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

This year's Shaw Prize is proof that the power of science is as strong as ever in the 21st Century. It continues to push back the boundaries of science for the good of all mankind.

I am pleased to congratulate the four award winners. Their vision, quest for truth, and their commitment have produced remarkable discoveries that will enrich lives for generations to come.

The elite club of Shaw Laureates has now been expanded to 20 distinguished scientists. I am sure their knowledge and dedication in the areas of astronomy, life science and medicine, and mathematical sciences will inspire others to follow in their footsteps.

I wish the Shaw Prize continued success in inspiring and encouraging outstanding scientists around the world for years to come.

Donald Tsang
Chief Executive
Hong Kong Special Administrative Region

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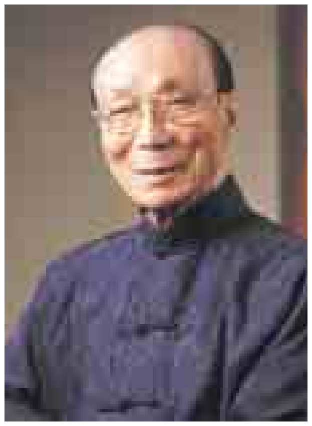
Message from the Founder



Education holds the key to progress and has long been recognized and revered as the foundation upon which future success will be achieved. Although the younger generation may, at times, feel overwhelmed by the challenges confronting them, we encourage them to seek inspiration from the accomplishments of others and to persevere in pursuit of distant goals. In acknowledging the achievements of our laureates, the Shaw Prize seeks to stimulate scholarly inquiry and encourage the young in their endeavours to unravel the mysteries of our universe.

Run Run Shaw

Message from Chairman of Board of Adjudicators

The three scientific fields covered by the Shaw Prizes, Astronomy, Life Science and Medicine, and Mathematical Sciences, have all made spectacular progress in recent years: As we shall hear from Professor Frank Hsia-san Shu, astronomers are enjoying their golden age of new developments; in life science and medicine, the clarification of structures and functions of important receptors in cells heralds the days when powerful new drugs will lead to new medication for many diseases; and in mathematics, its oldest and basic branch, number theory, is infused with new life through the introduction of new insight related to the concept of symmetry. The Shaw Prize Foundation is proud to recognize the trail-blazing achievements in these three fields.

Chen Ning Yang

Chen-Ning Yang

The Shaw Prize Medal

The front of the medal displays a portrait of Run Run Shaw, next to which are the words and Chinese characters for the title of "The Shaw Prize". On the reverse, the medal shows the award category, the relevant year and the name of the prizewinner. A seal of imprint of the Chinese phrase "制天命而用之" (quoted from Xun Zi – a thinker in the warring states period of Chinese history in 313 – 238 B.C.) meaning "Grasp the law of nature and make use of it" appears in the upper right corner.

AGENDA

Arrival of Officiating Guest and Winners

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

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Speech by Professor 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 11, 2007

AWARD PRESENTATION

(Category listed in alphabetical order)

Astronomy

Professor Peter Goldreich

Life Science and Medicine

Professor Robert Lefkowitz

Mathematical Sciences

Professor Robert Langlands

&

Professor Richard Taylor

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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 2007

Peter Goldreich

in recognition of his lifetime achievements in theoretical astrophysics and planetary sciences.

An Essay on on Peter Goldreich

The past fifty years represent a golden age for astronomy. Exciting new discoveries occurred across a wide range of phenomena. Our intellectual horizons expanded correspondingly. At the edge of that expansion, often creating mighty explosions of his own, one invariably finds Peter Goldreich.

Goldreich's career began auspiciously with his explanation, with Peale, of the role of resonances in the solar system. This understanding formed the basis for the later successful prediction that volcanoes would exist on Io. When the motion of Io was found to correlate with intense decametric radio emission from Jupiter, Goldreich and Lynden-Bell put forth an elegant explanation that relied on the presence of a million-ampere tube of electric current flowing between Io and Jupiter's magnetosphere, a prediction that was later confirmed by direct satellite imaging of the hot spot in Jupiter's atmosphere that is linked magnetically to Io.

In the mid-1960s, the origin of the beautiful spiral arms seen in disk galaxies became a hot topic of astrophysical research. In a classic paper with Lynden-Bell, Goldreich identified the swing amplifier as the dominant mechanism that causes self-gravitating, differentially-rotating, disks of gas and stars to spontaneously generate spiral instabilities.

With the stunning discovery of radio pulsars, many theorists focused on explanations that involved the emission of electromagnetic waves into a vacuum from a strongly magnetized, rapidly spinning, neutron star. With Julian, Goldreich pointed out that the immense electric fields associated with the rotation of a magnetized rotating neutron star would rip out electric charges from its surface and fill its magnetosphere with highly energetic particles. This picture has become the paradigm for all further theoretical development of pulsar emission mechanisms, as well as many semi-empirical attempts to interpret the observational data.

Intense emission in radio lines from the near-vacuum of interstellar space came also as a surprise. If the emission were thermal in origin, the sources would have equivalent temperatures in excess of a trillion degrees. The emission has to arise

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instead from maser activity, and it was Goldreich and his students who constructed the most comprehensive theory of maser pumping and amplification in interstellar and circumstellar gas.

