The Shaw Prize

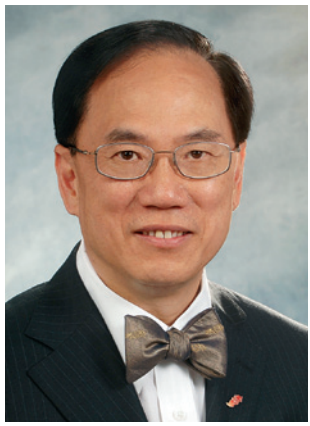
The Shaw Prize is an international award to honour individuals who are currently active in their respective fields and who have recently achieved distinguished and significant advances, who have made outstanding contributions in culture and the arts, or who in other domains have achieved excellence. 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 work is recently achieved and who are currently active in their respective fields.

Founder's Biographical Note

The Shaw Prize was established under the auspices of Mr Run Run Shaw. Mr Shaw, born in China in 1907, is a native of Ningbo County, Zhejiang Province. He joined his brother's film company in China in the 1920s. In the 1950s he founded the film company Shaw Brothers (Hong Kong) Limited in Hong Kong. He was one of the founding members of Television Broadcasts Limited launched in Hong Kong in 1967. Mr Shaw has also founded two charities, The Sir Run Run Shaw Charitable Trust and The Shaw Foundation Hong Kong, both dedicated to the promotion of education, scientific and technological research, medical and welfare services, and culture and the arts.

Message from the Chief Executive

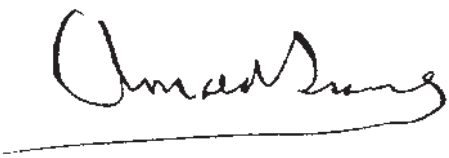


My congratulations to the seven recipients of this year's prestigious Shaw Prize. These distinguished scientists have made fascinating discoveries in their respective fields and expanded the frontiers of human knowledge.

The Shaw Prize recognises not only the excellent work of these eminent scientists, but also their passion and commitment to conquering the unknown.

The Shaw Laureates for 2011 have demonstrated that with imagination, determination and hard work, a scholar can make a huge impact in academia and beyond, where some of the brilliant research results later become daily applications that benefit the world.

I wish the Shaw Laureates every success in their future quests for truth and look forward to witnessing more scientific breakthroughs from them in the years to come.



Donald Tsang
Chief Executive
Hong Kong Special Administrative Region

Message from the Founder

In childhood, we gaze in wonder at the sky, the oceans, the mountains and forests, and questions roll off young tongues faster than answers appear. Those who retain a deep curiosity of the world around them and beyond, embark on a quest to demolish barriers and solve mysteries in their chosen field of inquiry. The Shaw Prize highlights the wonders of their achievements and acknowledges their dedication to the patient process of mastering details on the journey to discovery.

Run Run Shaw

Message from Chairman of the Board of Adjudicators

Tonight, three Shaw Prizes will be awarded to seven scientists for their distinguished contributions to Astronomy, Life Science and Medicine, and Mathematical Sciences.

The first Shaw Prize Award Ceremony took place in 2004. Since that time, including this year's awards, there have been all together 25 Shaw Prizes awarded to 43 scientists in three fields.

Astronomy is the oldest of all natural sciences. Indeed, Isaac Newton who begot modern science, based his great tome on the works of earlier astronomers Tycho Brahe and Johannes Kepler. In the sixty years since WWII the field has gone through explosive growth, yielding unbelievably mysterious and awesome discoveries so that today astronomy is the field that draws more freshmen students than any other scientific disciplines.

Life Science and Medicine likewise has gone through stunning revolutions in these sixty years, starting with the discoveries of the double helix, the gene to protein dogma, and all subsequent miraculous understanding of various aspects of the molecular basis of life.

Mathematical Sciences have also enjoyed vigorous growth in this period, both in depth and in breadth: Difficult old problems have been solved, and contacts with neighbouring disciplines, especially physics and astronomy, have produced new insights about the structure of the universe, both in the large and in the small.

The Shaw Prize is proud to play a role in recognizing revolutionary advances in these vibrant and productive areas of modern scientific research.

Chen Ning Yang

Chen-Ning Yang

The Shaw Prize Medal

The front of the medal displays a portrait of 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, the relevant year and the name of the prizewinner. A seal of imprint of the Chinese phrase "制天命而用之" (quoted from Xun Zi – a thinker in the warring states period of Chinese history in 313 – 238 B.C.) meaning "Grasp the law of nature and make use of it" appears in the upper right corner.

AGENDA

Arrival of Officiating Guest and Laureates

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Welcome Speech by Professor Chen-Ning Yang
Member of the Council
Chairman of the Board of Adjudicators, The Shaw Prize

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Speech by Professor Jiansheng Chen
Member of the Board of Adjudicators
Chairman of the Selection Committee for the Prize in Astronomy

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Speech by Professor Yuet-Wai Kan
Member of the Board of Adjudicators
Chairman of the Selection Committee for
the Prize in Life Science and Medicine

****

Speech by Professor Peter C Sarnak
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
28 September 2011

AWARD PRESENTATION

(Category listed in alphabetical order)

Astronomy

Dr Enrico Costa

and

Dr Gerald J Fishman

Life Science and Medicine

Professor Jules A Hoffmann,

Professor Ruslan M Medzhitov

and

Professor Bruce A Beutler

Mathematical Sciences

Professor Demetrios Christodoulou

and

Professor Richard S Hamilton

Professor Jiansheng Chen

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

Professor Jiansheng Chen is a reputed astrophysicist and Fellow of the Chinese Academy of Sciences. He is currently a Professorial Research Scientist and Director of Department of Astronomy at Peking University and Director of Beijing Astrophysical Center.

Professor Chen is also the former Deputy Director of the Academic Division of Mathematics and Physics of the Chinese Academy of Sciences (1998 – 2002), the Chairman of the Astronomical Advisory Board of Chinese Academy of Sciences, Member of the Academic Degree Committee of the State Council, Member of the Expert Group for Post-doctorates of the Personnel Ministry, and Member of Special Nominating Committee of International Astronomical Union.

He has been primarily engaged in research in the fields of QSO absorption line, QSO survey, Galactic Physics and large scale astronomy.

The Prize in Astronomy 2011

Enrico Costa

and

Gerald J Fishman

for their leadership of space missions that enabled the demonstration of the cosmological origin of gamma ray bursts, the brightest sources known in the universe.

An Essay on the Prize in Astronomy 2011

Gamma ray bursts (GRBs) are intense flashes of gamma rays emanating from cosmic sources and lasting for a few seconds to minutes and were first detected serendipitously in 1967 by gamma ray detectors aboard the Vela satellites, and were announced by Klebesadel et al in 1973 the discovery of GRBs.

To understand the nature of GRBs the first and key step is to determine the distance of GRBs from the Earth. The two experiments, namely Burst and Transient Source Explorer (BATSE) on Compton Gamma Ray Observatory (CGRO) and BeppoSAX, play a leading role in answering this key question.

In 1991 the CGRO with BATSE instrument was launched. The BATSE experiment detected thousands of GRBs and showed that their distribution was nearly uniform in the sky — not biased towards any particular direction in space, such as toward the galactic plane or the galactic center. Because of the flattened shape of the Milky Way Galaxy, sources within our own galaxy would be strongly concentrated in or near the Galactic plane. The absence of any such pattern in the case of GRBs provided strong evidence that gamma-ray bursts must come from beyond the Milky Way, i.e. are located at cosmological distances far beyond the Milky Way galaxy. The BATSE experiment also showed that there are two distinct classes of GRBs.

Several models for the origin of gamma-ray bursts postulated that the initial burst of gamma rays should be followed by slowly fading emission at longer wavelengths created by collisions between the burst ejecta and interstellar gas. Early searches for this "afterglow" were unsuccessful, largely due to the difficulties in observing a burst's position at longer wavelengths immediately after the initial burst. The Dutch-Italian satellite BeppoSAX, launched in 1996, made the breakthrough. In

1997 an X-ray camera aboard BeppoSAX measured accurate positions of the X-ray afterglows of GRBs that enabled observers using ground-based optical telescopes to make the first identification of a GRB with a distant galaxy and the first identification of a GRB with a supernova explosion, confirming their cosmological origin. Within a few months, the controversy about the distance scale ended: GRBs are extragalactic events originating within faint galaxies at enormous distances.

