The Shaw Prize 2006
Award Presentation Ceremony

THE SHAW PRIZE
邵逸夫獎

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The Shaw Prize

The Shaw Prize is an international award which honours individuals for achieving distinguished breakthroughs in academic and scientific research or applications, 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, or whose works' profound impact becomes increasingly apparent.

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

Knowledge transcends national and geographical boundaries. Scholars and scientists are the vanguard who advances the frontier of knowledge, enhances our quality of life and enriches the civilization of mankind.

The Shaw Prize is dedicated to distinguished scholars and scientists in recognition of their outstanding accomplishments in academic and scientific researches. The remarkable achievements of the six talented Shaw Laureates of 2006 show how relentless pursuit of knowledge, coupled with unflagging determination to overcome difficulties and setbacks, could bring about important breakthroughs for the benefit of mankind. Their success will certainly inspire our younger generations in their quest for knowledge.

I congratulate the Shaw Laureates this year on their excellent achievements. May I also wish the Shaw Prize continued success in the future.

Donald Tsang
Chief Executive
Hong Kong Special Administrative Region

Message from the Founder

Yesterday's discoveries, in the competent hands of today's gifted innovators, empower and inspire human society to strive for social and cultural progress.

Men and women, whose startling revelations change our perception of the world around us, determine the future. The Shaw Prize responds to the ingenuity of these aspiring individuals, in the firm belief that the advancement of humanity is confined only by the limits of imagination.

Run Run Shaw

Message from Chairman of Board of Adjudicators

The Shaw Foundation is honored to award the three Shaw Prizes of 2006 to Drs. Mumford, Perlmutter, Riess, Schmidt, Wang and Wu for their trailblazing scientific works. While the Astronomy Prize and the Life Science and Medicine Prize this year recognize contributions to pure science, the Mathematical Sciences Prize this year recognizes contributions to applied mathematics, representing a deviation from the practice of previous years. The Shaw Foundation believes that in an increasingly complex modern world, applied mathematics is evolving into an increasingly important field of scientific research.

Chen Ning Yang

Chen-Ning Yang

The Shaw Prize Medal

The front of the medal displays a portrait of Sir 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 Frank H. Shu
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 12, 2006

AWARD PRESENTATION

(Category listed in alphabetical order)

Astronomy

Professor Saul Perlmutter,

Professor Adam Riess

&

Professor Brian Schmidt

Life Science and Medicine

Professor Xiaodong Wang

Mathematical Sciences

Professor David Mumford

&

Professor Wu Wentsun

Professor Frank H. Shu

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

Professor Frank H. Shu is presently Professor of Physics at the Center for Astrophysics and Space Sciences of University of California, San Diego and regarded as one of the world's leading authorities in theoretical astrophysics and star formation. He was the former President and Professor of Physics at the National Tsing Hua University in Taiwan.

Professor Shu is known for pioneering theoretical work in a diverse set of fields, including the origin of meteorites, the birth and early evolution of stars, the process of mass transfer in close binary stars, and the structure of spiral galaxies.

Educated at Massachusetts Institute of Technology and Harvard, Professor Shu held faculty appointments at the State University of New York at Stony Brook and University of California at Berkeley before becoming President of the National Tsing Hua University in 2002. From 1994 to 1996 he served as the President of the American Astronomical Society, and is a current member of the National Academy of Sciences, the American Academy of Arts and Sciences, the American Philosophical Society, and the Academia Sinica in Taiwan. He has received a number of honours and awards, i.e., Warner Prize (1977), Oort Professor of Leiden University (1996), Brouwer Award (1996), and Heineman Prize (2000).

THE SHAW PRIZE 邵逸夫獎

The Prize in Astronomy 2006

Saul Perlmutter,

Adam Riess,

and

Brian Schmidt

For discovering that the expansion rate of the universe is accelerating, implying in the simplest interpretation that the energy density of space is non-vanishing even in the absence of any matter and radiation.

An Essay on Saul Perlmutter, Adam Riess and Brian Schmidt

Einstein replaced Newton's conception of gravitation as a force with general relativity, which views gravitation as the dynamics of spacetime. In 1917 he applied his theory to the universe as a whole. He made two assumptions: the universe is homogeneous on average and static; and it is closed on itself, a curved volume of space with no boundary. However, Einstein's equations have no such solutions unless an extra term is inserted that acts as a repulsion to offset the gravitational attraction of matter for itself. Thus were born both modern cosmology and the notion of a cosmological constant, Lambda.

In 1929 Hubble found that the universe is expanding, a feature that Friedmann and Lemaître had shown were necessary consequences of Einstein's equations if Lambda were zero. There are then three models depending on whether the geometry of space is closed, Euclidean, or open. All three models are characterized by a deceleration in the expansion from a big bang.

Since Hubble's discovery, astronomers have largely focused on determining which of the three Lambda-free models applies on the large scale to the actual universe. **Brian Schmidt** recognized that white dwarf stars induced to explode as supernovae in galaxies of high expansional redshift z constitute a promising luminosity standard with which to measure the geometry of spacetime. In 1994 he formed the High-z Supernova Search team to develop this method. They performed the necessary local calibrations and the renormalizations of the different light-curve shapes needed to get accurate results.

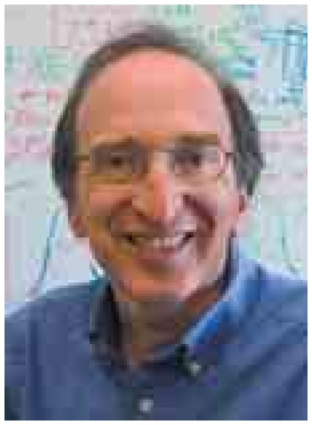
Contemporaneously, **Saul Perlmutter** assumed the leadership of a team that used robotic telescopes to find and characterize supernovae that explode in nearby galaxies. With a redirected effort, the Supernova Cosmology Project automated and brought to maturity the empirical techniques developed by astronomers. The discovery of many supernovae became routine and contributed to the early statistics that the universe may currently be accelerating in its expansion rate, a

surprising conclusion reached by the Perlmutter and Schmidt teams simultaneously in 1998.