Occultations of background stars by the planet Uranus showed that this giant planet is surrounded by an intricate set of narrow planetary rings. What keeps a ring confined to a narrow arc despite the disruption of continual collisions among the constituent particles? Goldreich and Tremaine proposed shepherding satellites, a prediction spectacularly confirmed by the Voyager satellite when it discovered two such bodies on either side of Saturn's F ring.

Related studies by Goldreich and Tremaine focused on the resonant gravitational interactions that occur in a rotating disk of material encircling a central body and nearby or embedded companions orbiting the same body. They foresaw that the back reaction of the spiral density wave produced in the disk would cause the companions to migrate in orbital location. Thus, when the discovery of extrasolar planets came a decade ago, theorists had ready-made explanations for the peculiar proximity of many such bodies to their host stars.

Among the most intractable of scientific problems is the nature of astrophysical turbulence. Rising to the challenge Goldreich produced the best theory of how the turbulence driven by solar convection can excite the rich spectrum of small-amplitude solar oscillations that provide such fruitful probes of the interior of the Sun. He has also studied how magnetohydronamic turbulence can explain the properties of interstellar radio scintillation and other transient phenomena observed in the interstellar medium.

The variety, depth, breadth, and innovativeness of Goldreich's most important contributions to theoretical astrophysics are truly staggering. He is universally admired as one of the most influential scientists in modern astronomy. Everything he touches turns to gold. For his lifetime achievements in theoretical astrophysics and planetary sciences, he is a most worthy recipient of the Shaw Prize in Astronomy for 2007.

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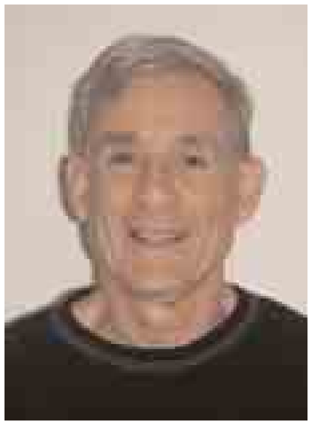
Peter Goldreich



I am a general purpose astrophysicist. My goal is to understand natural phenomena revealed by astronomical observations. When a discovery piques my interest, I try to find the physical mechanism that underlies it. Often I devise a simple model, one that I can analyze to see if it captures critical aspects of the phenomenon. Typically, astronomical observations offer an incomplete picture, so this step involves inspired guesswork. After a while, if I don't succeed, which is the most frequent outcome, I'll go on to something else, while remaining vigilant to clues that new observations may offer. If I feel that I've made significant progress, I'll report the results in a paper.

My father came to the US from Hungary, and my mother's parents from Lithuania. My parents were the first members of their families to be educated beyond grade school. They benefitted from free education at the City College of New York and became biology teachers in New York City high schools.

I was born in 1939 in New York City. Through high school, I was an indifferent student, more interested in playing sports than in schoolwork. As an undergraduate at Cornell University, I discovered that physics and mathematics were more interesting than sports. Although it took some time, I also concluded that my future would be better served by focusing on academic work. However, I still enjoy intense exercise, and do some almost every day.

An important event in my life occurred the summer after I completed high school. My parents took me along when they attended a summer school at the University of Colorado. This was the first time I had ventured outside the east coast of the US. Of even greater significance, it was in Boulder, Colorado that I met my future wife, Susan Kroll. We married four years later just as I was graduating from Cornell and have been together ever since. Our two boys, Eric and Dan, were born in 1963 and 1965.

At the end of my junior year at Cornell, I encountered Tommy Gold. He had recently arrived from Harvard to head the astronomy department. Tommy offered me a summer job, and later convinced me to stay at Cornell for graduate study. Part of the inducement included a nice apartment on the top floor of his beautiful house. My interactions with Tommy had an enormous influence in shaping my scientific career. Until the time I began to write my thesis, my firm intent was to become a theoretical particle physicist. However, in conversations with Tommy, I was exposed to many fascinating astronomical puzzles. In later years, my choice of research topics continued to be influenced by what I had heard about from him. In my scientific life, I have followed Tommy's example and tried to think broadly about science. I owe him a debt of gratitude for showing me the way.

After completing my PhD in January 1963, I was appointed an instructor at Cornell and taught a graduate course in astronomy. I then went on to Cambridge University to do a postdoc with Fred Hoyle, but ended up working with Donald Lynden-Bell. This was a fruitful collaboration and resulted in our discovery of what was later named the 'swing amplifier' of spiral density waves by Alar Toomre, who independently discovered the same mechanism with his student, Bill Julian.

I returned to the US in the fall of 1964 to take up a faculty position at UCLA. My most interesting work at UCLA was done in collaboration with Stan Peale, and involved explaining how the planet Mercury came to be rotating exactly 3 times for every 2 orbits it makes about the sun.

In 1966, I accepted a professorship at Caltech where I remained for the next 36 years. Caltech was a wonderful place for me. It's small, blessed with excellent students and faculty, and an administration committed to enabling the faculty to do great things. Private funds are invested in scientific projects, not only in endowment. Strong connections cut across conventional departments, the most significant for me being those between physics and astronomy. Most of the projects I've worked on were stimulated by what I learned while teaching or talking with colleagues at Caltech. While at Caltech, I obtained a broad education in astronomy, planetary science, and physics, principally by teaching classes composed of excellent students.