The cosmological origin of the GRB shows that during the flash, a GRB outshines all the stars and galaxies in the universe. GRBs appear so bright because they emit narrow beams of relativistic particles, and those that are observed happen to have these beams directed toward Earth. There at least two distinct types of GRBs. The long-duration bursts are associated with rare types of supernova explosions and may be caused by the formation of a black hole at the center of a collapsing massive star. The short-duration bursts may be caused by the merger of two neutron stars.

Although the physical mechanisms responsible for the GRB phenomena remain uncertain, there is no doubt that the GRB sources manifest some of the most extreme physical environments in the cosmos. The ongoing study of GRBs is one of the most exciting fields of astrophysics today.

Gerald Fishman was Principal Investigator of the BATSE experiment on CGRO and **Enrico Costa** led the development of the Dutch-Italian satellite BeppoSAX. For their outstanding achievements, Enrico Costa and Gerald Fishman are awarded the 2011 Shaw Prize in Astronomy.

Enrico Costa
Laureate in Astronomy

I was born in 1944 in Sassari, a small city on the island of Sardinia. My brother and I were educated by my grandmother and three uncles. I had the opportunity to ride horses and drive (illegally) cars since I was very young. At the age of ten I moved to Rome to live with my father and be close to my mother, where I have lived ever since. Until I was twenty I maintained links with Sardinia, continuing to participate (with some success) in horse shows, while still saving some time to play guitar.

My father was a judge, my mother was teaching Education at University but I haven't followed them. I studied 8 years of Latin and 5 years of Greek and still today I can read texts. I was greedy for knowledge, especially of archeology, history and astronomy. I still cultivate an interest in history, philology, anthropology, different civilizations, movies and the arts. In my house, books and humans are in a perpetual fight for territory.

I had too many passions spanning humane and scientific disciplines. At university my first choice was chemistry as I was aiming to become a biochemist, but after one year I switched to physics. The Rome Institute was permeated with a spirit of excellence and severe discipline. Yet I was not attending too regularly. I was also doing politics and leading the Youth Movement of the Republican Party, a small radical party with deep roots in Italian history. But becoming a professional politician was not that attractive: I went back to science, finished my classes and went for a thesis at the Institute of Space Astrophysics (IAS). Under the supervision of Giulio Auriemma I worked to prepare rocket experiments X-rays and various detectors. These years were the most important in forming my scientific personality.

In 1975 I completed my studies and in 1976 had a first position at the IAS. Later I worked on stratospheric balloons: a great school to image, build, perform and analyze an experiment. In 1981 I was part of a team, led by Livio Scarsi, that proposed to the Italian Space Agency the "Satellite per Astronomia X"(SAX), aimed to broad band on a narrow field combined with Wide Field Cameras (WFC), provided by the Dutch Institute. Within SAX I joined the Phoswich Experiment (PDS) led by Filippo Frontera: this collaboration was the basis for the future discoveries on Gamma Ray Burst (GRB). He proposed to convert the anticoincidence of PDS into a Gamma Ray Burst Monitor (GRBM), so that we could steer the search for bursts in the Wide Field Cameras. The encounter was

crucial from another point of view: during a campaign to launch a balloon to test phoswich technologies, I met Alda who was working on the electronics. She is the woman of my life, my wife, my expert in electronics and the mother of my children. When the elder child, Ettore, was born in 1987 I was in Brazil, trying to grasp gamma rays from the SuperNova. Elettra, the second one, was more lucky: when she was born in 1991 I was in Rome.

SAX, launched in 1996, was dedicated to Beppo Occhialini. Before the launch, a worldwide announcement was issued for data. In the PDS group we decided to submit a proposal, led by myself, to observe GRBs with the WFC, on GRBM trigger. This proposal was selected. We prepared a procedure for a fast determination of the coordinates and a repointing of the telescopes. Since the data center had no remote access, then in cooperation with the Mission Scientist Luigi Piro, we set up a team from our institutes that, in connection with duty scientists and satellite operators, manage all needed operations at the center itself. On 28 February 1997, the GRBM detected a burst, Wide Field Camera localized it and Narrow Field Instruments were re-pointed in 8 hours. A decaying source was detected and localized with arcminute precision: the first afterglow. Many optical telescopes were pointed and Ian Van Paradijs was the first to announce the optical afterglow ten days later. Two months later, on another burst, the radio afterglow was detected and the first red-shift measured. After 25 years, the origin of GRBs was no more a mystery: they come from remote galaxies.

Since 1999, I have contributed the X-ray Instrument to the Italian gamma-ray mission AGILE, that is still producing results: first of all, the detection of unexpected flares from the Crab Nebula.

X-ray polarimetry is another passion of mine. With Novick we built an instrument for the SRG mission – but that was never launched. With Ronaldo Bellazzini we built a gas-filled device to perform photoelectric focal plane polarimetry of X-ray sources with unprecedented sensitivity, but could not yet embark aboard any satellite. We are also developing large area experiments for timing studies of bright sources.

Next year I am forced to retire but I hope and plan to continue doing research. I cannot imagine my future without experiments. Ettore is studying Contemporary History. Elettra is studying Law. They will, for sure, play a great role in my future.

Gerald J Fishman
Laureate in Astronomy

I was born in 1943 in St. Louis, Missouri, USA. As a child I had a great interest in scientific and technical toys, hobbies, and subjects in school. I attended schools in the St. Louis area through high school, from which I graduated in 1961. I enrolled at the University of Missouri, in Columbia, Missouri. There I received a scholarship in the physics department and also worked as a student assistant in astronomy, where I operated a telescope for student and public demonstrations. I graduated from the University of Missouri in 1965, obtaining a B S degree with Honors in Physics.

Following my undergraduate work, I enrolled in graduate school as a research assistant in the Department of Space Science at Rice University in Houston, Texas. This was a new department, one of several in the U.S. that was sponsored by NASA during the Apollo era in the late 1960's. There I was fortunate to participate in some pioneering balloon-borne observations in gamma-ray astronomy under Professor R C Haymes. We performed some of the first observations of gamma-ray emitting objects such as neutron stars, black holes, active galaxies, supernova remnants and the Galactic Center. As a graduate student, I led the research group that discovered pulsed high-energy x-rays and gamma rays from the pulsar in the Crab Nebula. I received the PhD degree in Space Science from Rice University in 1970 with a thesis on observations of x-ray emission from nearby active galaxies.

Following graduate school, I moved to Huntsville, Alabama, working as a research scientist at the NASA-Marshall Space Flight Center. My initial work there was as a scientific consultant for a new series of NASA spacecraft, the High Energy Astronomy Observatories. I also led a number of small observational programs in gamma-ray astronomy and background radiation measurements in space. For a year, I served as a staff scientist at the NASA Headquarters office of space science in Washington, DC, where I helped administer and manage research projects in high-energy astrophysics projects sponsored by NASA.

Soon after the mysterious gamma-ray bursts were discovered in the early 1970's I became intrigued by these enigmatic objects and wanted to study them. This was difficult because these bursts occurred randomly in the sky for only a brief period, from a fraction of a second to several minutes. Their distance was unknown, although most astrophysicists speculated at that time that they originated from high-energy objects within our galaxy. I started an observational research program for these bursts using instrumentation carried by high-altitude balloons, using

detectors of a size that were larger than those used previously by other researchers. The experience with this instrumentation led to a proposal submitted to NASA to perform similar observations with a satellite-borne experiment that could observe many of these gamma-ray bursts over the entire sky over a period of several years.

In 1978, I was selected to be the Principal Investigator of the Burst and Transient Source Experiment (BATSE), one of the experiments to be placed on the Compton Gamma Ray Observatory. At the time, this observatory was the largest scientific spacecraft ever developed by NASA. It was launched and placed into orbit by the Space Shuttle Atlantis in April 1991 and operated until May 2000. The design, development, testing and operation of the BATSE experiment was the result of the work of many scientists, engineers and technicians in a time span of over twenty years.

From the observations of the BATSE and the Italian BeppoSAX spacecraft, it was finally determined in the late 1990's that gamma-ray bursts came from objects near the edge of the observable Universe and they represent the largest explosions in the Universe. As such, they are providing new observational data on the conditions in these distant regions and at the earliest periods in the history of the Universe.

Currently, I am continuing my research in gamma-ray astronomy as well as geophysics as a co-investigator on the Gamma-ray Burst Monitor experiment on the Fermi Gamma-ray Space Telescope Observatory. As with BATSE, this experiment was also designed primarily for the observation of gamma-ray bursts, which has constituted the major activity of my research career. Another of my current scientific interests is the study of the high-energy gamma rays that are associated with thunderstorms.