Adam Riess realized that observations at redshifts z larger than readily measurable by telescopes on the ground could eliminate alternative explanations. He led the effort to use the Hubble Space Telescope to find supernovae at z larger than unity. These definitive observations show that supernovae look substantially fainter at large z than predicted by any of the Lambda-free models. Acceleration is required. The best fit for the data is achieved when the current energy-density of the vacuum is about 70% of the critical value that makes the large-scale geometry of space Euclidean, where the last result is suggested by the fluctuations in the microwave background. The corresponding small but nonzero value for the cosmological constant then turns out neatly to resolve the conflict of the universe's age in Euclidean-space models where Lambda is set to zero.

The discovery of a non-vanishing energy density of the vacuum, or some more bizarre alternative, has profound consequences for physics, astronomy, and philosophy. It is an accomplishment richly deserving of the Shaw Prize in Astronomy 2006.

Saul Perlmutter



My grandparents immigrated to the United States from Eastern Europe, part of a generation of poor but optimistic intellectuals, who expected that education and rationalism would build a better world. Unsurprisingly, their children became professors, my mother in social work, and my father in chemical engineering. On weekends our home was full of their friends, discussing politics and movies, books and arts. In this atmosphere I grew up wanting to know about all the universal "languages" – music, literature, math, science, architecture, psychology. When I headed off to college, I thought I would pursue my fascination with the biggest mysteries: How does the world work? How does the mind work?

I majored in physics at Harvard, and when I arrived at graduate school at Berkeley in 1981, my goal was to find a research project with real data – not just theory – that would address a deep philosophical question. I found an unusual, dynamic, eclectic research group led by Professor Richard Muller, with projects ranging from fundamental gravity measurements to atmospheric carbon-cycle measurements to a table-top cyclotron.

I focused on a robotic-telescope supernova project, since it offered the possibility of a fundamental measurement, the Hubble constant. I developed the software and some hardware that made it possible to identify automatically and reliably the supernovae in the images. By 1986, when I graduated, the automated supernova search was successfully running, and I was asked to stay on as a postdoc.

By this time, there was evidence (particularly from Gustav Tammann and Bruno Leibundgut) that the new sub-classification of Type "Ia" supernovae could be used as a distance indicator, perhaps better than the originally targeted Type II's. This news prompted group-member Carl Pennypacker and me to think about new projects. Since the 1930's there had been the hope that supernovae could someday be used to measure the deceleration of the universe's expansion. The Type Ia's uniformity re-opened this possibility, and we also now had built up experience with novel tools to study them: the first generation of ultra-sensitive CCD imagers and the corresponding image-analysis software.

In 1987 Carl and I proposed a new project: we would build a wide-field camera, the widest ever with a CCD on a 4-meter telescope, and develop the software to search through ~10,000 galaxies in one night (the previous nearby searches had studied just one galaxy in each image). In several years we could discover sufficient numbers of much more distant, high-redshift ($z\sim0.3$) supernovae to measure the deceleration parameter. The project started in 1988, a founding project of Berkeley's new Center for Particle Astrophysics, but began slowly with several years of bad weather at the telescope. Still, by early 1992, when I was asked to take over from Rich as leader of the supernova research group, we had found a Type Ia supernova at $z=0.45$ – doubling the world's high-redshift sample.

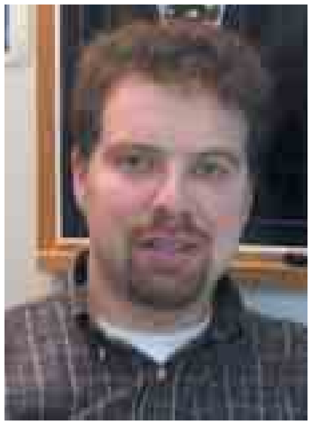
Two key problems stood in our way: relating brightnesses of high- and low-redshift supernovae (measured in different filters); and guaranteeing distant supernova discoveries in advance – and in time to measure their peak brightness. Without such a guarantee, one could not obtain time on the large telescopes needed to study them. By 1994, we had solved these problems and we were able to guarantee entire "batches" of multiple high-redshift supernovae, all still brightening, and all found on a pre-selected date, perfect for scheduling the measurements of brightness and spectrum. Such "guarantees" led us to propose a novel use of the Hubble Space Telescope: precision measurements of distant supernovae, particularly important for the ultra-far $z\sim1$ supernovae that Ariel Goobar and I had shown could be used to distinguish among cosmological theories.

Meanwhile, between 1990 and 1993, supernova researchers, including David Branch, Mark Phillips, Mario Hamuy, and Nick Suntzeff, had developed empirical techniques and beautiful nearby supernova datasets to further calibrate the Type Ia standard candle. So, by late 1994, with our batch discovery and multi-band follow-up of high-redshift supernovae, our now-international team of scientists was working together round-the-clock, collecting new batches of high-redshift supernova data using the best telescopes in the world. And so was a new team, organized by Shaw co-winner Brian Schmidt.

Finally, in 1997, we were analyzing our haul of 42 Type Ia supernovae at redshifts about $z\sim0.5$ and finding an odd result: the universe's expansion was actually speeding up – this didn't fit with known models of physics! We announced these results at the American Astronomical Society January 1998 meeting. Because both our team and Brian's team – including Shaw co-winner Adam Riess – independently announced matching results at conferences in the beginning of the year, by the end of the year most of the scientific community had accepted the startling findings.

When we started the project we thought that whatever answer we found would be exciting: if the universe were decelerating enough then it would be finite and coming to an end; if not then the universe is likely infinite in space and time. We could not have imagined the actual outcome, a surprise that presents a major puzzle for fundamental physics. Since 1998 we and others have begun the exciting, painstaking effort to collect new data to explore this puzzle. We have even begun developing a new space telescope. Perhaps when my three-year-old daughter, Noa, enters high school, humankind will have the next answers – or, better yet, new surprising questions about our world.

Adam Riess



I was born in December 1969 in Washington D.C., the youngest of three children with two older sisters. Growing up I was a lover of all sports (especially soccer) and curious about everything. Besides pestering my family with questions, I conducted my own "experiments" to learn about the world around me including sticking wires into electrical outlets, tasting everything in the spice rack and cutting earthworms in half - all to see what would happen.

After high school I attended the Massachusetts Institute of Technology where I majored in physics. The work was very hard but very satisfying. I especially enjoyed the experimental labs where we reproduced many of the famous experiments of the early 20th Century. I decided to make science and perhaps astrophysics a career. That summer I worked at the Lawrence Livermore National Laboratory as an intern on the search for Massive Compact Halo Objects, where I met a young and clever researcher, Saul Perlmutter, a Co-winner of the Shaw Prize!