I retired from Caltech in 2002 in order to have more time for my research. Since then I have been spending the academic year in Princeton working at the Institute for Advanced Study (IAS) where I am a professor in the School of Natural Sciences. Aside from my own research, my main duty is interacting with their excellent group of astrophysics postdocs. I return to Pasadena and Caltech each summer.

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 2007

Robert Lefkowitz

For his relentless elucidation of the major receptor system that mediates the response of cells and organs to drugs and hormones.

An Essay on Robert Lefkowitz

The human body is made up of many different types of tissues and many different kinds of cells. To co-ordinate body functions, cells signal to other cells in the same organ and in different organs by releasing chemical messengers that travel through the bloodstream. The chemical messengers control all of the vital body processes. For example, they determine the force of a heartbeat and the number of beats per minute, the height of the blood pressure, and the propulsive energy of the intestine. In the brain these chemicals profoundly influence our moods and our behavior, including our drives for food and sex. When Lefkowitz began his work in the late 1960's, scientists had already identified several chemical messengers but they did not know how these chemicals affected the target cells so as to alter their behavior. Over the subsequent 35 years Lefkowitz and his students painstakingly elucidated a family of molecules on the surface of target cells that receive the chemical messages. These receiving molecules are known as G protein-coupled receptors (GPCRs).

GPCRs are proteins embedded in the surface membrane of target cells with their receiving ends facing the outside fluid. Each cell produces many different GPCRs, each tuned to respond to different chemical messengers. For example, certain GPCRs called beta-adrenergic receptors located on heart muscle cells recognize adrenalin secreted by the adrenal gland and thereby control the heartbeat. When a human is physically threatened, the adrenal gland releases adrenalin which travels through the bloodstream and attaches to beta-adrenergic receptors on heart muscle. Once stimulated by the adrenalin, the receptors initiate a cascade of events that causes the heart to beat stronger and faster. This prepares the threatened person for "fight or flight."

In the late 1960's beta-adrenergic receptors were a theoretical concept. Scientists knew that adrenalin stimulated heart muscle cells, and they postulated that there must be a receptor that transmits this message. It is a long way from postulating a receptor to actually having a purified molecule in hand. Undaunted by the enormous challenge, in the late 1960's Lefkowitz began the tedious process of purifying the beta-adrenergic receptor. Purification required separating tiny amounts of the receptor protein from the thousands of other proteins that are much more abundant in cells. The problem was compounded because the beta-

adrenergic receptors are designed to function in cell membranes which are composed of oily lipid molecules. The proteins do not dissolve in water and therefore they must be handled with special procedures that differ from those used for water soluble proteins. To overcome these obstacles, Lefkowitz and his colleagues had to employ ingenious technologies, including the use of artificial chemicals that mimic adrenalin and bind very tightly to the receptor. These synthetic chemicals contained radioactive atoms so that tiny amounts could be detected by radiation counting. Lefkowitz and colleagues used detergents to dissolve the receptor from cell membranes, and they devised methods to measure the amount of receptor by allowing it to bind to the radioactive chemical and then measuring the amount of chemical that was bound. Then the receptors were separated from other proteins using special techniques that separate proteins based on their individual properties, such as size, charge and hydrophobicity. The whole process took 15 years. Along the way, they learned much about the chemical properties of the beta-adrenergic receptor, but the ultimate goal was to determine the precise chemical makeup.

Like all other proteins, the beta-adrenergic receptor is composed of a linear chain of amino acids. Each position in this chain contains one of 20 possible amino acids. The sequence of amino acids is specified by the gene for the receptor according to the universal genetic code that was elucidated in the 1960's by Nobel Prize winner Marshall Nirenberg. A milestone was reached in 1986 when Lefkowitz finally had enough purified receptor to permit a molecular characterization. He collaborated with scientists at Merck Sharp and Dohme Research Laboratories to determine the partial sequence of amino acids in the protein using methods developed by Fred Sanger, another Nobel Prize winner. Lefkowitz and his Merck collaborators used this amino acid information to isolate a copy of the messenger RNA encoding the receptor. The messenger RNA consists of a string of chemicals called nucleotides. By determining the sequence of nucleotides in the messenger RNA and following the rules of the genetic code, the workers were able to deduce the sequence of all 418 amino acids in the receptor.

Inspection of the amino acid sequence of the beta-adrenergic receptor caused an immediate shock. The receptor sequence was not entirely unique. It strongly resembled a protein whose sequence was determined several years before. This protein was rhodopsin, the protein in the retina of the eye that acts as a receptor for photons of light and enables vision. Rhodopsin is a very abundant protein in the eye, and it had been relatively easy to isolate. A form of rhodopsin is also found in light-harvesting bacteria, another rich source of the protein. Scientists had shown that rhodopsin is sewn into the membrane of bacteria and photoreceptor cells. Like a sewing thread going through a fabric, the amino acid chain of rhodopsin crisscrosses the membrane seven times. The amino acid sequence of the beta-adrenergic receptor predicted that it also crosses the membrane seven times, and the overall sequence resemblance suggested that the beta-adrenergic receptor must function in the same way that rhodopsin functions.

