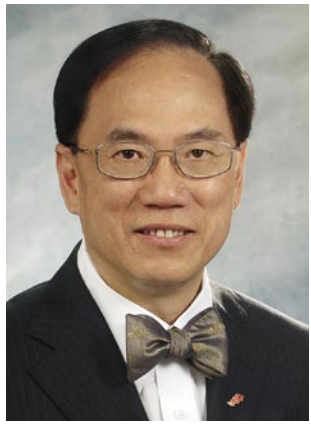
The Shaw Prize

The Shaw Prize is an international award to honour individuals who are currently active in their respective fields and who have 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 will be given to individuals whose significant work was recently achieved.

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 has been Executive Chairman of Television Broadcasts Limited in Hong Kong since the 1970s. 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

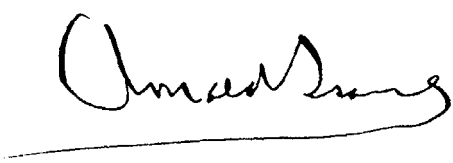


I am delighted to congratulate the six distinguished scientists who receive this year's Shaw Prize. Their accomplishments enrich human knowledge and have a profound impact on the advancement of science.

This year, the Shaw Prize recognises remarkable achievements in the areas of astronomy, life science and medicine, and mathematical sciences.

The exemplary work and dedication of this year's recipients vividly demonstrate that constant drive for excellence will eventually bear fruit.

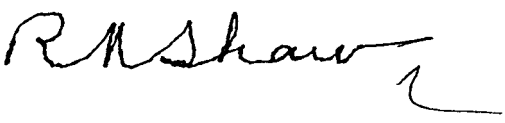
The six scientists join an elite club of 20 outstanding Shaw Laureates who have made significant contributions to mankind through their fascinating discoveries. I am confident the Shaw Prize will encourage scientists around the world to strive for even greater achievements in the future.



Donald Tsang
Chief Executive
Hong Kong Special Administrative Region

Message from the Founder

In every age there are visionaries whose discoveries transcend the boundaries of our imagination and lead us on a journey to the high points of man's achievements. These pioneers transform our perception of what is probable, and inspire future generations to pursue the impossible. The Shaw Prize hopes to focus attention on the constant growth and widening of the human imagination so clearly illustrated in the accomplishments of our laureates.



Run Run Shaw

Message from Chairman of Board of Adjudicators

Welcome to the fifth annual Shaw Prize Award Ceremony. Tonight we shall be honouring six Laureates.

Professor Reinhard Genzel working with Townes had early indications that the centre of our galaxy harboured a massive black hole. He then developed instruments with which to carry out observations on the centre of our Milky Way. He and his group's efforts over many years led to the discovery of a huge black hole in the centre of our galaxy. This discovery profoundly influenced current thinking about the early formation of all the galaxies in the universe.

This year's Shaw Prize in Life Science and Medicine is awarded to Sir Ian Wilmut, Professor Keith H S Campbell and Professor Shinya Yamanaka for their work in the cloning process of mammalian cells and in stem cell production. The possible benefits of future developments along such research lines are limitless, including the growth of human tissues and organs to combat various kinds of diseases.

Professor Vladimir Arnold and Professor Ludwig Faddeev are winners of this year's Mathematical Sciences Shaw Prize. Professor Arnold made fundamental contributions to the study of stability of dynamical systems. Professor Faddeev together with Professor Boris Popov solved a fundamental and difficult problem in non-Abelian gauge theory, which led to, among other results, the Nobel Prize winning work of 't Hooft and Veltman. Professor Arnold and Professor Faddeev's works have profoundly influenced the developments of both mathematics and physics.

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 Winners

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

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

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

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Speech by Sir Michael Atiyah
Member of Board of Adjudicators
Chairman of the Prize in Mathematical Sciences Committee

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Award Presentation

Grand Hall
Hong Kong Convention and Exhibition Centre
September 9, 2008

AWARD PRESENTATION

(Category listed in alphabetical order)

Astronomy

Professor Reinhard Genzel

Life Science and Medicine

Sir Ian Wilmut,

Professor Keith H S Campbell

and

Professor Shinya Yamanaka

Mathematical Sciences

Professor Vladimir Arnold

and

Professor Ludwig Faddeev

Professor Jiansheng Chen

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

Professor Jiansheng Chen is a reputed astrophysicist and Fellow of the Chinese Academy of Sciences. He is currently Head of Department of Astronomy at Peking University.

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 and member of the Expert Group for Postdoctorates of the Personnel Ministry, Director of the Department of Astronomy of Peking University.

He has been primarily engaged in research in the fields of QSO absorption line, QSO survey, Galactic Physics and large scale astronomy and is now the PI of the National Major Research Project (973 Project) : "The Galaxy Formation and Galactic Evolution"; he has also been in charge of key projects of the National Science Foundation.

THE SHAW PRIZE 邵逸夫獎

The Prize in Astronomy 2008

Reinhard Genzel

in recognition of his outstanding contributions in demonstrating that the Milky Way contains a supermassive black hole at its centre.

An Essay on Reinhard Genzel

At the end of the 1960s and early 1970s, Donald Lynden-Bell and Martin Rees proposed that the Milky Way and perhaps most other galactic nuclei might contain a central massive black hole. But the evidence for such an object was lacking at the time because the centre of the Milky Way is obscured by interstellar dust, and was detected only as a relatively faint radio source.

In the late 1970s and early 1980s, Charles Townes and his collaborators including Reinhard Genzel, developed instruments capable of observing the centre of the Milky Way at infrared wavelengths, which can pass through the interstellar dust clouds with relatively little obscuration. By analyzing the spectrum of such radiation, they inferred that gas is swirling around a central concentration containing a few million solar masses. These authors suggested that the central object might be a supermassive black hole, but the observations did not have sufficient angular resolution to prove that conjecture.

Starting in 1990 Genzel and his collaborators continued to develop new instruments to observe the centre of the Milky Way at near-infrared wavelengths and with unprecedented angular resolution. In 1996, they reported two independent observations of the motions of stars clustered very close to the centre of the Milky Way, both of which provided compelling evidence that the central object was indeed a supermassive black hole. In the first technique they measured the velocities of the stars through the Doppler shifts of their spectra, while in the second technique they measured the transverse velocities of their positions. Subsequently, Genzel's group and, independently, a group led by Andrea Ghez, continued to track the orbits of these stars around the black hole and refined the

estimate of its mass, which we now know is about a million Suns. The Galactic Centre thus constitutes now the best evidence that the black holes predicted by General Relativity are realized in nature.

In their ongoing campaign to observe the centre of the Milky Way, Genzel and his group have continued to make major discoveries. By measuring the spectra and motions of the luminous stars near the centre of the Milky Way, they have found evidence that many of these stars were probably formed relatively recently (some six million years ago) from a disk of gas orbiting the supermassive black hole. They have also discovered simultaneous flares of infrared and X-ray emission from the central black hole, evidently due to sporadic accretion of gas.

The proof by Genzel's group that the concentration of bright stars at the centre of the Milky Way are orbiting a supermassive black hole leaves little doubt that similar concentrations of stars seen at the centres of other nearby galaxies also manifest the presence of supermassive black holes. The fact that many galaxies contain supermassive black holes is one of the outstanding clues to the mystery of how galaxies form.

In addition to his work on the centre of the Milky Way, Reinhard Genzel and his group have made many contributions to the study of the formation of stars in other galaxies in the nearby and distant universe through his development of pioneering instrumentation to observe these systems at infrared wavelengths. For his great achievements in observational astronomy, he is a most worthy recipient of the Shaw Prize in Astronomy for 2008.

Reinhard Genzel

I was born near Frankfurt, Germany in 1952 where I also attended the first school years. I went to high school in Freiburg at a 'humanistic gymnasium', featuring 9 years of Latin and Greek. Perhaps as a result I have enjoyed a lifetime interest in history and archaeology. My father was a well-known experimental solid-state physicist and I learned most of my early physics from him. I will always treasure how he showed me (age 16) how to build a pretty good spectrometer from its basic optical components. These early experiences instilled in me the desire to become an experimental physicist. To maintain balance in my life I spent a lot of my time doing intense sports. To this day I am proud of having been one of Germany's best young javelin throwers, as well as being on my school's handball team. I even made it into the national German, junior track and field team training for the 1972 Munich Olympics. I still feel compelled to do some daily workout activity and I regularly go on mountain hikes.

