operator algebras and for having been a founder of the non-commutative geometry”*.

**2000 POLYARTHRITIS**

RAVINDER N. MAINI and MARC FELDMANN, both of the Kennedy Institute of Rheumatology, London, UK, *“for their definition of TNF-alpha as a therapeutic target in rheumatoid arthritis”*.

**1999 BIOSCIENCES**

JOHN MAYNARD SMITH, University of Sussex, UK, ERNST MAYR, Harvard University, Cambridge MA, USA, and GEORGE C. WILLIAMS, State University of New York (SBU), NY, USA, *“for their fundamental contributions to the conceptual development of evolutionary biology”*.

**1998 GEOSCIENCES**

DON L. ANDERSON, California Institute of Technology, Pasadena CA, USA, and ADAM M. DZIEWONSKI, Harvard University, Cambridge MA, USA, *“for their fundamental contributions to our knowledge of the structures and processes in the interior of the Earth”*.

**1997 MATHEMATICS AND ASTRONOMY**

FRED HOYLE, University of Cambridge, UK, and EDWIN E. SALPETER, Cornell University, Ithaca, NY, USA, *“for their pioneering contributions to the study of nuclear processes in stars and stellar evolution”*.

**1996 BIOSCIENCES**

LORD ROBERT M. MAY, University of Oxford, UK, *“for his pioneering ecological research concerning theoretical analysis of the dynamics of populations, communities and ecosystems”*.

**1995 GEOSCIENCES**

WILLI DANSGAARD, Københavns Universitet, Denmark, and NICHOLAS SHACKLETON, University of Cambridge, UK, *“for their fundamental work on developing and applying isotope geological analysis methods for the study of climatic variations during the Quaternary period”*.

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#### 1994 MATHEMATICS AND ASTRONOMY

SIMON DONALDSON, University of Oxford, UK, “for his fundamental investigations in four-dimensional geometry through application of instantons, in particular his discovery of new differential invariants”, and

SHING-TUNG YAU, Harvard University, Cambridge, MA, USA, “for his development of non-linear techniques in differential geometry leading to the solution of several outstanding problems”.

#### 1993 BIOSCIENCES

SEYMOUR BENZER, California Institute of Technology, Pasadena, CA, USA “for his pioneering genetical and neurophysiological studies on behavioural mutants in the fruit fly, *Drosophila melanogaster*”, and

WILLIAM D. HAMILTON, University of Oxford, UK, “for his theories concerning kin selection and genetic relationship as a prerequisite for the evolution of altruistic behavior”.

#### 1992 GEOSCIENCES

ADOLF SEILACHER, Institut und Museum für Geologie und Paläontologie, Tübingen, Germany, “for his innovative research concerning the evolution of life in interaction with the environment as documented in the geological record”.

#### 1991 MATHEMATICS AND ASTRONOMY

ALLAN R. SANDAGE, The Observatories of the Carnegie Institution of Washington, Pasadena, CA, USA, “for his very important contributions to the study of galaxies, their populations of stars, clusters and nebulae, their evolution, the velocity-distance relation (or Hubble relation), and its evolution over time”.

#### 1990 BIOSCIENCES

PAUL R. EHRLICH, Stanford University, CA, USA, “for his research on the dynamics and genetics of fragmented populations and the importance of the distribution pattern for their survival probabilities”, and

EDWARD O. WILSON, Harvard University, Cambridge, MA, USA, “for the theory of island biogeography and other research on species diversity and community dynamics on islands and in other habitats with differing degrees of isolation”.

#### 1989 GEOSCIENCES

JAMES VAN ALLEN, University of Iowa, Iowa City, IA, USA “for his pioneering exploration of space, in particular the discovery of the energetic particles trapped in the geomagnetic field which forms the radiation belts – the Van Allen belts – around our planet Earth”.

**1988 MATHEMATICS AND ASTRONOMY**

PIERRE DELIGNE, Institute for Advanced Study, Princeton, NJ, USA and  
ALEXANDRE GROTHENDIECK, Université des Sciences et Techniques du  
Languedoc, France, “*for their fundamental research in algebraic geometry*”.  
(Mr Grothendieck declined his prize.)

**1987 BIOSCIENCES**

EUGENE P. ODUM, University of Georgia, Athens, GA, USA and  
HOWARD T. ODUM, University of Florida, Gainesville, FL, USA,  
“*for their pioneering contributions within the field of ecosystem ecology*”.

**1986 GEOSCIENCES**

CLAUDE J. ALLÈGRE, Université de Paris, France, and  
GERALD J. WASSERBURG, California Institute of Technology, Pasadena,  
CA, USA, “*for their pioneering studies of isotope geochemical relations and the  
geological interpretations that these results permit*”.

**1985 MATHEMATICS AND ASTRONOMY**

LYMAN SPITZER JR, Princeton University, NJ, USA, “*for his fundamental  
pioneering studies of practically every aspect of the interstellar medium,  
culminating in the results obtained using the Copernicus satellite*”.

**1984 BIOSCIENCES**

DANIEL H. JANZEN, University of Pennsylvania, Philadelphia, PA, USA,  
“*for his imaginative and stimulating studies on co-evolution which has inspired  
many researchers to further work in this field*”.

