The Shaw Prize

The Shaw Prize is an international award to honour individuals who are currently active in their respective fields and who have recently achieved distinguished and significant advances, who have made outstanding contributions in academic and scientific research or applications, or who in other domains have achieved excellence. The award is dedicated to furthering societal progress, enhancing quality of life, and enriching humanity's spiritual civilization.

Preference is to be given to individuals whose significant works were recently achieved and who are currently active in their respective fields.

Founder of The Shaw Prize

Mr Shaw, born in China in 1907, was a native of Ningbo County, Zhejiang Province. He joined his brother's film company in China in the 1920s. During the 1950s he founded the film company Shaw Brothers (HK) Limited in Hong Kong. He was one of the founding members of Television Broadcasts Limited (TVB) launched in Hong Kong in 1967. As an established figure in the film and media industry, Mr Shaw gained insight into the needs of the people, and as a visionary he saw how, in addition to the fleeting escapism of entertainment, the more substantial benefits of education and healthcare would greatly impact lives for the better. He established two charities: The Shaw Foundation Hong Kong and The Sir Run Run Shaw Charitable Trust, both dedicated to the promotion of education, scientific and technological research, medical and welfare services, and culture and the arts.

The Shaw Foundation quickly gained momentum in a wide range of philanthropic work: supporting educational institutions as well as hospitals and clinics in Hong Kong, the rest of China and beyond. Expanding his vision into new areas convinced him that the quest

Mr Run Run Shaw
(1907 – 2014)

for knowledge is key to sustaining the advancement of civilization, and strengthened his belief that scientists focussed on unmasking the mysteries of nature are pivotal to the well-being of mankind. He decided to use his influence, and with the unfailing support of his wife Mrs Mona Shaw, established The Shaw Prize to inspire and recognize imaginative individuals committed to scientific research and to highlight their discoveries. The Award continues to gain in stature, casting a beam of recognition on outstanding scientific achievements, and firing the imagination of pioneers who follow him in spirit and in deed, sustaining the continued success of the Shaw Foundation and the Shaw Prize Foundation as lasting tributes to his wisdom and generosity.

Messsage from the Chief Executive

It gives me great pleasure to congratulate the 2018 Shaw Laureates for their groundbreaking achievements in scientific research and its applications.

The year 2018 marks the 15th year that the Shaw Prize Foundation has offered its seminal awards, established by Hong Kong visionary and philanthropist Run Run Shaw to recognise significant advances and outstanding contributions in three scientific fields: astronomy, life science and medicine, and mathematical sciences. Each Shaw Prize award of US$1.2 million is gifted to distinguished scholars from around the world in recognition of their continuing pursuit of excellence and societal progress.

My Government shares the same unshakable commitment to the promotion of science, to nurturing creative minds and a community-wide culture of innovation. Indeed, Hong Kong's future will be predicated on how well — how effectively and comprehensively — we are able to realise the

The Honourable Mrs Carrie Lam Cheng Yuet-ngor

vast promise of innovation and technology.

By celebrating scientific achievement at the very highest levels, The Shaw Prize will continue to encourage the breakthroughs that shape our collective future. No less critical, its Laureates will continue to serve as remarkable role models for our aspiring youth. For that, we are all very grateful.

Carrie Lam

Mrs Carrie Lam
Chief Executive
Hong Kong Special Administrative Region

In Memory of Mrs Mona Shaw

Mrs Mona Shaw, a successful businesswoman, chose to focus her energies on supporting the interests of her lifelong partner Mr Run Run Shaw and together they formed an alliance of entrepreneurship and philanthropy. Building on Mr Shaw's success in the film industry, they expanded their sphere of influence in the realm of media and entertainment with the founding of Hong Kong Television Broadcasts Limited (TVB) in 1967. With great foresight, Mrs Shaw created a nurturing environment for the development of young talent thus enabling TVB to continue building its own library of historical drama. Under her leadership, TVB rapidly made headway in advancing innovative applications for online streaming, positioning the company at the forefront of a new era of broadcast media.

Established in 1973, the Shaw Foundation Hong Kong quietly made contributions to all walks of life throughout Asia, including Hong Kong, the rest of China, as well as Chinese communities abroad, bringing healthcare and education to where it was most needed, as well as leaving its imprint on the higher echelons of academia in Asia, the United States of America and the United Kingdom.

Always seeking opportunities to inspire research and expand knowledge for the benefit of all, Mr and Mrs Shaw decided to widen the scope of their charitable ventures and set up the Shaw Prize Foundation in 2002, swiftly followed by the inaugural awards in 2004. With respected academics Mrs Shaw continued to lead the Prize to prominence, taking forward her husband's vision of recognizing outstanding scientific achievements worldwide. Over the years, raised firmly on the shoulders of its internationally acclaimed Laureates, the Shaw Prize has rapidly gained a reputation as a major award in the world. Mrs Mona Shaw's dedicated strength and energy continue to sustain The Shaw Prize, and her well-remembered warmth and humour add a warm glow to the annual awards ceremony.

The Shaw Prize Council

In Memory of Professor Ma Lin

Professor Ma Lin, Founding Member of the Shaw Prize Council, was an internationally renowned biochemist and former Vice-Chancellor of The Chinese University of Hong Kong. Under his leadership the University made significant progress on different fronts, including the establishment of the Department of Biochemistry and the Faculty of Medicine, and the founding of Shaw College. After stepping down as Vice-Chancellor, he continued to serve as Chairman and then Senior Advisor of the Board of Trustees of Shaw College. His long-standing support for the College and his friendship with the Shaws provided the connection that led to his instrumental role in launching the Shaw Prize in 2002.

Mr Run Run Shaw, Founder of the Shaw Prize, envisaged a future of societal progress through the advancement of knowledge. His vision was enthusiastically shared by Professor Ma and other members of the Shaw Prize Council. As a scientist and educator, Professor Ma understood very well the importance of the creation and application of knowledge, and his love for knowledge left its indelible mark on the Prize, which over the past years has drawn much attention and acclaim from both academia and the community, so much so that it has become a byword for distinguished discovery and research, and has come to be widely recognized as one of the most important prizes in the scientific world. Professor Ma's influence as a Founding Member is still felt today.

There can be no doubt that the spirit of the Shaw Prize will continue to inspire many more talented men and women to venture into the unknown for a better tomorrow. The Shaw Prize Council has inherited a legacy of dedication and hope instilled by Professor Ma, who will forever remain in our fond memories for his selfless devotion to this noble cause.

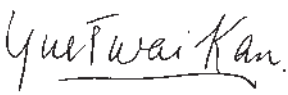
The Shaw Prize Council

Message from the Chairman of the Board of Adjudicators

Welcome to the fifteenth annual Shaw Prize Award Presentation Ceremony. The Shaw Prize was established in 2002 to honour international scientists in the fields of Astronomy, Life Science and Medicine, and Mathematical Sciences. The inaugural Shaw Prize Award Ceremony took place in 2004. Tonight, at this first Ceremony since the passing of Mrs Mona Shaw, we remember with gratitude her fiery spirit that transformed a vision of honouring excellence into reality with the creation of the Shaw Prize.

Together with Mr Run Run Shaw, Mrs Shaw forged an alliance of entrepreneurship and philanthropy, inspiring the quest for knowledge and highlighting outstanding achievements. A woman of great humility, Mrs Shaw was the mighty force of progress and her dedicated strength and energy continue to inspire her fellow Council Members in sustaining The Shaw Prize. Future generations will, under the direction of The Shaw Prize Foundation, continue to broaden the Shaw vision of advancing knowledge through scientific discoveries, thus strengthening and enhancing the aims of The Shaw Prize. Those of us who have been involved in the enterprise are committed to carry on Mr and Mrs Shaw's vision.

Tonight, we honour three scientists in the designated fields for their distinguished contributions. They are Dr Jean-Loup Puget in Astronomy; Professor Mary-Claire King in Life Science and Medicine; and Professor Luis A Caffarelli in Mathematical Sciences.



Yuet-Wai Kan
Chairman, Board of Adjudicators
Shaw Prize 2018

The Shaw Prize Medal

The front of the medal displays a portrait of Mr Run Run Shaw, next to which are the words and Chinese characters for the title of "The Shaw Prize". On the reverse, the medal shows the award category and year, the name of the laureate, and in the upper right corner, an imprint of a saying due to Xun Zi (313 – 238 BCE), a thinker in the Warring States period of Chinese history: "制天命而用之", meaning "Grasp the law of nature and make use of it".