Following the general physics education at the Universities in Freiburg and Bonn (1970-1974), I began my astronomy career as a thesis student at the then newly founded Max-Planck Institute for Radio Astronomy (MPIfR) in Bonn (under Peter Mezger). At that time the MPIfR started to put into operation the 100m telescope in Effelsberg, a fantastic opportunity for a young student. I was particularly fascinated by the emerging field of molecular spectroscopy. Working in close collaboration with Dennis Downes, my PhD thesis work (1976-78) was on the phenomenon of interstellar water vapour masers, which then led seamlessly to postdoctoral work at the Harvard-Smithsonian Centre for Astrophysics (with James Moran). In 1980 I was offered the unique opportunity to change fields and joined the group of Charles Townes at the University of California, Berkeley (UCB). Townes, Nobel Laureate for the invention of the Maser and Laser, and his group was carrying out ground-breaking experimental astrophysics work in the infrared, which fascinated me enormously. Life in the next six years at Berkeley was intense and exciting. I was trying to combine physics teaching (as associate professor in physics), with research in infrared spectroscopy, developing new instruments, working with my first graduate students, hunting for grants and finding time for the family.

At that time, my family was also developing. In 1976, I married Orsolya Boroviczény. She had studied medicine in Germany and then carried out her paediatrics residency in Boston and Oakland. Our older daughter, Daria, was born in Boston in 1979 and the younger one, Lisa, in Berkeley in 1983. California and Berkeley became more than a temporary residence. Even after returning to Germany in 1987 the family considered Berkeley our real home; that sentiment being an important factor in my taking on a commitment as part-time professor in the UCB Physics department in 1999.

In 1986 I became a director at the Max-Planck Institute for Extraterrestrial Physics (MPE) in Garching, near Munich. At the time, I was quite unsure whether

returning to Germany was the best choice. Berkeley was wonderful, Europe looked pretty un-dynamic. However, I never regretted it. The older I get the more I am grateful to the Max-Planck Society (MPG) for providing such an absolutely wonderful opportunity to pursue basic research at a top level with so few strings attached. Outside the MPG, our research programme in the last twenty years, including the work for which I am being honoured by the Shaw Prize, would not have been possible.

My interest in the question of whether the Galactic nucleus harbours a black hole goes back to the Berkeley period. Townes and his group (including myself) had concluded from the motions of interstellar gas in the vicinity of the compact central radio source SgrA* that there was a non-stellar central mass concentration of about four million solar masses, most likely in the form of a massive black hole. Few others were persuaded by the evidence, however.

At MPE we made the quest for the black hole in the Galactic Centre one of our central research themes, others being studies of active galactic nuclei and of the evolution of galaxies in the early Universe. To exclude other possible explanations of the mass concentration we needed to make dynamical measurements much closer to SgrA*. For this purpose, we developed a series of ever more powerful instruments exploiting high resolution imaging and spectroscopy in the near-infrared, including the novel technique of adaptive optics. We used these instruments for increasingly more precise observations of the motions of stars in the vicinity of SgrA*, initially (starting 1991) at the 3.5m New Technology Telescope and since 2002, at the 8m Very Large Telescope (VLT) of the European Southern Observatory (ESO). The excellent collaboration with ESO was one of the cornerstones for our success, for which I am very grateful. ESO and the VLT are an exemplary success story of European cooperation. Another key element was the ingenuity, dedication and outstanding capabilities of the members of our entire MPE team. I would like to mention especially Andreas Eckart, Frank Eisenhauer, Dieter Lutz, Albrecht Poglitsch and Linda Tacconi.

From the stellar dynamics evidence, in conjunction with very long baseline radio interferometry observations of SgrA* by Mark Reid and others, we can now conclude, after almost twenty years of research, that the central mass of four million solar masses must indeed be a massive black hole, beyond any reasonable doubt. A second team led by Andrea Ghez at UCLA carried out similar observations with the Keck telescope on Mauna Kea and independently came to exactly the same conclusions. Nature was good to us and our perseverance paid off! Considering the Galactic Centre a laboratory for studying phenomena that are occurring also in most other galactic nuclei, this result takes on a broader relevance. It is now widely believed that the dark mass concentrations found in many galaxies, including the spectacular quasars, probably are all massive black holes accreting gas in various amounts. The formation and evolution of massive black holes and of their host galaxies appear to be intimately connected. Their symbiotic relationship started when the Universe was less than 1 billion years old.

It has been a privilege for me to be able to actively contribute in a little way to this remarkable and completely unexpected story. It has been (and continues to be) a lot of fun!

Professor Yuet-Wai Kan

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

Professor Yuet-Wai Kan is the Louis K. Diamond Professor of Hematology at the University of California, San Francisco. He 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 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 SHAW PRIZE 邵逸夫獎

The Prize in Life Science and Medicine 2008

Ian Wilmut,
Keith H S Campbell
and
Shinya Yamanaka

for their recent pivotal innovations in reversing the process of cell differentiation in mammals, a phenomenon which advances our knowledge of developmental biology and holds great promise for the treatment of human diseases and improvements in agriculture practices.

An Essay on Ian Wilmut, Keith H S Campbell and Shinya Yamanaka

During the development of vertebrates, including humans, the fertilized egg develops into the embryo, and the cells in the embryo then proceed to differentiate to form somatic cells of different tissues and organs. The fertilized egg is considered totipotent, as it can develop into a whole organism, while the cells in the embryo are pluripotent because they are capable of differentiating into somatic cells that make up all the organs. Half a century ago, it was found by John Gurdon that this developmental clock can be reversed, and that differentiated somatic cells in a frog model could regain their pluripotency or totipotency. Attempts were then made to show that mammalian cells – and human cells in particular – could also be reprogrammed back to a pluripotent state, because it is believed that such knowledge may advance our understanding of developmental mechanisms, and yield new approaches for disease treatment. The breakthroughs came within the last 15 years. The scientists honoured by the 2008 Shaw Prize in Life Science and Medicine used different approaches to reprogramme an adult cell into the totipotent or pluripotent state, and in doing so made important contributions to potential new approaches to improve agriculture practices and to treat human diseases.

Ian Wilmut and Keith H S Campbell worked together in the Roslin Institute near Edinburgh for many years, using sheep as the model, in order to understand the early physiology of the egg and how laboratory manipulations can improve our knowledge of the development from egg to birth. They pioneered a new technique of starving embryo cells before transferring their nucleus to fertilized egg cells. The technique synchronized the cell cycles of both cells and the results led Wilmut and Campbell to believe that any type of cell could be used to produce a clone. In 1995, they produced a pair of lambs called Megan and Morag from embryonic cells. They performed nuclear transfer experiments in which nuclei from embryonic, foetal and adult cells of the sheep were transplanted into fertilized eggs derived from ewes. Although the yield was low, they were successful in obtaining live newborn lambs from these transfers. One of the live-born lambs, Dolly, was derived from the transplantation of the nucleus of an adult mammary cell. Thus, Dolly was the first example of the reprogramming of the adult cell back to totipotency in a mammal. They further created a sheep called Polly in which they showed that it was possible to incorporate a human gene into the donor's DNA before cloning, thus indicating that it may be possible to use animals to produce human proteins

for the benefit of mankind. Since then, the work of Wilmut and Campbell has been duplicated in many other animal species and has provided approaches to produce useful therapeutic products with cloned animals and to improve agricultural practices.

