

# JAPAN PRIZE NEWS

THE SCIENCE AND TECHNOLOGY  
FOUNDATION OF JAPAN (JSTF)

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## American and Japanese Scientists Named as Laureates of the 1996 (12th) Japan Prize

The Science and Technology Foundation of Japan (Chairman: Jiro Kondo) announced that an American scientist, Dr. Charles Kuen Kao, 62, who helped to pioneer research on wide-band, low-loss optical fiber communications, and a Japanese doctor of medicine, Dr. Masao Ito, 67, who helped to elucidate the functional principles and neural mechanisms of the cerebellum, have been named as laureates of the 1996 (12th) Japan Prize. The two scientists will be honored during a Prize presentation ceremony scheduled to be held at the National Theatre in Tokyo on Friday, April 26, 1996. Both will receive a certificate of merit, commemorative medal and a cash award of ¥50 million (about US\$500,000).

Dr. Kao is Vice Chancellor and President of The Chinese

University of Hong Kong and Dr. Ito is the System Director-General of Frontier Research Systems at The Institute of Physical and Chemical Research (RIKEN) as well as President of the Science Council of Japan.

A total of 238 nominees for the 1996 prizes were recommended by top scientists and academics from around the world, comprising 86 nominees in the category of Information, Computer and Communication Systems and 152 nominees in the category of Neuroscience.

The Japan Prize was created to commend scientists and technologists throughout the world for major scientific and technological achievements that advance peace and the prosperity of mankind.

### Category of Information, Computer and Communication Systems

Reasons for Award: For pioneering research on wide-band, low-loss optical fiber communications

Dr. Charles K. Kao (U.S.A.)

Vice-Chancellor and President, The Chinese University of Hong Kong



The construction of information and communication network, which is expected to bring forth an extensive social innovation from the end of this century toward the beginning of the next, owes very much to the recent progress in the communication technologies. Above all, the development of optical fiber communication technology, which allows to transmit a large quantity of information at reduced loss, has intensively promoted the progress. The optical communication system is composed of optical fiber to transmit light, semiconductor laser to emit light, photo diode to detect light, and various optic components to control the flow of light signals. In particular, the optical fiber has provided significant motive power to the growth of optical communications, owing to its low loss and enormous capacity of signal transmission in the single mode fiber, and excellent mechanical properties such as small diameter, and adequate tensile and bending strength.

The research on optical communications has been substantially started in 1960 by the invention of laser, and followed by studies simultaneously in three facets: light source, transmission line and light detector. The laureate, Dr. Kao reported, in a paper published in 1966 in collaboration with Mr. G. A. Hockham, a foresight, in concrete terms, for the potential of massive optical communications based on single mode optical fiber, through estimation of transmission capacity of single mode optical fiber and transmission distance derived from the magnitude of expected loss and acceptable light power. Subsequently, Corning, Inc. developed low-loss optical fiber in 1970, to make a long stride to the commercialization of low-loss, large-capacity optical fiber communication and to open the way to the realization of Dr. Kao's foresight. In this way, the achievement of Dr. Kao and his coworker has played a leading and pioneering role in a series of efforts for exploiting transmission lines based on fiber optics, and provided tremendous impact to the further development of optical communication technology, acquiring high esteem in the international communities.

As mentioned in the above, the candidate, based on his foresight for the potential capability of optical fiber to transmit broadband information at low loss and on experimental demonstration of its feasibility, has exerted a sizable impact to the exploitation of optical fiber communications, which is currently under way to the world wide applications.

In conclusion, Dr. Charles K. Kao is a meritorious recipient deserving the 1996 (12th) Japan Prize.