The great value of this insight lay in the fact that scientists already knew a great deal about how rhodopsin functions. They knew that light triggers rhodopsin to initiate a cascade of chemical reactions relayed by specialized proteins within the cell. These intracellular relay proteins have the property that they bind intracellular chemicals called guanine nucleotides. Even before the beta-adrenergic receptor had been isolated, biochemical experiments by Lefkowitz and other scientists had shown that the beta-adrenergic receptor also acts by stimulating guanine nucleotide-binding proteins. In the genetic code guanine is abbreviated by the letter G and the intracellular relay proteins had been called “G proteins.” In 1994 the Nobel Prize was awarded to Alfred Gilman and Martin Rodbell for their discovery of G proteins. Since beta-adrenergic receptor activation is coupled to G proteins, the receprtor was designated as a G Protein-Coupled Receptor (GPCR). The parallels between rhodopsin and GPCRs allowed scientists to combine insights learned from studies of vision together with those emerging from study of beta-adrenergic receptors and other GPCRs to produce a complete picture of the mechanism by which GPCRs work, and more importantly, to reveal how the activity of the GPCRs is regulated so as to prevent too much or too little activity.

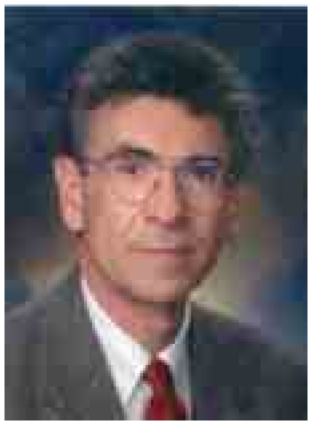
With the messenger RNA sequence of the beta-adrenergic receptor as a starting point, Lefkowitz and others soon found that the genome of animals encodes hundreds of related receptors, each specific for a different chemical messenger. The GPCRs respond not only to chemicals produced within the body, they also

respond to chemicals in the environment. The nose has a family of GPCRs called odorant receptors that detect volatile chemicals. A Nobel Prize for this discovery was awarded to Richard Axel and Linda Buck. Certain GPCRs also respond to drugs. Many of the drugs in common use today, including some of those that treat Parkinson's Disease, schizophrenia and high blood pressure, act by binding to specific GPCRs and either increasing their activity or decreasing it. James Black received a Nobel Prize for discovering drugs that act upon GPCRs. He did this even before GPCRs were discovered. The discoveries of Lefkowitz and colleagues explain how Black's drugs work.

Even before the receptors were isolated, indirect experiments had shown that receptors are not always active. After they transmit their signals, the receptors are silenced by a feedback mechanism that prevents over-stimulation. In recent years, Lefkowitz demonstrated a remarkably sophisticated biochemical mechanism that is responsible for such down-regulation. In elucidating this mechanism, Lefkowitz discovered novel proteins that not only silence receptors, but also play diverse roles in physiology, controlling processes that include cell growth and differentiation. This work was aided immeasurably by the ability to compare and contrast discoveries made in the photoreceptor system with those made with the GPCRs.

As with any problem of central importance in biology and medicine, the elucidation of GPCRs was aided by efforts from many laboratories over the past three decades. Although many scientists contributed, Lefkowitz and his colleagues led the way throughout. As a result of their work, pharmaceutical companies now understand how many of their classic drugs control pathologic processes. Examples include ß-blockers (such as propranolol) for high blood pressure and congestive heart failure, H^2 antagonists (such as cimetidine) for peptic ulcers, H^1 antagonists (such as chlorpheniramine) for allergy, and dopamine antagonists (such as clozapine) for schizophrenia. This knowledge now permits companies to search for even more powerful drugs that target a wide variety of G protein coupled receptors, thereby treating a wide assortment of diseases. The future of human health has been aided immeasurably by the work of Robert Lefkowitz, this year's recipient of the Shaw Prize for Life Science and Medicine.

Robert Lefkowitz



I was born in 1943, the only child of Max and Rose Lefkowitz, in the Bronx, New York City. My grandparents had immigrated to the United States from Poland in the earliest years of the Twentieth Century. My mother, an elementary school teacher, and my father, an accountant, stressed the importance of learning, and I remember reading voraciously even in elementary school. Some days I would feign illness (usually a stomach ache), to stay at home and read the many books which my parents owned. I particularly enjoyed adventure tales with a strong hero.

A strong formative influence was my family physician, who made house calls when anyone in the family was ill. He became my hero and role model, and I decided by the third grade that I wanted to be a physician like him. I attended public schools, including the well known Bronx High School of Science. Admission was by competitive examination, and the curriculum stressed mathematics and the sciences, but not to the exclusion of literature and history. I received my bachelor's degree from Columbia University, and in 1962 entered the Columbia University College of Physicians and Surgeons. I loved clinical medicine and had no aspirations to become a scientist. Upon graduation, in 1966, I did a medical internship and one year of medical residency at the Columbia Presbyterian Medical Center in New York City. My goal was to become an academic physician and teach clinical medicine.

After medical residency, in 1968, I entered the United States Public Health Service and was assigned to the National Institutes of Health in Bethesda, Maryland for two years. Here, under the direction of Jesse Roth and Ira Pastan, I began my research career. During the first year, failure was my constant companion, a new experience for me. Frustrated, I made arrangements to continue my clinical training at the Massachusetts General Hospital in Boston. However, during my second year my experiments began to work and I had my first taste of success. I developed a means of studying receptors for a peptide hormone called adrenocorticotrophic hormone (ACTH), and published my first papers.