Shinya Yamanaka focuses his research on ways to reprogramme adult somatic cells to generate cells that resemble embryonic stem cells. The experiments of Wilmut and Campbell indicate that adult mammalian cells can be reprogrammed into pluripotent embryonic stem cells by nuclear transfer. Building on these insights, Yamanaka sought a different and more direct way to reprogramme adult cells. He systematically analyzed hundreds of genes that are expressed differently in embryonic and somatic cells. In 2006, he startled the scientific community by reporting that the addition of just four genes could induce adult mouse skin cells back to embryonic-like cells that he called induced pluripotent stem (iPS) cells. He further showed that these pluripotent stem cells could produce fully reproductive mice, proving definitively that these cells are totipotent. His work was rapidly duplicated and validated by researchers in many laboratories. The next question was whether his method would work in human skin fibroblasts. In November 2007, Yamanaka's laboratory, concurrently with James Thomson's of Wisconsin, startled the world with the news that pluripotent stem cells can also be induced from human skin cells in a similar fashion. Based on his discovery in the mouse, animal experiments by others have already shown that it was possible to cure mouse models of sickle cell anaemia and Parkinson Disease. While more work needs to be done for human therapeutic applications, his discovery opens up the possibility of generating from a patient's own skin pluripotent stem cells that can be manipulated for the treatment in a host of human diseases. Since the DNA is the patient's own, immunological rejection of donor's cells can be circumvented. It is an improvement on therapeutic cloning, which requires nuclear transfer into human donor eggs to derive stem cells, a procedure which raises ethical concerns and which has not yet been successful with human cells.

The discoveries of Wilmut and Campbell and of Yamanaka have ushered in a new era of studying mammalian development and cell differentiation. They have also provided new approaches of improving agriculture practices, and novel treatment of human diseases.

Ian Wilmut

I was born in 1944 in a small village in the middle of England, Hampton Lucy. During the war nursing homes had been moved from the bomb damaged city of Coventry where my parents lived. My parents were both school teachers. My father was an outstanding student of mathematics at the University of Cambridge, but because his ambition was to teach, he declined opportunities to stay and carry out research. I have a younger sister, Mary, who initially trained for biological research, but later became a teacher for children with special needs.

To gain promotion for my father, we moved to the north of England - first to Shipley and then Scarborough. At Scarborough Boys High School I came under the influence of Gordon Whalley who taught biology. I entered the University of Nottingham to study agriculture. My ambition at that time was to train for advisory work to enable me to work overseas. Fortunately, all students in the School of Agriculture took the same courses for the first year and during that time I came into contact with scientific research for the first time. It was this experience that made me elect to study animal science in the Department led by Professor Eric Lamming. Two of his colleagues, Dr "Bas" Haynes and Barry Crichton spent a great deal of time in the laboratories talking to the students and were also very important in my career development.

The girl who I met at school and was later to marry worked in Cheltenham at that time and I wrote to laboratories at ever increasing distances from there seeking an opportunity for a summer internship. The first to reply was Professor Christopher Polge FRS and I spent eight weeks in his laboratory in Cambridge during the summer of 1966. I was very fortunate after I graduated in 1967 to move to Chris Polge's laboratory. For research on the Deep Freeze Preservation of Boar Semen I was awarded a PhD by Darwin College, Cambridge in 1971. Chris was a very generous and wise mentor and the greatest influence on my research career.

I then had the opportunity to hold a fellowship with Professor Polge and Mr LEA (Tim) Rowson, FRS who was an eminent veterinary surgeon in the field of animal reproduction. At that time we produced the first calves from frozen embryos and I learned some of the techniques of experimental

surgery. Together these posts had given me a thirst for research and experience of a range of important techniques. I took up a post at the research institute on the outskirts of Edinburgh which later became known as the Roslin Institute.

My research has always been concerned with gametes or embryos. In some studies this was concerned with defining the mechanisms that control normal development, but in collaborative studies with David Sales and Cheryl Ashworth it was with understanding the abnormal events that lead to failure of development.

In 1984 my life was transformed by the launch of a project to genetically modify sheep so that they produced in their milk proteins needed to treat human disease. This project was led first by Rick Lathe and then John Clark, but was always with the help of Professor John Bishop. To make the genetic change, a few hundred copies of the specific gene were injected into the nucleus of an early embryo. It was to establish a new means of more effective genetic modification that we started to develop methods for nuclear transfer.

Nuclear transfer in livestock involves a large team of people each with a different essential skill. Key to our progress was the recognition by Keith Campbell of the importance of co-ordinating events in the two cells that are involved in nuclear transfer, the egg and the donor cell. It was fortuitous that for a matter of convenience we made some donor cells inactive, or quiescent and went on to produce the first offspring cloned from an adult cell, Dolly. We now know that this treatment is not essential, but it does confer an advantage.

My present appointment is as Director of the MRC Centre for Regenerative Medicine in the University of Edinburgh. The aim of the Centre is to develop new treatments for human disease through innovative research with stem cells. My own research aims to understand the molecular mechanisms by which unknown factors in the egg are able to modify the function of the donor cell so that it is able to control development to term.

My wife Vivienne and I have three children and five grandchildren. We live in a small village and enjoy being immersed in the countryside, watching the wildlife and following the changing seasons. I am a keen photographer, enjoy gardening and listening to a great variety of different music.

Keith H S Campbell

I was born on 23rd May 1954 in Birmingham, England to Marjorie Regina Campbell (née Smith) and Henry (Harry) Stockman Campbell. My mother, being of English origin thought that Henry was too harsh a name for a baby and added Keith to the family name. I am presently married to Kathryn and have two wonderful teenage daughters Claire and Lauren from a previous relationship.

At age 3 - my parents, myself and younger, only, sister moved to Perth, Scotland where I began my education. At age 8 - we moved back to Birmingham where I remained until the age of 21. Here I was educated at King Edward VI Grammar School for boys and then trained and qualified as a Medical Laboratory Technologist specialising in Medical Microbiology at Selly Oak Hospital. At age 21, I attended Queen Elizabeth College, London where I obtained a BSc in Microbiology. During these studies I initiated my interests in the cell cycle and cellular growth. Following brief locum positions, firstly as Chief Medical Laboratory Technologist in Southern Yemen and then on a programme to eradicate Dutch Elm Disease in parts of Southern England, I joined the cytogenetics group of Dr N Bishun at the Marie Curie Institute. The Marie Curie Foundation funds basic research into the underlying causes and mechanisms of cancer, as well as providing hospice and home care for cancer sufferers. Here my interests in the regulation of cellular growth and in particular differentiation increased. In 1983 I was awarded the Marie Curie Research Scholarship and moved to the University of Sussex as a postgraduate student where I studied the cytoplasmic control of nuclear behaviour during the development of amphibian eggs, early embryos and during cell growth and division in yeast; in particular, the ubiquitous nature of such factors in eucaryotic cell types. I was awarded a D.Phil. for my thesis titled "Aspects of cell cycle control in Yeast and *Xenopus*". After these studies I returned to Scotland, not only to pursue my career but also because of my love of the outdoors and my keen interests in hill walking and mountain biking. Following two postdoctoral fellowships I joined the Roslin Institute in 1991 to study animal 'cloning' by nuclear transplantation. Here I applied the knowledge gained from my studies in cancer and amphibian embryos and my interests in cell specialisation to studies on nuclear equivalence in mammals. At this time it was known that the majority of cells within an adult contain an intact genome; however, many scientists were sceptical that the nuclei of such cells could be

reprogrammed to control development. Stubbornly, I always believed that such technology was possible and in 1995 these studies led to the birth of 'MEGAN' and 'MORAG', two Welsh Mountain lambs. These were the first mammals to be 'cloned' from cultured differentiated cells. In 1996 these experiments were repeated and extended resulting in the birth of 'DOLLY', the first mammal to be 'cloned' from an adult derived somatic cell.

In collaboration with PPL Therapeutics (a company producing human proteins in the milk of transgenic farm animals) firstly as a consultant and then as Head of Embryology, I was involved in the production of 'POLLY' the first transgenic mammal to be produced by nuclear transfer and produce a human protein. In joining PPL my aims were to accelerate the benefits of transgenic technology in the field of human medicine and to further understand the mechanisms underlying embryo development and cellular differentiation; more specifically, the development of methods for gene targeting in livestock and methods for the production of cloned pigs for Xenotransplantation. In July 1999 we were successful and produced the world's first gene targeted lambs (Cupid and Diana) followed in March 2000 by the world's first piglets cloned from somatic cells.