(Born in November 1933, 62 years old)

# JAPAN PRIZE

## Category of Neuroscience

Reasons for Award: Elucidation of the functional principles and neural mechanisms of the cerebellum

Dr. Masao Ito (Japan)

System Director-General, Frontier Research System, The Institute of Physical and Chemical Research (RIKEN); President, Science Council of Japan



Dr. Masao Ito was born in Nagoya, Japan. He graduated from The University of Tokyo School of Medicine and received his M.D. in 1953 and his Ph.D. in 1959. As his doctoral dissertation, he worked out the electrical activity of spinal ganglion cells with intracellular micro-electrode. During his post-doctoral training in Dr. John Eccles' laboratory at the

Australian National University (1959-62) he studied the ionic permeability of inhibitory post-synaptic membranes of spinal motoneurons and established the theory that the ionic permeability depends on the size of hydrated ions.

From 1962 he systematically analyzed the neuronal circuits of the medulla and the cerebellum at The University of Tokyo School of Medicine and discovered the inhibitory action of the cerebellar Purkinje cells. At that time, it was believed that only interneurons with short axons exhibited an inhibitory action in the spinal cord and brain, and no one imagined that the Purkinje cells, which are the big projection neurons that provide sole output from the cerebellar cortex, exhibited an inhibitory action upon the target neurons. Thus his discovery had great impact on our understandings of the mechanism and role of inhibitory synapses in the spinal cord and brain. He also found, in collaboration with Dr. Kunihiko Obata, that the chemical transmitter substance that mediates Purkinje cell inhibition is  $\gamma$ -aminobutyric acid. This finding established the fact that  $\gamma$ -aminobutyric acid acts as a chemical transmitter substance in vertebrate central nervous systems. Then he accomplished a series of systematic researches on cerebellar neuronal circuits, the results of which were published in the book "The Cerebellum as a Neuronal Machine" (Springer-Verlag, 1967) co-authored by Drs. Eccles and Szentagothai.

In 1970 he found that a part of the cerebellum, the flocculus, has a direct connection with a basic reflex circuit, the vestibulo-ocular reflex. Further analyses of this connection led his proposal in 1972 of a hypothesis that the flocculus is the center for adaptive control that modifies the dynamics of the vestibulo-ocular reflex by means of error signals from the retina. This hypothesis states that the cerebellum functions as a device that provides reflexes with adaptability, and opened a new era of research on the cerebellar mechanisms. Thereafter he and his colleagues succeeded in proving this hypothesis by various experiments. These achievements elucidated the general principle of mechanisms of cerebellar motor learning, for which he was awarded the Fujiwara prize in 1981.

The "flocculus hypothesis" on the adaptive control of the vestibulo-ocular reflex shared a basic operational concept with the

Marr-Albus theory of cerebellar function which assumed a special class of synaptic plasticity in the cerebellar cortex and which thereby proved the learning capability of cerebellar cortical neural circuits. At that time many eminent experimentalists had attempted to prove the synaptic plasticity hypothesis in vain. In 1982 he succeeded in discovering a synaptic plasticity, the long-term depression, in the neural circuits of the cerebellar cortex. The long-term depression is the basic of the learning capability of cerebellar cortical neural circuits, and the discovery of this synaptic plasticity provided us a basic understanding of the mechanisms of cerebellar motor learning. He received the Japan Academy Prize and the Imperial Award in 1986 for this discovery.

In 1984 he published a book "The Cerebellum and Neural Control" (Raven Press, New York), wherein he compiled knowledge on the structure and function of cerebellar neural circuits and formulated general principles along which the cerebellum works. Then he conjectured that these principles are applicable to higher brain functions, such as cognition, and provided a theoretical basis for recent noninvasive methods of measurement of human brain activity. It is now generally accepted that the cerebellum plays an important role both in motor and cognitive functions.

In 1989 he moved to the Frontier Research System in the Institute of Physical and Chemical Research (RIKEN) and organized new laboratories to study molecular processes of the long-term depression. He and his collaborators elucidated roles of intracellular second messengers such as cGMP that lead to phosphorylation of glutamate receptors. Using knowledge from molecular/cellular research, they succeeded in inducing a reversible learning deficit by temporally inactivating the long-term depression. This achievement is the first direct demonstration of a causal relationship between the cerebellar long-term depression and motor learning. He has been President of both the Neuroscience Society of Japan and the Physiological Society of Japan for many years and, since 1994, has taken on the important responsibility of promoting the whole field of scientific research as President of the Science Council of Japan. He has also served as President of the International Brain Research Organization and the International Union of Physiological Sciences. He has been elected to the Japan Academy, Royal Society, Royal Swedish Academy of Sciences, Armenian Academy of Sciences and Russian Academy of Sciences.