AGENDA

Arrival of Officiating Guest and Laureates

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Welcome Speech by Professor Yuet-Wai Kan
Member of the Council
Chairman of the Board of Adjudicators, The Shaw Prize

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Speech by Professor Reinhard Genzel
Member of the Board of Adjudicators
Chairman of the Selection Committee for the Prize in Astronomy

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Speech by Professor Randy W Schekman
Member of the Board of Adjudicators
Chairman of the Selection Committee for
the Prize in Life Science and Medicine

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Speech by Professor W Timothy Gowers
Member of the Board of Adjudicators
Chairman of the Selection Committee for
the Prize in Mathematical Sciences

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Award Presentation

Grand Hall
Hong Kong Convention and Exhibition Centre
26 September 2018

AWARD PRESENTATION

(Category listed in alphabetical order)

Astronomy

Dr Jean-Loup Puget

Life Science and Medicine

Professor Mary-Claire King

Mathematical Sciences

Professor Luis A Caffarelli

Professor Reinhard Genzel

Member of the Board of Adjudicators
Chairman of the Selection Committee for the Prize in Astronomy

Professor Reinhard Genzel, born in 1952 in Germany, is the Director and Scientific Member at the Max Planck Institute for Extraterrestrial Physics, Garching, Germany, Honorary Professor at the Ludwig Maximilian University, Munich since 1988 and Professor in the Graduate School, UC Berkeley (since 2017).

He received his PhD from the University of Bonn in 1978. He was a Postdoctoral Fellow at Harvard-Smithsonian Center for Astrophysics, Cambridge, Massachusetts (1978–1980), an Associate Professor of Physics and Associate Research Astronomer at Space Sciences Laboratory (1981–1985) and a Full Professor of Physics at UC Berkeley (1985–1986).

Professor Genzel has received many awards, including Newton Lacy Pierce Prize (1986), Leibniz Prize (1990), Janssen Prize (2000), Balzan Prize (2003), Petrie Prize (2005), the Shaw Prize in Astronomy (2008), Jansky Prize (2010), Karl Schwarzschild Medal (2011), Crafoord Prize in Astronomy (2012) and Tycho Brahe Prize (2012), Herschel Medal of the Royal Astronomical Society (2014), Great Cross of Merit (with Star) of Germany (2014), Honorary Doctorate (Dr.h.c.), Paris Observatory OPSPM (2014), Harvey Prize in Science and Technology, Technion Israel Institute of Technology (2014).

He is a member of the European Academy of Sciences, the German Academy of Natural Sciences Leopoldina, the Bavarian Academy of Sciences. He is also a Foreign Member/Foreign Corresponding Member/Associate of the Academy of Sciences of France, the US National Academy of Sciences, the Royal Spanish Academy, and the Royal Society of London. He is also Member of the Order Pour Le Merite for Science and Arts of the Republic of Germany.

The Prize in Astronomy 2018

Jean-Loup Puget

**for his contributions to astronomy
in the infrared to submillimetre spectral range.
He detected the cosmic far-infrared background
from past star-forming galaxies, and
proposed aromatic hydrocarbon molecules
as a constituent of interstellar matter.
With the *Planck* space mission,
he has dramatically advanced our knowledge
of cosmology in the presence of
interstellar matter foregrounds.**

An Essay on the Prize in
Astronomy 2018

The infrared-to-millimetre spectral range (1 to 10,000 μm) offers a unique and little explored window on the Universe. Such radiation probes cold, dusty objects such as dense interstellar material, forming stars, and obscured young galaxies. The longest wavelengths, near a few millimetres, also give information on conditions when the Universe was around 400,000 years old, via the Cosmic Microwave Background (CMB). To detect the faint cosmic signals in this waveband in the presence of very large instrumental, atmospheric and astronomical foreground radiation is challenging. It requires special cryogenic sensors, and optimized telescopes above the Earth's atmosphere and in space. Jean-Loup Puget has made pivotal contributions to all these aspects, scientific as well as technical.

In the 1970s and early 1980s mysterious spectral emission features between 3 and 12 μm were discovered in Galactic reflection nebulae. Léger & Puget (1984) and independently Allamandola, Tielens and Barker (1985) proposed that these puzzling features come from large polycyclic aromatic hydrocarbon (PAH) molecules, similar to car exhaust, and composed mainly of carbon-hydrogen rings. The PAHs represent a new form of interstellar "dust". Dust grains and PAHs are heated when they absorb ultraviolet radiation from massive stars. They re-emit this energy as a grey-body thermal continuum in the infrared-submillimetre band and as PAH features. The total intensity of such emission measures cosmic star formation, integrated over the entire history of the Universe. In 1996 Puget and co-workers discovered in data of the NASA COBE satellite a pervasive 100 μm background radiation plausibly from an active star formation phase about 10 billion years ago. Many infrared measurements have since confirmed this discovery and shown that this was the epoch when most of stars in galaxies were formed.

The culmination of Puget's work, building on his technical and scientific knowledge of far-infrared/ submillimetre/ millimetre astronomy, has been his leadership of the development and scientific exploitation of the High Frequency Instrument (HFI) on the European Space Agency's *Planck* satellite. Between 2009 and 2013, Puget and his international team used HFI's novel cryogenic sensors to measure the CMB plus the foreground emission due to the Milky Way's dust and gas with superb sensitivity between 350 μm and 3 mm. By working at these short wavelengths, HFI has studied the CMB with an angular resolution three times better than any alternative all-sky CMB map. HFI is also uniquely sensitive to foreground dust emission, which dominates at short wavelengths. The ability to separate foregrounds was critical to the *Planck* results, which measure the

cosmological parameters to exquisite precision — for example, the total density of dark matter is measured to 2% accuracy.

These precise results potentially allow us to probe within a small fraction of one second after the Big Bang, in the hypothesized inflationary era, when amplified quantum fluctuations may have created both the initial density fluctuations and relic gravitational waves. The gravitational waves induce very weak distortions of the CMB, but their detection is challenging due to possible confusion with dust foreground emission. *Planck*'s precise foreground separation showed that the true level of primordial gravitational waves must lie below the predictions of the simplest inflationary models. It also showed that the density fluctuations are purely Gaussian, with no detectable phase correlations. At a stroke, these results removed large classes of inflation theories from consideration. We thus still lack definitive evidence that inflation happened, and what exactly caused it — but we now know a great deal about what it is *not*.

Today, the expansion of the Universe is accelerating. If Einstein's relativistic theory of gravity is correct, this requires a non-zero vacuum energy density. Alternatively the acceleration may indicate a modification of the strength of gravity on large scales, in which case density fluctuations in the Universe would develop at a non-standard rate. *Planck* can measure this effect, because the CMB radiation is deflected by intervening mass fluctuations. This gravitational lensing effect has been mapped comprehensively by *Planck*, and matches the expectations of standard gravity. This work nicely closes a loop on Puget's career, since the inferred foreground mass concentrations correlate in position with fluctuations in the far-infrared background: the dusty star forming galaxies whose integrated effect was first found by Puget more than two decades ago.

Finally, the CMB detects scattering due to ionized gas that is created by the first stars and quasars. The latest *Planck* data indicate that the onset of this reionization era was more recent than previously supposed: within the last factor of ten of the cosmic expansion. This result complements the far-infrared background's measurement of total energy release, closing in on a complete picture of the history of cosmic star formation.

Jean-Loup Puget's wide-ranging contributions and leadership in infrared and submillimetre astronomy make him a fitting recipient for the 2018 Shaw Prize.

Jean-Loup Puget
Laureate in Astronomy

I was born on 7 March 1947 in Chalon-sur-Saône, Burgundy. My parents worked in the city hospital — Mother as a midwife and Father as an X-ray technician. My father was a self-taught man who had received only primary school education. My younger brother and I went to a technical high school and during this early period, inspired by the encyclopaedia my father bought, I became very interested in science and astronomy.

Later, I was admitted to "Lycée du Parc" in Lyon to prepare for the competitive examinations for admission to the selective schools of French universities. At that time, my idea was to become an engineer. It was only when I had to choose between the schools I had gained admittance to, that a friend and I discussed our futures and decided that we wanted to try to go into scientific research; we chose to go to "Ecole Normale supérieure, Cachan". I followed Physics studies at "Université Paris Sud" in Orsay and gained a master in theoretical physics.

In 1969, I attended a seminar by Roland Omnés on a model of the universe he had developed in which the symmetry between matter and antimatter was preserved, a topic I found fascinating, and I was successful in obtaining a master internship under him and Evry Schatzman (my future thesis adviser). The problem they gave me was to compute the annihilation rate between a matter and an antimatter plasma filling two half space. Evry Schatzman took me as a graduate student to keep working on the baryon symmetric model at CERN during his sabbatical year there — a chance I only measured later!

This was followed by two years, 1970–1972, at Goddard Space Flight Center (GSFC) with a fellowship of the European Space Research Organisation (ESRO), ancestor of the European Space Agency. NASA had built the first gamma ray satellite aimed at mapping the whole sky and I worked with Floyd Stecker trying to find evidence of annihilation in the form of a cosmic gamma-ray background. The galactic gamma ray emission was very dominant and we did high-energy galactic astrophysics in parallel to searching for the cosmic gamma ray background. On my return to Paris, I was asked by the Fundamental Physics Panel of ESRO to write a report on what space observations could bring to the study of Cosmic Background radiations. This led me to learn the potential power of detailed observations of the microwave background discovered eight years before by Penzias and Wilson, and, in the seminal paper of Partridge and Peebles, the potential of detecting the Cosmic optical and infrared backgrounds containing the radiation coming from all generations of galaxies.