For my research on gamma-ray bursts with the BATSE experiment, I was awarded the Bruno Rossi Prize of the High Energy Astrophysics Division of the American Astronomical Society in 1994, that Division's highest prize. I was also elected a Fellow of the American Physical Society for this research.

My wife Nancy and I have been married since 1967. We have two daughters and three granddaughters, all of whom also live in Alabama. For enjoyment and exercise I enjoy hiking in the woods and working on our nearby ranch.

Professor Yuet-Wai Kan

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

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 that 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.

The Prize in Life Science and Medicine 2011

Jules A Hoffmann,
Ruslan M Medzhitov
and
Bruce A Beutler

for their discovery of the molecular mechanism of innate immunity, the first line of defense against pathogens.

An Essay on the Prize in
Life Science and Medicine 2011

The immune system is central to the survival of humans in a world filled with potentially deadly microbes. Immunity has two major components: (i) the familiar "adaptive" immune system, mobilized by previous infections or vaccines to protect us against subsequent encounters with specific microbes, and (ii) the less well-known, innate immune system, which is immediately mobilized in response to infection through inflammatory responses. Both systems are essential for human survival. Infants born without a functioning adaptive immune system, such as those with "severe combined immunodeficiency", require heroic measures, such as bone marrow transplantation, if they are to survive. But the lack of a normally functioning innate immune system is also life-threatening, as is seen in the repetitive severe infections in those with mutations in key components of the innate immune system.

The 2011 Shaw Prize in Life Science and Medicine is awarded to **Jules Hoffmann**, Professor at the University of Strasbourg, **Ruslan Medzhitov**, David W. Wallace Professor of Immunobiology at Yale University, and **Bruce Beutler**, Professor of Immunology, University of Texas, Southwestern Medical Center at Dallas. These three scientists have done path-breaking work that established the mechanisms of the innate system and provide new avenues for drug design to improve the overall function of the immune system.

The story begins with **Jules Hoffmann** who recognized that the innate immune system is evolutionarily ancient while adaptive immunity is only seen in vertebrates. Hoffmann studied the fruit fly, *Drosophila melanogaster*, identifying mutations that prevented it from making a protective immune response to the fungus, *Aspergillus fumagatus*. Through analysis of these mutations, Hoffmann showed that antifungal immunity depended on the activation of a surface molecule called Toll. Interestingly, Toll had been previously known in flies for its important role in establishing the orientation of the Drosophila embryo. Its role in innate immunity was entirely unanticipated and this discovery immediately attracted the attention of scientists working on the innate immune responses of higher animals and humans.

Ruslan Medzhitov and his then research mentor Charles A Janeway, Jr (now deceased) recognized that humans might have a similar system for the initiation of the innate immune response. Indeed, Janeway had earlier predicted the existence of generalized mechanisms through which cells of the innate immune system

could detect or "sense" a pathogen. Medzhitov and Janeway asked whether there were human molecules that resembled *Drosophila* Toll. By searching a database of human genes, they found a human homolog of Toll that is now referred to as a Toll-like receptor, a TLR. Within a year of Hoffmann's report, Medzhitov showed that if human TLR molecules on the surface of certain blood cells were stimulated to form aggregates, they caused the production of a series of potent molecules (cytokines) that were capable of initiating inflammatory responses that would mobilize cells to eliminate pathogens.

Still unresolved after Medzhitov and Janeway's work was what the TLR "sensed". **Bruce Beutler**'s key contribution was to prove that the TLRs recognized specific molecules known to be stimulants of inflammatory responses. He had been studying responses of mouse cells to a potent bacterial product, the endotoxin lipopolysaccharide (LPS), a component of an important class of bacteria. LPS was known to cause inflammatory responses in infected humans through production of several inflammatory cytokines. To determine what molecules the cells of the innate immune system used to recognize LPS, Beutler took advantage of the fact that certain mutant mouse strains were unable to respond to LPS. In elegant experiments, he showed that the mutant gene was precisely the TLR gene that Medzhitov and Janeway had identified in the human data base, now known as TLR4. Beutler's work showed that TLRs were physiologically important activators of the innate immune system of humans and other vertebrates as a result of being stimulated by TLRs. His work established the paradigm that common bacterial products, and later viral and parasite products, mediated their activation of innate immunity by being recognized by TLRs and other sensors of the innate immune system.

These three scientists, through their critical work, laid out the principles underlying the pathogen recognition/response model of the innate immune system. Their work opened the floodgates to an enormous body of work and to a deeper understanding of the TLRs as microbial sensors important in innate resistance to pathogens and to additional work that identifies other microbial sensors in cells. This body of work has revolutionized our understanding of the innate immune system and provides targets for drug development and for the strategy for developing a new generation of vaccines.

Jules A Hoffmann
Laureate in Life Science and Medicine

I was born in Luxembourg where I grew up during the difficult post-war years. My father was a high-school teacher in Biology and a fervent entomologist. He spent his spare-time collecting and identifying insects and he conveyed his passion for this exceptionally diverse group of animals to me during our numerous field studies. My scientific work has always focused on insect models since that period. Outside this field, my main interests are languages and history.

After High School, I left Luxembourg for the University of Strasbourg (France), where I majored in Biology. There, I felt attracted by the laboratory of Professor Pierre Joly, who worked on endocrine regulations of development and reproduction in grasshoppers, a major pest in African countries. Professor Joly offered me a position with the French National Research Agency (CNRS) and I started studying the antimicrobial defenses in grasshoppers. The choice of this problem was motivated by the fact that my host-laboratory had worked for several decades on transplantations of endocrine organs between grasshoppers: although these experiments had been routinely performed under septic conditions, no microbial developments were ever observed in the recipient insects, suggesting that grasshoppers had efficient mechanisms to counter opportunistic microbial infections. Virtually nothing was known on antimicrobial defenses in insects at that time, beyond the classical observations of Metchnikoff at the end of the 19th century, on the engulfment of microbes by blood cells (phagocytosis).

During the studies which led to my PhD defense in 1969, I focused on the origin of blood cells in grasshoppers and discovered a well-developed blood-forming tissue (hematopoietic tissue) in the vicinity of the heart vessel. Selective X-ray treatment of this tissue resulted in a massive septicemia and, more surprisingly, in an arrest of the endocrine control of molting. The latter is governed by the steroid hormone ecdysone, which had just been characterized in Germany by the renowned biochemist Peter Karlson. I went for a postdoctoral stay in his laboratory in Marburg in 1973, while our group in Strasbourg started analysing the biological and biochemical contexts of infections in grasshoppers.

In 1978, upon the retirement of Professor Joly, I became Director of the laboratory which, under the name of 'Endocrinology and Immunology of Insects' continued to work in the two directions: (1) endocrine studies focusing on the biosynthesis and metabolism of the molting hormone ecdysone and its biological roles in reproduction and development; (2) the antimicrobial defenses, the latter studies shifted gradually to biochemical identifications of the induced antimicrobial molecules which largely contribute to the survival of infected insects. This direction was boosted by

the discovery of the antimicrobial peptide cecropin in infected pupae of the moth Hyalophora cecropia, by Professor Hans Boman in Stockholm where my co-worker (and wife) Danièle Hoffmann spent a postdoctoral period in 1979.

By 1990, the laboratory had considerably grown. To the initial research competences of experimental and cell biology, biochemistry and chemistry, we had added molecular genetics. We decided to concentrate our future efforts on the antimicrobial defenses and abandon our previous insect model organisms for the gentically tractable model Drosophila. In the 15 or so years which followed that decision, we were able to characterize in this species several families of inducible antimicrobial peptides, and to decipher the control of expression of their genes. We were also able to identify the receptor molecules which recognize diverse microorganisms and activate the signaling cascades leading to the expression of the immune-response genes (namely to that of the antimicrobial peptide genes). By then, our studies, in conjunction with those of several other groups in Europe, the US and Japan, had led to a comprehensive view of the fly immune system and had established it as a paradigm of innate immunity. These studies had also contributed to a more global understanding of innate defenses in other animal groups, namely in mammals, in particular as regards the roles of Toll receptors.