In 1992 I went to Harvard University to earn a doctorate in astrophysics. After a first course I knew I wanted to help measure the expansion rate of the Universe. Professor Robert Kirshner suggested I proceed by measuring distances to type Ia supernovae in collaboration with Professor William Press. I was extremely fortunate to work with Bob who had great commonsense, and Bill who had incredible talents in data analysis. Bob's senior graduate student, Brian Schmidt (the other co-winner of the Shaw Prize!) patiently taught me the techniques of making precise measurements with telescopes. This work culminated in my thesis, the Multicolor Light Curve Shape Method, a technique which could distinguish between the effects of distance, dust and dimness in type Ia supernovae and the collection of one of the largest datasets of type Ia supernovae, 22 in all, for measuring the recent expansion rate of the Universe. (My thesis later received the 1999 PASP Trumpler Award for the doctoral thesis with the greatest impact in astrophysics.)

I went to UC Berkeley in 1996 as a Miller Fellow, having recently become a founding member of the competing High-z Supernova Team. At Berkeley I was again fortunate to work with the best, Professor Alex Filippenko, an enthusiastic and nurturing figure. By 1997 the High-z Team had managed to find and observe a significant sample of very distant supernovae. Working down the hill from Saul's talented and competing team, I collected the raw data and led the process of analyzing it, transforming large pixelated images into a record of the light history of a dozen distant supernovae. Armed with a similar product from local supernovae from my thesis (as well as the Calan-Tololo Survey) I measured the recent and past expansion rate of the Universe and transformed these measurements into an expectation of the forces at work in the Universe. The initial results indicated the dominating presence of negative mass accelerating the Universe! Since there is no such thing as negative mass I introduced the next best

thing, Einstein's famous cosmological constant to the fit in desperation and immediately found that its dominating presence (i.e., a non-zero vacuum energy with negative pressure causing repulsive gravity) could explain the apparent acceleration I was seeing. This was remarkable and experience told me that such "discoveries" are usually the result of simple errors. Being young and insecure about my capabilities, I spent a long time double checking my results but could find no errors. With growing confidence in the results, I told Brian who spot-checked the final calculations and came to the same conclusions.

Coincidentally, another, even more exciting event was occurring in my life as Nancy Joy Schondorf and I were married on January 10th in 1998, the best day of my life.

In the end the High-z Team published our paper entitled, "Observational Evidence From Supernovae for an Accelerating Universe and a Cosmological Constant". Saul's competing team reached the same conclusion and together the two teams' conclusion became the "Breakthrough of the Year" of Science Magazine in 1998.

Our lingering worries about the correctness of the results remained. What if we somehow were being fooled and the supernovae appeared dim for some non-cosmological reason (i.e., an astrophysical contaminant like some kind of exotic dust or evolution) making us only think the Universe was accelerating? A powerful test of competing paradigms was suggested: measure supernovae even farther and see if they begin to look relatively brighter. If so, we would be witnessing the expected but never seen effect of the matter-dominated Universe, decelerating the expansion when cosmic structures first formed, before acceleration began. If instead more distant supernovae looked relatively fainter we would have been fooled in 1998 by some unexpected and still unexplained astrophysical source of dimming. The only problem was that such SNe were too faint to be discovered with any telescopes except the Hubble Space Telescope. This was not inconvenient for me because in 1999 I had moved to its headquarters at Space Telescope Science Institute in Baltimore.

Trolling through the archives in 2001 I found evidence of the preceding deceleration---a very good sign. In 2002 when a new, more powerful camera was put on Hubble, I formed a new team, the Hubble Higher-z Team, to make a definitive measurement of this confirming or refuting effect. My teammates were very skilled and knowledgeable and we worked hard to use Hubble to find and measure the dozen most distant supernovae known. In 2004 we reached the conclusion that the supernova story told in 1998 was correct – the Universe had indeed only recently begun accelerating and that the dark energy-like force causing this phenomenon did look just like Einstein's cosmological constant was expected to. That year I was honored to receive the Warner Prize of the American Astronomical Society and the Sackler Prize from Tel Aviv University for my work on the accelerating Universe.

That same year my favorite "supernova" was born, my daughter, Gabrielle. Her own light curve has continued to rise and I observe it closely. In 2006 I moved to Johns Hopkins University. The big question has now changed for me to, "What is the nature of this Dark Energy?" The quest for the answers fills my research time as it stirs my mind and tweaks my curiosity.

Brian Schmidt

I was born in Missoula Montana in 1967 to my parents Dana and Donna Schmidt, who were both attending the University of Montana. My parents were young, and as I grew up, so did my parents. They were poor students without childcare resources, so I was included in every aspect of their lives, whether it be at home, work, parties, or vacation.

When my father had finished his PhD in Oregon in 1973 we returned to Montana, where I attended primary and middle school. In 1981 we moved up to Alaska, and here, at what I can only describe as a great High School, Bartlett, my own studies in science got underway. Unsure of what I wanted to do in life, I decided to do something I would be willing to do for free, Astronomy, and in 1985 left Alaska for the Tucson desert to attend the University of Arizona.

The social life at the University of Arizona was not really my scene, and instead I immersed myself in a heavy load of classes. Professor Tom Swihart took me under his wing and taught me the fundamentals of Astrophysics, while Professor John McGraw brought me into his group which was doing one of the first wide field astronomical surveys in Astronomy. With these two astronomers' support I was accepted into several good graduate schools, with my final decision made when Professor Robert (Bob) Kirshner of Harvard University visited Tucson. I liked his area of research, supernovae, and I cornered him and said if I could work with him, I would come to Harvard.

The moment I arrived at Harvard in 1989, I loved it. I loved the intellectual environment and the city of Boston. I decided to work on measuring distances with type II supernovae, something Bob was working on with a finishing student, Ron Eastman. Ron was a theorist, and we agreed we could make the most of his work by me concentrating on the observations, and combining them with his theoretical models. Within a year I had our first distances to supernovae, and I refined these over the course of my PhD. Along the way, in 1991, I traveled to Chile, and learned all about making accurate photometric measurements from Nick Suntzeff, Mark Phillips, and Mario Hamuy at Cerro Tololo. This visit also exposed me, for the first time, to the work that they were doing with type Ia supernova -and was the beginning of our affiliation which eventually led to the formation of the High-Z SN Search team in 1994.