As described, Dr. Ito's achievements which uncovered the design of the brain through analyses of structure and function of neural networks have been truly outstanding, creative and the most successful representation of modern neuroscience research.

In conclusion, Dr. Masao Ito is a meritorious recipient deserving the 1996 (12th) Japan prize.

(Born in December 1928, 67years old)

# JAPAN PRIZE

## Members of The 1996 (12th) Japan Prize Selection Committee

Name	Post
Chairman Jiro Kondo	Chairman, The Science and Technology Foundation of Japan Director-General, Research Institute of Innovative Technology for the Earth

### Selection Panel for Category of Information, Computer and Communication Systems

Chairman Hiroshi Inose	Director General, National Center for Science Information Systems
Acting Chairman Yasuharu Suematsu	Director General, National Institute for Advanced Interdisciplinary Research
Member Hideo Aiso	Chairperson and Professor, Graduate School of Media and Governance, Keio University
Member Eiichi Goto	Professor, Faculty of Science, Kanagawa University
Member Yasuhiko Yasuda	Professor, School of Science & Engineering, Waseda University

### Selection Panel for Neuroscience

Chairman Tutomu Hiroshige	Professor Emeritus, Hokkaido University
Member Yasuo Kakimoto	Professor Emeritus, Ehime University
Member Ichiro Kanazawa	Professor, Faculty of Medicine, The University of Tokyo
Member Kiyoshi Hama	Director General, Okazaki National Research Institute, Institute for Physiological Sciences
Member Yasushi Miyashita	Professor, Faculty of Medicine, The University of Tokyo



Chairman Jiro Kondo receives the list of recommended candidates from Dr. Hiroshi Inose and Dr. Tutomu Hiroshige

## International Exchange Activities

The Science and Technology Foundation of Japan maintains a close relationship with the Nobel Foundation in Sweden. Every year it sends two Japanese students to the Stockholm International Youth Science Seminar (SIYSS), an annual meeting held during the Nobel Prize Week in early December sponsored by the Swedish Federation of Young Scientists and supported by the Nobel Foundation. The participants in the 1995 seminar were Mr. Hideyuki Mieda, a second-year student at the Department of General Education at the Medicine, Hokkaido University; and Mr. Satoshi Nakazawa, a first-year doctor's course student majoring in electronic engineering at The University of Tokyo, The Faculty of Engineering. Both reports follow.

### Hideyuki Mieda

Department of General Education at the Medicine, Hokkaido University

The climax of the Stockholm International Youth Science Seminar must be participating in the Nobel Prize Awards Ceremony. How wonderful it is for a young scientist to witness the most honorable moment in science.

But if I were to be satisfied only with taking part in the ceremony, that would be to observe a formality alone. I could enlarge my experience by understanding the achievements and the ways of



Dr. Mario J. Molina, winner of Nobel Prize for chemistry and Mr. H. Mieda

thinking of the laureates. In this sense also, the seminar was significant. For I had opportunities to listen to the laureates' lectures and to talk with them.

When I spoke to them, full of eagerness, they answered all my questions. It was a moment of supreme bliss for me. I could hardly distinguish

any more between reality and dreaming.

The seminar was crowned by events related to the Nobel Prize—these were the "flowers"—but there was also a concrete outcome. The occasion bore fruit. That is to say, students from all over the world communicated with one another. The culture of each was different, depending on their nationality. But there was an intellectual atmosphere of having much in common during the time we were together. I was stimulated by the differences of culture and ways of thinking. And I felt we had a lot in common. Other participants must have felt as I did. I think that is the reason why we became closer friends during the seminar.