During the 80s and 90s, I had been involved in several advisory committees of our research agency CNRS, many of which I chaired, and in 1994, the agency appointed me as Director of the prestigious CNRS Institute of Cellular and Molecular Biology (IBMC) in Strasbourg. Our laboratory moved from the Institute of Zoology which had hosted us so far, to the IBMC, a move which I would surely not have anticipated during the 'grasshopper years'.

In 1992, I had been elected a Member of the French National Academy of Sciences and served as Vice-President and President of this Academy from 2005 to 2008. This was for me an exceptionally interesting period during which I came to personally know remarkable scientists in various fields from Mathematics to Astronomy, from Climate Science to Theoretical Physics, to name but a few. It was also an opportunity to encounter the Presidents and Councils of the major foreign Academies with whom I still maintain warm relations.

It goes without saying that the scientific achievements of our laboratory over the many years, as recounted above, are to be credited to a long list of collaborators of high intellectual and human calibers. Many in this list are now Distinguished Class Professors and heads of well-recognized groups in the field, here in France and in other countries. I express my admiration and warm gratitude to all of them.

Ruslan M Medzhitov
Laureate in Life Science and Medicine

I was born in 1966 in Tashkent, Uzbekistan, which was then a Republic of the Soviet Union. Both of my parents and my two brothers are mathematicians and I grew up hearing about things like "von Neumann algebra on a Hilbert Space" – concepts too abstract for me to comprehend. I spent most of my school years playing basketball, until about the eighth grade, when I decided to become a scientist. For the next two years, I spent most of my time reading books on botany, zoology, physiology and evolution, which my father rented out for me from a college library. I have always been fond of beetles and my first experiments, at the age of seven, were to observe their behavior after I would let them inhale cheap cologne thus rendering them intoxicated.

I went to college at Tashkent University, majoring in Biology. Though I was eager to study, my college experience was very frustrating. Every fall we had to go to the cotton fields for a couple of months, picking cotton by hand from sunrise to sunset. This left little time for studying. In the summer of 1984, after I finished the first year of college, I was drafted to serve two years in the Soviet Army. Military service was intellectually debilitating and I thought my chances of becoming a scientist were ruined. However, I managed to finish college where I'd had to rely mostly on self-education.

I was very lucky to have met a famous biochemist, Vladimir Skulachev, at Moscow State University, who arranged for me to enter a PhD program in his Department in 1990. This coincided with a severe economic crisis in Russia, which made experimental research practically impossible. Consequently, I spent most of my time in the libraries, reading up on various subjects related to molecular evolution. My main interest at the time was the evolution of cell communications and molecular recognition. This drew my attention to immunology, an interest that developed after I attended lectures given by Garry Abelev, one of the founders of tumor immunology. Abelev became my unofficial second mentor and his and Skulachev's guidance and encouragement were instrumental in my early development as a scientist.

One day, while studying in a library, I came across an article written by Charles Janeway Jr published in 1989: "Proceedings of the Cold Spring Harbor Symposia". The article described a theory of pattern recognition and innate control of adaptive immunity. I became interested in the concept and contacted Janeway to discuss its various implications.

In 1993, while still a PhD student in Moscow, I got a UNESCO fellowship to study protein evolution in the laboratory of Russell Doolittle at UCSD. Doolittle is a pioneer in the field of bioinformatics and a wonderful teacher. Learning about protein evolution directly from him was an invaluable experience. Although I only spent a few months in his lab, Doolittle's mentorship had a long-lasting impact on my scientific development. While I was in San Diego, he arranged for me to meet with local immunologists, including Mel Cohn and Dick Dutton. With recommendations from Doolittle and Dutton, I was lucky to join Janeway's lab without any credentials or research experience.

I arrived at Yale in early 1994 to start my postdoctoral studies with Janeway. Our main objective was to identify receptors that control activation of the adaptive immune system. At the time, nothing was known about these receptors and what they were supposed to look like. Based on an assumption that such receptors should activate the NF-κB signaling pathway, we identified a human homologue of the *Drosophila* Toll protein in early 1996. The Toll protein in *Drosophila* was known at the time to signal through the NF-κB signaling pathway during embryonic development. However, in 1996 Bruno Lemaitre and Jules Hoffmann discovered that the same receptor is also involved in the fly's immune defense. This further reinforced our assumption that mammalian Toll may be involved in microbial recognition and activation of adaptive immunity. Subsequent studies by many laboratories have elucidated many fascinating aspects of biology of the mammalian Toll-like receptor family.

Sadly, Charlie Janeway passed away in 2003. His ideas made a fundamental impact on our understanding of the immune system. He was a remarkable scientist and I was truly fortunate to work with him for almost ten years.

In 1999, I joined the faculty of Immunobiology at Yale University Medical School, where I remain to this day. In 2000 I became an Investigator of the Howard Hughes Medical Institute. I have been fortunate to have many talented students and postdoctoral fellows work with me over the past ten years.

In 2007 I married my wife Akiko Iwasaki, who is also a faculty member in our Department. We have two young daughters, Emi and Naomi, who keep us very busy and happy.

Bruce A Beutler
Laureate in Life Science and Medicine

I was born on December 29th, 1957 in Chicago, IL, USA. My earliest memory is of newly fallen snow blanketing the earth around our home, probably in December of 1959. "Who did that?" I asked, suspecting that my older brothers, sometimes mischievous, had somehow been responsible. It was the last snowfall I would see for several years, because my family moved to the small city of Arcadia, near Los Angeles, CA, where I grew up.

Mine was a family with strong academic standards. Three of the four children would become physicians, and the remaining child a successful software designer and businessman. My father and his parents, refugees from Nazi Germany, were physicians themselves. My mother, born in America to immigrants from Ukraine, was a homemaker, and for some years a technical writer. As a child I felt duty-bound to excel in school, and usually did well. I had a clear goal in mind. From the age of 7 or so, I wanted to be a biologist, and nothing else. Even now, it is difficult for me to imagine pursuing a different career.

My interest in biology grew from a deep fascination with nature, animals in particular. The ability of atoms and molecules to assemble themselves into living creatures, endowed with consciousness, volition, and mobility, and seeming much more than the sum of their parts, inspired awe. "Molecular biology" seemed the right appellation for what I wished to understand, and Watson's "*Molecular Biology of the Gene*," which I read while in high school, impelled me to study genetics and biochemistry in depth. Luckily, there were special ways for me to do so. When I was 14, my father, himself an esteemed scientist, first allowed me to work in his laboratory at the City of Hope Medical Center, where I learned to purify proteins, and to characterize erythrocyte enzymes. I also worked in the laboratory of Susumu Ohno, a mammalian geneticist famous for recognizing the essential role of gene duplication in evolution.

With a sense of mission, I hurried to finish high school and college, skipping several grades and graduating from the University of California at San Diego at the age of 18. At my father's suggestion, I went to medical school at the University of Chicago, to learn about physiology, pathology, and pharmacology, and to see firsthand the major challenges confronting medicine. I believe this was excellent advice, since biomedical inquiry sometimes yields profound insight into how living systems operate.

After graduating from medical school I completed an internship in medicine and a year of residency in neurology at the University of Texas, Southwestern Medical Center at Dallas. But my foremost wish was to devote myself to scientific work. I did so, beginning in 1983, with a fellowship and later a faculty appointment at the Rockefeller University. I returned to UT Southwestern as an HHMI investigator in 1986; then moved to the Scripps Research Institute in La Jolla, CA, in 2000. I will rejoin the faculty of UT Southwestern later this year.

My most important scientific accomplishments have included: 1) the isolation of mouse tumor necrosis factor (TNF), and discovery of its inflammatory properties; 2) the invention of recombinant inhibitors for TNF, now widely used for the treatment of inflammatory diseases; and 3) the discovery of the receptor for lipopolysaccharide (LPS), which revealed how mammals sense infection, and how certain inflammatory diseases begin.

These advances were made sequentially between 1984 and 1998, and were intimately tied to one another. Each was rooted in the exploration of innate immunity: the ability of multicellular organisms to sense infection and resist it. In the early 1990s, while at UT Southwestern, I first embraced a classical genetic approach to the study of innate immune responses. The genetic philosophy is one in which hypothesis is renounced in favor of a search for exceptions to the norm, induced by mutation. Using genetics to answer questions about mammalian immunity was an epiphany for me, and genetics will likely sustain my work for the rest of my life.