In 1990, while at Harvard, I met my wife, Jennifer Gordon, who was working on a PhD in Economics. We enjoyed skiing, hiking, and general companionship, and got married in 1992. Jenny was on, among other things, a Fulbright Fellowship from Australia, and when she finished her PhD in July 2003, we had a hard decision of where to go next. We decided Jenny would take a temporary teaching job in Boston, and we would move to Australia within two years, with or without me having a job there. In early 1994, I was successful in getting a postdoctoral fellowship at Mt Stromlo, Australia, and during this time, we had our first child, Kieran, who was born in October 1994.

In my postdoctoral fellowship at the Harvard-Smithsonian Center for Astrophysics, I was trying to come to grips with what I wanted to do next in Astronomy. Saul Perlmutter's group had been working since 1988 to use Type Ia supernovae to measure cosmology, but I remained skeptical, and their progress had been slow. My attention switched in early 1994 to this research when Mario Hamuy visited from Cerro Tololo and showed that type Ia supernovae could be used to measure very accurate distances, and soon after Saul's group at Berkeley demonstrated that it was possible to find distant supernovae in large numbers. These two advances were the spark that led to Nick Suntzeff and I forming the High-Z SN search team in August 1994. We decided to compete against Saul's team, using our expertise in understanding and measuring supernovae as our competitive advantage. We got our first telescope time at Cerro Tololo as I arrived in Australia, in early 1995, and discovered SN 1995K - the most distant Type Ia supernova at that time. More supernovae followed and by the end of 1997 we had 15 objects and a big surprise. The Universe was not slowing down due to the presence of dark matter, as we had expected, but rather speeding up. Little did we know that Saul Perlmutter's group was also finding an accelerating Universe.

Since this discovery, I have worked to continue to improve our measurements of the cosmic acceleration - first through the High-Z team, and more recently, through the Essence Project (led by Christopher Stubbs). But I have also worked on exploding stars known as Gamma Ray Bursts, chased asteroids, and am now in the process of digitally mapping the entirety of the southern sky with a new telescope known as SkyMapper. While not undertaking Astronomy, I live with family on a 35 hectare farm just outside of Canberra, where you can often find me working in our vineyard or winery.

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.

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The Prize in Life Science and Medicine 2006

Xiaodong Wang

For his discovery of the biochemical basis of programmed cell death, a vital process that balances cell birth and defends against cancer.

An Essay on Xiaodong Wang

The human body is composed of 10 trillion cells. Each day billions of cells die and are replaced by fresh cells. The birth and death of cells must be perfectly balanced. If cell birth exceeds death, organs enlarge and cancer results. If death exceeds birth, organs degenerate, as in Alzheimer's disease. The factors controlling cell birth have been studied for many decades and much has been learned. In contrast, cell death was considered a random event until the studies of Horvitz in roundworms revealed a gene-determined control mechanism called programmed cell death. Although the phenomenon was recognized, the biochemical mechanism was obscure until Xiaodong Wang showed that the executioner is an internal organelle, the mitochondrion, which was previously thought to function only as an energy generator.

Every nucleated animal cell contains many mitochondria, which are tiny membrane-bound structures filled with enzymes that oxidize foodstuffs and generate high-energy chemicals. When a cell is programmed to die, the mitochondria release proteins that trigger cell death. One such protein, cytochrome C, was long known as an essential component of the energy-generating system. Using clever biochemical measurements, Wang showed that mitochondria-derived cytochrome C binds to a cytosolic protein, Apaf-1, thereby activating a protease called caspase-3. Activated caspase 3 triggers a cascade of reactions that lead to fragmentation of nuclear DNA, dissolution of the cell membrane, and engulfment of the dying cell by neighboring scavenger cells. Cells resist the suicidal action of cytochrome C by producing proteins called IAPs that block the caspase. Wang showed that mitochondria overcome this resistance by releasing another protein, Smac, which neutralizes the IAPs, permitting cell death

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to proceed to completion. Wang also discovered a mitochondria-derived nuclease that assists in the fragment of nuclear DNA.

Wang's discoveries have profound implications for therapeutics. Companies are hard at work developing drugs that block the lethal actions of the mitochondrial proteins. Such drugs might prevent cell death in conditions like myocardial infarction and ischemic strokes where cells are programmed to die in response to hypoxia. At the other extreme, cancer cells survive by producing proteins that block the mitochondrially derived proteins, thereby preventing programmed cell death. Pharmaceutical companies are developing drugs that mimic the mitochondrial death-inducers, thereby overcoming the resistance of the cancer cells and eliminating the cancer.

Because of Wang's work and that of others in the field (most notably the late Stanley Korsmeyer) programmed cell death is now understood mechanistically as well as programmed cell birth, thereby restoring the balance necessary for a complete understanding of animal life.

Xiaodong Wang

Born in Wuhan, China, I was raised by my grandparents from the age of two when my mother became seriously ill. I spent my childhood in Xingxiang, Henan Province with my grandfather, Jingshang Wang, who was an English teacher in high school, and my grandmother, Wanru Xi, who took early retirement from her primary school teaching job to take care of me full time.

When I entered elementary school in 1969, it was the third year into The Cultural Revolution. There was not much academic learning. Not until 1977, when regular school education resumed and the door to higher education reopened, did I start studying. In 1978, I was able to enter one of the top high schools in the Province, the High School Affiliated to Henan Normal University.

I started my college education at Beijing Normal University in the fall of 1980. Dr. Shaobai Xue, a professor in cell biology, supervised my undergraduate thesis research and introduced me to modern cell biology and biochemistry. His belief in using biochemistry methods to solve biological problems influenced me to continue my graduate study in this field.

I came to the US through a State-sponsored program organized by Professor Ray Wu from Connell University - the Chinese-United States Biochemistry Examination and Application (CUSBEA) - which provided a major bridge to enter US graduate schools. In the hot summer of 1985, I arrived at the University of Texas Southwestern Medical Center in Dallas to begin my postgraduate training. I joined Dr. Richard Padgett's laboratory to study mRNA splicing. This period greatly advanced my understanding in biochemistry and molecular biology. In particular, the in-depth training in protein and nuclear acid chemistry set me up well for my future research. It is also during this period that I married Xiaying Zhu and started a family.

