JAPAN PRIZE NEWS

THE SCIENCE AND TECHNOLOGY FOUNDATION OF JAPAN (JSTF)

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Categories Chosen for the 8th Japan Prize in 1992

The Science and Technology Foundation of Japan announced that the two categories for the eighth Japan Prize, to be awarded in 1992, would be "Science and Technology of Material Interfaces" and "Science and Technology for Biological Production", the concepts of which are as in the right column.

The Japan Prize, launched in 1985, is an international prize awarded to scientists and researchers who have made original and outstanding achievements in science and technology. The recipients are recognized for contributing not only to the progress of science and technology, but also to peace and prosperity for mankind.

Every year, two fields of research are selected for the award of the Japan Prize; the Prize is usually awarded to one person in each category, although the prize has sometimes been shared.

The Japan Prize is one of many projects sponsored by the Foundation to create greater awareness and understanding of science and technology.

The Japan Prize laureates receive certificates of merit and commemorative medals in addition to a supplementary cash award of ¥50 million per award field.

Regarding the concepts of categories chosen for the 8th Japan Prize in 1992, the explanations are made in the following Q&A format by Dr. Jiro Kondo, the chairman of the 1992 Fields Selection Committee and the president of the Science Council of Japan; Dr. Yasutaka Uemura, the vice-chairman of the committee and the professor, Department of Applied Physics of the Science University of Tokyo; and Dr. Hiroshi Harada, the general secretary of the committee and the professor, Institute of Biological Sciences of the University of Tsukuba.

Dr. Jiro Kondo

Q: I would like to have Chairman's comments on why the two categories "Science and Technology of Material Interfaces" and "Science and Technology for Biological Production" have been selected.

A: In these days, the development of science and technology has been in more specific and narrow fields. The purpose of awarding the Japan Prize is not necessarily to look for pioneering new science and technology but to find what scientific achievement would bring the most happiness to mankind and what development in technology would be valued as the best for the world. This search may easily reveal some contributions to industry or social welfare, which will, however, be too obscure to be considered a winner. The two categories for 1992 have thus been selected based on the purpose outlined above taking into account the categories selected in the past.

"Science and Technology of Material Interfaces" may be rather difficult to be understood except by those who are specialists in this particular field. The scope of the category may be regarded as being rather narrow. In fact, it is wider than it may appear, since this category would include new aspects of materials, the reactions which take place and the materials which may be created at the boundaries of two different and adjacent materials and the reaction or resulting material may have a new application.

"Science and Technology for Biological Production" prin-

Concepts of the Categories

Science and Technology of Material Interfaces

Innovation in the science and technology of materials always has a great impact upon progress in modern technologies. In particular, the understanding of material interfaces (including surfaces) at the atomic level has greatly expanded in recent years.

"Science and Technology of Material Interfaces" covers fields such as catalysts, thin films, colloids and various interfaces of metal and semiconductor.

The prize for 1992 will be awarded for outstanding achievements in the formation and control of material interfaces, their characterization techniques, clarification of their phenomena and development of materials and/or devices which utilize special functions of material interfaces.

Science and Technology for Biological Production

Production of materials for food and other uses by the utilization of living organisms in agriculture, forestry, fisheries and related industries has been, and will be, the basis of the survival of mankind. Improvement in its efficiency as well as its diversification will therefore be of more vital importance in the future than ever before.

The prize for 1992 will be awarded for outstanding achievements in the development of science and technology relating to the cultivation, breeding, protection and related aspects of food production, with a view to increasing productivity by the utilization of living organisms.

cipally covers the science and technology of the basic requirements of food production. This may be regarded as being wide in scope, because the production of food for the survival of mankind merely involves the use of products already existing in nature. However, the category focuses, on the other hand, on research, advanced processes and new or improved applications in science and technology and, in this respect, is narrower than it may appear.

To sum up, the scope of the two categories is balanced, being neither too narrow or too wide. What I want to stress on this occasion is to ask everybody to watch who will ultimately be awarded the Prize. The real worth of the Japan Prize is reflected in the achievements of those who receive it. At this moment, I have no idea at all who will be the laureates in the relevant fields. I do, however, hope that every person will be pleased and convinced with the ultimate laureates selected and the achievements they have established for mankind. This requires streneous efforts to be made by the Selection Committee which will choose the laureates.

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Dr. Yasutaka Uemura

Q: What does "material interface" mean?

A: It means a boundary region between two different materials. Commonly, the "material interface" between vacuum and crystal is called the "surface" of the crystal. However, "material interface" has a rather wider meaning and includes boundaries between liquid and crystal, and even those between two different crystals or liquids.