I married while still in medical school, at the age of 22, and between 1983 and 1987 had three sons: Daniel, Elliot, and Jonathan, with whom I remain very close today, although my marriage ended in 1988. They witnessed much of my career in science, and saw firsthand the commitment, rewards, and traumas that science entails: relentless work punctuated sometimes by joyful enlightenment, and sometimes by frustration. None of my sons became scientists, but they do have an avocational interest in science, often leading to animated discussion. Two of them share with me a deep admiration for J S Bach (which in my own case, materialized rather suddenly, at a performance of the Matthäus-Passion, attended when I was 15 years old). Indeed, many members of my family, living and deceased, have enjoyed music of the baroque era. Perhaps this is a heritable trait!

Professor Peter C Sarnak

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

Professor Peter C Sarnak is currently the Eugene Higgins Professor of Mathematics at Princeton University and Professor of the Institute for Advanced Study.

He has made major contributions to number theory, and to questions in analysis motivated by number theory. His interest in mathematics is wide-ranging, and his research focuses on the theory of zeta functions and automorphic forms with applications to number theory, combinatorics, and mathematical physics.

Professor Sarnak received his PhD from Stanford University in 1980. In the same year, he became Assistant Professor of Courant Institute of Mathematical Sciences of New York University and an Associate Professor in 1983. In 1987 he moved to Stanford University. He joined Princeton University as Professor in 1991, became the Henry Burchard Fine Professor of Mathematics in 1995 and the Chair of the Department of Mathematics from 1996 – 1999. From 2001 – 2005, he was Professor of Courant Institute of Mathematical Sciences of New York University.

He has received many awards, including the Frank Nelson Cole Prize, American Mathematical Society (2005) and Levi L Conant Prize, AMS (2003). He was elected as a Member of the US National Academy of Sciences and Fellow of the Royal Society of London in 2002.

The Prize in Mathematical Sciences 2011

Demetrios Christodoulou

and

Richard S Hamilton

for their highly innovative works on nonlinear partial differential equations in Lorentzian and Riemannian geometry and their applications to general relativity and topology.

An Essay on the Prize in
Mathematical Sciences 2011

After Newton's introduction of calculus and in particular differential equations to describe the motion of the planets, classical physics and geometry developed with more complex phenomena naturally being formulated in terms of partial differential equations. The Einstein equations in general relativity and the Ricci Flow equation in Riemannian geometry are two celebrated geometric partial differential equations. The first describes the geometry of four dimensional spacetime and it relates gravitation to curvature. The second gives an evolution of (Riemannian) geometries in which the flow at a given time is dictated by the curvature of the space at that time. Both of these equations are very elegant in their formulation. They are nonlinear partial differential equations in several unknown quantities which in turn depend on several variables. While they are of quite different characteristics in terms of the classification of such equations, they share the feature that they are notoriously difficult to study rigorously (even on a computer). Central to the understanding of the solutions, is whether they form singularities or not, and if so what is their nature. In the spacetime setting, examples of singularities are black holes and more generally gravitational collapse. In the Ricci Flow, should singularities arise in the course of the evolution, then for certain applications they need to be resolved. Christodoulou, in the case of Einstein's equations, and Hamilton in the case of the Ricci Flow, have made many of the fundamental breakthroughs in the theory of these geometric equations and especially in understanding their singularities. Their works have spectacular applications both to mathematics and to physics.

Demetrios Christodoulou

Christodoulou works in mathematical physics and in particular the differential equations that describe classical physical phenomena. His continued and profound study of the global behavior of solutions to the Einstein equations has been instrumental in shaping our present day understanding of the critical features of these solutions. In particular, his striking recent proof of the dynamical development of trapped surfaces in the setting of Einstein's equations in a vacuum shows that black holes can be formed solely by the interaction of gravitational waves. Earlier, he had made a breakthrough study of the reduced spherically symmetric Einstein equations, showing that naked singularities can occur for these but that they are rare and unstable. This work resolved the much debated problem of "weak cosmic censorship" for these symmetrically reduced cases. His joint work with S Klainerman establishing the long sought after nonlinear stability

of Minkowski spacetime, is by now one of the classical theorems in the theory. In other very novel works, Christodoulou has given the first detailed treatment of the delicate problem of the formation of singularities, called shocks, in the equations for fluid flow in three dimensions. Christodoulou's work combines a deep understanding of the underlying physics with brilliant mathematical technique. This has allowed him to resolve central problems that have resisted progress for generations.

Richard Hamilton

Hamilton's work is in geometric analysis. He has provided the theory and one of the most powerful tools to study the shapes (in other words the topology, where we allow deforming but no tearing) of low dimensional spaces. He introduced the Ricci Flow on the space geometries on a given shape as a means of deforming a given geometry into a regular one. An early success of his theory was his proof that any positively curved three dimensional space is the ordinary three dimensional sphere. This opened the door for him to attack the much more general problem of classifying all three dimensional shapes. This classification problem for two dimensional spaces has been understood for over 100 years. Thanks to the work of Thurston, one had, by 1980, a strong expectation of what the corresponding classification in three dimensions should be. It is formulated in Thurston's Geometrization Conjecture, which itself is a far reaching extension of the well-known Poincare Conjecture. During the past three decades, Hamilton developed a host of original techniques to study the long time behavior of the geometry under his Ricci Flow. Among these is his technique of surgery allowing for a continuation of the flow should singularities form. In particular, his methods allowed him to classify four dimensional positively curved spaces. He has also pursued the application of his techniques in the study of related geometric flows, such as the curve shortening flow and the Gauss and the mean curvature flows. His ideas and techniques have been used by others to resolve a number of long standing problems in topology and geometry. In particular, Hamilton's program in three dimensions was completed in brilliant work of Perelman leading to a complete solution of the Conjectures of Poincare and Thurston. This classification of three dimensional shapes constitutes one of the finest achievements in mathematics.

Demetrios Christodoulou
Laureate in Mathematical Sciences

I was born in Athens in 1951 to a lower middle class family. My father was born in Alexandria to Greek parents from Cyprus who had immigrated to Egypt. My mother was born in Athens to a family of Greek refugees from Asia Minor. Neither of my parents had higher education, but my father inspired me in childhood with stories from a distant past when ancient Greece had made outstanding contributions to human civilization. A problem in Euclidean geometry was the spark which initiated in me, in the summer of 1966, a burning interest in mathematics and theoretical physics. My case was brought to the attention of Achilles Papapetrou, a Greek physicist at IHP, who in turn contacted Princeton physics professor John Wheeler, on leave in Paris at that time. So, at the beginning of 1968 I came to Paris and was examined by them. This led to my admission as a graduate student in the Princeton physics department in the fall of 1968.

A decisive turn in my career came in 1977, at a time when I was a postdoctoral fellow at the Max Planck Institute for Astrophysics in Munich. There, Jurgen Ehlers, the leader of the group in which I was working, although himself a physicist, realized that I had a talent in mathematics and gave me an unlimited leave of absence with pay to study mathematics in Paris under the guidance of Yvonne Choquet-Bruhat. Thus, I finally found my true calling and in the period 1977-1981 I studied mathematical analysis in the French school.

In 1981, I returned to the US and one of the first scientists I met was the famous Chinese mathematician Shing-Tung Yau. I became closely associated with him for a period of five years, an association which played a decisive role in my mathematical make-up. From Yau I learned geometry and how to effectively combine geometry with analysis in what is today called geometric analysis, a field which Yau pioneered. I can summarize my scientific contribution since, as the extension of geometric analysis from the initial field of elliptic equations to the field of hyperbolic equations.

The first work of geometric analysis of hyperbolic equations was my work with Sergiu Klainerman on the stability of the Minkowski space-time, the fruit of an intensive effort in the period 1984-1991. This work demonstrated the stability of the flat spacetime of special relativity in the framework of the general theory and gave a detailed description of the asymptotic behavior of the solutions. Basically, an initial disturbance in the fabric of space-time propagates, like the disturbance in

a quiet lake caused by the throwing of a stone, in waves, the so-called gravitational waves. However, as I showed in a further 1991 paper, there is a subtle difference from the lake paradigm. For whereas spacetime becomes, again, like the lake, flat after the passage of the waves, the final flat spacetime is related in a non-trivial manner to the initial flat spacetime and this leads to an observable effect: the permanent displacement of the test masses of a gravitational wave detector.