I joined Drs. Brown and Goldstein as a postdoctoral fellow in 1991 to study the molecular mechanism for feedback regulation of cholesterol homeostasis in cells. After two years, my studies there led to the discovery that cells regulate their cellular cholesterol content by cholesterol-regulated cleavage of SREBP, a transcriptional factor that makes mRNA from genes encoding proteins for cholesterol import and synthesis.

In the next two years at Brown and Goldstein's laboratory, I focused on searching for the protease that cleaved SREBP. I did not find the cholesterol regulated

protease but unintentionally identified caspase-3, a member of a protease family responsible for executing apoptosis, a programmed form of cell death.

After moving to the Department of Biochemistry at Emory University in Atlanta, Georgia in May 1995, I started to study caspase-3 activation during apoptosis in my own laboratory. Caspase-3 usually stays dormant in living cells and only becomes activated during apoptosis.

Using classical biochemical fractionation and reconstitution methods, we identified three components that were necessary and sufficient in activating caspase-3. The first required component turned out to be cytochrome c, a well-known component of mitochondria electronic transfer chain. We discovered that cytochrome c release from mitochondria was a critical regulatory step during apoptosis, a step controlled by the Bcl-2 family of proteins. Another component is Apaf-1 for Apoptotic Protease Activating Factor-1; and the third componet was procaspase-9. When released from mitochondria to cytosol, cytochrome c binds to Apaf-1 leading to the formation of a protein complex that is capable of recruiting and activating procaspase-9. Caspase-9 in turn cleaved procaspase-3 to activate it.

In August 1996 I moved back to UT-Southwestern to join Dr. Steve McKnight, the new Chair in the Biochemistry Department. A year later, I was also appointed as an assistant investigator to the Howard Hughes Medical Institute.

In 2000, we identified another mitochondrial protein Smac, which functions in apoptosis by removing the inhibition of caspases imposed by IAP (Inhibitor of apoptosis proteins). Smac antagonizes IAPs function by binding to them with its N-terminal 4 amino acid residues. Currently, there are several biotech and pharmaceutical companies trying to develop small molecule mimetics of these four amino acids. It can potentially be used for the treatment of cancer, in which IAP proteins are highly expressed to give cancer cell survival advantage.

We would like to continue our biochemical studies of apoptosis in future focusing on how to specifically induce apoptosis in cancer cells with chemical compounds such as Smac mimetic while leaving most of the normal cells intact.

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 in1966 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.

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The Prize in Mathematical Sciences 2006

David Mumford

For his contributions to mathematics, and to the new interdisciplinary fields of pattern theory and vision research;

and

Wu Wentsun

For his contributions to the new interdisciplinary field of mathematics mechanization.

An Essay on David Mumford and Wu Wentsun

David Mumford and Wu Wentsun both started their careers in pure mathematics (algebraic geometry and topology respectively) but each then made a substantial move towards applied mathematics in the direction of computer science.

Mumford worked on computer aspects of vision and Wu on computer proofs in the field of Geometry. In both cases their pioneering contributions to research and in the development of the field were outstanding. Many leading scientists in these areas were trained by them or followed in their footsteps.

Mumford's early work, for which he received the Fields Medal in 1974, was in algebraic geometry and especially the study of algebraic curves. This is an old and central subject in mathematics with contributions from many of the great names of the past. Despite this, much remained to be done and Mumford's great achievement was to revitalise and push forward the theory of moduli. Algebraic Curves depend on an important integer, the genus g. For $g = 0$ the curve is rational, for $g = 1$ it is elliptic and depends on an additional continuous parameter or modulus. For $g \geq 2$ there are $3g-3$ moduli, forming a (complicated) space whose features give us information about the totality of all curves. Mumford laid the foundations for a systematic and fruitful study of this moduli space. This has been widely influential even, surprisingly, in the physics of string theory.

After two decades in this field, Mumford made a drastic switch to computer vision, where he used his mathematical abilities and insight to make original and fundamental contributions. He helped to provide a conceptual framework and to provide examples of specific solutions that can in principle be generalized to a range of problems. His 1985 paper with Shah on variational approaches to signal processing was recently awarded a prize by the Institute of Electrical and Electronics Engineers (IEEE).

Mumford's many original contributions to pattern theory and vision research were described in his 1999 book *Two and Three Dimensional Patterns of the Face* (A. K. Peters Co.) and the forthcoming *Pattern Theory through Examples*.

Wu Wentsun was one of the geometers strongly influenced by Chern Shiing-Shen (Shaw Laureate in 2004). His early work, in the post-war period, centred on the topology of manifolds which underpins differential geometry and the area where the famous Chern classes provide important information. Wu discovered a parallel set of invariants, now called the Wu classes, which have proved almost equally important. Wu went on to use his classes for a beautiful result on the problem of embedding manifolds in Euclidean Space.

In the 1970's Wu turned his attention to questions of computation, in particular the search for effective methods of automatic machine proofs in geometry. In 1977

Wu introduced a powerful mechanical method, based on Ritt's concept of characteristic sets. This transforms a problem in elementary geometry into an algebraic statement about polynomials which lends itself to effective computation.

This method of Wu completely revolutionized the field, effectively provoking a paradigm shift. Before Wu the dominant approach had been the use of AI search methods, which proved a computational dead end. By introducing sophisticated mathematical ideas Wu opened a whole new approach which has proved extremely effective on a wide range of problems, not just in elementary geometry.

Wu also returned to his early love, topology, and showed how the rational homotopy theory of Dennis Sullivan could be treated algorithmically, thus uniting the two areas of his mathematical life.

In his 1994 Basic Principles in *Mechanical Theorem Proving in Geometry* (Springer), and his 2000 *Mathematics Mechanization* (Science Press), Wu described his revolutionary ideas and subsequent developments. Under his leadership Mathematics Mechanization has expanded in recent years into a rapidly growing discipline, encompassing research in computational algebraic geometry, symbolic computation, computer theorem proving and coding theory.

Although the mathematical careers of Mumford and Wu have been parallel rather than contiguous they have much in common. Beginning with the traditional mathematical field of geometry, contributing to its modern development and then moving into the new areas and opportunities which the advent of the computer has opened up, they demonstrate the breadth of mathematics. Together they represent a new role model for mathematicians of the future and are deserved winners of the Shaw Prize.