In July of 1970 I moved to Boston to continue my residency training. However, I missed the creative challenges that the laboratory provided. So, I resumed research activities in the laboratory of Dr. Edgar Haber, while simultaneously doing a two-year cardiology fellowship, a choice that was influenced by the strong history of heart disease in my family. During this research I decided to study the "adrenergic receptors", the cellular receptors for adrenaline and noradrenaline. At the time, there was great skepticism as to whether such specific cellular binding sites for hormones and drugs even existed. I was convinced that they must, and set out to prove it.

In 1973 I joined the faculty at Duke University Medical School in Durham, North Carolina. My research program grew rapidly but I continued to spend a significant part of my time doing clinical work. However, I was drawn more and more deeply into my research and spent progressively more time in the laboratory. In 1976, I became an Investigator of the Howard Hughes Medical Institute, a position I retain to this day.

The work went well and we achieved a number of significant breakthroughs. We developed the first means of studying the receptors by using radioactively tagged "beta blockers", and succeeded in purifying them away from all other molecules in the cell. An enormous job, this occupied more than a decade of work by dozens of devoted students and fellows. By the early 1980s we had purified all four known types of adrenergic receptors.

A major breakthrough came in 1986 when, in collaboration with a team at Merck, we succeeded in cloning the gene for the ß2-adrenergic receptor. Surprisingly, this revealed that the receptor bore a marked resemblance to another protein called rhodopsin, the visual pigment which enables us to perceive light. Both proteins have a characteristic arrangement in which the polypeptide chain of the receptor weaves across the plasma membrane seven times. Since these two proteins are known to transmit signals through an intermediate protein known as a G protein, they are referred to as G protein-coupled receptors (GPCRs). Immediately, we conceived the possibility that all of the dozens of GPCRs might bear a similar structure, and be members of the same gene family. We confirmed this by cloning the genes for several other adrenergic receptors and a receptor for serotonin.

Based on our early work, numerous other labs were then able to clone genes for many other GPCRs which mediate virtually all physiological responses. These seven transmembrane receptors represent the largest family of cellular receptors and the commonest target of therapeutic drugs. The elucidation of their structure facilitated the design and development of diverse classes of drugs such as adrenergic receptor blockers, antihistamines, psychotropic drugs, opioids, and many others.

I have also studied how the receptors are regulated. Continuous stimulation of GPCRs rapidly results in their "desensitization", a waning response to the stimulus. We discovered the molecular mechanisms involved and two novel classes of proteins which mediate the desensitization. These molecules are also involved in mediating some forms of signaling by the receptors. Currently, I am trying to leverage this new information to develop novel classes of pharmaceutical agents.

My research experiences are inextricably bound up with the mentoring of my students and fellows, more than 200 of whom have trained in my laboratory. Many have gone on to distinguished careers in academia and the pharmaceutical industry. My family is a source of great satisfaction and comfort. My wife, Lynn, accompanies me on many of my trips to interesting places around the world. I have five grown children and four grandchildren.

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Sir Michael Atiyah

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

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

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

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

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The Prize in Mathematical Sciences 2007

Robert Langlands

and

Richard Taylor

for initiating and developing a grand unifying vision of mathematics that connects prime numbers with symmetry.

An Essay on Robert Langlands and Richard Taylor

The work of Robert Langlands and Richard Taylor, taken together, provides us with an extraordinary unifying vision of mathematics. This vision begins with "Reciprocity", the fundamental pillar of arithmetic of previous centuries, the legacy of Gauss and Hilbert. Langlands had the insight to imbed *Reciprocity* into a vast web of relationships previously unimagined. Langlands' framework has shaped - and will continue to shape, unify, and advance - some of the most important research programmes in the arithmetic of our time as well as the representation theory of our time. The work of Taylor has, by a route as successful as it is illuminating, established - in the recent past - various aspects of the *Langlands programme* that have profound implications for the solution of important open problems in number theory.

For a prime number p form the (seemingly elementary) function that associates to an integer n the value +1 if n is a square modulo p, the value -1 if it isn't, and the value 0 if it is divisible by p. It was surely part of Langlands' initial vision that such functions and their number theory might be relatively faithful guides to the vast number-theoretic structure concealed in the panoply of automorphic forms associated to general algebraic groups. Langlands, viewing automorphic forms as certain kinds of representations (usually infinite-dimensional) of algebraic groups, discovered a unification of the two subjects, number theory and representation theory, that has provided mathematics with the astounding dictionary it now is in the process of developing and applying. Namely, the *Langlands Philosophy*: a dictionary between number theory and representation theory which has the uncanny feature that many elementary epresentation-theoretic relationships become - after translation by this dictionary - profound, and otherwise unguessed, relationships in number theory, and conversely.