Roger Penrose had introduced, in 1965, the concept of a trapped surface and had proved that a spacetime containing such a surface cannot be complete. A little later, it was shown that under the same assumption there is a region of spacetime which is inaccessible to observation from infinity: the black hole. However, the available mathematical methods were incapable of investigating how trapped surfaces form in evolution and of revealing the nature of the spacetime boundary. Penrose conjectured that the boundary is always contained in a black hole, a conjecture called cosmic censorship. Seeking to answer these questions in a simpler setting I studied, in a series of papers completed in the period 1984-1997, the spherically symmetric Einstein equations with a scalar field as the matter model. An unexpected result was that naked singularities, that is, singularities not contained in a black hole, can also form. Nevertheless, I proved that these are unstable, thus establishing a generic version of cosmic censorship in this framework.

As professor of mathematics at the Courant Institute 1988-1992 and at Princeton 1992-2001, I enjoyed a very stimulating scientific environment. In 2001, I returned to Europe, taking up my present position as professor of mathematics and physics at ETH in Zurich.

The period 2001-2008 was, for me, one of most intense intellectual effort. I turned to the study of the formation of shocks in compressible fluids in the physical case of 3 spatial dimensions. Here the aim was to carry out the analysis up to the singular boundary. The Eulerian equations of fluid mechanics have affinity with the Einstein equations of general relativity, both constituting nonlinear systems of hyperbolic type. At the same time, I turned to the study of the formation of trapped surfaces in general relativity, in vacuum and without any symmetry assumptions, through the focusing of incoming gravitational waves. The breakthroughs came in 2004, and the two works were completed in 2006 and 2008 respectively. In the case of the second work, the breakthrough took the form of a new method which exploits the assumption that the initial data contain somewhere an abrupt change and allows us to attack problems which had seemed unapproachable.

Richard S Hamilton
Laureate in Mathematical Sciences

I was born in Cincinnati, Ohio in 1943. My father was a surgeon; he had recently finished his residency at the Mayo Clinic when the Japanese bombed Pearl Harbor. He volunteered as a naval surgeon in the war, and was stationed in Portsmouth, England during my first two years of life, repairing wounded pilots. My mother lived with my grandmother, together with me and my brother Billie who was only one year older than I, until my father returned.

I attended Lotspeich elementary school, where I received an excellent education. In the fourth grade, out of curiosity I went to the library and took out a book on first year algebra. I taught myself first year algebra in a month, and went back for the second year algebra book. Then I attended Walnut Hills High School, one of the best in the nation, which was a public high school taking the brightest kids from the whole city. Skipping senior year, I went to Yale at 16, along with my brother. The most interesting classes were in ancient Greek, where we read the tragedies, the comedies and the great orators (in the original), and my philosophy classes with Brand Blanshard, a wonderful old scholar who had not changed his philosophical ideas since before WWI.

I did my graduate work at Princeton, writing my thesis at age 23 in 1966 on Riemann surfaces with Bob Gunning. During that time I was married (and divorced several years later) and my only son Andrew was born. My first academic position was at Cornell, where for several years I had the pleasure to work with Jim Eells Jr, who had just finished his groundbreaking paper with Joe Sampson on the harmonic map flow. This was the first example of using a nonlinear parabolic flow to solve an elliptic equation in geometry, and was my inspiration for creating the Ricci flow. My son Andrew would visit and we could snow ski in winter, and water ski and scuba dive in the summer.

By the mid seventies I had begun work on the Ricci flow, and published the first result in 1982 on the case of three dimensional manifolds with positive Ricci curvature. This got a lot of attention, and I was invited to visit the Mathematical Sciences Research Institute (MSRI), Berkeley, CA the first year it opened, along with S T Yau and Rick Schoen. The next year Yau, Rick and I all moved to the University of San Diego (UCSD), CA and Gerhard Huisken came to visit also.

With all these excellent mathematicians around working on similar problems in geometric analysis, it was the ideal environment to develop the Ricci flow further. Yau had already pointed out that the Ricci flow could pinch along necks, and that this could provide the first step in the proof, by breaking the manifold into simpler pieces which could sustain constant curvature geometries.

Later, I moved back to the East coast to Columbia University, where I am now Davies Professor. In the Ricci flow I extended the results to four dimensions, derived the important Li-Yau type estimate for the curvature, developed the classification of singularities by ancient solutions and proved many properties of ancient solutions, showed that in three dimensions the curvature is pinched toward non-negative, developed the method of analytic surgery to bypass pinching necks and used it to classify four dimensional manifolds with positive isotropic curvature. I also showed how one could complete the proof of the three dimensional Poincare conjecture provided one could also do similar surgeries in three dimensions, and explained the program to Grigory Perelman, pointing out the importance of avoiding collapses. In a series of brilliant papers in 2003 Perelman did this with a very clever non-collapsing result derived from a novel Li-Yau type estimate for the adjoint heat equation.

Now I am looking at future possible developments in the Ricci flow, including possible applications to four dimensional topology, Kaehler geometry, and stationary solutions in Relativity.

Organization
Preparatory Committee (Until July 2003)*

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

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

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

Mr Run Run Shaw (Founder of The Shaw Prize)

* Professor Yue-Man Yeung (Chairman)
Emeritus Professor of Geography and Resource Management
The Chinese University of Hong Kong;

* Mrs Mona Shaw (Member)
Chairperson, The Shaw Prize Foundation.

Back row, from right to left

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

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

* Professor Samuel Sai-Ming Sun (Member)
Master, S H Ho College, The Chinese University of Hong Kong;

* Professor Kwok-Kan Tam (Member)
Dean & Chair Professor, School of Arts and Social Sciences,
The Open University of Hong Kong;

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

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Mr Koon-Fai Chor (Secretary)

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;

Mr Run Run Shaw,
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 and

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;

Mr Run Run Shaw,
Founder of The Shaw Prize;

Mr Rafael Hui,
Acting Chief Executive of HKSAR (2005);

Sir Michael Berridge,
Laureate in Life Science and Medicine and

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,
Chief Executive of HKSAR;

Mr Run Run Shaw,
Founder of The Shaw Prize;

Professor Xiaodong Wang,
Laureate in Life Science and Medicine;

Professor David Mumford,
Laureate in Mathematical Sciences and

Professor Wentsun Wu,
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;

Mr Run Run Shaw,
Founder of The Shaw Prize;

Mr Henry Tang,
Acting Chief Executive of HKSAR (2007);

Professor Robert Langlands,
Laureate in Mathematical Sciences and

Professor Richard Taylor,
Laureate in Mathematical Sciences.

The Shaw Prize 2008

From right to left:

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Laureate in Astronomy;

Sir Ian Wilmut,
Laureate in Life Science and Medicine;

Professor Keith H S Campbell,
Laureate in Life Science and Medicine;

Mr Run Run Shaw,
Founder of The Shaw Prize;

Mr Donald Tsang,
Chief Executive of HKSAR;

Professor Shinya Yamanaka,
Laureate in Life Science and Medicine;

The Late Professor Vladimir Arnold (1937-2010),
Laureate in Mathematical Sciences and

Professor Ludwig Faddeev,
Laureate in Mathematical Sciences.

The Shaw Prize 2009

From right to left:

Professor Frank H Shu,
Laureate in Astronomy;

Professor Douglas L Coleman,
Laureate in Life Science and Medicine;

Mr Run Run Shaw,
Founder of The Shaw Prize;

Mr Donald Tsang,
Chief Executive of HKSAR;

Professor Jeffrey M Friedman,
Laureate in Life Science and Medicine;

Professor Simon K Donaldson,
Laureate in Mathematical Sciences and

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;

Mr Run Run Shaw,
Founder of The Shaw Prize;

Mr Donald Tsang,
Chief Executive of HKSAR;

Professor David Julius,
Laureate in Life Science and Medicine and

Professor Jean Bourgain,
Laureate in Mathematical Sciences

The Shaw Prize Foundation

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Professor Kenneth Young

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Council Member

Mrs
Mona Shaw

Mona Shaw, wife of Sir Run Run Shaw, is Chairperson of The Sir Run Run Shaw Charitable Trust, The Shaw Foundation Hong Kong Limited and The Shaw Prize Foundation. A native of Shanghai, China, she is an established figure in the Hong Kong media and entertainment industry and is Chairperson of the Shaw Group of Companies, and Deputy Chairperson and Managing Director of Television Broadcasts Limited.