I went back to GSFC for a postdoctoral year (1974–1975). During that time Floyd Stecker, Giovanni Fazio and I did predictions of the Cosmic Infrared Background for the problem of propagation of ultra high-energy cosmic rays through cosmological distances.

About the same time, with Charles Ryter and Guy Serra, we started investigating what fraction of starlight in galaxies is absorbed by interstellar dust and converted to far infrared. This was for me the start of involvement in conceiving instruments. We built a balloon borne experiment to measure the diffuse galactic far infrared emission. The IRAS satellite showed later, surprisingly, that 15% of the energy was reradiated in the mid infrared (6 to 60 micron). This has led to the discovery of a new key ingredient of the interstellar medium: Polycyclic Aromatic hydrocarbon molecules.

In 1978 I met Catherine Maussion, now my wife, who was a journalist on a major daily French newspaper (Liberation) and during these 40 years we both have maintained our professional activities. We have two sons, and now three grandchildren.

From 1978 to 1982 I was deputy director of "Institut d'Astrophysique de Paris" (IAP). I then joined the astrophysics team within the Physics department of "Ecole Normale Supérieure".

In 1990, I led the creation of the "Institut d'Astrophysique Spatiale" (IAS) in Orsay, which has taken a major role in many Space experiments over the last 30 years. I was director of IAS from 1997 to 2005.

By 1980, the main directions of my future research were set: space observations offer a unique window on the infrared-to-submillimeter spectral range. Observations with high sensitivity and resolution of the Cosmic microwave background and of dust emission from mid infrared to millimeter wavelengths in our Galaxy and from all galaxies, would lead to major advances in astrophysics and cosmology.

In 1993, in response to a call from ESA, I proposed, with a large international team, an instrument concept that was to become the High Frequency Instrument on the Planck mission.

This mission became, after COBE and WMAP, the third generation CMB mission. Its sensitivity, very broad frequency range, 5 arc minutes resolution and polarization capabilities, allowed it to confirm several generic predictions of an inflation phase in the very early universe. Although I know that this is what modern cosmology is about, I am still amazed that this can really be done. Looking back, this was made possible by these 50 years of incredible progress in cosmology but also in technology, and the work of a very large number of people.

Professor
Randy W Schekman

Member of the Board of Adjudicators
Chairman of the Selection Committee for the Prize in Life Science and Medicine

Professor Randy W Schekman is a Professor in the Department of Molecular and Cell Biology, University of California, Berkeley, and an Investigator of the Howard Hughes Medical Institute. When he joined the faculty at Berkeley, he developed a genetic and biochemical approach to the study of eukaryotic membrane traffic, which reveals how proteins enter and move between membrane-bound compartments of cells.

Among the honours he has earned are the Gairdner International Award, the Albert Lasker Award in Basic Medical Research in 2002, and the Nobel Prize in Physiology or Medicine in 2013 — which he shared with James Rothman of Yale University and Thomas Südhof of Stanford University — for their discoveries of the mechanism regulating vesicle traffic, a major cellular transport system. In 2011, he was appointed Editor-in-Chief of the open access journal, "eLife", sponsored by the HHMI, The Wellcome Trust/UK and the Max Planck Society.

The Prize in Life Science and Medicine 2018

Mary-Claire King

for her mapping of
the first breast cancer gene.
Using mathematical modeling,
King predicted and then demonstrated that
breast cancer can be caused by a single gene.
She mapped the gene which facilitated its
cloning and has saved thousands of lives.

An Essay on the Prize in
Life Science and Medicine 2018

Breast cancer is a common complex disease, and until Mary-Claire King's work, the prevailing view was that such diseases arise from interactions among multiple genetic and environmental factors. But she was intrigued by hints that there might be inherited forms of breast cancer and beginning in 1974, long before there were genomic tools for human genetic analysis, she tested this head-on by studying more that 1500 families, each identified through one woman with breast cancer. Using a mathematical approach, she determined that clustering of breast cancer in these families occurred more frequently than expected by chance, and that this clustering could be best explained by the presence of mutations in an unknown gene that greatly increased risk in about 4% of families. By studying patterns of breast and ovarian cancer in families, she predicted that among women carrying mutations in this hypothetical gene, the risk of breast cancer would be about 80% by age 70, ten times more than among women in the same families without any mutation in this hypothetical gene.

The field was skeptical about her mathematical model so she set out to prove that her hypothetical gene existed, by mapping it to an exact chromosomal location. Toward this end, King analyzed DNA from hundreds of women in 23 families very severely affected with breast cancer. In many of these families, breast cancer struck young women, often in both breasts, and in some families, breast cancer even occurred in men. Finding the home of the hypothetical gene was difficult for multiple reasons. First, most cases of breast cancer are not familial. Might the critical mutations be inherited from unaffected fathers as well as from mothers with the disease? Second, breast cancer is common, so common that both inherited and non-inherited cases could occur in the same families. Third, breast cancer might not strike all women who carry a high-risk gene; some might be fortunate. And fourth, different families might carry different high-risk genes. No one had previously tackled such complexities, and an attempt to unearth a breast cancer gene seemed woefully naïve.

King was not dissuaded by these challenges, and by late 1990, she had found the home of her breast cancer gene. She identified a section of chromosome 17 that carried definitive genetic markers, or signposts, in women with breast cancer in the most severely affected families. Somewhere in that stretch of DNA lay the gene, which she named *BRCA1*.

King's announcement revolutionized an entire field. Geneticists who had dismissed the notion that a disease as complex as breast cancer could be linked to any one gene started pursuing that very gene using positional cloning, the only possible approach before the Human Genome Project. Four years later, the gene was cloned by a commercial lab. King's discovery of the existence of the gene and the identification of its chromosomal position was the key to cloning it. Alterations in *BRCA1* and in a second breast-cancer susceptibility gene, *BRCA2*, cloned shortly later, increase risk of both breast and ovarian cancer. The proteins encoded by these genes repair broken DNA. When the *BRCA1* or *BRCA2* proteins fail to perform their jobs, genetic integrity is compromised, setting the stage for cancer.

King subsequently showed that the risks of breast and ovarian cancer among women with mutations in *BRCA1* are very high — up to 80% lifetime risk for breast cancer and 50% lifetime risk for ovarian cancer. She also showed that risks have increased over the decades for non-genetic reasons.

In order to enable all patients to be tested for mutations in these genes, King and her group developed a multi-gene platform (named BROCA, in honour of the 19th century French surgeon who first described familial breast cancer) to simultaneously detect all classes of mutations in all breast and ovarian cancer genes. This platform has been put into clinical use worldwide. As a direct result of her efforts, there now exist tests for mutations in *BRCA1* and in all other breast cancer genes. Millions of women worldwide have benefitted from these tests.

King's approach to gene discovery for breast cancer is a model for the discovery of genes responsible for many common complex diseases. The paradigm is to identify rare families in which the complex disease characteristics are inherited. Identification of the gene critical to the disease pathology in such families both reveals disease mechanisms and provides the genetic basis for identification of mutations in patients with little or no family history of the disease. In addition to being applied to millions of women worldwide at risk of breast and ovarian cancer, this approach has been the basis for gene discovery in diabetes, colon cancer, coronary artery disease, hypertension, Alzheimer's disease, Parkinson's disease and other complex traits. Meanwhile, for breast and ovarian cancer, the results of her work have saved the lives of countless women.

Mary-Claire King
Laureate in Life Science and Medicine

I was able to become a scientist because my father and mother made educational opportunity for my brother Paul and me their highest priority. My parents did not have the opportunity for advanced education. My father was born in the 19th century and left his family's farm after learning everything offered in a one-room schoolhouse. My mother grew up in Oklahoma and began university at the University of Chicago but had to drop out during the worst of the Great Depression, when her father lost his job, her mother died, and her family went bankrupt. My brother and I were protected from any hardship, living north of Chicago near a very fine public high school. In high school, I learned the beauty of mathematics. From my very fine high school English teacher, I learned to treasure the English language, to value those who have used it well, and to write clearly myself. For 50 years my goal has been to teach as well as I was taught; I am still working at it. Emboldened by my math teachers, I majored in mathematics at Carleton College, even though I clearly was not strong enough to be a theoretician. But my college professors recognized my interest and suggested I consider graduate school in statistics or applied math, in particular at Berkeley. It was 1966 and I needed no more encouragement.

