THE SHAW PRIZE 邵逸夫獎

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

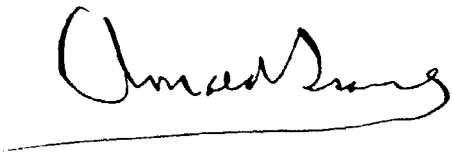
The Shaw Prize was established under the auspices of Mr Run Run Shaw. Mr Shaw, born in China in 1907, is a native of Ningbo County, Zhejiang Province. He joined his brother's film company in China in the 1920s. In the 1950s he founded the film company Shaw Brothers (Hong Kong) Limited in Hong Kong. He 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 wish to congratulate the five eminent scientists on winning this year's Shaw Prize. The Shaw Prize is an internationally renowned recognition of the unwavering efforts of scholars and scientists who have achieved significant breakthroughs for the benefit of mankind.

This year's recipients have demonstrated great enthusiasm and steadfast determination in the search for answers to some of the mysteries of the universe. They are outstanding examples of what can be achieved and inspire those who follow in their footsteps.

The winners join an illustrious group of 26 pioneering Shaw Laureates who have led us to marvellous discoveries. I congratulate them on their outstanding achievements, and I am sure their work will continue to inspire a new generation of great scholars and scientists.



Donald Tsang
Chief Executive
Hong Kong Special Administrative Region

Message from the Founder

Throughout the ages, resourceful individuals have persevered in contesting the unknown with unfailing energy and unwavering belief, with resultant success that benefits society. Their personal journeys towards enlightenment mark the path of progress and signal the challenges of the future. The Shaw Prize chooses to highlight the endeavours of these dedicated individuals and focus recognition on achievements that undoubtedly make a difference and enhance the lives of us all.

Run Run Shaw

Message from Chairman of Board of Adjudicators

This year's three Shaw Prizes will be awarded tonight to 5 scientists.

Professors Douglas L Coleman and Jeffrey M Friedman discovered a gene called leptin which regulates food intake for animals and for humans. Their discovery clarifies the important subject of the origin of obesity.

The geometry of 3-dimensional and 4-dimensional space has been the centre of attention in the field of mathematics during the past half century. Professors Simon K Donaldson and Clifford H Taubes used new techniques to reach deeper understanding of the complexity of 3-dimensional space, 4-dimensional space and 4-dimensional space-time. Especially important, and mystifying, is the connection between their work and physicists' understanding of the fundamental structure of all forces of nature.

Professor Frank H Shu is a renowned theoretical astronomer. His work on how stars have formed in the billions of past years has revolutionized our understanding of the history of the universe. We are especially happy that Professor Shu was the first Chairman of the Astronomy Committee of the Shaw Prize Foundation.

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
October 7, 2009

AWARD PRESENTATION

(Category listed in alphabetical order)

Astronomy

Professor Frank H Shu

Life Science and Medicine

Professor Douglas L Coleman

and

Professor Jeffrey M Friedman

Mathematical Sciences

Professor Simon K Donaldson

and

Professor Clifford H Taubes

THE SHAW PRIZE 邵逸夫獎

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 a Professorial Research Scientist and Director of Department of Astronomy at Peking University and Director of Beijing Astrophyscical Center.

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

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

THE SHAW PRIZE 邵逸夫獎

The Prize in Astronomy 2009

Frank H Shu

in recognition of his outstanding life-time contributions in theoretical astronomy.

An Essay on Frank H Shu

In a career that spans forty-five years, Professor Frank H Shu has spurred fundamental changes in the existing paradigms of three different fields of astrophysics: galactic dynamics, stellar evolution, and the astrophysics of small bodies in the solar system.

Shu's research career began auspiciously in 1964 with the publication, together with his adviser C C Lin, on the density-wave theory of spiral structure in disk galaxies. Although highly controversial at its inception, this theory has since gathered widespread observational support and computational elaboration. The philosophy that useful theories must be testable has informed all of his subsequent research. Shu has been at the forefront of theoretical developments, particularly with his group's semi-analytical investigations of the nonlinear, non-ideal theory as applied to galactic shocks in the 1970s and resonantly forced analogues in Saturn's rings in the 1980s.

Shu has also applied his talents to the problem of interacting binary stars. His study using matched asymptotic analysis in 1975 with his student Lubow on the gas dynamics of semi-detached binaries is considered the definitive theoretical work on this subject. Their work is widely cited by observers and constitutes a benchmark for numerical accuracy in computer simulations.

In 1977, Shu published his ideas on the inside-out gravitational collapse of the singular isothermal sphere as a model for star formation from molecular cloud cores. This paper allowed the definitive study in 1980, with his student Stahler and collaborator Taam, on the physical properties of accreting protostars, which settled a controversy then raging amongst the supporters of Richard Larson and Chushiro Hayashi on this subject.

In 1984, together with his student Terebey and his co-worker Cassen, he published a seminal paper showing how circumstellar disks form around protostars as a natural consequence of the collapse of rotating molecular cloud cores. With his student Adams and colleague Lada, he showed in 1987 how radiative reprocessing of starlight through the dusty envelope and in the surrounding disk provides a spectral classification of young stellar objects, a scheme that, with one modification, provides the basis for modern empirical identifications of the so-called class 0, I, II, and III objects in low-mass star formation.

In 1987, Shu and his student Lizano published an influential paper on bimodal star formation. They proposed that ambipolar diffusion in magnetized molecular cloud cores underlies the formation of isolated low-mass stars, whereas gravitational collapse through dynamical flows leads to supercritical states that yield cluster formation. Shu, Adams, and Lizano summarized the theoretical and observational state of affairs in a review article in 1987, one of the most referenced articles in the Annual Reviews of Astronomy and Astrophysics.