Recently, great progress has been made to form, to control, and to observe various kinds of interfaces at the atomic or molecular level.

As a result, various new applications have been developed with feed-back effects which have in turn stimulated further research in this field.

Q: What are the applications of "material interfaces"?

A: Typical examples are catalysts in chemical reactions and the fabrication and integration of various kinds of semiconductor devices. In addition, "Science and Technology of Material Interfaces" plays an important role in many functional materials such as; (1) this films, multilayered films, and artificial super lattices, (2) texture controlled alloys, (3) very fine particles and colloidal dispersion, (4) electrode and surface charge sensitive materials and in technologies such as, (5) adhesion, vapour deposition, and epitaxy, (6) tribology and lubrication.

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Dr. Hiroshi Harada

Q: What research subjects can be included in the coverage of the category of "Science and Technology for Biological Production"?

A: Other than the coverage of the category as defined and as comprehenced, the following are the examples to be further included:

utilization of sea and fresh-water organisms (including aquaculture, analysis of excursion phenomena of fishes);

propagation of livestock;

production of drought and/or salt tolerant plants for the prevention of desertification;

improved production of useful forest trees;

breeding of street trees and shrubs which could reduce air pollutants;

human or animal food production from biomass conversion using new enzymes; and

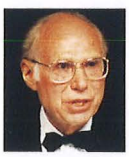
production of useful substances by living organisms (for example, amino acids, enzymes, proteins, hormones; antibiotics for agricultural and fishery use; new functional substances).

Profiles of Japan Prize Laureates

1985 (1st)

Information and Communications

"Outstanding achievement in the field of electronics and communications technologies"



Dr. John R. Pierce (U.S.A.)

Professor emeritus at Stanford University.

Dr. Pierce's achievements in the field of information and telecommunication engineering represent the highest scientific caliber in the United States. His work has resulted in the theoretical development of the possibilities of communications satellites and of broad-band digital transmissions via pulse code modulations and multivalent signals.

Biotechnology

"Outstanding achievement in basic theory in the field of immobilized enzymes and their practical applications"

Dr. Ephraim Katchalski-Katzir (Israel)

Professor at Tel Aviv University and at Weizmann Institute of Science.

Dr. Katzir, the fourth President of the State of Israel from 1973 to 1978, is credited with the invention and development of the bioanalyzer and bioreactor, two devices employing immobilized enzymes and cells which form part of the foundation of biotechnology.

1986 (2nd)

Materials Science and Technology

"Pioneering contributions to materials science with impact on new materials technology such as amorphous solids"

Dr. David Turnbull (U.S.A.)

Professor at Harvard University

Dr. Turnbull, who formulated the guiding principles of new materials development, predicted what kinds of alloys will, like glass, tend to assume an amorphous character with an irregular alignment of atoms in rapid cooling from a molten state. In addition, this prominent scientist cleared the way for the production of high-density ceramics and perfect crystals for use in ICs.

Medical Technology

"Research and development of artificial organs and their relevant technology"

Dr. Willem J. Kolff (U.S.A.)

Professor at the University of Utah. Head of the Institute for Biomedical Engineering. Born in the Netherlands.

As father of the artificial organ technologies, Dr. Kolff achieved clinical success in the development of a rotating drum-type kidney device in 1943. He then continued to work to popularize disposable-type artificial kidneys while playing a leading role in the development of artificial lungs and hearts.

1987 (3rd)

Improvements of Biological Functions

<Joint Award>

"Development of the IR8 and IR36 strains for rice breeding strategies geared to the tropical and subtropical zones"

Dr. Henry M. Beachell (U.S.A.)

Former head of the Plant Breeding Department at the International Rice Research Institute (IRRI). Advisor to the Farms of Texas Company.

Dr. Beachell has taken part in the IRRI's rice strain improvement projects since the institute's establishment. In 1966 he developed the IR8 strain that helped pave the way for the "green revolution" in developing nations.

Dr. Gurdev S. Khush (India)

Head of the Plant Breeding Department at the International Rice Research Institute.

Carrying on the work begun by Dr. Beachell, Dr. Khush further improved IR8 and in 1976 developed IR36, a strain highly tolerant of poor environmental conditions. IR36 contributed immensely to the attainment of production stability and self-sufficiency in rice in tropical and subtropical countries.

Electro-Optics

"Development and demonstration of a ruby laser, the world's first laser oscillation"

Dr. Theodore H. Maiman (U.S.A.)