In my first year as a graduate student at Berkeley, I had the extraordinary good luck to wander into the genetics course taught, for the last time before his retirement, by Curt Stern. His lectures still resonate for their clarity, elegance, and whimsy. Genetics was a collection of beautiful puzzles. One could disentangle hopelessly knotty data into rational strands based on Mendelian logic, propose solutions to relationships among the strands, and test them, with flies from Strawberry Canyon offering the perfect experimental system. I couldn't believe people were paid to do this. With the blessing and continued support of my advisors from statistics, I transferred to genetics and have never looked back.

Life as a graduate student at Berkeley was tumultuous. Becoming an experimental geneticist with no background in biology or chemistry would have been difficult in the calmest of environments and Berkeley in the 1960s was not calm. Very fortunately, my advisor Allan Wilson assured me that together we could design a project that would be within my experimental skills and perhaps even exploit

my propensity to write down equations. Out of these conversations came my dissertation, the demonstration that humans and chimpanzees share 99% of our protein coding sequences, and the consequent hypothesis that our differences in morphology and behaviour are due to a few critical differences in timing and regulation of genes rather than to accumulation of large numbers of mutations in primary sequences. Allan died of leukemia at age 58 in 1991, so did not see our work vindicated by the chimpanzee genome sequence. Of course, he was sure we were correct, that the experimental evidence spoke for itself.

My introduction to the problem of breast cancer came thanks to Nicholas Petrakis of UCSF, where in 1974 I took a research position that we would now call a post-doc. Nick encouraged me to follow my intuition in designing very high-risk long-term studies to test whether familial clustering of breast cancer could be due to inherited mutations in a single gene. When I moved, two years later, to a faculty position back at UC Berkeley, he urged me to take the project with me. Allan and Nick shared the understanding that proof in science takes a long time, and that the most important questions deserve whatever time it takes.

At Berkeley, our work on inherited breast cancer was carried out by a small group of postdocs and students: geneticists Jeff Hall, then Lori Friedman, Beth Ostermeyer, and Eric Lynch; epidemiologists Beth Newman and Sarah Rowell; and statistician Ming Lee. We shared curiosity, hard work, and fabulous feasts.

My move to the University of Washington in 1995 was thanks to Arno Motulsky who encouraged me to immerse myself in an environment with great strengths in both medicine and genomics, and remained my dear and critical friend until his death in 2018. I now have the great pleasure of working every day with about 20 young professors, postdocs, students and research staff. It is irresistible to be excited by every new experiment. We have many years of opportunities ahead of us.

Our breast cancer work would not have been possible without the support of both the US National Cancer Institute and private foundations. Private philanthropy is now a major force in biomedical research. I am enormously grateful.

And finally, thanks and love to my daughter Emily, whose work in Berkeley is devoted to animal welfare. She lives a life of good works, grace and style, and does so in her own way.

Professor W Timothy Gowers

Member of the Board of Adjudicators
Chairman of the Selection Committee for the Prize in Mathematical Sciences

Professor Timothy Gowers was born in Marlborough, England, in 1963. From 1973 to 1976 he was a chorister in the choir of King's College, Cambridge, after which he went as a scholar to Eton College. He studied mathematics at Trinity College, Cambridge, where he also did his PhD, under the supervision of Bèla Bollobàs. In 1989 he became a research fellow at Trinity, moving to University College London two years later as a lecturer. In 1995 he returned to Cambridge, and Trinity, where he was first a Lecturer and then a Professor. He is currently a Royal Society Research Professor and also holder of the Rouse Ball Chair in Mathematics. In the early part of his career he solved some old problems in Banach space theory, including two of Banach himself. He then discovered the first quantitative proof of Szèmèrèdi's theorem and has subsequently worked in additive combinatorics. For this work he was awarded a Fields Medal in 1998.

The Prize in Mathematical Sciences 2018

Luis A Caffarelli

for his groundbreaking work on
partial differential equations,
including creating a theory of regularity for
nonlinear equations such as the Monge–Ampère equation,
and free-boundary problems
such as the obstacle problem, work that has influenced
a whole generation of researchers in the field.

An Essay on the Prize in
Mathematical Sciences 2018

Differential equations are fundamental to large parts of mathematics, physics, and indeed all the sciences. For example, if a physical system is in a certain state, and obeys certain laws, then a differential equation will tell you the state of the system infinitesimally later, and by putting together all these infinitesimal changes one can follow the evolution of the system in time. Or if a static system is held together by certain forces, a differential equation can often say how one part of the system depends on its immediate neighbours, and putting together this local information can give a global description of the system.

The simplest differential equations, known as ordinary differential equations, concern functions that depend on just one variable. For example, if a stone is thrown vertically in the air, then there is an ordinary differential equation that describes how its height varies as a function of time, given its initial height and velocity. However, the most useful equations, known as partial differential equations, concern functions of several variables (such as, for example, three spatial coordinates and one temporal coordinate) and are significantly more complicated as a result. Partial differential equations can be used to model heat flow, fluid motion, electromagnetic waves, quantum mechanics, the shape of soap bubbles, and innumerable other physical phenomena.

A few very simple equations can be solved explicitly — that is, one can find an exact formula for their solutions — but this is very much the exception rather than the rule. Instead, one has to be content with being able to show that solutions exist, and with being able to say something about how they behave.

A very important example of this is the Navier–Stokes equation, which describes the motion of a viscous fluid. It is not known whether, given appropriate initial conditions, there must be a solution to the Navier–Stokes equation that remains well-behaved forever, or whether singularities will necessarily develop. To put it more graphically, if you stir a bucket of water, is there a danger that a week later it will blow up? Probably not, but nobody knows how to prove this, and it is one of the major unsolved problems of mathematics. Indeed, it is considered so important that it was chosen as one of the seven problems for the solution of any of which the Clay Mathematics Institute offers a reward of one million US dollars. (One of the problems has been solved, so the total number is now down to six.)

Although it is not known how to solve the Navier–Stokes equations, one can find so-called "weak solutions", which are abstract objects that solve the equations, but not in quite the sense one wants. This very important insight goes back to Leray in 1934, who looked at a sequence of approximations to the Navier–Stokes equations, finding for each one a solution, and then constructing a limiting object that can be interpreted as solving the actual Navier–Stokes equation. However, these limiting objects are not genuine functions: if one could show that they were "regular", then they would be, and the Navier–Stokes problem would be solved. A famous result of Caffarelli, Kohn and Nirenberg is the closest anybody has come to that: it shows that weak solutions exist that are regular except on a set of singularities that has to be very small in a precise mathematical sense.

Another area in which Caffarelli has created a new and highly influential theory is obstacle problems. Here one would like to know the shape that will be taken by an elastic membrane with a given boundary if it has to lie above a certain obstacle. The shape taken will be the one that minimizes its energy, but the important questions concern how well-behaved, or "regular", a solution of this kind will be. As with all important problems in partial differential equations, this one arises in many contexts that at first glance look extremely different, including fluid filtration in porous media, and financial mathematics.

In general, because one does not usually have explicit formulae for solutions to partial differential equations, the analysis of their properties is very hard, and depends on extremely delicate estimates. Caffarelli is a master at this, frequently coming up with arguments that have left other researchers wondering how he could possibly have thought of them. He continues to work at the forefront of the field and has had a huge influence, both through his own work and that of his doctoral students, many of whom have themselves become extremely distinguished mathematicians. In a way that few mathematicians achieve even once, he has repeatedly created important areas almost from scratch that are extremely active to this day.

Luis A Caffarelli
Laureate in Mathematical Sciences

I was born in Buenos Aires to Luis and Hilda Caffarelli. I have two sisters, Maria Luisa and Alicia, plus a large family of aunts, uncles and cousins, who have all shared good and bad times and remain a very tightly-knit group. Among my most cherished teenage memories is working at the Buenos Aires shipyards in summertime, side by side with my father, while the sun rose over Rio de La Plata.

I am happily married to Irene Martinez Gamba, also a mathematician, and we have three wonderful sons, Alejandro, Nicolas, and Mauro.

I started mathematical studies at the Universidad de Buenos Aires in 1966. Luis Santalo, Manuel Balanzat and Carlos Segovia taught me how to see and think mathematics and gave me support, advice and encouragement. Calixto Calderon became my mentor and, with his help and guidance I completed my PhD thesis by 1972.

Funded by CONICET–Argentina, I left for Minnesota to work with Eugene Fabes and Calixto. From the hot Buenos Aires summer to the Minnesota winter was a dramatic change, but with the generous help of Fabes and Walter Littman I got to love Minneapolis.

Hans Lewy visited a year after my arrival and gave a beautiful course on Potential theory. He also suggested I take a look at his recent work with Stampacchia on the obstacle problem.

The mathematics of numerical simulations was developing and this problem was at the core of variational inequalities modeling in continuum mechanics: the minimization of energy within given convex constraints of staying above the obstacle. I was able to show regularity and stability properties of the solution and transition surface under rather general conditions. The obstacle problem resurfaced in the modeling of porous media flows, game theory, optimal insulations, semi-permeable membranes, involving local and integral diffusion processes. I made several significant contributions, and this problem remains today a source of challenge in diverse areas of mathematics.