In 1988, Shu and his colleagues discovered observationally that bipolar outflows are driven by neutral stellar winds. This discovery led his group to propose what came to be called the "X-wind" theory of stellar jets and bipolar outflows. Their model is widely regarded as the most likely magnetohydrodynamic explanation for this fascinating and important phenomenon. For the past decade, Shu and his co-workers have proposed several observational tests of the model, each of which has been successfully passed.

In 1996, with his student Shang and his collaborator Lee, Shu applied the X-wind model to explain a long-standing puzzle concerning primitive meteorites: namely, chondrules and calcium-aluminium-rich inclusions (CAIs) thermally processed at temperatures above 2000 K are intimately mixed with a hydrated carbonaceous matrix that has never been above 600 K. The same theory also allows a particle-irradiation origin near the protosun for the generation of short-lived radioactivities that are inferred for the CAIs and chondrules of such meteorites. These suggestions also generated controversy when first proposed, but the prediction that CAIs and chondrules would be found in comets, which were previously thought to be formed from pristine material far removed from the Sun, was spectacularly confirmed in a 2006 dust sample returned from Comet Wild.

In 2007, Shu and co-workers published an analytic theory of the mechanisms of turbulent viscosity and resistivity in the magnetized accretion disks that ubiquitously surround young stellar objects. Their prediction that such disks become sub-Keplerian in their rotation when they age awaits confrontation with observations.

Frank H Shu

I was born in Kunming, China in 1943, the third of four children. In 1949, we emigrated to the United States where my father had gone for graduate study shortly after I was born. Thus, almost my entire formal education took place in the United States. Although I briefly flirted with the idea of becoming an artist, the launch of Sputnik in 1957 settled the issue of what I was to do in life.

When I was offered a chance to work with Professor C C Lin on a senior physics project at MIT on a novel picture of spiral structure as a density wave, I jumped at the opportunity. The crucial confrontations between theory and observations often take decades to develop in astronomy. How could one succeed in such an environment? Professor Lin's example was crucial in forming my scientific character: one must be brutally honest with oneself to avoid getting lost in false leads; one must not fear to swim against the tide if one's ideas and calculations are well-founded; and important problems require a commitment for the long haul, but one should be prepared to make a clean break and move on if one is no longer able to make progress.

After getting my PhD in astronomy from Harvard, I was recruited by Steve Strom for a faculty position at SUNY Stony Brook. My research interest had shifted to the interstellar medium and its connection to the large-scale pattern of massive star formation in spiral galaxies. By the time I moved to UC Berkeley in 1973, we still knew too little theoretically and observationally to make good progress. The launch of the Uhuru satellite led to the discovery of low-mass X-ray binaries. My first Berkeley graduate student, Steve Lubow, and I started to study the process of mass transfer in such systems. We wrote two papers that are still considered the definitive work on this subject. Our work on contact binaries was less well received (there is still no accepted theory of these objects), and in 1976, two of my mentors from this period, Bart Bok and Steve Strom, both encouraged me to work instead on star formation.

In 1977, I produced my paper on the inside-out, self-similar collapse of a singular isothermal sphere. This work is one of my most cited papers, perhaps because the analysis is both simple and elegant. Most workers in the field regard the model, when properly generalized to include the effects of rotation and magnetic fields, to provide a succinct description of the process by which low-mass sunlike stars form from dense condensations of gas and dust in giant molecular clouds.

The breakthrough allowed the overall problem with a huge dynamic range to be separated into two separate calculations, one that involves the collapse of a molecular cloud core to form a star plus a surrounding accretion disk, and the other that follows the internal dynamics and structure of the disk and star. By partitioning the effort in this manner, Steve Stahler, Ron Taam, and I were able, in 1980, to resolve a hot controversy between Chushiro Hayashi and Richard Larson on the physical properties of protostars.

However, this work did not provide a natural and convincing way to determine how a forming star acquired its final mass. When bipolar outflows were discovered in 1980, I got the idea that a protostar, through such a ubiquitous outflow driven by a powerful protostellar wind, determines its own mass by blowing out material that would otherwise have fallen into the central regions. Objections were raised that the observed winds and jets contained too little ionized material to provide the momentum that drives bipolar outflows. We argued that there must be a much larger background of neutral material that was not being measured in the wind. Together with my graduate students Susana Lizano, Carl Heiles, Luis Rodriguez, and a few other collaborators, we succeeded in 1988 in detecting this neutral wind.

The high speed of the neutral wind detected in the unusual combination of carbon monoxide and atomic hydrogen suggested to Susana Lizano, Steve Ruden, Joan Najita and myself that this material must be flowing from the interface of an accretion disk and a magnetized protostar. This realization led to X-wind theory. Although the theory originally had many detractors, recent observational results from the submillimeter array show that the rotation rate of jets from young stellar objects are too small to be anything other than X-winds. Additional measurements increasingly indicate that the origin of high-mass stars is, from a local view, just a scaled-up version of the birth of low-mass stars. This apparent unity is gratifying and promises to provide the crucial link between galactic spiral structure and high-mass star formation that stymied me early in my career.

THE SHAW PRIZE 邵逸夫獎

Professor Yuet-Wai Kan

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

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

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

The Prize in Life Science and Medicine 2009

Douglas L Coleman

and

Jeffrey M Friedman

for their work leading to the discovery of leptin,
a hormone that regulates food intake and body weight.