In November 1999, I became Professor of Animal Development at the University of Nottingham where I continue research into the basic mechanisms underlying early development and cellular differentiation; these studies provide basic knowledge on 'epigenetic' programming of nuclear and chromatin structures involved in controlling and maintaining cellular differentiation.

I believe that understanding and improving the cloning process has many applications in basic and applied research for both human medicine and agriculture. However, the major objectives of these studies are to understand epigenetic control and reprogramme differentiated cells to become stem cells, whilst avoiding the requirement for embryo production. This will allow not only development of cell based models for many studies in aging and age related diseases but also aid in the development of novel therapies for both human and veterinary applications.

I lecture regularly to both scientific and lay audiences and liaise with the press on current advances in biotechnology, giving regular interviews to the newspapers, radio and TV. I believe that public understanding of science is crucial for continued research and introduction of the benefits produced in many areas.

Shinya Yamanaka

I was born on September 4, 1962 in Osaka, Japan. I used to practice Judo until high school. Every time I got injured, I went to see a doctor - and to be a doctor was my intended future goal. I was assigned my MD from Kobe University in 1987 and my PhD from Osaka City University in 1993. From 1987 to 1989 I was a trainee doctor at the National Osaka Hospital. I had a patient who was suffering from rheumatism. I thought I had to research how to cure the seriously ill, like those with rheumatism. To do that, I had to start from basic research. I was a postdoctoral fellow in the Gladstone Institute of Cardiovascular Disease in San Francisco from 1993 to 1996. During my stay in the US, I fortuitously found a certain gene, which related to Embryonic Stem (ES) cells. I returned to Osaka City University Medical School to take an assistant professor position in 1996, and became an associate professor at Nara Institute of Science and Technology in 1999, and a professor in 2003. In 1998, human ES cells were established by a US researcher and that led me to study ES cell and pluripotency-related research more. I became a professor at Kyoto University in 2004. Afterwards, I was assigned as a visiting scientist at the Gladstone Institute in 2007. In 2008, I became Director of Center for iPS Cell Research and Application (CiRA), and also a member of the International Society of Stem Cell Research (ISSCR) Board of Directors.

Owing to its ability to exert self-renewal and pluripotency, ES cell has been recognized as suitable sources for cell transplantation therapy for incurable disorders. There have been two major issues: ethical controversy on manipulation of human embryo and possible immune rejection after the transplantation. Finding the means to generate patient-specific pluripotent cells may be one of the solutions. So far, successful nuclear transfers from somatic cell into oocyte, and cell fusion between somatic with ES cell have been reported. However, they still remain ethically problematic for usage of human embryo. Alternatively, these achievements indicate that ES cell and oocyte possess pluripotency–inducing factors.

Before I started exploring a new method to gain patient-specific pluripotent cell, I made a hypothesis that most of pluripotency-inducing factors might also be essential to pluripotency-maintaining factors. During the first phase, I identified several genes expressed specifically in ES cell, utilizing Expressed Sequence Tag database. On the experimental basis, I named

newly shown genes as ES cell associated transcripts (ECAT). By thoroughly analyzing ECATs by biochemical and cell biological approaches as well as conducting numerous experiments with knockout mice, my lab members finally concluded the results that ECAT4 (Nanog) is an indispensable factor in maintaining pluripotency (Cell, 2003) and ECAT5 (ERas) is a factor to expedite self-renewal activity in cells (Nature 2003).

Then, I selected 24 highly promising factors - some function in pluripotency and some specifically expressed in ES cells - as candidates for pluripotency-inducing factors, and followed their thorough evaluation. When each candidate factor is introduced one by one into mouse fibroblasts, pluripotency was not induced. While all the 24 factors were introduced altogether, cells with pluripotency were obtained. Among myriad ways of combination of factors, our lab members finally figured out that the four defined factors; *Oct3/4, Sox2, Klf4 and c-Myc* are crucial pluripotency-inducing factors (Cell, 2006). Retrovirus vector was used to ferry the combined four factors into mouse fibroblasts culture, which finally led to the generation of iPS cells. iPS cells were able to be cultured for a long period of time, possessing very similar features as ES cells in shape and proliferating ability. iPS cells exhibited capability of self-renewal and differentiation into various tissue cells including nerves, cartilages, muscles, etc. Then, I found pluripotency in mouse iPS cells, which were then proved to be tantamount to ES cells (Nature 2007). Moreover, we successfully established iPS cells without using a proto-oncogene, *c-Myc* (Nature Biotechnology, 2008). Later, we learned that generation of iPS cells from the stomach and liver cells of mouse was also successfully conducted (Science 2008). Finally, they reached the point of generating pluripotent stem cells from human fibroblasts (Cell, 2007).

Without using any single embryo or oocyte, iPS cells can be generated by introducing defined factors into cells. This breakthrough is most likely to advance the cell transplantation therapy. Furthermore, patient-specific iPS cell will also give a new avenue to future medicine by its clinical application in understanding disease mechanisms, drug screening and toxicology.

Our discovery would never have happened without ES cells and we are thankful for the pioneering of ES cells. Also, I still can't believe how lucky we were that we were able to find out the four defined factors. Overall, I truly appreciate the huge effort of my lab members.

THE SHAW PRIZE 邵逸夫獎

Sir Michael Atiyah

Member of Board of Adjudicators
Chairman of the Prize in 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. He was knighted in 1983 and made a member of the Order of Merit in 1992.

He was awarded the Fields Medal in 1966 and the Abel Prize in 2004. He is a foreign member of around 20 national academies and has over 30 honorary degrees. In 2005 he became President of the Royal Society of Edinburgh.

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 mathematicians and physicists.

THE SHAW PRIZE 邵逸夫獎

The Prize in Mathematical Sciences 2008

Vladimir Arnold

and

Ludwig Faddeev

for their widespread and influential contributions to Mathematical Physics.

An Essay on Vladimir Arnold and Ludwig Faddeev

Mathematics and Physics have, over the centuries, had a long and close relationship. The modern era was ushered in by Galileo who said that the laws of nature were written in the language of mathematics. This was taken a giant step forward by Isaac Newton who developed and applied calculus to the study of dynamics. From that time on the whole theoretical framework of physics has been formulated in terms of differential equations.

Both of the 2008 Shaw Laureates in the Mathematical Sciences, Vladimir Arnold and Ludwig Faddeev, are part of this great tradition. Arnold's contributions are mainly in classical mechanics, emphasizing the geometrical aspects as developed over the centuries by Newton, Riemann and Poincare. Faddeev has been attracted more by the challenges of quantum theory and the algebraic formalism that is related to it.

Arnold has made many important contributions to a wide variety of problems on the Analysis/geometry frontier, but his most famous is the Kolmogorov-Arnold-Möser (KAM) theory. This theory shows the persistence of quasi-periodic orbits of dynamical systems under suitable perturbations. Originating in Newton's work on a single planetary orbit, it deals with the more general N-body problem, has been enormously influential and has important applications from the solar system to particle accelerators. Arnold also pointed out (in 1964) a subtle instability, now called Arnold diffusion, which has been much studied by mathematicians and physicists.

The general theory of Hamiltonian mechanics (in which energy is conserved) has an elegant formulation in geometrical terms – symplectic geometry. Arnold made a deep study of this subject and formulated some profound conjectures relating Hamiltonian flows to topology. These were very influential, leading to a fruitful development over the subsequent decades, culminating in the proof of some versions of the Arnold conjectures by Andreas Floer and others.

Geometrical structures frequently exhibit singularities, a subject of study by algebraists and geometers for a long time, but Arnold's interest in them centres around their appearance as caustics in wave-propagation. He emphasized the geometrical approach in this field but incorporated new results from algebra and topology.

Arnold was also a pioneer of the geometric approach to the study of the Euler equations for the dynamics of ideal fluids, an approach that has had great influence over the last thirty years. In 1966 he obtained general criteria for the stability, both linear and non-linear, of the Euler equations, while in 1974 he provided an interpretation of the helicity invariant of the Euler equations as an asymptotic Hopf invariant of linked vortex lines.