David Mumford

I was born on June 11, 1937 in Three Bridges, Sussex, England to a British father and an American mother. I believe I inherited my good math genes from my Father's Mother, Edith Read, who was among the very first women ever to receive a "first" in maths from Cambridge University. Growing up in the US, I went to Phillips Exeter Academy, where I won a prize in the Westinghouse Science Talent Search with a primitive relay based computer that short circuited, burned its paper tape and never stirred again. So when I went to Harvard as a freshman in 1953, I found myself led to pure mathematics. There the lectures of George Mackey and Oscar Zariski were especially inspiring. I stayed at Harvard through 1995, eventually becoming Higgins Professor of Mathematics.

Following Zariski's lead, I spent the first half of my career working in the field of algebraic geometry - a part of pure mathematics which studies the geometric objects defined as the loci of zeros of one or more polynomials (but with a twist: the zeroes can be in any field of numbers). Artin, Hironaka and I were all students when Grothendieck came to Harvard with his own extraordinary new insights. His synthesis of the older tools of the more intuitive geometric Italian school with the newer French ones of cohomology as well as their use of nilpotent functions to algebrize infinitesimal calculus were very exciting and led to rapid progress in the field. My specific contributions came from the application of the ideas of classical invariant theory (especially the ideas of Hilbert) and of theta functions to the problem of constructing the so-called moduli space for the set of algebraic curves of fixed genus. This moduli space is a kind of map, a way of packaging all possible algebraic curves into a single universal object. I received the Fields Medal for this work in 1974. A long term interest of mine was the global structure of this moduli space: one of the most exciting aspects of math is when such a universal object - one likes to call it a 'God-given' object - turns out not to be simple but to have its own inner nature. For example, I later proved with Joe Harris that these moduli spaces for large odd genus are 'of general type' (extended to large even genus by Eisenbud and Harris). This is a weak way of saying they mirror the curves they classify, that the nature of the atlas mimics the land it represents.

In the early 80's, influenced by the work of Benoit Mandelbrot and David Marr, I returned to my early interests in computation and the brain, the central issue for

me being what is the right mathematical model for understanding the processes of thought. An early digression was to put the now more reliable computers to the test of drawing a kind of fractal spin-off of the moduli spaces, called Kleinian limit point sets, a project which led to the recently published semi-popular book "Indra's Pearls", with Caroline Series and Dave Wright. But my primary interest since then has been the study of vision, both the process of vision in natural intelligences and the algorithms for reducing these abilities to code. Marr's book "Vision" put forward the idea that on a certain theoretical level, understanding vision for an engineering application and vision in a biological system really ought to be identical problems. With Jayant Shah, we introduced the mathematical tool of variational calculus and free-boundary value problems to the theory of vision.

A second revelation was discovering the power and ubiquity of statistical reasoning in perception and, more generally, all thought. This was an idea pioneered by Ulf Grenander and his collaborators at Brown, where I moved in 1995 because of its flourishing inter-disciplinary culture. In the last 10 years, I have been pursuing statistical models and analyses of many aspects of natural images and algorithms for inferring from them the structure of the world. For example, the intuitive idea that the world is cluttered, that every scene has objects of all sizes, objects which break up into parts and subparts, has a precise mathematical translation in terms of the probability distribution for natural images: that it should be self-similar and of high kurtosis.

Most recently I have been studying object recognition in images through the analysis of the object's shape. One can apply the same mathematical approach which led to moduli spaces for algebraic curves: form an abstract 'map' of all possible shapes. This map is now an infinite-dimensional space with local coordinate charts (the pages of the atlas): this is called a manifold by mathematicians. With Peter Michor and many others, we are exploring the geometry of this fascinating object.

I have been blessed with 16 PhD students in vision and 29 in algebraic geometry. Above all, I have been strongly supported throughout my career by the tireless love and understanding of two wonderful women: my first wife, the poet Erika Jentsch Mumford (deceased 1988), with whom I have had 4 children, and of my present wife, the artist Jenifer Gordon Mumford. Having brought two families together, we now enjoy yet another blessing: 7 children and 12 grandchildren. Research, to me, is teamwork: work with students and colleagues and the encouragement that only a family can give you.

Wu Wentsun

I was born in Shanghai, China on May 12, 1919. I received my BS degree in mathematics from Jiaotung University, Shanghai in 1940 during the war against Japan (1937 - 1945). On graduating from university, because of the war I had to teach for years in junior middle schools bringing to a halt my further learning of mathematics. In 1946 I met the great geometer Chern Shiing-Shen. Chern is particularly reknowned for the introduction of CHERN Classes and CHERN numbers of unitary bundles which are of extreme importance among the various kinds of characteristic classes of fiber bundles. At that time Chern was in charge of the newly established Institute of Mathematics belonging to Academia Sinica. This meeting with Chern was decisive for the future of my career in mathematics.

Chern admitted me as one of the young students in his institute, all learning algebraic topology under his guidance. One year later I brought out my first paper about a simple proof of the product formula of sphere bundles discovered by H. Whitney for which his original proof was extremely complicated and had never been published.

In 1946 I also passed the national examination for sending students abroad and in 1947 I was sent to study mathematics in France as part of a Sino-France Exchange Program. I went to Strasbourg to study under Professor Ch. Ehresmann. In 1949 I passed my doctor thesis and then went to Paris to study under Prof. H. Cartan. During my stay in Strasbourg I made the acquaintance of R. Thom who was also a student of Cartan but who while at Strasbourg, had much contact with Ehresmann too. The collaboration was a very fruitful one. In 1950 Thom discovered the topological invariance of Stiefel-Whitney classes, while I, with the aid of Cartan, discovered the classes and formulas now bearing my name.

In 1951 I returned to China, and in 1953 became a researcher in the Chinese Academy of Sciences (CAS) where I remain to the present day. From 1953 onwards I made a somewhat systematic investigation of classical topological but non-homotopic problems which were being ignored at that time owing to the rapid development of homotopy theory. I introduced the notion of imbedding classes, and established a theory of imbedding, immersion, and isotopy of polyhedra in

Euclidean spaces which was published in book form later in 1965. In 1965, I was awarded one of the three national first prizes for natural sciences for my work on characteristic classes and imbedding classes.