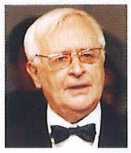
Former chief of research at Hughes Research Laboratories. President of Maiman Associates Inc.

This pioneer in electro-optics became in 1960 the first scientist to succeed in generating radiation with a ruby laser, greatly aiding subsequent research on lasers. Dr. Maiman has also made a major contribution toward the advancement of the fields of natural science and engineering technology.

1988 (4th)

Energy Technology

"Establishment of Fast Breeder Reactor Technology"



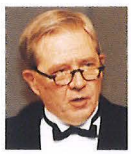
Dr. Georges Vendryes (France)

Scientific advisor to the president of the Commissariat à l'Energie Atomique (CEA).

Following his contribution to the establishment of the fundamentals of nuclear power design and the promotion of fast breeder reactor development, Dr. Vendryes' work led to the successful completion of "Super Phoenix," the world's first large-scale test breeder, establishing practical technologies for a solution to mankind's energy problem in the future.

Preventative Medicine

"Smallpox and Its Eradication" <**Joint Award**>



Dr. Donald A. Henderson (U.S.A)

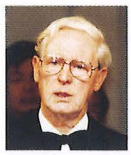
Dean, Johns Hopkins University, School of Hygiene and Public Health.

As the first chief medical officer of the WHO World Smallpox Eradication Office, Dr. Henderson dedicated his efforts to the development of group vaccination programs and contributed to its historical success through the worldwide eradication of smallpox.

Dr. Isao Arita (Japan)

Director, Kumamoto National Hospital.

As the second chief medical officer of the WHO World Smallpox Eradication Office, Dr. Arita established basic disease control knowledge and performed epidemiological analyses as well as surveys and research into vaccine quality improvement.



Dr. Frank Fenner (Australia)

Professor Emeritus, Visiting Fellow, The John Curtin School of Medical Research, The Australian National University.

Dr. Fenner, as the chairman of the WHO Smallpox Eradication Surveillance Committee, supervised implementation of the global smallpox eradication program and his consistent efforts greatly contributed to its success.

"Discovery of AIDS-Causing Virus and Development of Diagnostic Methods" <**Joint Award**>

Dr. Luc Montagnier (France)

Chief, Department of Virus Tumours, Pasteur Institute.

Leading the joint research staff at the Pasteur Institute in 1983, Dr. Montagnier became the first researcher in the world to discover HIV, the pathogen behind AIDS, thus launching the start of genuine HIV research. He has also developed practical blood serum diagnostic methods for the establishment of basic preventative countermeasures.

Dr. Robert C. Gallo (U.S.A.)

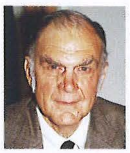
Chief, Laboratory of Tumour Cell Biology, National Institutes of Health.

Leading his own independent research group, Dr. Gallo established a method of culturing human T cells and succeeded in isolating the HIV virus, making a major contribution to analysis of its relationship with AIDS. He is also a pioneer in the research and development of AZT, the most effective AIDS treatment thus far, as well as in the effort to manifest a virus gene and realize and AIDS vaccine.

1989 (5th)

Environmental Science and Technology

"Studies on the mechanisms of stratospheric ozone depletion by chlorofluorocarbons"



Dr. Frank Sherwood Rowland (U.S.A.)

Professor at University of California Irvine

In 1974, Dr. Rowland, who studied physical chemistry, was the world's first scientist to point out the mechanisms by which chlorofluorocarbons could destroy the ozone layer, which protects life on earth from harmful ultraviolet solar radiation.

He also predicted that if emission of chlorofluorocarbons continues at a current rate, it would eventually result in a 7-13% loss of the total ozone.

Dr. Rowland's theoretical insights and predictions have been verified by scientists throughout the world, and have done much to strengthen international efforts for the preservation of stratospheric ozone.

Medicinal Science

"Pioneering contributions to the syntheses of prostaglandins and related compounds of great therapeutic value"

Dr. Elias James Corey (U.S.A.)

Professor at Harvard University

Dr. Corey's study covered almost all fields of organic chemistry. He became the first researcher to synthesize pure prostaglandins in natural, optically active form. This allowed the large scale production of all natural prostaglandins so as to provide a stable supply for other researchers, thus contributing considerably to the development of biochemistry and medicine.

His synthesis had three major advantages over other methods in terms of 1) efficiency, 2) versatility, and 3) economy.

Dr. Corey's achievement in the synthesis of eicosanoids is a monumental work in modern medicinal science. It is broadly expected that this synthesis will facilitate development of medicines for such diseases as cerebral thromboisis, arteriosclerosis, gastric and intestinal ulcers.