An Essay on Douglas L Coleman and Jeffrey M Friedman

Individuals vary in their ability to control body weight. Obesity is frequently associated with insulin resistance and diabetes, which often leads to heart, kidney and other diseases. Obesity is an important health problem and has reached epidemic proportions in many countries. The discovery by Douglas L Coleman led the way to the work of Jeffrey M Friedman, who uncovered a hormone that increased our understanding of the biological pathways that regulate body weight.

These studies began with the work of Douglas L Coleman at The Jackson Laboratory in Bar Harbor, Maine, USA. Coleman investigated two strains of mice (ob/ob and db/db), both of which exhibit grossly morbid obesity and severe diabetes caused by homozygosity, for two different recessive mutations. Coleman suspected that the ob/ob mice lacked a circulating hormone whereas the db/db mice overproduced it. So, he performed experiments in which the circulations of these 2 different strains of mice were joined together in a technique called parabiosis. When attached to a db/db mouse, the ob/ob mouse stopped eating and lost weight, while the db/db mouse remained obese. Coleman concluded that the ob/ob mice failed to produce a functional hormone that inhibits eating whereas the db/db mice overproduced the hormone, but lacked the receptor necessary to receive and transmit the hormone signal. When the circulations of ob/ob and db/db mice were joined during the parabiosis, the anti-obesity hormone from the db/db mouse crossed into the ob/ob mouse and induced its weight loss. The db/db mouse showed no change in body weight because it lacked the receptor for this hormone and therefore remained obese.

Coleman's hormone hypothesis was validated dramatically by Jeffrey M Friedman, working at The Rockefeller University in New York, USA. Using the then new techniques of gene mapping associated with conventional matings in mice, Friedman narrowed down the genetic region that contains the ob gene. The task was arduous because the genetic trait is recessive and the heterozygous mice have no manifestations. Thus he had to breed these mice for many generations to locate the chromosome that contained the gene locus. After years of work he found the gene on mouse chromosome 6. The gene encoded a secreted protein that Friedman named leptin. This gene was mutated in the ob/ob mouse resulting in the absence of leptin production. As the function of leptin was to suppress appetite, these mice continued to eat and became obese. Surprisingly, the leptin gene was active in fat cells and secreted leptin. This was a totally unexpected result because fat cells were thought to form a passive tissue for storage and not known before to produce and secrete important hormones. Subsequently, Friedman and others identified the leptin receptor, and showed that the leptin receptor gene is defective in db/db mice, thereby confirming Coleman's foresight in proposing his hypothesis.

The Coleman/Friedman discoveries foster an explosion in our knowledge of how fat cells signal the brain to control energy intake. Friedman showed that leptin acts in the hypothalamus region of the brain to trigger a cascade of signals that regulate food intake.

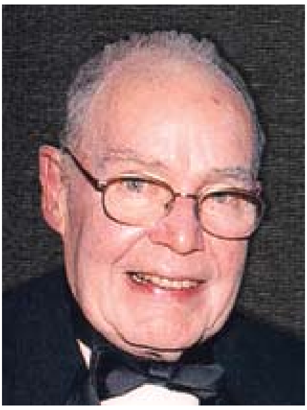
A morbidly obese human individual with a mutation in the leptin gene was later found by English scientist Stephen O'Rahilly who demonstrated that leptin is also important for humans. Individuals with leptin mutations have insatiable appetites from birth and in the case of one boy, a staggering weight of 42 kg was reached by 3 years of age. Injection of leptin into this boy led to rapid weight loss and reduced food intake. Subsequently, mutations in the leptin receptor were identified in other obese people – human equivalents of db/db mice. Today we know that all normal humans depend on leptin to control their body weight.

Leptin and leptin receptor mutations are not common in humans and unfortunately, leptin is not effective when administered to obese humans who have normal genes for leptin and its receptor. Ongoing studies are beginning to determine why ordinary obese humans become resistant to their own leptin.

The discoveries of Coleman and Friedman have changed our concept of obesity from a defect in willpower to a misbalance of hormone signalling. Stimulated by their work, scientists identified other hormonal signals for appetite control.

Soon after its discovery, Farid Chehab at the University of California, San Francisco and Jeffrey Flier at Harvard University found that leptin triggers reproductive function. These studies led to promising ongoing clinical trials to treat some types of amenorrhea. Furthermore, Marc Reitman at NIH and Michael Brown and Joseph Goldstein at the University of Texas Southwestern Medical School showed that loss of body fat – so called lipodystrophy – in mice results in drastically low leptin levels and onset of diabetes, which could be treated with leptin. Based on these observations, individuals with lipodystrophy and diabetes can now be treated with exogenous leptin to prevent or ameliorate their diabetes. All of these advances would have been inconceivable without the pioneering work of Coleman and Friedman.

Douglas L Coleman



I was born on October 6, 1931, in Stratford, Ontario, Canada. After attending elementary and secondary schools in Stratford, I went on to McMaster University, Hamilton, Ontario, and received a BSc in Chemistry in 1954. It was there that I met my future wife, Beverly Benallick. I received my MS and PhD from the University of Wisconsin, Madison, in 1956 and 1958, respectively.

I came to what was then known as the Roscoe B Jackson Memorial Laboratory in 1958 as associate staff scientist. My intention was to stay one or two years, learning some biology and genetics. Instead, I spent my entire career at the Laboratory, rising through the ranks to senior staff scientist and serving stints as assistant director of research and interim director. I retired from my scientific career in 1991. At my retirement ceremony, someone commented that my career was characterized by the ability to use the simplest technique to answer the most complex biological questions.