Another connection between geometry and analysis emerges from real algebraic geometry associated with the characteristics of partial differential equations. Whereas complex algebraic geometry has a rich and beautiful theory, most of this disappears over the real numbers. For plane curves one of Hilbert's famous problems asked questions about the disposition of real ovals. Arnold attacked this problem by a highly ingenious and effective topological approach giving the best results at the time.

Ludwig Faddeev has made many important contributions to quantum physics and to the differential equations that underpin it.

He is best known for his work with Victor Popov showing the right way to quantize the non-Abelian gauge theories which underlie all contemporary work on sub-atomic physics. Gauge symmetry is well understood in electromagnetic theory as formulated by Clerk Maxwell: it amounts to the ambiguity of the vector potential. The challenge was how to extend this simple linear situation to the non-linear case of the Yang-Mills equations relevant to particle physics. The answer lay in the introduction of what are now called "Faddeev-Popov ghosts". These have totally transformed the theory in an elegant and conceptual way, leading in due course to the work of 't Hooft and Veltman which was recognized by the Nobel Prize for Physics of 1999.

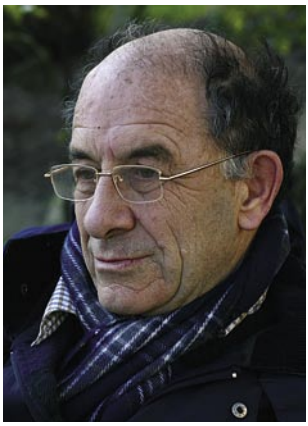
One of the surprising results of the past fifty years has been the discovery that a number of interesting non-linear partial differential equations that arise, in certain simplified physical situations, are "integrable". This means that they can be solved explicitly as a consequence of a beautiful and somewhat mysterious mathematical structure. The quantization of some of these theories is physically meaningful and Faddeev, in collaboration with many of his students, developed a quantum version of integrability, which led to the notion of quantum groups. It has had important applications in solid state physics as well as in recent work on string theory.

An important area of study in mathematical physics is that of "Scattering Theory". Here one envisages some kind of obstacle which diverts or reflects a flow of incoming waves, for example light waves, the scattering being the way incoming waves are related to outgoing waves. In practice one is frequently interested in the inverse problem, how to read information about the obstacle from the scattering data.

Peter Lax and Ralph Phillips developed this theory (in 1964), in the context of the spectral theory of linear differential operators. This was then brilliantly applied, by Faddeev and Boris Pavlov, to the geometry of the upper-half plane and the action of the modular group. They found a most surprising connection between this scattering theory and the famous (and still unsolved) Riemann hypothesis of number theory on the zeroes of the zeta function. This link between number theory and physics through subtle spectral analysis is illustrative of Faddeev's breadth of interest and insight.

While the detailed contributions of Arnold and Faddeev do not overlap, together they cover an enormous range of topics in mathematical physics. Rooted in the past, but with the incorporation of new and exciting ideas of our time, their work shows the continued vitality of mathematical physics in ways that would have gratified both Galileo and Newton. Arnold and Faddeev are worthy recipients of the Shaw Prize.

Vladimir Arnold



I was born on 12 June 1937 in Odessa and studied at the Moscow University from 1954 to 1959.

I was a Candidate of physical-mathematical sciences, for the Thesis, resolving the Hilbert's 13-th problem, Applied Mathematics (Keldysh) Institute in 1961 and attained the physical-mathematical sciences doctor in 1963, for the Thesis on the stability of the Hamiltonian systems, at the same Institute. The graduated studies were supervised by AN Kolmogorov.

Since 1965 I have worked as a professor at the chair of differential equations of the mathematical-mechanical faculty of the Moscow State University and since 1986 also at the Steklov Mathematical Institute, Moscow. I was elected a member of the Russian Academy of Sciences in 1990.

I served as the vice-president of the International Union of Mathematicians (1999-2003), being also the President of the Moscow Mathematical Society.

The list of scientifical journals, on whose Editorial Boards I participated, includes, for instance:

Doklady RAN, Izvestia RAN, Russian Mathematical Surveys, Functional Analysis and its Applications, Functional Analysis and Other Mathematics, Proceedings of Petrovski Seminar, Inventiones Mathematicae, Physica D-Nonlinear Phenomena, Quantum, Bulletin des Sciences Mathematiques, Selecta, Journal of Geometry and Physics, Topological Methods in Nonlinear Analysis.

Being Moscow University's professor for 30 years, I worked also as the professor at the University Paris-Dauphine from 1993 to 2005 (remaining now its honorary professor).

I have published several dozens of books. Examples are:

- Ergodic Problems of Classical Mechanics (with A Avez);
- Ordinary Differential Equations;
- Mathematical Methods of Classical Mechanics;
- Geometrical Methods of theory of Ordinary Differential Equations;
- Catastrophes Theory;
- Singularities of Caustics and of Wave Fronts;
- Problems for Children from 5 to 15 years old;
- Huygens and Barrow, Newton and Hooke – first steps of calculus and of catastrophes theory;
- Yesterday and Long Ago;
- Contact Geometry and Wave Propagation;
- Lectures of Partial Derivatives equations;
- Pseudoperiodic Topology (with M Kontsevitch and A Zoritch);
- Mild and Soft Mathematical Models;
- Continued Fractions;
- Euler Groups and Geometric Progressions Arithmetics;
- Dynamics, Statistics and Projective Geometry of Galois Fields;
- New Obscurantism and Russia's Educational System;
- Is Mathematics Needed at Highschools;
- Geometry of Complex Numbers, Quaternions and Spins;
- Experimental Mathematics;
- What is Mathematics;
- Experimental Discoveries of Mathematical Facts;
- Science of Mathematics and Arts of Mathematicians;
- Geometry.

The above list contains 10 university textbooks.

Most known mathematical papers of mine deal with Hamiltonian systems (including the discovery of the "Arnold diffusion" and the creation of the symplectic topology).

My articles on the "quantum catastrophies theory" include the studies of the bifurcations of the caustics, based on my discovery of unexpected interrelations betwen the simple critical points of functions and simple Lie algebras (and also to Coxeter reflections' groups).

The real algebraic geometry of plane curves was related by me to the four-dimensional topology (and to quantum fields theory) – this discovery generated many studies by many mathematicians of the algebraic geometry part of the 16th problem of Hilbert.

My recent works on arithmetical turbulence provide unexpected statistical properties of the Young diagrams of the cycles of random permutations of $N \to \infty$ points.

Many domains of modern mathematics, generated by my articles, include, for instance:

- Lagrange and Legendre cobordism theories (in symplectic and contact topologies);
- Statistics of the most frequent representations of finite groups;
- Ergodic theory of the segments' permutations;
- Planetary dynamo theory (in magnetohydrodynamics);
- Statistics of the higherdimensional continued fractions;
- Theory of singularities of the distribution of galaxies;
- Arnold's discovery of the "strange duality" of Lobachevsky triangles (leading to the mirror symmetry theory of the quantum fields physics);
- Asymptotical statistics of the Fermat-Euler geometrical progressions of residues;
- Theory of the weak asymptotics (for the distributions of the solutions of Diophantine problems);
- Description of the boundary singularities of the optimal control problems (in terms of the geometry of icosahedron);
- Topological Galois theory (of radical insolvability for the algebraic equations of degrees ≥ 5);
- Creation of the characteristic classes theories for the Braids and for the algebraic functions;
- Arnold's discovery of the topological reasons of the divergences of the permutation theory's series (including the classification of the neigbourhoods and in the orbits spaces of dynamical systems);
- Asymptotical study of irreducible representations frequencies (in the eigenspaces of the Laplacian on a symmetrical Riemannian manifold);
- Topological classification of the immersed smooth plane curves;
- Ergodic theory and projective geometry of Galois fields;
- Statistics of the convex polygons, whose vertices are integer points on the plane;
- Topological interpretation of the Maxwell's multipole formula for the spherical harmonics;
- Palindromicity theory for the periodic continued fractions of the quadric irrationalities ($x^2+px+q=0$);
- Arnold's discovery of the validity of the Gauss-Kuz'min statistics for the random periodic continued fractions;
- Arnold's discovery of the violation of the Gauss-Kuz'min statistics for the periodic continued fractions of eigenvalues of the random matrices (in $SL(2, \mathbf{Z})$);
- Arnold's invention of the characteristic class, involved in the quantization conditions;
- Arnold's symplectic geometry theory of the Lagrange tore in completely integrable Hamilton systems;
- The ergodic and number-theoretical "Arnold's cats" of physicists (F Dyson, I Persival, ...).