In the mid 1960's Robert Langlands was one of the prime movers in the development of the general analytic theory of automorphic forms and their relationship to representation theory. Of particular note is his much celebrated general theory of Eisenstein series. Remarkably quickly after this, he was able to ennunciate in a rather precise way the audacious "Langlands philosophy" which has guided the subject ever since. This includes his extremely general "reciprocity conjecture" connecting automorphic forms with number theory and his "principle of functoriality", a beautiful conjecture that subsumes all these ideas in terms of internal properties of representations. In the 1970's and 1980's Langlands went on to attack many important special cases of his conjectures using generalizations of

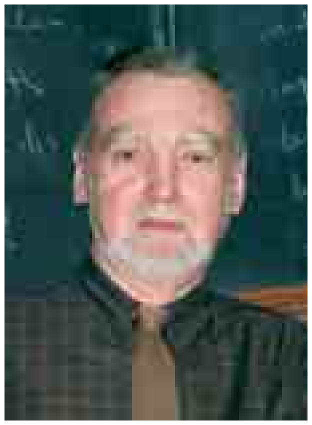
the Selberg Trace Formula. Of particular note is his theory of cyclic base change for GL(2), an example of "functoriality" which has profound applications to number theory. He pioneered the use of the trace formula to study Shimura varieties. He also laid out a very detailed blueprint (the theory of "endoscopy") on how to overcome deep problems that were encountered when trying to apply the trace formula to analyse Shimura varieties or to prove cases of functoriality. In sum, Langlands' insight offers us a grand unification, already used to establish some of the deepest advances in number theory in recent years.

Indeed, it is thanks to the work of Richard Taylor that we now have some of these advances. To cite the most recent of these breakthroughs, he and co-workers (Michael Harris, Laurent Clozel, and Nicholas Shepherd-Barron) have established an important part of a basic conjecture that has been around for 40 years. At the same time, they have extended - in a striking way - our ability to make use of Langlands' ideas, in combination with work of others, for arithmetic purposes. The technical statement of what they have done is to have proved *the Sato-Tate conjecture for elliptic curves over totally real fields, provided that the curve has a place of multiplicative reduction.* The Sato-Tate conjecture predicts that certain error terms in a broad class of important numerical functions of prime numbers conform to a specific probability distribution. In this recent work we see otherwise separate mathematical sub-disciplines coming together and connecting with each other in an illuminating way. Moreover, the successful strategy adopted, in keeping with Langlands' principle of functoriality, involves an infinite sequence of automorphic forms attached to algebraic groups of higher and higher rank. All this is surely just the beginning of a much bigger story, as envisaged by Langlands.

Richard Taylor's earlier work includes his celebrated collaboration with Wiles on the resolution of Fermat's Last Theorem followed by his quite significant contribution to the collaborative effort to finish fully the modularity of elliptic curves over the rational number field, his collaboration with Michael Harris culminating in the resolution of the local Langlands' Conjecture for the general linear group in n dimensions, and his work resolving the classical Artin conjecture for a quite important class of non-solvable Galois representations of degree two.

The work of Robert Langlands and Richard Taylor demonstrates the profundity and the vigour of modern number theory and representation theory. Together they amply deserve the honour of the Shaw Prize.

Robert Langlands



I was born on October 6, 1936 in New Westminster, British Columbia, Canada to Kathleen Johanna (née Phelan) Langlands and Robert Langlands. In 1956 I married Charlotte Lorraine Cheverie. We have four children, William, Sarah, Robert and Thomasin, and several grandchildren.

I received my elementary and high-school education in New Westminster and in White Rock, a nearby settlement. I then gained a bachelor's degree and a master's degree from the University of British Columbia in Canada, and in 1960 a Ph.D. from Yale University in New Haven, Connecticut.

In the succeeding years, 1960 to 1972, I held positions at Princeton University, Yale University, and for one-year periods at the Institute for Advanced Study in Princeton, the University of California in Berkeley, the Middle East Technical University, Turkey and at the University of Bonn in Germany. Since 1972 I have been attached as professor to the Institute for Advanced Study in Princeton, and am now professor emeritus. During my time at the Institute I have spent brief periods, from a few months to a year, at the Centre de recherches mathématiques in Montréal, at the University of Bonn and several other institutes in Germany, especially Berlin and Heidelberg, and at several institutes and universities in France. There has also been a long visit to the Tata Institute of Fundamental Research in Mumbai as well as several short visits to Turkey, especially to Yildiz Technical University (previously called Yildiz University) in Istanbul.

Although my thesis was in functional analysis and partial differential equations (see the book *Elliptic operators and Lie groups* by Derek Robinson), my interest turned quickly, partly under the influence of a course by Steven Gaal at Yale, to the ideas of Hecke and Selberg, thus to zeta-functions and, effectively, to the theory of Eisenstein series. This interest, as well as a nascent interest in class field theory that began in Princeton, was further encouraged by Salomon Bochner. Atle Selberg had developed for $SL(2, \mathbb{Z})$ $SL(2, \mathbb{R})$ and for some other discrete subgroups of rank one, the theory of Eisenstein series, but he was not able to extend the theory to discrete subgroups of higher rank. It was created, I think it is fair to say, by me in the early sixties. I was of course aware of Selberg's methods, as well as the general reduction theory recently developed by Borel and Harish-Chandra, and of the general concept of cusp form introduced by Israel Gelfand. The new difficulties in

higher rank arise largely because there the theory is a spectral theory for several commuting unbounded operators. It has not yet been well understood by analysts, but in addition to my own exposition of the theory there is an excellent book by Moeglin and Waldspurger. There is also an early exposition by Harish-Chandra, who after Bochner was the mathematician responsible for the first recognition of my efforts, but Harish-Chandra's exposition stopped short of the higher-dimensional theory, which is an essential element of the trace formula, created first for $SL(2)$ by Selberg and developed in general by Arthur, a development that itself is still largely neglected by analysts and little understood, except by a very small number of specialists. It is, in my view, now central to the analytic theory of automorphic forms and therefore to the arithmetic as well.