At the time, I made several contributions on free boundary problems also related to flows cavitating past an obstacle, opening a new venue to solve challenging fundamental problems in science and engineering concerning fluid solid interactions, flame propagation, optimal insulation and species segregation and phase transition problems that are sources of fundamental areas of beautiful mathematics.

I moved to Courant Institute at NYU, the heart of analysis and applied mathematics, in 1980. It was an exceptional time in my career. With Kohn and Nirenberg, we proved that sets of infinite speed for solutions to Navier–Stokes equations are imperceptible (could not even fill a curve in space-time). I also developed, in collaboration with Nirenberg and Joel Spruck, an extensive theory of existence and regularity for fully nonlinear equations, symmetric functions of the Hessian and the Monge Ampere equation. This beautiful model is a challenging subject due to its geometry and "fragility", and its role in optimal transportation.

Soon after, in my mid-thirties, Felix Browder invited me to join the University of Chicago faculty. Felix enormously endorsed me then and through the years. I am greatly indebted to him.

Throughout that period, I met some of the best young mathematicians abroad, and between math and family we created a wonderful circle of lasting friendships.

In 1986 we moved to the Institute for Advanced Study at Princeton. I worked on weak regularity theory for the Monge–Ampere Equation, optimal transportation, and parabolic phase transition. Yet, I missed having graduate students. Two years after Irene was awarded an NSF fellowship to work with Cathleen Morawetz at Courant, we both joined their faculty in 1994, beginning my second stay at NYU. It proved to be a great time for further advancement.

In 1997, UT Austin offered us an exciting opportunity to contribute to the expansion of graduate programmes in non-linear analysis and computational applied mathematics, bringing together science and engineering through the Institute of Computational Engineering and Sciences where Irene and I became Core Faculty. Many ideas surged in this new setting: modeling for fractional diffusion, stochastics, phase transitions, fully nonlinear models.

Our scientific family of students, postdocs, collaborators and colleagues kept on growing and blooming. Thanksgiving celebrations at our home and picnics at the Oden Ranch remain highlights that have bonded many of us together. Our scientific and personal lives intertwined in a mesh of common objectives and mutual support. We visited Buenos Aires and Mar del Plata, our hometowns, developing further mentoring and collaborations.

The Shaw Foundation recognition is a merit that extends to those who have participated in our passion for the advancement of mathematics. Also, it is to be shared with our children, who have grown up to become a lawyer, a molecular scientist and a medical doctor, brought Elise, Camille and Camila into our family, and given us our grandchildren Isabella and Luca.

I am deeply indebted to my wife Irene for her unwavering love and support in our life's journey.

Organization
Preparatory Committee (Until July 2003)*

Front row, from right to left

* Professor Kwok-Pui Fung (Member)
Head, United College, The Chinese University of Hong Kong;

* The late Professor Lin Ma (Promoter) (1924– 2017)
Chairman, Board of Trustees, Shaw College, The Chinese University of Hong Kong;

Professor Chen-Ning Yang (Chairman, Board of Adjudicators)

The late Mr Run Run Shaw (Founder of The Shaw Prize) (1907– 2014)

* Professor Yue-Man Yeung (Chairman)
Director, Hong Kong Institute of Asia-Pacific Studies,
The Chinese University of Hong Kong;

* The late Mrs Mona Shaw (Member) (1934– 2017)
Chairperson, The Shaw Prize Foundation.

Back row, from right to left

* Mr Raymond Wai-Man Chan (Member)
Director, Shaw Movie City Hong Kong Limited;

* Professor Pak-Chung Ching (Member)
Pro-Vice-Chancellor & Head of Shaw College,
The Chinese University of Hong Kong;

* Professor Samuel Sai-Ming Sun (Member)
Chairman, Department of Biology, Faculty of Science, The Chinese University of Hong Kong;

* Professor Kwok-Kan Tam (Member)
Department of English, Faculty of Arts, The Chinese University of Hong Kong;

* Professor Sunny Kai-Sun Kwong (Member)
Associate Professor, Department of Economics, Faculty of Social Sciences,
The Chinese University of Hong Kong;

Mr Charles Cheuk-Kai Cheung

Mr Koon-Fai Chor (Secretary)

Remarks: Titles of Members were then as of July 2003.

The Shaw Prize 2004

From right to left

The late Sir Richard Doll (1912–2005)
Laureate in Life Science and Medicine

Professor James Peebles
Laureate in Astronomy

Professor Stanley Cohen
Laureate in Life Science and Medicine

The late Mr Run Run Shaw (1907–2014)
Founder of The Shaw Prize

Mr Chee-Hwa Tung
The then Chief Executive of HKSAR

Professor Herbert W Boyer
Laureate in Life Science and Medicine

Professor Yuet-Wai Kan
Laureate in Life Science and Medicine

The late Professor Shiing-Shen Chern (1911–2004)
Laureate in Mathematical Sciences

The Shaw Prize 2005

From right to left

Professor Michel Mayor
Laureate in Astronomy

Professor Geoffrey Marcy
Laureate in Astronomy

The late Mr Run Run Shaw (1907–2014)
Founder of The Shaw Prize

Mr Rafael Hui
The then Acting Chief Executive of HKSAR

Sir Michael Berridge
Laureate in Life Science and Medicine

Professor Andrew Wiles
Laureate in Mathematical Sciences

The Shaw Prize 2006

From right to left

Professor Brian Schmidt
Laureate in Astronomy

Professor Adam Riess
Laureate in Astronomy

Professor Saul Perlmutter
Laureate in Astronomy

Mr Donald Tsang
The then Chief Executive of HKSAR

The late Mr Run Run Shaw (1907–2014)
Founder of The Shaw Prize

Professor Xiaodong Wang
Laureate in Life Science and Medicine

Professor David Mumford
Laureate in Mathematical Sciences

The late Professor Wentsun Wu (1919–2017)
Laureate in Mathematical Sciences

The Shaw Prize 2007

From right to left

Professor Peter Goldreich
Laureate in Astronomy

Professor Robert Lefkowitz
Laureate in Life Science and Medicine

The late Mr Run Run Shaw (1907–2014)
Founder of The Shaw Prize

Mr Henry Tang
The then Acting Chief Executive of HKSAR

Professor Robert Langlands
Laureate in Mathematical Sciences

Professor Richard Taylor
Laureate in Mathematical Sciences

The Shaw Prize 2008

From right to left

Professor Reinhard Genzel
Laureate in Astronomy

Sir Ian Wilmut
Laureate in Life Science and Medicine

The late Professor Keith H S Campbell (1954–2012)
Laureate in Life Science and Medicine

The late Mr Run Run Shaw (1907–2014)
Founder of The Shaw Prize

Mr Donald Tsang
The then Chief Executive of HKSAR

Professor Shinya Yamanaka
Laureate in Life Science and Medicine

The late Professor Vladimir Arnold (1937–2010)
Laureate in Mathematical Sciences

The late Professor Ludwig Faddeev (1934–2017)
Laureate in Mathematical Sciences

The Shaw Prize 2009

From right to left

Professor Frank H Shu
Laureate in Astronomy

The late Professor Douglas L Coleman (1931–2014)
Laureate in Life Science and Medicine