My early studies involved muscular dystrophy and the development of a new field, mammalian biochemical genetics, establishing that genes control enzyme turnover as well as structure. I am best known for my studies on diabetes-obesity syndrome in mice. I established that the severity of the diabetic state produced by either the obese or diabetes mutation was dependent on the inbred background on which the mutations were maintained. When maintained on the same inbred background, the condition produced was identical. This suggested that each mutation caused different defects in the same metabolic pathway. In a series of studies involving blood exchange among the two mutants and normal mice, I established that the obese mutant lacked some factor that prevents overeating by causing satiety, whereas the diabetes mutant produced the factor in excess, but was unable to respond to it because of a defect in the hypothalamus. These observations explained the identical syndrome produced by each mutation. In addition, these defects caused functional sterility, a thermoregulatory defect, and an increased metabolic efficiency that enabled the mice to survive and become obese on minimal amounts of food.

This increased metabolic efficiency extended to "normal" heterozygotes that had only one dose of the mutant gene. This increase in heterozygotes allowed them to survive on limited amounts of food, amounts insufficient to permit survival in homozygous normal mice. This beneficial effect brought out during periods of limited amounts of food may provide a mechanism whereby diabetic and obesity conditions persist in human populations. Dr Jeffrey Friedman identified the satiety substance in the mid-1990s and named it leptin. Leptin replacement in the obese mouse prevented all of the secondary defects and clearly established that all of the predictions in our studies were correct.

The leptin discovery provided the foundation for great advances in the understanding of the central and peripheral regulation of energy balance. We now know that adipose tissue is not merely a storage tissue, but is an endocrine organ that secretes a variety of hormones and cytokines essential for normal development as well as energy homeostasis.

I am very surprised that what I thought was an interesting set of observations would turn out to have such a major impact in the field of obesity.

In 1977, I was awarded the Claude Bernard Medal by the European Diabetes Federation. I was elected to the National Academy of Sciences in 1998, received the McMaster University Distinguished Alumni Award for the Sciences in 1999 and received the 2005 Gairdner Foundation Award. I served as a consultant to the National Institutes of Health, serving on the Metabolism Study Section from 1972 to 1974. I was frequently called on to consult on various special Study Sections involving genetic diabetes, obesity, and nutrition. I was a member of the special Study Section that established the first Diabetes, Research and Training Centres.

After leaving The Jackson Laboratory in 1991, I plunged into retirement with the same enthusiasm that I had for research. My love of the outdoors and concern for the environment led me to become actively interested in forest management, land protection, conservation, and other ecological issues. I've spent long hours each day rehabilitating our woodlot, making recreational trails that the public, especially students, were encouraged to use for both recreational and educational purposes. In all things science as well as environment, I've tried to leave things better than I found them.

As well as hiking and sailing, my wife and I travelled extensively, and were particularly interested in Native American cultures and their problems, extending from populations in the Arctic to South America. I lost my dear Beverly in April 2009.

Louis Pasteur said luck favours the prepared mind. My mind was prepared by many mentors at The Jackson Laboratory.

Jeffrey M Friedman

My laboratory identified leptin, a hormone that is produced by fat tissue. Leptin acts on the brain to modulate food intake and functions as an afferent signal in a feedback loop that regulates weight. My route to this hormone is filled with a number of chance events and turns of fate that were in no way predictable at the time that I started my career.

I grew up in the suburbs of New York City in a village where children had enormous freedom. I recall from an early age riding my bicycle everywhere without my parents, or anyone else for that matter, knowing my whereabouts. My father was a radiologist and my mother was a teacher. No one in my family or community had pursued an academic career and at the time I was completely unaware of the possibility that one could make a career in science. In my family, the highest level of achievement was to become a doctor and, despite my earliest dreams of a career as a professional athlete (made unlikely by a notable lack of talent) and a later wish to become a veterinarian, I became a doctor.

I was originally trained in internal medicine with some subspecialty training in gastroenterology. In medical school and as a medical resident, I participated in some modest research studies. The first piece of work I completed related to the effects of dietary salt on the regulation of blood pressure. After completing this project, I excitedly submitted a paper for publication. I remember one of the reviews verbatim: "This paper should not be published in the *Journal of Clinical Investigation* or anywhere else." Fortunately, one of my mentors in medical school still thought I might have some aptitude for research. He suggested that I go to The Rockefeller University to work in a basic science research laboratory. I joined the laboratory of Dr Mary-Jeanne Kreek to study the effects of endorphins in the development of narcotic addiction.

I was fascinated by the idea that endogenous molecules could alter behaviour and emotional state. At The Rockefeller University, I met another scientist, Bruce Schneider. Bruce was studying cholecystokinin (CCK), a peptide hormone that is secreted by intestinal cells. CCK aids digestion by stimulating the secretion of enzymes from the pancreas and bile from the gallbladder. CCK had also been found in neurons of the brain, although its function there was less clear. In the late 1970s, it was shown that injections of CCK reduce food intake. This finding appealed to me as another example of how a single molecule can change behavior. One other fact also piqued my interest: There were indications that the levels of CCK were decreased in a genetically obese ob/ob mouse. These mutant mice are massively obese as a consequence of a defect in a single gene. The mice eat excessively and weigh 3 to 5 times as much as normal mice. It was thus hypothesized that CCK functions as an endogenous appetite suppressant and that a deficiency of CCK caused the obesity evident in ob/ob mice. Fascinated by this possibility, I set out to establish the possible role of CCK in the pathogenesis of obesity in these animals. To do this I was going to need additional training in basic research, so I abandoned my plans to continue medical training in gastroenterology and instead entered the PhD program at The Rockefeller University.