The general theory of Eisenstein series led to a much better understanding of the kinds of L-functions that could be attached to automorphic forms, and then to the notion of *functoriality*, still today in large part conjectural but with some cases of unexpected importance proved. These conjectures, inspired also in part by Artin's reciprocity law and with the analytic continuation of all the Artin L-functions as immediate consequences, are perhaps my major contribution. They were followed in the two decades after their discovery by various researches, meant to permit the detailed formulation of the conjectures and their consequences, to establish links to the L-functions of arithmetic, beyond those of Artin, and to develop methods for their proof, my favoured tool being the trace formula and Shimura varieties the principal example. I continue to reflect on these matters, very much encouraged by the recent work of Laumon and Ngo, itself influenced by earlier work of Kottwitz, Goresky and MacPherson, on the fundamental lemma. There is much left to do.

It was a great pleasure for me, but also a great surprise, when Wiles incorporated some of the work on functoriality and, thus, the trace formula into the proof of Fermat's theorem as an essential ingredient.

In addition to the theory of automorphic forms, I have also, in part with Yvan Saint-Aubin and other collaborators, studied various aspects of mathematical physics. Here, even more than elsewhere, I fell far short of my goals, but I am assured that the numerical work on percolation and crossing probabilities influenced the important work of Smirnov on conformal invariance and of Schramm on the *SLE*-theory. I am very pleased by this, and very fortunate, but I would nevertheless very much like to be able to discover some genuine mathematical handle on the analysis of renormalization.

Richard Taylor

I was born on May 19, 1962 in Cambridge, England, but two years later we moved to Oxford where I spent the rest of my childhood. My mother, Mary, was a piano teacher and my father, John, a theoretical physicist. I enjoyed mathematics from a young age and was blessed with a number of inspiring mathematics teachers, including Tony Middleton at Magdalen College School. Although never a star at them, I greatly enjoyed the mathematics olympiads, which gave me my first experience of working on problems which took more than a few minutes to solve. But the biggest influence on my early scientific development was undoubtedly my father, who taught me never to be satisfied until I had really understood something completely. I also learnt from him not to fear asking simple-minded questions.

I was an undergraduate at Clare College, Cambridge. At this stage I developed a passion for travel and mountaineering, visiting the Alps, the Indian Himalayas and later the Karakoram and Ecuadorean volcanoes. I found it a great way to relax from mathematics which otherwise could be very consuming. It also became clear to me that number theory was the field that I found most exciting. I was attracted by the combination of simple problems, beautiful structure and the variety of techniques that were employed. However I very nearly chose to do graduate work in another area because I felt my abilities were insufficient to make an impact in such a hard field with so many outstanding practitioners. I overcame these doubts and went to graduate school in Princeton. Here I chose to work with Andrew Wiles attracted both by the beauty of his work and his approachability. It was a wise choice. Andrew's influence on my work has been enormous. After completing my PhD I spent a year at the Institut des Hautes Etudes Scientifiques outside Paris before returning to Cambridge University and Clare College. I stayed there for the next 6 years, during which time I benefitted greatly from John Coates' support.

In 1994 I had the wonderful good fortune to meet Christine Chang, who has made my life much happier. We married in August 1995 and now have two children: Jeremy (born in 1998) and Chloe (born in 2000). Since then I have devoted significantly less time to mathematics, but paradoxically my mathematical work has improved.

In an effort to combine our two scientific careers I left Cambridge University following my marriage to Christine, first for the Savilian chair of geometry at

Oxford and then a year later for Harvard University, where I am currently the Herchel Smith professor of mathematics. At Harvard I have found a supportive and stimulating home with incomparable colleagues and students.

My mathematical interests centre on the relationship between two very different kinds of symmetry: certain discrete symmetries of polynomial equations discovered by Galois in the first half of the 19th century, and other continuous symmetries arising in geometry. In the simplest (commutative) case this relationship was one of the great mathematical achievements of the first half of the 20th century (class field theory). More recently a much more general (non-commutative) theory has developed which is often loosely described as the Langlands program. I am fascinated by the way these ideas relate two very different kinds of mathematics (one coming from algebra, the other more closely related to analysis) which on the face of it have no reason to be related. I am also deeply impressed at how progress on this “program” has led to the solution of old, concrete problems in number theory. The most notable, but certainly not the only instance of this, being Andrew Wiles' proof of Fermat's last theorem. (It was a wonderful opportunity when in December 1993 Andrew asked me to help him repair the gap in his first attempt to prove Fermat's last theorem, a task at which we succeeded in less than a year, though we used a wholly unexpected argument.)