The late Mr Run Run Shaw (1907–2014)
Founder of The Shaw Prize

Mr Donald Tsang
The then Chief Executive of HKSAR

Professor Jeffrey M Friedman
Laureate in Life Science and Medicine

Professor Simon K Donaldson
Laureate in Mathematical Sciences

Professor Clifford H Taubes
Laureate in Mathematical Sciences

The Shaw Prize 2010

From right to left

Professor Charles L Bennett
Laureate in Astronomy

Professor Lyman A Page Jr
Laureate in Astronomy

Professor David N Spergel
Laureate in Astronomy

The late Mr Run Run Shaw (1907–2014)
Founder of The Shaw Prize

Mr Donald Tsang
The then Chief Executive of HKSAR

Professor David Julius
Laureate in Life Science and Medicine

Professor Jean Bourgain
Laureate in Mathematical Sciences

The Shaw Prize 2011

From right to left

Dr Enrico Costa
Laureate in Astronomy

Dr Gerald J Fishman
Laureate in Astronomy

Professor Jules A Hoffmann
Laureate in Life Science and Medicine

Professor Ruslan M Medzhitov
Laureate in Life Science and Medicine

The late Mr Run Run Shaw (1907–2014)
Founder of The Shaw Prize

Mr Donald Tsang
The then Chief Executive of HKSAR

Professor Bruce A Beutler
Laureate in Life Science and Medicine

Professor Demetrios Christodoulou
Laureate in Mathematical Sciences

Professor Richard S Hamilton
Laureate in Mathematical Sciences

The Shaw Prize 2012

From right to left

Professor Arthur L Horwich
Laureate in Life Science and Medicine

Professor Franz-Ulrich Hartl
Laureate in Life Science and Medicine

Mr C Y Leung
The then Chief Executive of HKSAR

Professor David C Jewitt
Laureate in Astronomy

Professor Jane Luu
Laureate in Astronomy

Professor Maxim Kontsevich
Laureate in Mathematical Sciences

The Shaw Prize 2013

From right to left

Professor Michael W Young
Laureate in Life Science and Medicine

Professor Michael Rosbash
Laureate in Life Science and Medicine

Professor Jeffery C Hall
Laureate in Life Science and Medicine

Mr C Y Leung
The then Chief Executive of HKSAR

Professor David L Donoho
Laureate in Mathematical Sciences

Professor Steven A Balbus
Laureate in Astronomy

Professor John F Hawley
Laureate in Astronomy

The Shaw Prize 2014

From right to left

Professor Daniel Eisenstein
Laureate in Astronomy

Professor Shaun Cole
Laureate in Astronomy

Professor John A Peacock
Laureate in Astronomy

Mr C Y Leung
The then Chief Executive of HKSAR

Professor Kazutoshi Mori
Laureate in Life Science and Medicine

Professor Peter Walter
Laureate in Life Science and Medicine

Professor George Lusztig
Laureate in Mathematical Sciences

The Shaw Prize 2015

From right to left

Mr William J Borucki
Laureate in Astronomy

Professor Bonnie L Bassler
Laureate in Life Science and Medicine

Professor E Peter Greenberg
Laureate in Life Science and Medicine

Mr C Y Leung
The then Chief Executive of HKSAR

Professor Gerd Faltings
Laureate in Mathematical Sciences

Professor Henryk Iwaniec
Laureate in Mathematical Sciences

The Shaw Prize 2016

From right to left

Professor Kip S Thorne
Laureate in Astronomy

Professor Rainer Weiss
Laureate in Astronomy

Mr C Y Leung
The then Chief Executive of HKSAR

Professor Adrian P Bird
Laureate in Life Science and Medicine

Professor Huda Y Zoghbi
Laureate in Life Science and Medicine

Professor Nigel Hitchin
Laureate in Mathematical Sciences

Remarks: The late Professor Ronald W P Drever (1931-2017),
Laureate in Astronomy, was unable to participate in the ceremony

The Shaw Prize 2017

From right to left

Professor Simon D M White
Laureate in Astronomy

Professor Ronald D Vale
Laureate in Life Science and Medicine

The Hon Mrs Carrie Lam Cheng Yuet-ngor
Chief Executive of HKSAR

Professor János Kollár
Laureate in Mathematical Sciences

Professor Claire Voisin
Laureate in Mathematical Sciences

Remarks: The late Professor Ian R Gibbons (1931-2018), Laureate in Life Science and Medicine, was unable to participate in the ceremony

The Shaw Prize 2017 Award Presentation Dinner

The Shaw Prize Council

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Professor Chen-Ning Yang

Council Members

Professor Kenneth Young (Chairman)

Professor Yuet-Wai Kan

Professor Pak-Chung Ching

Professor Wai-Yee Chan

Mr Raymond Wai-Man Chan

Professor Frank H Shu

Founding Member

Professor Chen-Ning Yang

Professor Chen-Ning Yang, an eminent physicist, was Albert Einstein Professor of Physics at the State University of New York at Stony Brook until his retirement in 1999. He has been Distinguished Professor-at-large at The Chinese University of Hong Kong since 1986 and Professor at Tsinghua University, Beijing, since 1998.

Professor Yang has received many awards: Nobel Prize in Physics (1957), Rumford Prize (1980), US National Medal of Science (1986), Benjamin Franklin Medal (1993), Bower Award (1994) and King Faisal Prize (2001). He is a Member of the Chinese Academy of Sciences, the Academia Sinica in Taiwan, the US Academy of Sciences, the Royal Society of London, the Russian Academy of Sciences and the Japan Academy.

Since receiving his PhD from the University of Chicago in 1948, he has made great impacts in both abstract theory and phenomenological analysis in modern physics.

Council Member (Chairman)

Professor
Kenneth Young

Professor Kenneth Young is a theoretical physicist, and is Emeritus Professor of Physics at The Chinese University of Hong Kong. He pursued studies at the California Institute of Technology, USA, 1965–1972, and obtained a BS in Physics (1969) and a PhD in Physics and Mathematics (1972). He joined The Chinese University of Hong Kong in 1973, where he has held the positions of Chairman, Department of Physics and later Dean, Faculty of Science, Dean of the Graduate School and Pro-Vice-Chancellor. He was elected a Fellow of the American Physical Society in 1999 and a Member of the International Eurasian Academy of Sciences in 2004. He was also a Member of the University Grants Committee, HKSAR and Chairman of its Research Grants Council. He served as Secretary and then Vice-President of the Association of Asia Pacific Physical Societies. His research interests include elementary particles, field theory, high energy phenomenology, dissipative systems and especially their eigenfunction representation and application to optics, gravitational waves and other open systems.

Council Member

Professor Yuet-Wai Kan

Professor Yuet-Wai Kan is currently the Louis K Diamond Professor of Hematology at the University of California, San Francisco and he focuses his research on the use of gene and cell therapy to treat sickle cell anemia and thalassemia. Professor Kan was born in Hong Kong, graduated from the Faculty of Medicine at the University of Hong Kong and trained at Queen Mary Hospital, Hong Kong, before going to the United States for further studies.

Professor Kan's contributions led to the innovation of DNA diagnosis and the discovery of human DNA polymorphism that have found wide application in genetics and human diseases. For his work, he has received many national and international awards including the Albert Lasker Clinical Medical Research Award, the Gairdner Foundation International Award and the Shaw Prize. He is the first Chinese elected to the Royal Society, London, and is a Member of the US National Academy of Sciences, Academia Sinica, the Third World Academy of Sciences and the Chinese Academy of Sciences. He has received honorary degrees from The University of Caglieri, Italy, The Chinese University of Hong Kong, The University of Hong Kong and The Open University of Hong Kong.

Council Member

Professor
Pak-Chung Ching

Professor Pak-Chung Ching is Director of Shun Hing Institute of Advanced Engineering and Choh-Ming Li Professor of Electronic Engineering of The Chinese University of Hong Kong. He received his Bachelor in Engineering (First Class Honours) and PhD degrees from the University of Liverpool, UK, in 1977 and 1981 respectively. Professor Ching is a Fellow of IEEE, IET, HKIE and HKAES. He is Chairman of the Veterinary Surgeons Board of Hong Kong and Chairman of the Board of Directors of the Nano and Advanced Materials Institute. Professor Ching was awarded the IEEE Third Millennium Award in 2000, the HKIE Hall of Fame in 2010, as well as the Bronze Bauhinia Star and Silver Bauhinia Star by the Government of HKSAR in 2010 and 2017 respectively. His research interests include adaptive digital signal processing, time delay estimation and target localization, blind signal estimation and separation, automatic speech recognition, speaker identification/verification and speech synthesis, and advanced signal processing techniques for wireless communications.

Council Member

Professor Wai-Yee Chan

Professor Wai-Yee Chan is Pro-Vice-Chancellor, Master of CW Chu College, Professor of Biomedical Sciences and Acting Director of School of Biomedical Sciences, Faculty of Medicine, The Chinese University of Hong Kong (CUHK), Hong Kong. Professor Chan obtained his BSc (First Class Honours) from CUHK in 1974 and PhD from the University of Florida, Gainesville, Florida, USA in 1977. Prior to assuming his current position in June of 2009, he was Professor of Pediatrics, Georgetown University, Washington, DC, and Head and Principal Investigator, Section on Developmental Genomics, National Institute of Child Health and Human Development, National Institutes of Health, Bethesda, MD, USA.

His expertise is in developmental genomics and molecular genetics of endocrine disorders. He received the 1988 Merrick Award for Outstanding Biomedical Research and the 2008 Presidential Award from the Association of Chinese Geneticists in America. He serves on the editorial board of a number of international scientific journals and on review panels of regional and international research funding agencies.

Council Member

Mr
Raymond Wai-Man Chan

Mr Raymond Chan assumed the role of Managing Director of the Shaw Group of Companies and was appointed Chairman of the Shaw Prize Foundation in 2018. Born and educated in Hong Kong, he continued his studies in the United Kingdom gaining BA (Hons) and B Arch (Hons) and became a Member of the Royal Institute of British Architects, the Architects Registration Board and the Hong Kong Institute of Architects.