Council Member

Professor Lin Ma

Professor Lin Ma was Professor of Biochemistry (1972 – 78) and Vice-Chancellor (1978 – 87) of The Chinese University of Hong Kong; he is Emeritus Professor of Biochemistry and has published largely on protein chemistry. Professor Ma also served as Chairman of the Board of Trustees of Shaw College, The Chinese University of Hong Kong (1987-2011). He has received honours from Great Britain, Japan and Germany, and honorary degrees from several international universities as well as from universities in Hong Kong, Macau and China.

Professor Ma was the Convenor of two sub-groups of the Hong Kong Basic Law Drafting Committee: (1) Education, Science and Arts, and (2) Hong Kong Flag and Emblem.

Council Member

Professor Chen-Ning Yang

Professor Chen-Ning Yang, an eminent contemporary 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 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, Royal Society of London and the Russian Academy of Sciences.

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

Professor Kenneth Young

Professor Kenneth Young is a theoretical physicist, and is Professor of Physics and Master of C W Chu College 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 held the position 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 Sheung-Wai Tam

Professor Sheung-Wai Tam is the President Emeritus of The Open University of Hong Kong (OUHK). With more than 30 years experience in teaching, research and university administration at The Chinese University of Hong Kong (1965 – 1995), Professor Tam has attained many achievements in higher education and demonstrated excellence in teaching and research in natural products, mass spectrometry and organometallic chemistry.

Professor Tam served as the President of the OUHK for 8 years (1995 – 2003). During this period the OUHK was heading towards the goal of becoming a regional Centre of Excellence in Distance and Adult Learning. As a result, the OUHK has won a number of accolades, including the '*Prize of Excellence for Institutions*' (International Council for Open and Distance Education) and the '*Award of Excellence for Institutional Achievement in Distance Education*' (Commonwealth of Learning) in 1999 as well as the '*Stockholm Challenge Award*' (City of Stockholm and European Commission) in 2000.

For his significant contributions to open and distance education, Professor Tam was awarded the '*Prize of Excellence for Individuals*' (International Council for Open and Distance Education) in 2001 and the '*Meritorious Service Award*' (Asian Association of Open Universities) in 2002, and honorary degrees: Hon D Univ (UKOU) 2002; Hon D Sc (OUHK) 2006; (Nottingham U) 2008; and Hon U Fellow (CUHK) 2011.

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Professor
Peter Goldreich

Astronomy Committee

Professor Peter Goldreich is the Lee A DuBridge Professor of Astrophysics & Planetary Physics Emeritus at the California Institute of Technology in Pasadena California.

He received a PhD from Cornell University in 1963. After spending one year as a postdoc at Cambridge University and two as an Assistant Professor at the University of California, Los Angeles, he joined the Caltech faculty as an Associate Professor in 1966. He was promoted to Full Professor in 1969 and remained at Caltech until he retired in 2002. Subsequently, he was appointed Professor in the School of Natural Sciences at the Institute for Advanced Study in Princeton from which he retired in 2009. Professor Goldreich is a Member of the US National Academy of Sciences and a Foreign Member of the Royal Society of London. His awards include the Henry Norris Russell Lectureship of the American Astronomical Society, the US National Medal of Science, the Gold Medal of the Royal Astronomical Society, the Grande Medaille of the French Academy of Sciences, and the Shaw Prize. Professor Goldreich's research involves the application of physics to the understanding of natural phenomena, in particular those revealed by astronomical observations.

Selection Committee Member

Professor Michel Mayor

Astronomy Committee

Professor Michel Mayor, an Emeritus Professor, Department of Astronomy, University of Geneva and past Director of Geneva Observatory has been the founding President of the new Commission of Extrasolar Planets of the International Astronomical Union (IAU).

Among his recognitions, mention must be made of the E Balzan International Prize awarded in 2002, the Einstein Medal in 2004, the 2005 Shaw Prize for Astronomy and last but not least, the Ambartsumian Prize in 2010. He is a Foreign Member of the French Academy of Sciences, the British Royal Astronomical Society and the US National Academy of Sciences.

Professor Mayor pioneered in the nineties the search for exoplanets through precise radial velocity measurements. Together with his team he has a substantial share in the number of exoplanets detected so far. They detected in particular the first giant planet orbiting a solar-type star, 51 Pegasi. These discoveries have opened an entirely new exciting research area, both on the observational side and in theoretical studies. They are leading as well to major instrumental developments, in which the Geneva Observatory is deeply involved and plays a key-role.

Selection Committee Member

Professor
Richard McCray

Astronomy Committee

Professor Richard McCray is the George Gamow Distinguished Professor of Astrophysics, Emeritus, at the University of Colorado in Boulder.

Professor McCray received a BS from Stanford University in 1959 and a PhD from the University of California at Los Angeles in 1967. He was a postdoc at Caltech (1967 – 68), an Assistant Professor at the Harvard College Observatory (1968 – 71), and a Professor at the University of Colorado since then.

His research includes the theory of the heating, cooling, chemistry and dynamics of interstellar gas; the physics of compact cosmic X-ray sources; and the physics of supernovae and supernova remnants. He also uses the Hubble Space Telescope and the Chandra Observatory to observe these phenomena.

He is a Member of the American Astronomical Society, the International Astronomical Union, the American Association for the Advancement of Sciences and the US National Academy of Sciences. He was awarded a Guggenheim Fellowship and the Dannie S Heinemann Prize for Astrophysics.

Selection Committee Member

Professor Brian P Schmidt

Astronomy Committee

Professor Brian P Schmidt is a Laureate Fellow at The Australian National University's Mount Stromlo Observatory.

He received undergraduate degrees in Physics and Astronomy from the University of Arizona in 1989, and completed his Astronomy PhD from Harvard University in 1993. In 1994 he formed the High-Z SN Search Team, a group of 20 astronomers on 5 continents who used distant exploding stars to trace the expansion of the Universe back in time. This group's discovery of an accelerating Universe was named Science Magazine's Breakthrough of the Year for 1998. In 2006 Professor Schmidt was jointly awarded the Shaw Prize for Astronomy, and shared the 2007 Gruber Prize for Cosmology with his High-Z SN Search Team colleagues. In 2008 he was elected a Fellow of the Australian Academy of Sciences, and the United States National Academy, and Foreign Member of the Spanish Royal Academy of Sciences. Professor Schmidt is currently leading Mt Stromlo's SkyMapper telescope, a new facility that will provide a comprehensive digital map of the southern sky.

Selection Committee Member

Professor
Peter C Agre

Life Science and Medicine Committee

Professor Peter C Agre studied chemistry at Augsburg College (BA 1970) and medicine at Johns Hopkins (MD 1974). He completed his residency at Case Western Reserve University in Cleveland and an Oncology Fellowship at the University of North Carolina at Chapel Hill. A Johns Hopkins faculty member since 1984, Professor Agre was Professor of Biological Chemistry and Professor of Medicine. In 2003, Professor Agre shared the Nobel Prize in Chemistry for discovering aquaporins, a family of water channel proteins found throughout nature, responsible for numerous physiological processes in humans and implicated in multiple clinical disorders.

In 2005, Professor Agre moved to the Duke University School of Medicine to become Vice Chancellor for Science and Technology and James B Duke Professor of Cell Biology. Professor Agre is a Member of the US National Academy of Sciences and chairs their Committee for Human Rights. On 1 January 2008 Professor Agre has moved to Johns Hopkins Bloomberg School of Public Health where he became Director of the Malaria Research Institute.

Selection Committee Member

Professor
Linda B Buck

Life Science and Medicine Committee

Professor Linda B Buck is a Howard Hughes Medical Institute Investigator at Fred Hutchinson Cancer Research Center and Affiliate Professor of Physiology and Biophysics at the University of Washington. She received a BS from the University of Washington in 1975, a PhD from the University of Texas Southwestern Medical Center, Dallas in 1980, and was previously Professor of Neurobiology at Harvard Medical School. Professor Buck is a Fellow of the American Association for the Advancement of Science and a Member of the US National Academy of Sciences, the Institute of Medicine of the National Academies, and the American Academy of Arts and Sciences.

Professor Buck's research has provided key insights into the mechanisms underlying the sense of smell. In recognition of her contributions, she has received numerous awards, including The Lewis S Rosenstiel Award for Distinguished Work in Medical Research (1997), The Gairdner Foundation International Award (2003), and The Nobel Prize in Physiology or Medicine (2004).