As a PhD student I worked in the laboratory of Jim Darnell, studying the regulation of gene expression in liver, and learning the basic tools of molecular biology. But I carried my interest in the ob/ob gene with me. At the end of my graduate studies, two colleagues and I successfully isolated the CCK gene from mouse. One of the first studies we performed after isolating the gene was to determine its chromosomal position. We found that the CCK gene was not on chromosome 6, where the ob mutation had been localized, which thus excluded defective CCK as the cause of the obesity. The question thus remained: What is the nature of the defective gene in ob/ob mice?

After receiving my PhD in 1986, I became an assistant professor at The Rockefeller University and set out to answer this question. The culmination of what proved to be an 8-year odyssey was the identification of the ob gene in 1994. We now know that the ob gene encodes the hormone leptin. The discovery of this hormone, a singular event in my life, was absolutely exhilarating. The realization that nature had happened upon such a simple and elegant solution for regulating weight was the closest thing I have ever had to a religious experience. Subsequent studies revealed that injections of leptin dramatically decrease the food intake of mice and other mammals. My current studies now focus on several questions, including the one that originally aroused my interest in this mutation: How is it that a single molecule – leptin – profoundly influences feeding behaviour? An esteemed colleague of mine remarked recently that I had searched for the ob gene primarily so that I could approach the question I had started with. It is as yet unclear whether I will succeed in understanding how a single molecule can influence a complex behaviour.

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 of London. From 2005-2008, he was the President of the Royal Society of Edinburgh. He was knighted in 1983 and made a member of the Order of Merit in 1992.

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

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

THE SHAW PRIZE 邵逸夫獎

The Prize in Mathematical Sciences 2009

Simon K Donaldson

and

Clifford H Taubes

for their many brilliant contributions to geometry in 3 and 4 dimensions.

An Essay on
Simon K Donaldson and Clifford H Taubes

Over the past 30 years, geometry in 3 and 4 dimensions has been totally revolutionized by new ideas emerging from theoretical physics. Old problems have been solved but, more importantly, new vistas have been opened up which will keep mathematicians busy for decades to come.

While the initial spark has come from physics (where it was extensively pursued by Edward Witten), the detailed mathematical development has required the full armoury of non-linear analysis, where deep technical arguments have to be carefully guided by geometric insight and topological considerations.

The two main pioneers who both initiated and developed key aspects of this new field are Simon K Donaldson and Clifford H Taubes. Together with their students, they have established an active school of research which is both wide-ranging, original and deep. Most of the results, including some very recent ones, are due to them.

To set the scene, it is helpful to look back over the previous two centuries. The 19th century was dominated by the geometry of 2-dimensional surfaces, starting with the work of Abel on algebraic functions, and developing into the theory of complex Riemann surfaces. By the beginning of the 20th century, Poincaré had introduced topological ideas which were to prove so fruitful, notably in the work of Hodge on higher dimensional algebraic geometry and also in the global analysis of dynamical systems.

In the latter half of the 20th century there was spectacular progress in understanding the topology of higher dimensional manifolds and fairly complete results were obtained in dimensions 5 or greater. The two “low dimensions” of 3 and 4, arguably the most important for the real physical world, presented serious difficulties but these were expected to be surmounted, along established lines, in the near future.

In the 1980’s this complacent view was shattered by the impact of new ideas coming from physics. The first breakthrough was made by Simon K Donaldson in his PhD thesis where he used the Yang-Mills equations of SU(2)-gauge theory to study 4-dimensional smooth (differentiable) manifolds. Specifically, Donaldson studied the moduli (or parameter) space of all SU(2)-instantons, solutions of the self-dual SU(2) Yang-Mills equations (which minimize the Yang-Mills functional), and used it as a tool to derive results about the 4-manifold. This instanton moduli space depends on a choice of Riemannian metric on the 4-manifold but Donaldson was able to produce results which were independent of the metric.

There are serious analytical difficulties in carrying out this programme and Donaldson had to rely on the earlier work of Karen Uhlenbeck and Clifford H Taubes. As these new ideas were developed and expanded by Donaldson, Taubes and others, spectacular results came tumbling out. Here is an abbreviated list, which shows the wide and unexpected gulf between topological 4-manifold (where the problems had just been solved by Michael Freedman) and smooth 4-manifold:

(1) Many compact topological 4-manifold which have no smooth structure.
(2) Many inequivalent smooth structures on compact 4-manifold.
(3) Uncountably many inequivalent smooth structures on Euclidean 4-space.
(4) New invariants of smooth structures.

The invariants in (4) were first introduced by Donaldson using his instanton moduli space. Subsequently, an alternative and somewhat simpler approach emerged, again from physics, in the form of Seiberg-Witten theory. Here, one just counted the finite number of solutions of the Seiberg-Witten equations (i.e., the moduli space was now zero dimensional).

One of Taubes' great achievements was to relate Seiberg-Witten invariants to those introduced earlier by Gromov for symplectic manifolds. Such manifolds occur both as phase spaces in classical mechanics and in complex algebraic geometry, through the Kähler metrics inherited from projective space and exploited by Hodge. Although symplectic manifolds need not carry a complex structure, they always carry an almost (i.e., non-integrable) complex structure. Gromov introduced the idea of "pseudo-holomorphic curves" on symplectic manifolds and obtained invariants by suitably counting such curves. Taubes, in a series of long and difficult papers, proved that, for a symplectic 4-manifold, the Seiberg-Witten invariants essentially coincide with the Gromov-Witten invariants (an extension of the Gromov invariants). The key step in the work of Taubes is the construction of a pseudo-holomorphic curve from a solution of the Seiberg-Witten equations. This is fundamental since it connects gauge theory (a theory of potentials and fields) to sub-varieties (curves). Roughly, it represents a kind of non-linear duality.