### Satoshi Nakazawa

The University of Tokyo, The Faculty of Engineering

The Nobel Prize Awards Ceremony ended. Next, the Nobel Banquet was held at the city hall. On the stage at the hall there were ballet and opera performances and then the laureates made their wonderful speeches. Everyone felt the emotion of the atmosphere and shared in the radiance of the occasion. Brilliant tapestries were hung from the windows of the hall.



Mr. S. Nakazawa (Second from right) with foreign students

I closed my eyes to shut out the flash of the cameras, but I could still see before me the scene of the laureates hugging each other in delight after the ceremony ended.

I thought to myself: This is one tapestry. Here are different people from different cultures who have woven themselves into that tapestry as individual threads. And in the tapestry one sees a single beautiful dream, as envisaged by Nobel as his contribution to the peace and happiness of mankind.

I felt intense pleasure at being on the spot, and I hoped that we could inherit the dream.

# JAPAN PRIZE

## Foundation's Annual Science and Technology Seminar Held in Fukuoka

A special annual seminar to discuss the general science and technology in plain language was held on November 30, 1995, in Fukuoka, one of Japan's largest cities. This is the fourth year that this seminar has been held in Fukuoka.

In Tokyo, the Foundation has held a monthly seminar for the general public since March 1989. In this seminar, famous scientists lecture about various topics in science and technology in plain language to develop and disseminate information and ideas regarding science and technology. The Tokyo seminar witnessed the 68th meeting in December 1995.

The Fukuoka version of the seminar was launched in 1990 as a result of an agreement reached between the Foundation and the Fukuoka City Municipal Office marking the establishment of the Fukuoka Asian Culture Award.

The 1995 Fukuoka special seminar was held in the Fukuoka City Women's Center, Amicas, attended by some 200 people. The lecturers were delivered by Prof. Miki Wadachi of the Dept. of Physics, Faculty of Science, The University of Tokyo; and Jiro Kondo, President of the Foundation and Professor Emeritus, The University of Tokyo. Prof. Wadachi spoke of the developments of non-linear sciences and the 21st century, and Prof. Kondo spoke about prediction and counterplan—from forecast of an earthquake to the economy.



The audience at the Fukuoka City Special Seminar (upper)

Dr. M. Wadachi (right)

Chairman Jiro Kondo (lower)



## Categories Selected for the 1997 (13th) Japan Prize

The Science and Technology Foundation of Japan has announced the two categories for the 1997 (13th) Japan Prize. The categories are "Systems Engineering for an Artifactual Environment" and "Biotechnology in Medicine."

### Concepts of the Categories

#### Systems Engineering for an Artifactual Environment

The world is composed of -- and human actions take place in -- an environment of artifacts in modern society. Systems engineering plays an important role in the creation and management of artifacts for the sustainable development of an artifactual environment, with a view to enhancing the welfare of mankind.

"Systems Engineering for an Artifactual Environment" covers a wide variety of technologies and knowledge systems for the creation of an artifactual environment such as design engineering, product engineering, measuring and control engineering, robotics, knowledge engineering, computational sciences, safety and reliability engineering, standardization, quality control engineering and so on.

The 1997 Japan Prize will be awarded for achievement in the above technologies and knowledge systems, or contribution to progress of related basic disciplines and technologies.

#### Biotechnology in Medicine

Rapid progress in biotechnology has led to advances in medical sciences, resulting in the development of new methods of preserving and improving human health. The prosperity of the human race in the 21st century and beyond will depend on our ability to wisely apply the fruits of medical research to the understanding of human diseases.

The 1997 Japan Prize will be awarded to the scientist who has made a significant contribution to medicine through a discovery in the field of biotechnology including molecular biological technology and organ transplantation that not only promotes an understanding of human diseases, but also markedly improves our ability to prevent, diagnose and treat those diseases.

### The Foundation's Internet Service

The Foundation has opened a home page on the meshnet Internet Service.

Home page address <http://www.meshnet.or.jp/jstf>

E-Mail address [jstf@mx.meshnet.or.jp](mailto:jstf@mx.meshnet.or.jp)