To understand the natural interrelations between such different subjects as mentioned above, I recommend reading my articles (approximately 700) explaining these interrelations.

Ludwig Faddeev

I was born on March 10, 1934 in Leningrad (now St Petersburg), where I have resided for most of my life. The exception was during the war from the middle of 1941 till the beginning of 1945, when I was evacuated from Leningrad and lived in several places in the East, mostly in Kazan.

Both my parents were mathematicians. My father's interests were very wide, but he considered himself an algebraist. It is acknowledged now, that he was an independent creator of the homological algebra. My mother worked on applied problems; her most known contributions are to the computational methods of linear algebra.

In high school I had many different interests including photography, radio modelling and cross-country skiing. I was good at mathematics in class, but was not an "Olympiad boy". I decided to get higher education at the Department of Physics of Leningrad University to be independent of my father, who was Professor at the Department of Mathematics.

However, mathematics caught me there. Due to the influence of academicians V A Fock and V I Smirnov the mathematical education of students of the Department of Physics was excellently organized. My tutor from the third year of undergraduate studies was Professor O A Ladyzhenskaya, a renowned specialist in PDE. She did not push me into this field of classical mathematical physics. Rather, she proposed me as an additional reading papers on the quantum scattering problem. The first was a paper of N Levinson on the uniqueness in the reconstruction of potential in the radial Schroedinger operator from the phase shift. Also, I was to read and relate on the special seminar the book of K O Friedrichs "Mathematical Aspects of Quantum Field Theory". Of course I came through all traditional courses in Theoretical Physics. So I was very lucky to get an excellent education both in Theoretical Physics and Mathematics which defined my future career as a mathematical physicist with prime interest in quantum theory.

I finished my undergraduate studies in 1956 and graduated with the degree of Candidate of Sciences in 1959. During this time I was happy to marry Anna Veselova. We have two daughters and four grandchildren, already quite adult.

My first scientific paper was published in 1956, so I have been involved in active scientific work for more than 50 years. I began by treating the mathematical questions of the quantum scattering theory, both direct and inverse problems. The treatment of the quantum scattering theory for the system of three particles,

based on the integral equations, now bearing my name, brought me my first success. The work was highly appreciated by the specialists in nuclear physics. The attention of mathematicians came later and now the theory of many body quantum scattering is an active subject of modern mathematical physics. However, personally I estimate higher my solution of the overdetermined many dimensional inverse problem for the Schroedinger operator with local potential. Recently, I have heard that this work gets practical applications in tomography.

The first success and defence of the Doctor of Science dissertation in 1963 allowed me to turn to Quantum Field Theory – my dream of younger years. At that time the QFT was practically forbidden in the Soviet Union because of the (pure scientific) censorship of Landau. Fortunately, living in Leningrad I was outside the scope of Moscow influence and was free to do what I wanted. After reading the Polish lecture of R Feynman and the book by A Lichnerowitz on the theory of connections, I decided to work on the problem of quantization of the Yang-Mills field. In the fall of 1966, in collaboration with a bright young colleague, Victor Popov, I came to the proper formulation of this theory in terms of the functional integral. We calculated the formal measure, on the manifold of the gauge equivalent classes of connections. Later it was said that we overplayed Feynman in his field. Our short paper, published in 1967, became popular only several years later, when the Yang-Mills field was incorporated into the unified theory of Electromagnetic and Weak Interactions by S Weinberg, A Salam.

In 1970 I was introduced by V Zakharov to the inverse scattering method of solving the nonlinear evolution equation on two dimensional space-time. Our first joint result – the Hamiltonian interpretation and complete integrability of the Korteveg de Vries equation – defined my activity for 20 years. The main achievements here, made together with a large group of excellent students (now called "Leningrad School"), are the unravelling of the algebraic structure of quantum integrable models (the Yang-Baxter equation) and formulation of the Algebraic Bethe Ansatz. This development eventually became a base of construction of quantum groups by V Drinfeld.

It is quite invigorating for me to watch how this formalism was resurrected in the modern treatment of the Yang-Mills theory.

In later years I also returned to the Yang-Mills theory, however without connection with integrability. Together with my colleague, A Niemi, I try to find an adequate picture for the particle-live excitations in this theory. We envision a possible knot-like soliton structure for them. However, the work is in its preliminary stage.

At present I live quite comfortably in St Petersburg. I enjoy contacts with my former students, living in Europe and the USA, and hope to recruit new ones from the generation more than 50 years younger than me.

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The Open University of Hong Kong

Mrs Mona Shaw
Chairperson
The Shaw Prize Foundation

Preparatory Committee (Until July 2003)*

Front row, from right to left

* Professor Kwok-Pui Fung
* Professor Lin Ma

Professor Chen-Ning Yang

Mr Run Run Shaw

* Professor Yue-Man Yeung
* Mrs Mona Shaw

Back row, from right to left

Mr Raymond Wai-Man Chan

* Professor Pak-Chung Ching
* Professor Samuel Sai-Ming Sun
* Professor Kwok-Kan Tam
* Professor Sunny Kai-Sun Kwong

Mr Charles Cheuk-Kai Cheung

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Shaw Prize 2004

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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 Tung Chee-Hwa,
***Chief Executive of HKSAR*;**

Professor Herbert W. Boyer,
***Laureate in Life Science and Medicine*;**

Professor Kan Yuet-Wai,
Laureate in Life Science and Medicine and

Late Professor Chern Shiing-Shen,
***Laureate in Mathematical Sciences*.**

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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;

Sir Michael Berridge,
Laureate in Life Science and Medicine and

Professor Andrew Wiles,
Laureate in Mathematical Sciences.

Shaw Prize 2006

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Professor Adam Riess,
Laureate in Astronomy;

Professor Saul Perlmutter,
Laureate in Astronomy;

Mr Donald Tsang,
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Mr Run Run Shaw,
Founder of the Shaw Prize;

Professor Wang Xiaodong,
Laureate in Life Science and Medicine;

Professor David Mumford,
Laureate in Mathematical Sciences and

Professor Wu Wentsun,
Laureate in Mathematical Sciences.

Shaw Prize 2007

From right to left:

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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;

Professor Robert Langlands,
Laureate in Mathematical Sciences and

Professor Richard Taylor,
Laureate in Mathematical Sciences.

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Professor Lin Ma

Professor Chen-Ning Yang

Professor Kenneth Young

Professor Sheung-Wai Tam

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Mrs
Mona Shaw
Chairperson

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, currently serving as Managing Director and Deputy Chairperson of Shaw Brothers (Hong Kong) Limited and Deputy Chairperson and Acting Managing Director of Television Broadcasts Limited.

Council Members

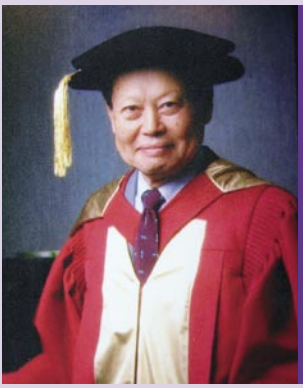
Professor Lin Ma

Member

Professor Lin Ma was Professor of Biochemistry (1972-1978) 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 established Shaw College in The Chinese University of Hong Kong in 1987 and has served as Chairman of the Board of Trustees since its inauguration. 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 Members



Professor Chen-Ning Yang

Member & Chairman, Board of Adjudicators

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 Members

Professor Kenneth Young

Member

Professor Kenneth Young is a theoretical physicist, and is Professor of Physics and Pro-Vice-Chancellor 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 and Dean of the Graduate School. 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 Members

Professor Sheung-Wai Tam

Member

Professor Sheung-Wai Tam is the President Emeritus of the Open University of Hong Kong (OUHK). With more than 38 years experience in teaching, research and university administration he has attained many achievements in higher education. During his three decades with The Chinese University of Hong Kong, Professor Tam has demonstrated excellence in teaching and research in organic chemistry in the fields of natural products, mass spectrometry and organometallic chemistry.