During the cultural revolution I was sent to a factory manufacturing computers. I was initially struck by the power of the computer. I was also devoted to the study of Chinese ancient mathematics and began to understand what Chinese ancient mathematics really was. I was greatly struck by the depth and powerfulness of its thought and its methods. It was under such influence that I investigated the possibility of proving geometry theorems in a mechanical way. In 1977 I ultimately succeeded in developing a method of proving mechanical geometry theorem. This method has been applied to prove or even discover hundreds of non-trivial difficult theorems in elementary geometries on a computer in a simplistic way and was henceforth called WU's method in the literature. The discovery of WU's method marks the second turning point in my scientific life, the first one being my meeting with Chern. Since that time I have completely changed my direction of research and concentrated my efforts on extending the method in various directions, both theoretical and practical, aiming at what I have called “mechanization of mathematics”.

Among the honors I have received for my research we may cite:

In 1991 I received the mathematics award from and became a member of the Academy of Sciences for the Developing World (previously called The Third World Academy of Sciences). In 1997 I received the Herbrand Award on automated deduction for my mechanical geometry theorem-proving. In 2001 I was awarded the first State Supreme Science and Technology Award of the Chinese government in recognition of my achievements in mathematics research, both in pure mathematics and in mathematics mechanization.

Finally, Mumford and I together were named as winners of the 2006 Shaw Prize in Mathematical Sciences for our research in pure mathematics, especially with regard to computer applications to mathematics which represents a new role model for mathematicians of the future.

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(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

Mr. Koon-Fai Chor

Shaw Prize 2004

From right to left:

Late Sir Richard Doll,
Laureate in Life Science and Medicine;

Professor James Peebles,
Laureate in Astronomy;

Professor Stanley Cohen,
Laureate in Life Science and Medicine;

Sir Run Run Shaw;
Founder of the Shaw Prize;

Mr. Tung Chee-Hwa,
Chief Executive of HKSAR;

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

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

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

Shaw Prize 2005

From right to left:

Professor Michel Mayor,
Laureate in Astronomy;

Professor Geoffrey Marcy,
Laureate in Astronomy;

Sir Run Run Shaw;
Founder of the Shaw Prize;

Mr. Rafael Hui,
Acting Chief Executive of HKSAR;

Sir Michael Berridge,
Laureates in Life Science and Medicine and

Professor Andrew Wiles,
Laureate in Mathematical Sciences.

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Emeritus President
The Open University of Hong Kong

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Mrs
Mona Shaw
Chairperson

Mona Shaw, wife of Sir Run Run Shaw, has for many years been Chairperson of The Sir Run Run Shaw Charitable Trust and The Shaw Foundation Hong Kong and was appointed Chairperson of The Shaw Prize Foundation upon its inception in 2002. 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 Acting Managing Director and Chairperson 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 Ji-Bei Hoang and Kai-Qun Lu Professor at Tsinghua University, Beijing, since 2005.

Professor Yang received many awards: Nobel Prize in Physics (1957), Rumford Prize (1980), U.S. 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 U.S. Academy of Sciences, Royal Society of London, and the Russian Academy of Sciences.

Since receiving his Ph.D. 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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(October 1, 2005 - September 30, 2007)

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School of Mathematical Sciences, Peking University, China

Chairman, Board of Adjudicators

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 Ji-Bei Hoang and Kai-Qun Lu Professor at Tsinghua University, Beijing, since 2005.

Professor Yang received many awards: Nobel Prize in Physics (1957), Rumford Prize (1980), U.S. National Medal of Science (1986), Benjamin Franklin Medal (1993), Bower Award (1994) and others. He is a member of the Chinese Academy of Sciences, the Academia Sinica in Taiwan, the U.S. Academy of Sciences, Royal Society of London, and the Russian Academy of Sciences.

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

Selection Committee (2005-2007)

Professor Jiansheng Chen

Member of Astronomy Committee

Professor Jian-sheng Chen is a reputed astrophysicist and Fellow of the Chinese Academy of Sciences. He is currently Head of Department of Astronomy at Peking University (Beijing 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 Post-doctorates 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.

Professor Joseph Hooton Taylor

Member of Astronomy Committee

Professor Joseph Taylor, an American, is the James McDonnell Distinguished University Professor of Physics at Princeton University and works in the field of radio astronomy. He co-discovered the first binary pulsar and was awarded the Nobel Prize for Physics in 1993.

He has been Professor of Physics at Princeton since 1980, and served as Dean of the Faculty there from 1997 to 2003. He taught at the University of Massachusetts, Amherst, from 1969 to 1980.

He is a member of the National Academy of Sciences and the American Philosophical Society and a fellow of the American Academy of Arts and Sciences and the American Physical Society. He was co-chair of the National Research Council's Decade Survey of Astronomy and Astrophysics from 1999 to 2002. He earned his BA degree with honors in physics from Haverford College and his Ph.D. degree in Astronomy from Harvard University.

Professor Taylor has received numerous awards including the Dannie Heineman Prize of the American Astronomical Society and American Institute of Physics, a MacArthur Fellowship, and the Wolf Prize in Physics.

Dr. Robert Woodrow Wilson

Member of Astronomy Committee

Dr. Robert W. Wilson is a Senior Scientist at the Smithsonian Astrophysical Observatory of the Harvard Smithsonian Center for Astrophysics in Cambridge Massachusetts. He is technical leader of the Sub-Millimeter Array, a recently completed 8 element synthesis radio telescope.

Dr. Wilson received a B.A. from Rice University in 1957 and a Ph.D. from the Caltech in 1962. After a one year postdoc at the Caltech, he joined Bell Laboratories. From 1977 until 1994 Dr. Wilson was Head of the Radio Physics Research Dept. in Holmdel, NJ.

His early work was in the fields of Galactic radio astronomy and precision measurement of radio source strengths. He was a co-discoverer in 1964 of the 3K cosmic background radiation which originated in the Big Bang and for which he shared the 1978 Nobel Prize in Physics. In 1970 he and his co-workers discovered a number of interstellar molecules including Carbon Monoxide in the 2-3 mm band. This opened up the study of molecular clouds and star forming regions.

He is a member of the American Astronomical Society, the American Academy of Arts and Sciences, the International Astronomical Union, the International Union of Radio Science, the American Physical Society, the National Academy of Sciences.

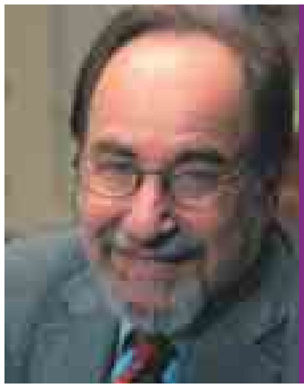
Professor Youyuan Zhou

Member of Astronomy Committee

Professor You-yuan Zhou is a Chinese Astrophysicist and is presently a professor at the University of Science and Technology of China (USTC), as well as vice-president of the Academic Committee of USTC.