Selection Committee Member

Sir
Tim Hunt

Life Science and Medicine Committee

Sir Tim Hunt works at Cancer Research UK, Clare Hall Laboratories, in South Mimms, Hertfordshire. Sir Tim was born in 1943 and grew up in Oxford, moving to Cambridge in 1961 to read Natural Sciences. In 1968, he obtained his PhD in the Department of Biochemistry. He spent almost 30 years in Cambridge, working on the control of protein synthesis, with spells in the USA; he was a postdoctoral Fellow with Irving London at the Albert Einstein College of Medicine in 1968-70 and spent summers at the Marine Biological Laboratory, Woods Hole from 1977 until 1985, both teaching and doing research.

In 1982, he discovered cyclins, which turned out to be components of "Key regulators of the Cell Cycle", and led to a share of the Nobel Prize in Physiology or Medicine in 2001, together with Lee Hartwell and Paul Nurse.

Sir Tim Hunt is a Member of the Scientific Council of the ERC. He was elected as Fellow of the Royal Society in 1991 and became a Foreign Associate of the US National Academy of Sciences in 1999. He was knighted in the Queen's Birthday Honours List of 2006 and was the Chair of EMBO council from 2006 – 2010.

Selection Committee Member

Professor
David M Livingston

Life Science and Medicine Committee

Professor David M Livingston is Deputy Director of the Dana-Farber/Harvard Cancer Center; Chief of the Charles A Dana Division of Human Cancer Genetics, the Emil Frei Professor of Genetics and Medicine at Harvard Medical School, and the Chairman of the Executive Committee for Research at the Dana-Farber Cancer Institute, the senior faculty group that oversees all aspects of the Institute's research program. His research focuses on the genetic and molecular mechanisms by which normal human cells emerge as cancer cells.

Professor Livingston has received numerous awards and honours, including the Clowes Award of the American Association for Cancer Research and the Boveri Award of the German Cancer Society. He has been elected to the US National Academy of Sciences, the Institute of Medicine of the US National Academy of Sciences and the American Academy of Arts and Sciences. He sits on multiple editorial boards and science advisory boards of other research institutions. Professor Livingston has authored more than 195 scientific publications.

Selection Committee Member

Dr
William E Paul

Life Science and Medicine Committee

Dr William E Paul discovered the cytokine interleukin-4, demonstrated that it is the central regulator of allergic inflammation and is known for work on cytokine biology, lymphocyte dynamics, T-cell antigen-recognition and B-cell development. He is Chief of the Laboratory of Immunology of the National Institute of Allergy and Infectious Diseases and a National Institutes of Health Distinguished Investigator. From 1994 to 1997, he was Director of the NIH Office of AIDS Research and was responsible for a new emphasis on HIV vaccine development. Dr Paul is a Member of the US National Academy of Sciences, its Institute of Medicine and the American Academy of Arts and Sciences. He received the Founder's Prize of the Texas Instruments Foundation, the 3M Life Sciences Award and the Max Delbruck Medal. Dr Paul was President of the American Society for Clinical Investigation and the American Association of Immunologists (AAI) and is a recipient of Lifetime Achievement Awards from the AAI and the International Cytokine Society. He is the recipient of honorary degrees from the Hebrew University of Jerusalem, the University of Rome La Sapienza, the National University of Athens and several other universities, is the editor of the adavanced textbook Fundamental Immunology and the founding editor of the Annual Review of Immunology, now in its 29th volume.

Selection Committee Member

Professor
Randy W Schekman

Life Science and Medicine Committee

Professor Randy W Schekman is a professor in the Department of Molecular and Cell Biology at UC Berkeley and an Investigator of the HHMI. Schekman's lab elucidated key components and events of the secretory pathway in Saccharomyces cerevisiae. His group discovered that protein transport in yeast is mediated by the same organelles and proteins that operate in mammalian cells.

Among his honours are the Eli Lilly Award in microbiology, the Lewis S Rosenstiel Award in basic biomedical science, the Gairdner International Award, the Amgen Award from the Protein Society, the Albert Lasker Award for Basic Medical Research, the Louisa Gross Horwitz Prize of Columbia University, the Dickson Prize from the University of Pittsburgh, the Massry Prize (2010), the E.B. Wilson Award of the American Society for Cell Biology and the inaugural Arthur Kornberg and Paul Berg Lifetime Achievement Award of Stanford Medical School (2011). Professor Schekman is a Member of the US National Academy of Sciences, the American Academy of Arts and Sciences and the American Philosophical Society. He is Past President of the American Society of Cell Biology and currently serves as Scientific Director of the Jane Coffin Childs Memorial Fund for Medical Research and Editor-in-Chief of the Proceedings of the National Academy of Sciences USA.

Selection Committee Member

Sir
Michael Atiyah

Mathematical Sciences Committee

Sir Michael Atiyah is an Honorary Professor at Edinburgh University. He was previously a professor at Oxford and at the Institute for Advanced Study in Princeton. In the 1990's he was Master of Trinity Cambridge, Director of the Isaac Newton Institute and President of the Royal Society of London. From 2005 – 2008, he was the President of the Royal Society of Edinburgh. He was knighted in 1983 and made a member of the Order of Merit in 1992.

Sir Michael was awarded the Fields Medal in1966 and the Abel Prize in 2004. He is a foreign member of around 20 national academies and has over 30 honorary degrees.

His main work has been in geometry and topology and their relation to analysis. This involved, in particular, the development of K-theory and index theory and their connections with physics. In recent years, he has been a strong advocate of collaboration between mathematiciansand physicists.

Selection Committee Member

Professor
David Kazhdan

Mathematical Sciences Committee

Professor David Kazhdan was born in 1946 in Moscow, Russia. His father Alexander Kazhdan was a known historian. Professor Kazhdan studied mathematics under Israel Gelfand from an early age. He earned a doctorate under Alexandre Kirillov in 1969 and was a leading member of Israel Gelfand's School of Mathematics. Professor Kazhdan emigrated from Russia to take a position at Harvard University in 1975.

In 2002, he emigrated to Israel and is a Professor at The Hebrew University of Jerusalem and a Professor Emeritus at Harvard University.

Professor Kazhdan held a MacArthur Fellowship from 1990 to 1995. He is a Member of the US National Academy of Sciences and Israel Academy of Sciences (2006), and was elected to the American Academy of Arts and Sciences in 2008.

Selection Committee Member

Professor Yum-Tong Siu

Mathematical Sciences Committee

Professor Yum-Tong Siu was born in 1943 in Guangzhou, China. He received a BA from The University of Hong Kong in 1963 and a PhD from Princeton University in 1966. Currently, he is the William Elwood Byerly Professor of Mathematics at Harvard University, where he has been teaching since 1982. He is a Member of the American Academy of Arts and Sciences, US National Academy of Sciences, Chinese Academy of Sciences (Foreign Member), Academia Sinica (Taiwan), and Goettingen Academy of Sciences (Corresponding Member). His research interests lie in several complex variables, complex algebraic geometry, and complex differential geometry.

Selection Committee Member

Professor
Margaret H Wright

Mathematical Sciences Committee

Professor Margaret H Wright is Silver Professor of Computer Science and Mathematics in the Courant Institute of Mathematical Sciences, New York University. She received her BS (Mathematics) and MS and PhD (Computer Science) from Stanford University.

Her research interests include optimization, scientific computing, and optimization in real-world applications. Prior to joining NYU, she worked at Bell Laboratories (Lucent Technologies), where she was named as a Bell Labs Fellow.

She was elected to the National Academy of Engineering (1997), the American Academy of Arts and Sciences (2001), and the US National Academy of Sciences (2005). During 1995 – 1996 she served as President of the Society for Industrial and Applied Mathematics (SIAM), and has chaired advisory committees for several mathematical sciences institutes and government agencies.

In 2000, she received an honorary doctorate in Mathematics from the University of Waterloo, Ontario, Canada and she was named an Honorary Doctor of Technology by the Swedish Royal Institute of Technology in 2008.

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 gameshow on legal knowledge "Justice for All" brought her career to a new height. She also hosted the 2008 Beijing Olympics for TVB and has been one of the presenters for the Shaw Prize Award Presentation Ceremony since its inception in 2004.

THE SHAW PRIZE 邵逸夫獎

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 music for the movie "Perhaps Love" won him a Golden Horse Award and a Hong Kong Film Award. For the stage, he received four Best Score awards for his musicals in Hong Kong. He was the musical director of Jacky Cheung's 2004 world tour of "Snow, Wolf, Lake". Recent works include "Takeaway", the first major British Chinese musical which premiered in London this year. 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 Arts Development Council.

Special Acknowledgement

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