Professor Tam served as the President of the OUHK from 1995 until his retirement in 2003. During this period the OUHK was geared 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) as well as an honorary degree (UKOU) in 2002.

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Members of Selection Committee

(October 1, 2007 - September 30, 2009)

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Chief Scientist, Astrophysics Science Division, NASA/ GSFC, USA

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Selection Committee (2007 – 2009)

Professor
Douglas N C Lin

Member of
Astronomy Committee

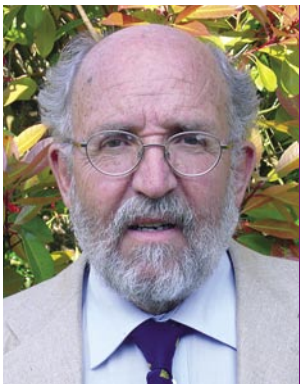
Professor Douglas Lin is the founding director of the Kavli Institute of Astronomy and Astrophysics, Peking University. He is also a Professor of Astronomy and Astrophysics at the University of California, Santa Cruz. He obtained his BSc from McGill University in 1971, PhD from Cambridge University in 1976. He received his postdoctoral fellowships at Cambridge and Harvard Universities before joining the faculty at the University of California, Santa Cruz in 1979. He was awarded the Otto Schmidt Metal, the Churchill overseas, John Simon Guggenheim, Alexander von Humboldt, and Sackler Distinguish fellowships. He was elected a member of the American Academy of Arts and Science in 2002. His areas of expertise include theory of star and planet formation, interstellar medium, accretion disks, galactic dynamics, and active galactic nuclei. He has published over 180 research papers in refereed journals. He has served on numerous NASA committees.

Dr
John C Mather

Member of
Astronomy Committee

Dr John C Mather is Senior Project Scientist for the James Webb Space Telescope at Goddard Space Flight Center, and Chief Scientist of the Science Mission Directorate of NASA Headquarters. His research centres on infrared astronomy and cosmology. He led the proposal for the Cosmic Background Explorer (COBE) and was the Project Scientist, as well as the Principal Investigator for the Far IR Absolute Spectrophotometer (FIRAS) on COBE. He showed that the cosmic microwave background radiation has a blackbody spectrum within 50 ppm, confirming the Big Bang theory. His awards include the Nobel Prize in Physics (2006) with George Smoot.

He received his BA from Swarthmore College with highest honours in physics in 1968, and his PhD in physics from the University of California at Berkeley in 1974. His doctoral advisor was Paul Richards, and his thesis led directly to the COBE satellite.



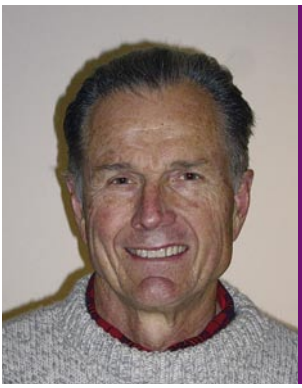
Professor Michel Mayor

Member of Astronomy Committee

Professor Michel Mayor, an Emeritus Professor, Department of Astronomy, University of Geneva and past Director of Geneva Observatory is 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 and last but not the least, the 2005 Shaw Prize for Astronomy. He is a foreign member of the French 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.



Professor Richard McCray

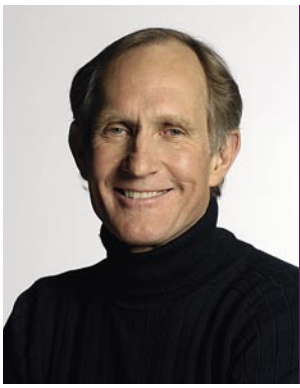
Member of Astronomy Committee

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 National Academy of Sciences. He was awarded a Guggenheim Fellowship and the Dannie S Heinemann Prize for Astrophysics.

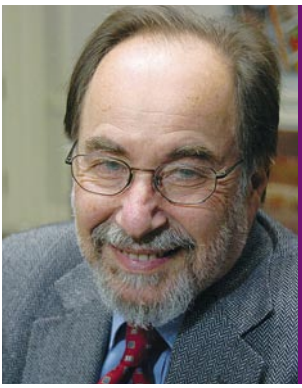


Dr
Peter C Agre

Member of Life Science and Medicine Committee

Dr Peter 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, Dr Agre was Professor of Biological Chemistry and Professor of Medicine. In 2003, Dr 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, Dr 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. Dr Agre is a member of the National Academy of Sciences and chairs their Committee for Human Rights. On 1 January 2008 Dr Agre has moved to Johns Hopkins Bloomberg School of Public Health where he became Director of the Malaria Research Institute.



Professor David Baltimore

Member of Life Science and Medicine Committee

After serving as President of the California Institute of Technology for nine years, in 2006 Professor David Baltimore was appointed President Emeritus and the Robert Andrews Millikan Professor of Biology. Previously, he was an Institute Professor at the Massachusetts Institute of Technology, Founding Director of the Whitehead Institute for Biomedical Research at MIT, and the President of Rockefeller University.

Awarded the Nobel Prize at the age of 37 for research in virology, Professor Baltimore has profoundly influenced national science policy on such issues as recombinant DNA research and the AIDS epidemic.

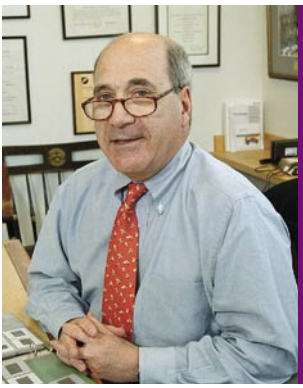
His career has been distinguished by his dual contribution to biological research and to national science policy. Professor Baltimore has served as Head of the National Institutes of Health AIDS Vaccine Research Committee and was Co-Chair of the National Academy of Sciences and Institute of Medicine's Committee on a National Strategy for AIDS. He helped pioneer the molecular study of animal viruses, and his research in this field had profound implications for understanding cancer and, later, AIDS.

He has received numerous awards including the National Medal of Science.

Professor Michael S Brown

Member of Life Science and Medicine Committee

Professor Michael S Brown received an MD degree in 1966 from the University of Pennsylvania, USA. He was a resident at the Massachusetts General Hospital and a post doctoral fellow with Earl Stadtman at the National Institutes of Health. He is currently Director of the Jonsson Center for Molecular Genetics at the University of Texas Southwestern Medical School in Dallas. Professor Brown and his colleague, Dr Joseph L Goldstein, discovered the low density lipoprotein (LDL) receptor, which controls cholesterol in blood. They showed that mutations in this receptor cause Familial Hypercholesterolemia, a disorder that leads to premature heart attacks. Their work laid the groundwork for drugs called statins that lower blood cholesterol and prevent heart attacks. Statins are taken daily by more than 20 million people worldwide. Professor Brown and Dr Goldstein shared many awards for this work, including the US National Medal of Science and the Nobel Prize for Medicine or Physiology.



Professor David M Livingston

Member of Life Science and Medicine Committee

Professor David M Livingston received his AB from Harvard and his MD (Magna Cum Laude) from Tufts University School of Medicine in 1965. He completed his clinical training in internal medicine at Peter Bent Brigham Hospital, followed by research fellowships at the National Cancer Institute and Harvard Medical School. In 1973, he joined the faculty of Harvard Medical School and DFCI as an assistant professor and rose to full professorship in 1982.

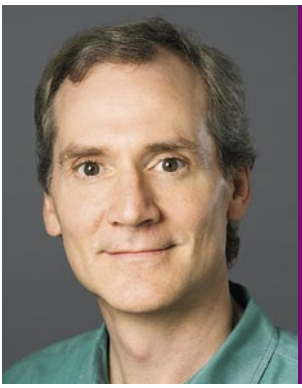
Professor Livingston is chief of the Charles A Dana Division of Human Cancer Genetics at Dana-Farber, the deputy director of the Dana-Farber/Harvard Cancer Center, and the Emil Frei Professor of Medicine and Genetics at Harvard Medical School. He has received numerous prizes and awards – such as the AACR-GHA Clowes Awards (2005) and The Boveri Award (2005) from the German Cancer Society. He is a member of the National Academy of Sciences, its Institute of Medicine, and the American Academy of Arts and Sciences.