1990 (6th)

Technology of Integration – Design, Production and Control Technologies

"Establishment of an academic field named Artificial Intelligence and the proposal of fundamental theories in that field"

Dr. Marvin Minsky (U.S.A.)

Professor of Electrical Engineering, MIT. Born in 1927.

Dr. Marvin Minsky published his paper "Steps Toward Artificial Intelligence" in 1961 that gave Artificial Intelligence (AI) world wide exposure and has earned the title of "father of AI". Artificial Intelligence became increasingly complex by the 1970s, involving vast amounts of knowledge and the need to use specially appropriate pieces of knowledge at particular times. Professor Minsky proposed a theory of frames for the effective representation and utilization of knowledge in computers. In the 1980s, AI has produced many more practical application systems and many researchers have turned toward the question of how to make machines learn more by themselves. In addition to the development of the theory and practical application systems, he emphasized necessity of study on human mind including emotion and self consciousness. In his book "Society of Mind," he has proposed a model of the human mind which consists of many small agents (computers) working together by communicating with each other. His proposal is expected to further expand the AI technology to other fields of science and to help promote AI applications.

Earth Science <**Joint Award**>

"Initiation of the theory of plate tectonics and contributions to its development"

Dr. William Jason Morgan (U.S.A.)

Professor at Princeton University. Born in 1935.

Dr. Morgan began his revolutionary work by dividing Earth's outer shell into some 20 plates, analyzing their movements as rigid, rotating segments of the shell, and measuring absolute velocities of plate motion. Mid-oceanic ridges, subduction zones and transform faults all came to be interpreted as results of the movements of these plates. The great significance of Dr. Morgan's theory became widely recognized and his work subsequently triggered numerous studies in a variety of fields.

Dr. Dan Peter McKenzie (U.K.)

Professor at Cambridge University. Born in 1942.

Dr. McKenzie has analyzed earthquake systems in the circum-Pacific region and has demonstrated independently that the floor of the Pacific Ocean moves as a single plate, rotating against North America and East Asia. In collaboration with Dr. Morgan, Dr. McKenzie has also carried out a geometrical analysis of triple junctions where three plates meet. This work has contributed greatly to understanding the relative motion of plates and the energetics of plate movements. He has also proposed the highly original model that large sedimentary basins, important in the formation of oil and natural gas deposits, are formed by thinning of the crust due to plate motion.

Dr. Xavier Le Pichon (France)

Directeur du Département de Géologie, Ecole Normale Supérieure. Born in 1937.

Dr. Le Pichon, inspired by the work of Dr. Morgan, has independently determined plate movements over the entire surface of Earth, using ocean floor spreading velocities estimated from paleomagnetic patterns and the directions of transform faults. He has also published a book on plate tectonics which has had a great influence on earth scientists throughout the world, and has played a major role in sea-floor investigation at plate boundaries. Through these work, he has contributed greatly to the understanding of the geological nature of plate boundaries under the ocean.

Foundation's First Display at an International Exposition

The Foundation contributed its first display at an international exposition when it participated in the 1990 International Garden and Greenery Exposition at Tsurumi-Ryokuchi, Osaka.

The Exposition was very successful drawing a total of 23 million visitors. This made it the largest international exposition so far held in Japan.

The Foundation's participation involved displays in the Aqua Hall of the International Exhibits from July through to the end of September.

The main theme of the display was suggested by Dr. Gurdev S. Kush from India, who is Head of the Plant Breeding Department, International Rice Research Institute. He received the 1987 (3rd) Japan Prize in the category of "Improvement of Biological Functions". The theme was inspired by the research for which Dr. Kush was awarded the Japan Prize: breeding of high yield rice varieties "IR8" and "IR36" adapted to tropical and subtropical regions.

The Foundation's display was adjacent to Dr. Norman Borlaug's display. Dr. Borlaug was awarded the Nobel Prize for Peace in 1970, for his contributions to enhancing wheat production.

Dr. Kush's suggestion for the main theme was made to the Foundation when he was in Japan last May.

Entire view of The International Garden and Greenery Exposition, and display.

General Science and Technology Seminars Held Monthly

The Foundation is holding a monthly General Science and Technology Seminar (in Japanese) for the general public free of charge. The aim is to promote a comprehensive spread and development of information and ideas regarding science and technology.

Lecturers at the seminars are distinguished scholars, scientists and engineers who are recognized as leaders in their fields.

The lectures are presented in easy-to-understand Japanese language.

Future subjects include "Electric Car" "Artificial Organ" "Space Development" "Biotechnology" and "Revolution of Materials".