Council Member

Professor
Frank H Shu

Professor Frank H Shu is a Shaw Laureate for his work in theoretical astrophysics. He was born in Kunming, China and emigrated to the United States at the age of six. He is a member of the US National Academy of Sciences, the American Philosophical Society, a Fellow of the American Academy of Arts and Sciences, and a Senior Fellow in the Institute for Advanced Study at City University of Hong Kong. While at Berkeley, in 1998 he was appointed as University Professor, an honour bestowed on only 35 faculty members in the UC system since its founding. From 2002 to 2006 he served as President of National Tsing Hua University in Taiwan. He then joined the Physics Department at the University of California at San Diego. In 2009 he retired from UCSD to work on climate change at Academia Sinica and to spin out a private company, Astron Solutions Corporation.

(Photo of Prof Frank H Shu©Stony Brook University)

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Professor John A Peacock
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Professor Scott Tremaine
Richard Black Professor of Astrophysics, School of Natural Sciences, Institute for Advanced Study, Princeton, USA

Professor Ewine van Dishoeck
Professor of Molecular Astrophysics, Leiden University, The Netherlands

Life Science and Medicine

Professor Bonnie L Bassler
HHMI Investigator and Squibb Professor and Chair, Department of Molecular Biology, Princeton University, USA

Professor Hans Clevers
Professor in Molecular Genetics, Hubrecht Institute, The Netherlands

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HHMI Investigator, Ralph D Feigin Professor of Pediatrics and Professor of Molecular and Human Genetics, Neurology and Neuroscience, Baylor College of Medicine, USA

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Professor Dusa McDuff
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Professor Felix Otto
Director, Max Planck Institute for Mathematics in the Sciences, Germany

Professor Wendelin Werner
Professor of Mathematics, Department of Mathematics, ETH Zürich, Switzerland

Selection Committee Member

Professor Victoria Kaspi

Astronomy Committee

Professor Victoria Kaspi is a Professor of Physics at McGill University, where she holds the Lorne Trottier Chair in Astrophysics and Cosmology, and a Canada Research Chair in Observational Astrophysics. She is also Director of McGill Space Institute. She received a BSc (Honours) in Physics from McGill University in 1989, and an MA and PhD in Physics from Princeton University in 1991 and 1993 respectively.

Professor Kaspi uses techniques of radio and X-ray astronomy to study rapidly rotating, highly magnetized neutron stars. She has done significant work involving radio pulsars and magnetars. More specifically, she has contributed among other things to the study of binary pulsar dynamics, the neutron star population, as well as the study of magnetars, the most highly magnetized objects known in the Universe.

Professor Kaspi has received numerous awards and honours, including the Killam Prize in 2015, NSERC's John C Polanyi Award in 2011, the Prix du Quebec in 2009 and the Harvard University Sackler Lectureship in 2009. She is a Fellow of the Royal Society of Canada and the Royal Society of London, and elected to the US National Academy of Sciences and the American Academy of Arts and Sciences.

Selection Committee Member

Professor
John A Peacock

Astronomy Committee

Professor John A Peacock studied Natural Sciences as an undergraduate at Jesus College, Cambridge, where he also completed a PhD in Radio Astronomy in 1981. He then moved to Edinburgh, initially working as a Research Astronomer at the Royal Observatory Edinburgh, before joining the University of Edinburgh as Professor of Cosmology in 1998. He was Head of Astronomy there between 2007 and 2013. Between 2015 and 2020, he will hold an Advanced Grant from the European Research Council.

His research interests lie at the interface of observational and theoretical cosmology: the evolution of active galaxies; gravitational lensing; galaxy formation and evolution; large-scale clustering. He was UK Chairman of the 2dF Galaxy Redshift Survey (1999–2005). He is the author of "Cosmological Physics", a highly successful postgraduate textbook.

Professor Peacock has received many significant awards for his work: most notably election as a Fellow of the Royal Society (2007) and the Shaw Prize in Astronomy (2014).

Selection Committee Member

Professor
Scott Tremaine

Astronomy Committee

Professor Scott Tremaine received his undergraduate degree from McMaster University in Canada and his PhD in Physics from Princeton. He has held faculty positions at MIT, the University of Toronto, and Princeton.

At the University of Toronto he was the first Director of the Canadian Institute for Theoretical Astrophysics, from 1985 to 1996, and at the Princeton University he chaired the Department of Astrophysical Sciences from 1998 to 2006. He is currently the Richard Black Professor of Astrophysics at the Institute for Advanced Study in Princeton.

He is a Fellow of the Royal Societies of London and of Canada and a member of the US National Academy of Sciences. His awards include the Dannie Heinemann Prize for Astrophysics, the Tomalla Foundation Prize for Gravity Research, the Dirk Brouwer Award, and honorary doctorates from McMaster, Toronto, and St. Mary's University.

His research has been focused on the dynamics of astrophysical systems, including planet formation and evolution, planetary rings, comets, supermassive black holes, star clusters, galaxies, and galaxy systems.

Selection Committee Member

Professor
Ewine van Dishoeck

Astronomy Committee

Professor Ewine F van Dishoeck is a Professor of Molecular Astrophysics at Leiden University, the Netherlands, and External Scientific Member of the Max Planck Institute for Extraterrestrial Physics in Garching.

She graduated at Leiden University, and held positions at Harvard, Princeton and Caltech from 1984–1990. The research of her group is at the boundary of astronomy, laboratory astrophysics and chemistry and uses ground-based and space-based observatories. The current focus is on the physical and chemical evolution of material from interstellar clouds to planet-forming disks and the importance of molecules as diagnostics of the star-formation process.

Professor van Dishoeck holds many national and international science policy functions, including Scientific Director of the Netherlands Research School for Astronomy (NOVA), President-elect of the International Astronomical Union, former member of the ALMA Board and Co-PI of the JWST-MIRI instrument.

She has received many prizes, including the 2018 Kavli Prize for Astrophysics, the 2018 James Craig Watson Medal of the US National Academy, the 2015 Albert Einstein World Award of Science, the 2014 Lodewijk Woltjer EAS prize lecture and the 2014 Lise Meitner Goteborg award in physics, as well as the Dutch Spinoza Award, an ERC Advanced Grant, and the Dutch Academy Prize. She is a Member of the Dutch Royal Academy of Sciences and the Leopoldina German Academy of Sciences, Foreign Associate of the US National Academy of Sciences, and Foreign Member of the American Academy of Arts and Sciences.

Selection Committee Member

Professor
Bonnie L Bassler

Life Science and Medicine Committee

Professor Bonnie L Bassler is a member of the US National Academy of Sciences, the National Academy of Medicine, and the American Academy of Arts and Sciences. She is a Howard Hughes Medical Institute Investigator and the Squibb Professor and Chair of the Department of Molecular Biology at Princeton University. Her research focuses on the molecular mechanisms bacteria use for intercellular communication. This process is called quorum sensing. Professor Bassler's discoveries are paving the way to the development of novel therapies for combating bacteria by disrupting quorum-sensing-mediated communication. She received the Shaw Prize in Life Sciences and Medicine in 2015. Professor Bassler is a member of the Royal Society and the American Philosophical Society. She served on the National Science Board from 2010–2016 and was nominated to that position by President Barack Obama. The Board oversees the NSF and prioritizes the nation's research and educational activities in science, math and engineering.

Selection Committee Member

Professor
Hans Clevers

Life Science and Medicine Committee

Professor Hans Clevers obtained his MD degree in 1984 and his PhD degree in 1985 from the University Utrecht, the Netherlands. His postdoctoral work (1986–1989) was done with Cox Terhorst at the Dana–Farber Cancer Institute of Harvard University, Boston, USA. From 1991–2002 Professor Hans Clevers was Professor in Immunology at Utrecht University and, since 2002, Professor in Molecular Genetics. From 2002–2012 he was director of the Hubrecht Institute in Utrecht. From 2012–2015 he was President of the Royal Netherlands Academy of Arts and Sciences (KNAW). Since June 1, 2015 he is Director of Research of the Princess Maxima Center for Pediatric Oncology.

Professor Hans Clevers has been a member of the Royal Netherlands Academy of Arts and Sciences since 2000, a member of the American Academy of Arts and Sciences since 2012 and a member of the US National Academy of Sciences since 2014. He obtained two ERC Advanced Investigator grants (2008 and 2016). He is Chevalier de la Legion d'Honneur since 2005 and Knight in the Order of the Netherlands Lion since 2012.

Selection Committee Member

Professor
Carol Greider

Life Science and Medicine Committee

Professor Carol Greider received a BA from UC Santa Barbara in 1983 and a PhD in 1987 from UC Berkeley. In 1984, together with Elizabeth Blackburn, she discovered telomerase, an enzyme that maintains chromosome ends. In 1988, Professor Greider was appointed as a Fellow at Cold Spring Harbor Laboratory, and in 1994 was promoted to Investigator. In 1997, Professor Greider moved to Johns Hopkins University School of Medicine. In 2004, she was appointed as the Daniel Nathans Professor and Director of the Department of Molecular Biology and Genetics at Johns Hopkins University.

Professor Greider's lab currently studies telomeres and telomerase in cancer and age-related degenerative disease. Professor Greider shared the Nobel Prize in Physiology or Medicine with Professors Elizabeth Blackburn and Jack Szostak in 2009.