Professor
Kim A Nasmyth

Member of Life Science and Medicine Committee

Professor Kim A Nasmyth is currently the Whitley Chair and Head of Department of Biochemistry, University of Oxford. Professor Nasmyth was formerly the Director of the Research Institute of Molecular Pathology (IMP) in Vienna.

His scientific work has addressed the mechanisms by which genes are turned on and off during development, how DNA replication is controlled, and how chromosomes ensure their segregation during mitosis and meiosis. He has received recognition through several awards, including Österreichisches Ehrenkreuz für Wissenschaft und Kunst/Ministry of Science (2007), Gairdner International Award (2007), Richard M Furlaud Distinguished Lecture/ The Rockefeller University (2005), Honorary Doctorate/ University of York (2003), the Boveri award for Molecular Cancer Genetics (2003), the Croonian Lecture/Medal of the Royal Society (2002), the Austrian Wittgenstein Prize (1999), the Louis Jeantet Prize for Medicine (1997), the Unilever Science Prize (1996), and the FEBS Silver Medal (1995). He is a fellow of the Royal Society (1989), a member of the Austrian Academy of Sciences (1999), and a foreign honorary member of the American Academy of Arts and Sciences (1999).



Dr Marc Tessier-Lavigne

Member of Life Science and Medicine Committee

Dr Tessier-Lavigne is a world leader in the study of brain development and regeneration. He has pioneered the identification of the molecules, including Netrins and Slits, that direct the formation of connections among nerve cells in the mammalian brain and spinal cord. These mechanisms are also providing essential tools to assist regeneration of nerve connections following trauma or injury, such as paralyzing injuries to the spinal cord.

Dr Tessier-Lavigne is currently Executive Vice President, Research Drug Discovery, at Genentech. Prior to taking up his current appointment in 2003, he was the Susan B Ford Professor in the Humanities and Sciences at Stanford University and an Investigator with the Howard Hughes Medical Institute.

Dr Tessier-Lavigne's accomplishments have earned him numerous awards and prizes, including being Elected Member of the National Academy of Sciences of the United States, Fellow of the Royal Society of London, Fellow of the Royal Society of Canada, and Member of the Academy of Medical Sciences of the UK.

Professor Zhi-Ming Ma

Member of Mathematical Sciences Committee

Zhi-Ming Ma is a professor of the Academy of Mathematics and Systems Science (AMSS), Chinese Academy of Sciences (CAS). He graduated from Chongqing Normal University in 1978, obtained his PhD degree from the Chinese Academy of Sciences (CAS) in 1984. His major research area is Probability and Stochastic Analysis. He has made contributions in the theory of Markov processes and Dirichlet forms. He joint with his co-authors found a new framework of quasi-regular Dirichlet forms which corresponds to right processes in one-to-one manner. Because of his contributions to Probability and Stochastic Analysis he was awarded several prizes including Shing-Shen Chern Mathematics Prize and Hua Loo-Keng Mathematics Prize.

Professor Ma is now an Academician of the Chinese Academy of Sciences, a Fellow of the Third World Academy of Sciences , and Vice President of the Executive Committee of International Mathematical Union. He was the Chairman of the Organizing Committee of ICM 2002, the International Congress of Mathematicians held in Beijing in 2002.

Professor Yuri Manin

Member of Mathematical Sciences Committee

Professor Yuri Manin is Board of Trustees Professor at Northwestern University, Evanston, USA, and Professor Emeritus at the MPI (Max Planck Institute) for Mathematics since 1993. He was Senior, then Principal Researcher of Steklov Mathematical Institute, Moscow 1960 – 1993 and since then he is Principal Researcher in absentia. He was Professor at the University of Moscow 1965 – 1992 and Professor of MIT 1992 – 1993. He was also Director of MPI for Mathematics 1995 – 2005. He worked in algebraic geometry, number theory, mathematical physics and computer science. Among his achievements one can list the proof of the functional case of Mordell conjecture, creation of the theory of modular symbols, a symmetry-based approach to quantum groups, theory of instantons (jointly with Atiyah, Drinfeld, Hitchin), the idea of quantum computation.

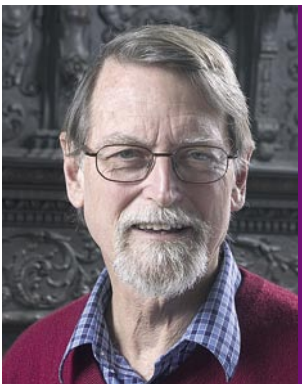
He was awarded Lenin Prize 1967, Frederic Esser Nemmers Prize 1994, Rolf Schock Prize in Mathematics 1999 and King Faisal International Prize in Mathematics 2002. He is a member/foreign member of several Academies of Sciences, including Russian AS, American AAS and Pontifical AS in Vatican.

Professor Cathleen S Morawetz

Member of Mathematical Sciences Committee

Professor Cathleen S Morawetz was born in Toronto, Canada. From 1943 to 1944 she worked in Quebec for the Inspection Board of the United Kingdom and Canada testing shells. She completed her BA in Toronto in 1945, received a master's degree from MIT in 1946 and a PhD in 1951 on implosions from New York University (NYU) under the direction of Kurt Friedrichs. From 1950 to 1951 she did postdoctoral work on hydrodynamic stability with Professor Chia-Chiao Lin at MIT. From 1951 to 1993 she was on the staff and later on the faculty of what became the Courant Institute at NYU. She was the Director from 1984 to 1988 and is now Professor Emerita. In 1998 Professor Morawetz received the President's Medal of Sciences (USA) and in 2006 the Birkhoff Prize in Applied Mathematics of the American Mathematical Society (AMS) and the Society for Industrial and Applied Mathematics. She served as President of the AMS in 1995 to 1996.

Professor Morawetz's mathematical work has been in linear and nonlinear partial differential equations, particularly the equations of mixed type which govern transonic flow and those of hyperbolic type which govern wave propagation and scattering theory. She has also worked in plasma physics.



Professor
David B Mumford

Member of Mathematical Sciences Committee

Professor David B Mumford is Professor Emeritus at Brown and Harvard Universities in both of which he taught for many years. His career has spanned both pure and applied mathematics. His work in pure mathematics centred on moduli problems, the roadmaps of algebraic geometry which have found application in string theory and for which he was awarded the Fields Medal in 1974.

His work in applied mathematics concerns mathematical techniques and statistical models for perception, especially vision, and its neurophysiological embodiment in the brain.

He has been a MacArthur Fellow and President of the International Mathematical Union. He is a member of US National Academy of Science, the American Philosophical Society and the Accademia Nazionale dei Lincei. He is also a foreign member of the Royal Society (2008). He shared the Longuet-Higgins Prize from the Institute of Electrical and Electronic Engineers (IEEE) in 2005, Shaw Prize in Mathematical Sciences in 2006, the Steele Prize from the American Mathematical Society in 2007 and the Wolf Prize in Mathematics in 2008.

THE SHAW PRIZE
邵逸夫獎

Presenter

Ms
Do Do Cheng

Award Winning Actress and Versatile TV Performer / Programme Host

Award winning actress and versatile TV performer / 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 TVB's 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" has brought her career to a new height.

THE SHAW PRIZE 邵逸夫獎

Presenter

Mr Stephen Chan

General Manager - Broadcasting, Television Broadcasts Limited

Mr Stephen Chan, General Manager — Broadcasting, Television Broadcasts Limited, has extensive experience in the administrative, broadcasting and corporate communication fields. After he graduated from The University of Hong Kong in Linguistics and Theatre Production, Mr Chan worked for the Administrative Service of the Hong Kong Government prior to joining the commercial broadcasting sector. He is the driving force behind the production of many highly acclaimed and socially relevant programmes including "Be My Guest", "On The Road" and "Poverty Campaign".

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