Professor Zhou is known for his important research work on galaxies and the universe, especially on active galactic nuclei, including the determination of cosmological parameters, the large scale structure of the universe, the structure and emission mechanism of active galactic nuclei and the redshift distribution of quasars.

Educated at Peking University, he worked at the University of Science and Technology of China as the director of the Center for Astrophysics of USTC and has been a member of the Chinese Academy of Sciences. He has received numerous honours and awards, i.e., special member of the China Center of Advanced Science and Technology (1988-1989), member of the Astronomic Academic Committee of the Chinese Academy of Sciences (1993-), member of the Astronomy Group of the Academic Degree Committee of the State Council of China (1992-1997), Standing Board member of the Chinese Astronomic Society (1998-2002), Outstanding Research Award of the Chinese Science Conference (1978), Natural Science Award of the Chinese Academy of Sciences (1980 and 1990) and the National Education Prize (1993).



Professor David Baltimore

Member of Life Science and Medicine Committee

In 1997 Professor David Baltimore, one of the USA's most distinguished biologists and winner of the 1975 Nobel Prize for his work in virology, became president of the California Institute of Technology. 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.

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

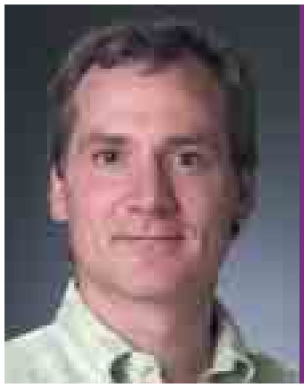
Professor Michael S. Brown received an M.D. degree in 1966 from the University of Pennsylvania, USA. He was a resident at the Massachusetts General Hospital and a post doctoral fellow with Earl Stadtman at the National Institutes of Health. He is currently Director of the Jonsson Center for Molecular 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 U.S. National Medal of Science and the Nobel Prize for Medicine or Physiology.

Professor Kim Nasmyth

Member of Life Science and Medicine Committee

Professor Kim Nasmyth is currently the Whitley Chair at the Department of Biochemistry, University of Oxford. He joined the Research Institute of Molecular Pathology (I.M.P) in Vienna in 1988 and was the Managing Director when he left in 2005. 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 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).

THE SHAW PRIZE 邵逸夫獎



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 Senior 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 Phillip A. Griffiths

Member of Mathematical Sciences Committee

Professor Phillip A. Griffiths, a renowned mathematician specialized in algebraic geometry, is presently professor of Mathematics at the Institute for Advanced Study, where he served as Director from 1991 to 2003.

Prior to joining the Institute, he was Provost and James B. Duke Professor of Mathematics at Duke University for eight years. From 1972 to 1983 he was a Professor of Mathematics at Harvard University. He has also taught at Princeton University and the University of California, Berkeley. He was a Member of the Institute's School of Mathematics from 1968-1970. He is the Chairman of the Science Initiative Group and the Secretary of the International Mathematical Union in the United States.

Professor Griffiths is a member of the National Academy of Sciences, the American Philosophical Society, and the Council on Foreign Relations. He is a Foreign Associate of the Third World Academy of Sciences and of the Accademia Nazionale dei Lincei and an Honorary Fellow of the Indian Academy of Sciences. He was a member of the National Science Board from 1991 to 1996 in the USA.

Professor Heisuke Hironaka

Member of Mathematical Sciences Committee

Professor Heisuke Hironaka is the President of the Japan Association for Mathematical Sciences, Tokyo, and is a director of the Inamori Foundation, Kyoto.

Professor Hironaka is known for his proof of resolution of singularity for algebraic and analytic varieties in all dimensions.

Educated at Kyoto University and then at Harvard, Professor Hironaka held faculty appointments at Brandeis, Columbia, Harvard and then Kyoto University. From 1996 to 2002 he served as the Resident of Yamaguchi University, and is currently the Academic Director of the University of Creation in Takasaki, Japan. He is a member of the Japan Academy, the American Academy of Arts and Sciences and a foreign member of academies in France, Russia, Korea and Spain. He is a professor emeritus of Harvard University, Kyoto University and Honorary Professor of Shang Dong University in China. He received the Fields Medal in 1970 and the Order of Culture, Tokyo, in 1975.

Professor Sergey Novikov

Member of Mathematical Sciences Committee

Professor Sergey Novikov is a well known Russian mathematician specialized in geometry, topology and mathematical physics. He is presently a professor at the University of Maryland, USA in the Department of Mathematics and the Institute for Physical Science and Technology.

Professor Novikov received his mathematical education in Moscow University (1955-1960), and awarded the degree of Ph.D. and Doctor of Science at the Steklov Institute of Mathematics in 1964 and 1965 respectively. He has worked at Moscow University since 1964 and he has been head of the Department of Higher Geometry and Topology since 1983.

He was elected a full Member of the Academy of Sciences of the USSR (1981); Honorary Member of the London Math. Society (1987); Honorary Member of the Serbian Academy of Art and Sciences (1988); Foreign Member of the "Academia de Lincei", Italy (1991); Member of Academia Europea (1992); Foreign Member of the National Academy of Sciences of US (1994); and Member of Pontifical Academy of Sciences in Vatican (1996). Professor Novikov served as President of the Moscow Mathematical Society from 1985-1996, and he was also a Vice-President of the International Association in Mathematical Physics from 1986-1990.

Professor Novikov has received Lenin Prize (1967); Fields Medal of the International Mathematical Union (1970); and Lobachevskii International Prize of the Academy of Sciences of the USSR (1981).

Professor Gong-Qing Zhang

Member of Mathematical Sciences Committee

Professor Gong-Qing Zhang has been Professor of the School of Mathematical Sciences of Peking University in China since 1983. Born in Shanghai, China in 1936, he was educated at the Department of Mathematics at Peking University from 1954 to 1959.

He has been selected as a member of the Chinese Academy of Sciences and a Fellow of the Third World Academy of Sciences.

He was President of the Chinese Mathematical Society from 1996-1999 and Director of the Institute of Mathematics of Peking University during the period 1988-1999.

His major research areas are Geometric analysis, Nonlinear Analysis, Infinite dimensional Morse theory and its applications to differential equations.

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