In fact, extending complex algebraic geometry to symplectic manifolds (of any even dimension) was again pioneered by Donaldson who proved various existence theorems such as the existence of symplectic submanifolds. In the apparently large gap between algebraic geometry and theoretical physics, symplectic manifolds form a natural bridge and the recent results of Donaldson, Taubes and others provide, so to speak, a handrail across the bridge.

All this work in 4 dimensions has an impact on 3 dimensions, especially through the work of Andreas Floer, and Taubes has made many contributions in this direction. His most outstanding result is his very recent proof, in 3 dimensions, of a long-standing conjecture of Alan Weinstein. This asserts the existence of a closed orbit for a Reeb vector field on a contact 3-manifold. Contact 3-manifold arise naturally as level sets of Hamiltonian functions (energy) on a symplectic 4-manifold, and the Weinstein conjecture now asserts the existence of a closed orbit of the Hamiltonian vector field. This latest *tour de force* of Taubes exhibits his real power as a geometric analyst.

In recent years Donaldson has turned his attention to the hard problem of finding Hermitian metrics of constant scalar curvature on compact complex manifolds. The famous solution by Yau of the Calabi conjecture is an example of such problems. Donaldson has recast the constant scalar curvature problem in terms of moment maps, an idea derived from symplectic geometry which played a key role in gauge theory. This construction of metrics is a much deeper problem, being extremely non-linear but Donaldson has already made incisive progress on the analytical questions involved. This new work of Donaldson represents an exciting new advance which is currently attracting much attention.

This quick summary of the contributions of both Donaldson and Taubes shows how they have transformed our understanding of 3 and 4 dimensions. New ideas from physics, together with deep and delicate analysis in a topological framework, have been the hallmark of their work. They are fully deserving of the Shaw Prize in Mathematical Sciences for 2009.

Simon K Donaldson

I was born in 1957 in Cambridge, England, the third of four children. At that time, my father worked as an electrical engineer in the Physiology Department of the University. My mother had been brought up in Cambridge and had taken a Science degree there. When I was 12 we moved to a village in Kent, following my father's appointment to lead a team in London developing neurological implants.

The passion of my youth was sailing. Through this, I became interested in the design of boats, and in turn in mathematics. From the age of about 16, I spent much time studying books, puzzling over problems and trying to explore. I did well in mathematics and physics at school, but not outstandingly so.

In 1976 I returned to Cambridge for my first degree. The subject I liked best was geometry, although there was rather little of this in the Cambridge course at that time and my main training was in analysis, topology and traditional Mathematical Physics. The word "geometry" may convey a misleading impression. The modern subject is very far from Euclid's, and it is perhaps better to think of vector calculus and, for example, the geometrical notion of the "flux" of a vector field.

In 1980 I moved to Oxford to work for a doctorate, supervised by Nigel Hitchin. This was an exciting time in Oxford. Penrose's "twistor theory" was dominant, an early example of the now-pervasive interaction between geometry and fundamental physics. Sir Michael Atiyah, who supervised my work later, was a driving force in this and a few years before he, Hitchin, Drinfeld and Manin had done renowned work on Yang-Mills instantons, using twistor theory and geometry of complex variables. These instantons solve generalisations of Maxwell's equations.

In my thesis I studied two different, but related, topics which have developed into the two themes of most of my subsequent research. The first theme is the interaction between differential and algebraic geometry. The problem that Hitchin proposed to me was to relate the instantons over complex spaces to "bundles" studied by algebraic geometers. What was unusual, in terms of the Oxford environment, was that I tried to tackle this problem using analytical techniques. This kind of approach was by no means new in other problems and in other parts of the world, but was not a strong tradition in the UK. I learnt the trade by studying preprints of Cliff Taubes and Karen Uhlenbeck, which opened up the analytical approach to Yang-Mills theory.

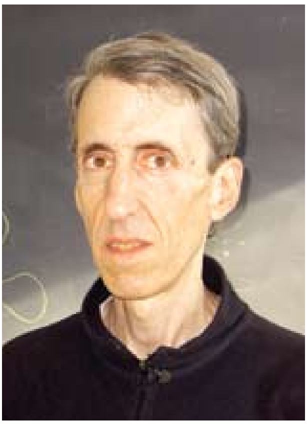
My original focus was on the case of a complex space, but certain central questions made sense on any 4-dimensional manifold. Thinking about these, and combining with an existence result proved by Taubes, led to the other topic of my thesis: the application of Yang-Mills theory to 4-manifold topology. This was quite unexpected. While the basic argument "stared me in the face", thanks to my training in topology, hard work was required to carry it through in detail.

Now I turn to the decade 1983-93. I spent a year in Princeton, and met my wife, Nora, during a visit to the University of Maryland. Our three children, Andres, Jane and Nicholas were born, joining my step-daughter Adriana. (Andres and Jane have both now gained degrees from Cambridge and Nicholas is nearing the end of high school. Adriana is a mathematics teacher.) In research, my focus was on developing the topological applications into a general theory. This was as part of a large endeavour by many mathematicians around the world. I wrote one monograph, with Kronheimer, about these ideas and another dealing with Floer's theory, which extends them to 3-dimensional manifolds. I was made a Professor in Oxford in 1985 and was fortunate to have many research students.