Selection Committee Member

Professor
Richard Lifton

Life Science and Medicine Committee

Professor Richard Lifton is President of The Rockefeller University where he is also Head of the Laboratory of Human Genetics and Genomics. He previously was Sterling Professor and Chair of Genetics at Yale University. Professor Lifton has used human genetics and genomics to identify mutations that identify key genes and pathways underlying a wide range of human diseases including hypertension, osteoporosis, cancer, and congenital malformations. Recently, he has pioneered the development of exome sequencing for disease gene discovery and clinical diagnosis.

Professor Lifton is a member of the US National Academy of Sciences, National Academy of Medicine and the American Academy of Arts and Sciences. He has received the highest scientific awards of the American Heart Association, the American and International Societies of Nephrology, the American and International Societies of Hypertension, and the New York Academy of Medicine. He received the 2008 Wiley Prize for Biomedical Sciences and the 2014 Breakthrough Prize in Life Sciences.

Selection Committee Member

Professor
Shinya Yamanaka

Life Science and Medicine Committee

Professor Shinya Yamanaka is most recognized for his discovery of induced pluripotent stem (iPS) cells, which are differentiated cells that have been reprogrammed to the pluripotent state. He is Director of the Center for iPS Cell Research and Application (CiRA) at Kyoto University and Senior Investigator at the Gladstone Institutes in San Francisco.

Since his breakthrough finding, he has received many prestigious awards including the Shaw Prize, the Albert Lasker Basic Medical Research Award, the 100th Imperial Prize, Japan Academy Prize, and the Wolf Prize in Medicine. The significance of iPS cells was culminated with Professor Yamanaka being awarded the Nobel Prize in 2012. He was elected to the US National Academy of Sciences, the US National Academy of Medicine, the Insitute de France, the Pontifical Academy of Sciences, and the Japan Academy. In 2014, he received an honorary degree from The University of Hong Kong and was named Dr Lui Che Woo Distinguished Professor by The Chinese University of Hong Kong.

Selection Committee Member

Professor
Huda Y Zoghbi

Life Science and Medicine Committee

Professor Huda Y Zoghbi is the Ralph D Feigin Professor of Pediatrics at Baylor College of Medicine, where she is also Professor of Molecular and Human Genetics, Neurology and Neuroscience. She has been an Investigator with the Howard Hughes Medical Institute since 1996. She is also the founding Director of the Jan and Dan Duncan Neurological Research Institute at Texas Children's Hospital.

Professor Zoghbi's interest is in understanding healthy brain development as well as what goes awry in specific neurological conditions. She has published seminal work on the cause and pathogenesis of Rett syndrome and late-onset neurodegenerative diseases, and has trained many scientists and physician-scientists. In 2000 she was elected to the Institute of Medicine, and in 2004 she was elected to the US National Academy of Sciences. Among Professor Zoghbi's recent honours are the Shaw Prize, the Breakthrough Prize and Canada's Gairdner prize.

Selection Committee Member

Professor Annalisa Buffa

Mathematical Sciences Committee

Professor Annalisa Buffa received her degree in Computer Science in 1996 and her PhD in Mathematics in 2000. She obtained a research position at the CNR Institute IMATI (Italy) in 2001. She became Research Director in 2004 and led the Institute from 2013 to 2016. In September 2016, she joined the Mathematics Department at EPFL (Switzerland) as Full Professor and holds the Chair of Numerical Modelling and Simulation at MATHICE.

In 2008 she was granted an ERC StG, she received the ICIAM Collatz Prize in 2015 and was awarded an ERC AdG in 2016. She was invited/plenary speaker at a number of international conferences, section speaker as International Congress of Mathematicians (2014, Seoul, Korea), and plenary speaker at ICIAM (Beijing, China, 2015). She is a member of the Academia Europaea.

Her work is focused on the numerical analysis of partial differential equations and her contributions span from functional analysis to algorithmic aspects and parallel computing.

Selection Committee Member

Professor
Dusa McDuff

Mathematical Sciences Committee

Professor Dusa McDuff, born in 1945, is the Helen Lyttle Kimmel '42 Professor of Mathematics at Barnard College, Columbia University. After completing an Undergraduate degree in Edinburgh, she received her PhD in 1971 from the University of Cambridge. After studying in Moscow and Cambridge, she served as a faculty member first at the Universities of York and Warwick in the UK, and then, from 1978 to 2007, at Stony Brook University, USA.

Dusa McDuff has been awarded numerous honours including the Ruth Lyttle Satter Prize of the American Mathematical Society in 1991, and honorary doctorates from the Universities of Edinburgh, York, St. Andrews, Strasbourg and the Pierre and Marie Curie campus of the Sorbonne, Paris.

She is a Fellow of the Royal Society of London, and of the American Academy of Arts and Sciences, as well as a member of the US National Academy of Sciences and of the American Philosophical Society.

Selection Committee Member

Professor
Felix Otto

Mathematical Sciences Committee

Professor Felix Otto is Director at the Max Planck Institute for Mathematics in the Sciences in Leipzig (Germany) since 2010. He received his PhD in Mathematics at the University of Bonn in 1993. He was Postdoc at the Courant Institute and the Carnegie-Mellon University. In 1997 he became assistant and in 1998 Full Professor at the University of California at Santa Barbara. In 1999 he became Full Professor at the Department of Applied Mathematics at the University of Bonn where he was the Managing Director of the Hausdorff Center for Mathematics from 2006–2009.

His main expertise is in the applied analysis of partial differential equations and in the calculus of variations. He has worked on gradient flows, on micromagnetics, and on stochastic homogenization.

He has received various awards, including the Max Planck Research Prize, the Leibniz Prize of the German Science Foundation and the Collatz Prize of CICIAM. He is a member of the German Academy of Sciences Leopoldina, the Berlin-Brandenburg Academy of Sciences and Humanities and the Academia Europaea.

Selection Committee Member

Professor
Wendelin Werner

Mathematical Sciences Committee

Professor Wendelin Werner is a French mathematician, currently professor at the ETH Zürich in Switzerland. He studied at the École Normale Supérieure in Paris and was awarded his PhD in 1993 by the University of Pierre and Marie Curie. After holding positions at CNRS in Paris and a post-doctoral stay at the University of Cambridge, he has been Professor of Mathematics at the Université Paris-Sud in Orsay from 1997 to 2013.

For his works in probability, at the interface between stochastics, analysis and mathematical physics, Professor Werner was awarded a number of awards including the Fermat Prize, the Loève Prize, and the Fields Medal in 2006. He is a member of the French, Berlin-Brandenburg, Leopoldina and Brazilian Academies of Sciences.

Presenter

Ms
Do Do Cheng

Award-winning Actress
Versatile TV Performer
Programme Host

Award-winning actress, versatile TV performer and programme host Ms Do Do Cheng has starred in many TVB classic dramas and won film awards, local and international. Her hosting of the Hong Kong version of "The Weakest Link" and starring in Television Broadcasts Limited's (TVB) sit-com "War of the Genders" became talk-of-the-town. Ms Cheng's success in hosting the TVB game show on legal knowledge "Justice for All" brought her career to a new height. In addition to the 2008 Beijing Olympics for TVB, she has also been hosting many yearly events of the Company namely TVB Anniversary Gala, TV Award Presentation and Miss Hong Kong Pageant. She has also been a popular talk show host at Hong Kong Commercial Broadcasting Corporation Ltd since September 2011. From its inception in 2004, Ms Cheng has been one of the presenters for the Shaw Prize Award Presentation Ceremony.

Presenter

Mr
Leon Ko

Theatre and Film Composer

Mr Leon Ko received a Richard Rodgers Development Award in the US for his musical "Heading East". His musical "Takeaway" in 2011 was the first major British Chinese musical to premiere in London. His music for the movie "Perhaps Love" won him a Golden Horse Award and a Hong Kong Film Award. He won Best Original Film Song for the movie "The Last Tycoon" at the 32nd Hong Kong Film Awards, and received another Best Song nomination for the movie "Insanity" at the 34th Hong Kong Film Awards. For the stage, he won eight music awards for his musicals in Hong Kong. Mr Ko was the musical director of Jacky Cheung's 2004 world tour of "Snow, Wolf, Lake". Recent works include "The Amazing Filmphony", a concert of his film music with Hong Kong Sinfonietta, and new music for the Cantonese opera "Shade of Butterfly and Red Pear Blossom" in Hong Kong and Macau, as well as the score for the movie "Monster Hunt" and "Monster Hunt 2". Besides music, Mr Ko launched "Time In A Bottle", the first-ever perfume bottle exhibition in Hong Kong in 2010, showcasing the artistry of vintage bottles in the context of theatre. Mr Ko is currently a council member of the Hong Kong Academy for Performing Arts.

Special Acknowledgement

(in alphabetical order)

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