Class field theory can be considered the one dimensional case of the program. My early work is concerned with the two dimensional case, most notably my work with Wiles alluded to above and its continuation with Breuil, Conrad and Diamond to prove the full Shimura-Taniyama conjecture which has important applications to the arithmetic of elliptic curves. Also my discovery of potential modularity results, which led to the proof of the meromorphic continuation and functional equation of the L-functions of all regular rank two motives. Subsequently Khare and Wintenberger again made use of these ideas in their ground-breaking proof of Serre's conjecture. More recently I turned my attention to any number of dimensions, most often in a long collaboration with Michael Harris. I consider our proof of the local Langlands conjecture and our work (in part with Clozel and Shepherd-Barron) on modularity lifting theorems and potential modularity theorems in any number of dimensions to be the highlights of this work. An application of this is the proof of the Sato-Tate conjecture (for elliptic curves with non-integral j-invariant). This account will make clear that I am someone who works best in collaboration with others. I am extremely fortunate to have had fruitful and very enjoyable collaborations with many different colleagues. I am also blessed to have been able to work with 20 very talented PhD students.

Organization

* *Preparatory Committee (Until July 2003)*
(Front row, from right to left)

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

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

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

Mr. Run Run Shaw (Founder of the Shaw Prize)

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

* Mrs. Mona Shaw (Member)

(Back row, from right to left)

Mr. Raymond Wai-Man Chan

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

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

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

* Professor Sunny Kai-Sun Kwong (Member)
Asso. Professor, Dept. of Economics, Faculty of Social Science, The Chinese University of Hong Kong

Mr. Charles Cheuk-Kai Cheung

Mr. Koon-Fai Chor (Secretary)

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.

Shaw Prize 2006

From right to left:

Professor Brian Schmidt,
Laureate in Astronomy;

Professor Adam Riess,
Laureate in Astronomy;

Professor Saul Perlmutter,
Laureate in Astronomy;

Mr. Donald Tsang,
Chief Executive of HKSAR;

Sir Run Run Shaw,
Founder of the Shaw Prize;

Professor Wang Xiaodong,
Laureate in Life Science and Medicine;

Professor David Mumford,
Laureate in Mathematical Sciences and

Professor Wu Wentsun,
Laureate in Mathematical Sciences.

Organization

Council

Mrs. Mona Shaw

Professor Lin Ma

Professor Chen-Ning Yang

Professor Kenneth Young

Professor Sheung-Wai Tam

Council Members

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 Deputy Chairperson and Acting Managing Director of Television Broadcasts Limited.

Council Members

Professor Lin Ma
Member

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

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

Council Members

Professor Chen-Ning Yang
Member & Chairman, Board of Adjudicators

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

Board of Adjudicators

(October 1, 2005 - September 30, 2007)

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Professor Chen-Ning Yang

(in alphabetical order)

Members of Astronomy Committee

Professor Jiansheng CHEN
Director, Department of Astronomy, Peking University, China

Professor Joseph H. TAYLOR
James S. McDonnell Distinguished University Professor of Physics, Princeton University, USA

Dr. Robert W. WILSON
Senior Scientist, Harvard-Smithsonian Center for Astrophysics, USA

Professor Youyuan ZHOU
Chairman, Centre of Astrophysics, University of Science and Technology of China

Members of Life Science and Medicine Committee

Professor David BALTIMORE
President Emeritus and Robert Andrews Millikan Professor of Biology, California Institute of Technology, USA

Professor Michael S. BROWN
University of Texas Southwestern Medical Center at Dallas, USA

Professor Kim A. NASMYTH
Whitley Chair, Department of Biochemistry, University of Oxford, UK

Dr. Marc TESSIER-LAVIGNE
Senior Vice President, Research Drug Discovery, Genetech Inc., USA

Members of Mathematical Sciences Committee

Professor Phillip A. GRIFFITHS
School of Mathematics, Institute for Advanced Study, Princeton, USA

Professor Heisuke HIRONAKA
The Japan Association for Mathematical Sciences (JAMS), Japan

Professor Sergey P. NOVIKOV
Institute for Physical Science and Technology, University of Maryland, USA

Professor Gongqing ZHANG
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.

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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.

THE SHAW PRIZE 邵逸夫獎

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.

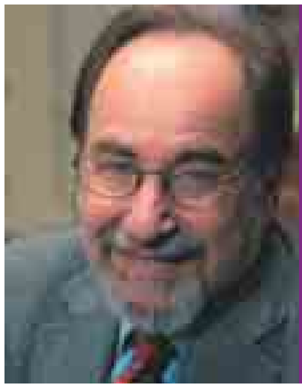
Professor Youyuan Zhou

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

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

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

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

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

Professor Michael S. Brown

Member of Life Science and Medicine Committee

Professor Michael S. Brown received an 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. Professor Nasmyth was formerly the Director of the Research Institute of Molecular Pathology (I.M.P) in Vienna.

His scientific work has addressed the mechanisms by which genes are turned on and off during development, how DNA replication is controlled, and how chromosomes ensure their segregation during mitosis and meiosis. He has received recognition through several awards, including the Boveri award for Molecular Cancer Genetics (2003), the Croonian lecture/Medal of the Royal Society (2002), the Austrian Wittgenstein Prize (1999), the Louis Jeantet Prize for Medicine (1997), the Unilever Science Prize (1996), and the FEBS Silver Medal (1995). He is a fellow of the Royal Society (1989), a member of the Austrian Academy of Sciences (1999), and a foreign honorary member of the American Academy of Arts and Sciences (1999).

Dr. Marc Tessier-Lavigne

Member of Life Science and Medicine Committee

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

Dr. Tessier-Lavigne is currently 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).

THE SHAW PRIZE 邵逸夫獎

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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