From about 1994 I developed a different research strand, introducing techniques into symplectic topology. The ideas meshed in well with the results obtained by Taubes around that time. After two decades of dramatic development, 4-manifold theory has reached a much more steady state and, while a great deal is known, there are huge areas where we are entirely ignorant. This strand was an example of an attempt to find some new approach.

We spent the year 1997-8 in Stanford, and I moved back to my current position at Imperial College, London. My wife runs a Medical Statistics Unit at King's College. There was little geometry in Imperial then, but now, thanks largely to the drive of my colleague Richard Thomas, we have one of the main centres for research in this area. My work over the past decade has in a sense returned to my thesis problem, but extended into Riemannian geometry. This is an area with a longer history and the problems are much harder, but the theory is developing in an exciting way. Many excellent young mathematicians around the world are entering the field and contributing to these developments.

Clifford H Taubes



I graduated from Cornell University with a degree in Physics in 1975, and then spent a year as a graduate student in the Astronomy Department at Princeton University. I found this not to my liking, and was fortunate enough to have met Bill Press, who helped facilitate a transfer to Harvard University where I enrolled as a graduate student in the Physics Department. I worked for a year there under the tutelage of Bill Press and Larry Smarr (then a Junior Fellow at Harvard), but soon moved to the more theoretical side of that department. My first substantive paper on gauge theoretic mathematics was the lucky result of hearing a lecture at Harvard by the physicist Eric Weinstein from Columbia. He posed a problem about the existence of solutions to the so-called *vortex equations*; these come from the Ginzburg-Landau model for superconducting vortices. I went home and stumbled on a proof that the postulated solutions did indeed exist. This was roughly in 1978, and to my amusement, these same vortex equations have been with me in one form or another for the past thirty years.

I did further work to elucidate the structure of the solutions to these vortex equations, but I also studied a non-abelian analog that is called the *Bogolmony monopole equations*. These equations came from a version of the then new Weinberg-Salam theory that unifies the weak and electromagnetic forces. Only one solution to the latter was known to exist at the time. During this time at Harvard, I was influenced most by Raoul Bott. Raoul had his class on differential geometry and topology; I and myriad others were enthralled by his glorious lectures.

I more or less finished writing my PhD thesis in the fall of 1979, and with six months until the June 1980 graduation, was at a bit of a loose end. Raoul Bott suggested that I hang out at the Institute of Advanced Studies to talk with a differential equations specialist by the name of Karen Uhlenbeck. Steve Adler was kind enough to arrange an unofficial sort of stay, and so I headed down to Princeton. Karen had a profound effect on my subsequent view of mathematics. She taught me (and is still teaching me) a tremendous amount, although I am too dim to learn more than a fraction of her wisdom. It was while visiting the Institute that I tripped over a general existence theorem for the Bogolmony monopoles. This good fortune came late one night in the Princeton library.

Shortly after receiving my PhD, I applied my monopole equation techniques to prove an existence theorem for the *instanton* equations on 4-dimensional spaces. I was starting a Harvard Junior Fellowship, with an office in Harvard's Mathematics Department. My first theorem required that the ambient space have a *positive definite intersection form*. I told Raoul about my theorem, and he asked: 'Well, can you tell me some spaces with such intersection forms?' I said 'Gee, I dunno, maybe the 4-sphere and the complex projective plane?' I didn't pursue this question; this was the first of many serious errors of judgement on my part.

My fellow Shaw laureate, Simon Donaldson (then a graduate student at Oxford) had the sense to ask and pursue this intersection form question, and so came to his first great theorem about smooth, 4-dimensional manifolds. I met Simon about a year later while spending the fall at Oxford at the invitation of Sir Michael Atiyah. Here, I truly began my lifelong study of mathematics under Simon's unknowing guidance. I freely admit that I owe Simon a tremendous debt for all that I have learned from him (and am still learning from him) over the subsequent years; and for his kindness to me as well.

The work on the instanton equations and their applications by Simon and then others, opened a vast new vista with regard to the interplay between geometry and topology in three and four dimensions. I was fortunate enough to be in at the beginning, and to have stumbled to more than my fair share of useful theorems.

A second great vista opened with Ed Witten's suggestion in 1994 to use what are called the *Seiberg-Witten* equations to study questions in four dimensional differential topology. I was again most fortunate to be in at the start of this new revolution; and to have Tom Mrowka and Peter Kronheimer as great friends and compatriots in the subsequent investigations of Witten's proposal. I owe them both a huge and steadily increasing debt as well.

I attribute my success to luck. I have been very, very lucky in life; and also in being influenced by great and wise people. I have mentioned some already; two others who taught me about both life and mathematics are Rob Kirby and S-T Yau.

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* Professor Lin Ma (Promoter)
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* Professor Samuel Sai-Ming Sun (Member)
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Mr Run Run Shaw,
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Mr Chee-Hwa Tung,
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Professor Herbert W Boyer,
Laureate in Life Science and Medicine;

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

The Late Professor Shiing-Shen Chern (1911-2004),
Laureate in Mathematical Sciences.

The Shaw Prize 2005

From right to left:

Professor Michel Mayor,
Laureate in Astronomy;

Professor Geoffrey Marcy,
Laureate in Astronomy;

Mr Run Run Shaw,
Founder of The Shaw Prize;

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

Sir Michael Berridge,
Laureate in Life Science and Medicine and

Professor Andrew Wiles,
Laureate in Mathematical Sciences.