**1983 GEOSCIENCES**

EDVARD N. LORENZ, Massachusetts Institute of Technology, Cambridge,  
MA, USA, and HENRY STOMMEL, Woods Hole Oceanographic Institution,  
MA, USA, “*for their fundamental contributions to the field of geophysical  
hydrodynamics, which in a unique way have contributed to a deeper  
understanding of the large-scale motions of the atmosphere and the sea*”.

**1982 MATHEMATICS AND ASTRONOMY**

VLADIMIR I. ARNOLD, Moscow State University, Soviet Union, and  
LOUIS NIRENBERG, New York University, NY, USA, “*for their  
outstanding achievements in the theory of non-linear differential equations*”.

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# Anna-Greta and Holger Crafoord

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Holger Crafoord (1908–1982) was prominent in Swedish industry and commerce. He began his career with AB Åkerlund & Rausing and devoted a larger part of his working life to this company. In 1964, Holger Crafoord founded Gambro AB in Lund, Sweden, where the technique of manufacturing the artificial kidney was developed. This remarkable dialyser soon became world famous. Since then, a series of medical instruments has been introduced on the world market making Gambro a leading company in this field.



In 1980, Holger Crafoord founded the Crafoord Foundation, which annually contributes greatly to the Anna-Greta and Holger Crafoord Fund.



HOLGER AND ANNA-GRETA CRAFOORD

Holger Crafoord became an honorary doctor of economics in 1972 and in 1976 an honorary doctor of medicine at Lund University.

Anna-Greta Crafoord (1914–1994) took, as Holger Crafoord's wife, part in the development of Gambro AB. Through generous donations and a strong commitment in the society around her, she contributed to the scientific and cultural life. In 1986 she founded the Anna-Greta Crafoord foundation for rheumatological research and in 1987 Anna-Greta Crafoord became an honorary doctor of medicine at Lund University.

Over the years, the Crafoords have furthered both science and culture in many ways and it is noteworthy that research in the natural sciences has received an important measure of support from the Anna-Greta and Holger Crafoord Fund.



## THE ROYAL SWEDISH ACADEMY OF SCIENCES

was founded in 1739 and is an independent non-governmental organisation, whose overall objective is to promote the sciences and strengthen their influence in society. The Academy has a particular responsibility for natural science and mathematics, but its work strives to increase interaction between different disciplines. The activities of the Royal Swedish Academy of Sciences primarily focus on:

- being a voice of science in society and influencing research policy (policy for science)
- providing a scientific basis for public debate and decision-making (science for policy)
- recognizing outstanding contributions to research
- being a meeting place for science, within and across subject boundaries
- providing support for young researchers
- stimulating interest in mathematics and natural science in school
- disseminating knowledge to the public
- mediating international scientific contacts
- preserving scientific heritage

**THE ACADEMY** has around 460 Swedish and 175 foreign members who are active in classes, committees and working groups. They initiate enquiries, consultation documents, conferences and seminars. The Academy has General Meetings eight times a year. Open lectures are held in association with these (read more at [www.kva.se/kalendarium](http://www.kva.se/kalendarium)). They can also be watched via [www.kva.se/video](http://www.kva.se/video).

**THE ACADEMY'S** institutes offer unique research environments in ecological economics, botany, the history of science and mathematics.

Every year, the Academy awards a number of prizes and rewards. The best known are the Nobel Prizes in Physics and Chemistry and the Sveriges Riksbank Prize in Economic Science in Memory of Alfred Nobel (the Prize in Economic Sciences). Other major prizes are the Crafoord Prize, Sjöberg Prize, Göran Gustafsson Prizes, Söderberg Prize and the Rolf Schock Prizes. The Göran Gustafsson Prizes are awarded to outstanding young researchers and are a combination of a personal prize and research funding. Since 2012, the Academy of Sciences has been one of the academies involved in implementing the Wallenberg Academy Fellows career programme, which provides long-term funding to the most promising young researchers. As well as a comprehensive range of scholarships, the Academy is also involved in appointments to research posts in a number of programmes funded by external foundations.

Through its working groups and committees, the Academy also works to promote sustainable, science-based societal development in the area of energy and the environment, among others. Issues relating to education and conditions for teachers are another major interest. The Academy regularly organises lectures and workshops on various scientific topics for teachers and students. In the 1990s, the Academy and the Royal Swedish Academy of Engineering Sciences founded one of Sweden's biggest school development programmes, NTA – Naturvetenskap och teknik för alla (Science and Technology for all).



**KUNGL.  
VETENSKAPS-  
AKADEMIEN**

THE ROYAL SWEDISH ACADEMY OF SCIENCES

THE CRAFOORD PRIZE IS AWARDED IN PARTNERSHIP BETWEEN THE ROYAL SWEDISH ACADEMY OF SCIENCES AND THE CRAFOORD FOUNDATION IN LUND. THE ACADEMY IS RESPONSIBLE FOR SELECTING THE CRAFOORD LAUREATES.

[WWW.CRAFOORDPRIZE.SE](http://WWW.CRAFOORDPRIZE.SE)

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