The Shaw Prize 2006

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Professor Adam Riess,
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Professor Saul Perlmutter,
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Mr Donald Tsang,
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Mr Run Run Shaw,
Founder of The Shaw Prize;

Professor Xiaodong Wang,
Laureate in Life Science and Medicine;

Professor David Mumford,
Laureate in Mathematical Sciences and

Professor Wentsun Wu,
Laureate in Mathematical Sciences.

The Shaw Prize 2007

From right to left:

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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,
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Professor Robert Langlands,
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The Shaw Prize 2008

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Laureate in Life Science and Medicine;

Mr Run Run Shaw,
Founder of The Shaw Prize;

Mr Donald Tsang,
Chief Executive of HKSAR;

Professor Shinya Yamanaka,
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Professor Ludwig Faddeev,
Laureate in Mathematical Sciences.

THE SHAW PRIZE 邵逸夫獎

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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 Managing Director of Television Broadcasts Limited.

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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.

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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 & Vice Chairman, Board of Adjudicators

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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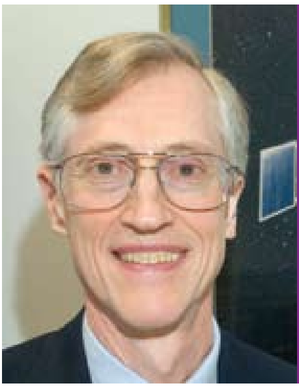
Professor Emeritus, Division of Applied Mathematics, Brown University, USA

Selection Committee

Professor Douglas N C Lin

Member of Astronomy Committee

Professor Douglas N C 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 Distinguished 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.

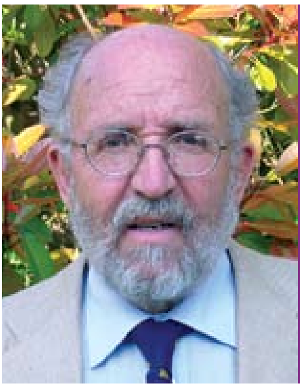


Dr
John C Mather

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.



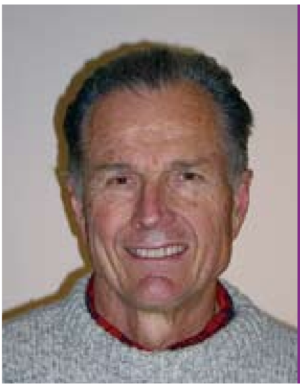
Professor Michel Mayor

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 least, the 2005 Shaw Prize in 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

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

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

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

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

Professor
Peter C Agre

Member of Life Science and Medicine Committee

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

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

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 in Physiology or Medicine (1985).

Sir
Tim Hunt

Member of Life Science and Medicine Committee

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

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

Sir Tim Hunt was elected as fellow of the Royal Society in 1991 and became a foreign associate of the US National Academy of Sciences in 1999. He was knighted in the Queen's Birthday Honours List of 2006 and is currently the Chair of the Council of European Molecular Biology Organization (EMBO).

Professor David M Livingston

Member of Life Science and Medicine Committee

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

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

Dr
William E Paul

Member of Life Science and Medicine Committee

Dr William E Paul discovered interleukin-4, demonstrated that it is the central regulator of allergic inflammation and is known for work on cytokine biology, lymphocyte dynamics, T-cell antigen-recognition and B-cell development. He is Chief of the Laboratory of Immunology of the National Institute of Allergy and Infectious Diseases and a National Institutes of Health Distinguished Investigator. From 1994 to 1997, he was Director of the NIH Office of AIDS Research and was responsible for a new emphasis on HIV vaccine development. Dr Paul is a member of the US National Academy of Sciences, its Institute of Medicine and the American Academy of Arts and Sciences. He received the Founder's Prize of the Texas Instruments Foundation, the 3M Life Sciences Award and the Max Delbruck Medal. Dr Paul was President of the American Society for Clinical Investigation and the American Association of Immunologists (AAI) and is a recipient of Lifetime Achievement Awards from the AAI and the International Cytokine Society.

Dr
Marc Tessier-Lavigne

Member of Life Science and Medicine Committee

Dr Marc 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 and Chief Scientific Officer at Genentech Inc. Prior to moving to Genentech 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

Professor 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 and 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 Shiing-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, the President of the Chinese Mathematical Society and the 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.

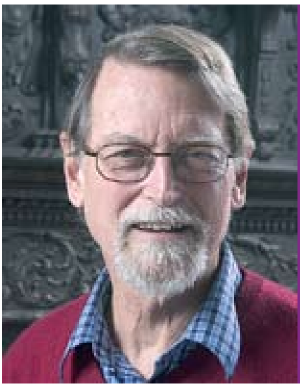
He was awarded Lenin Prize 1967, Frederic Esser Nemmers Prize 1994, Rolf Schock Prize in Mathematics 1999 and King Faisal International Prize in Mathematics 2002. He is a member/foreign member of several Academies of Sciences, including Russian AS, American AAS and Pontifical AS in Vatican.

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 from 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 Sciences, 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, the 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 Television Broadcasts Limited's (TVB) sit-com "War of the Genders" became talk-of-the-town. Ms Cheng's success in hosting the TVB gameshow on legal knowledge "Justice for All" has brought her career to a new height. She has been one of the presenters for the Shaw Prize Award Presentation Ceremony since its inception in 2004.

THE SHAW PRIZE 邵逸夫獎

Presenter

Mr
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 communications 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 many highly acclaimed, socially and environmentally relevant programmes including “Be My Guest”, “On The Road”, “Poverty Campaign” and “Vanishing Glacier”.

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