

# JAPAN PRIZE NEWS

THE SCIENCE AND TECHNOLOGY  
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## Three American Scientists Awarded 2008 (24th) Japan Prize

The Science and Technology Foundation of Japan (Chairman: Hiroyuki Yoshikawa) announced that three American scientists have been named as laureates of the 2008 (24th) Japan Prize.

Dr. Vinton Gray Cerf, 64, and Dr. Robert Elliot Kahn, 69, will receive the Japan Prize in this year's category of "Information Communication Theory and Technology". They contributed to the creation of network architecture and communication protocol for the Internet.

Dr. Victor A. McKusick, 86, will receive the Japan Prize in the category of "Medical Genomics and Genetics". He is credited with the establishment of Medical Genetics and contributed to its development.

### Information Communication Theory and Technology



**Dr. Vinton Gray Cerf**



**Dr. Robert Elliot Kahn**

### Medical Genomics and Genetics



**Dr. Victor A. McKusick**

## Japan Prize

The Japan Prize is awarded to world-class scientists and technologists who were credited with original and outstanding achievements and contributed to the advancement of science and technology, thereby furthering the cause of peace and the prosperity of mankind. In principle, original achievements in science and technology are given priority during the selection process.

No distinction is made as to nationality, occupation, race, or sex. Only living persons may be named.

Fields of study for the prize encompass all categories of science and technology, with two categories designated for the prize each year in consideration of developments in science and technology.

Each Japan Prize laureate receives a certificate of merit and a commemorative medal. A cash award of 50 million yen is also presented for each prize category. The award is intended for a single person, in principle, but small groups of researchers are also eligible.

## Information Communication Theory and Technology

### Achievement

## Creation of network architecture and communication protocol for the Internet

**Dr. Vinton Gray Cerf** (U.S.A.)

Vice President and Chief Internet Evangelist, Google Inc.

**Dr. Robert Elliot Kahn** (U.S.A.)

Chairman, CEO & President of Corporation for National Research Initiatives (CNRI)

### OUTLINE:

The appearance of the Internet has pioneered the way for the establishment of a network society that has completely transformed the lifestyles of people around the world. Two men in particular were instrumental in the creation of the concept for the basic framework and the TCP/IP communi-

cation protocol which has made the Internet possible. These men are Dr. Vinton Gray Cerf and Dr. Robert Elliot Kahn. Known as the "Fathers of the Internet," Dr. Cerf and Dr. Kahn continue to lead advances in information communication.

### The Fathers of the Internet

Today, the Internet enables us to communicate by text, audio and video transmissions, which until a short period of time ago, required such specialized types of media as teletype, telephone or television. That we are able to send and receive such a diverse array of data over the Internet is thanks to the communication protocols known as TCP (Transmission Control Protocol) and IP (Internet Protocol), which provide the basic infrastructure for the sending and receiving of data. The term "protocol" was originally associated with the conduct, conventions and formalities observed during diplomatic exchanges. However, in the world of communications, this term has come to mean the established rules that govern the transmission of data. The two TCP and IP communication protocols work together to guarantee the accurate communication of data transmitted between two Internet-connected devices. The creation of these protocols that make the Internet possible is the work of two dedicated researchers, Dr. Vinton Gray Cerf and Dr. Robert Elliot Kahn.

### The Origins of TCP and IP

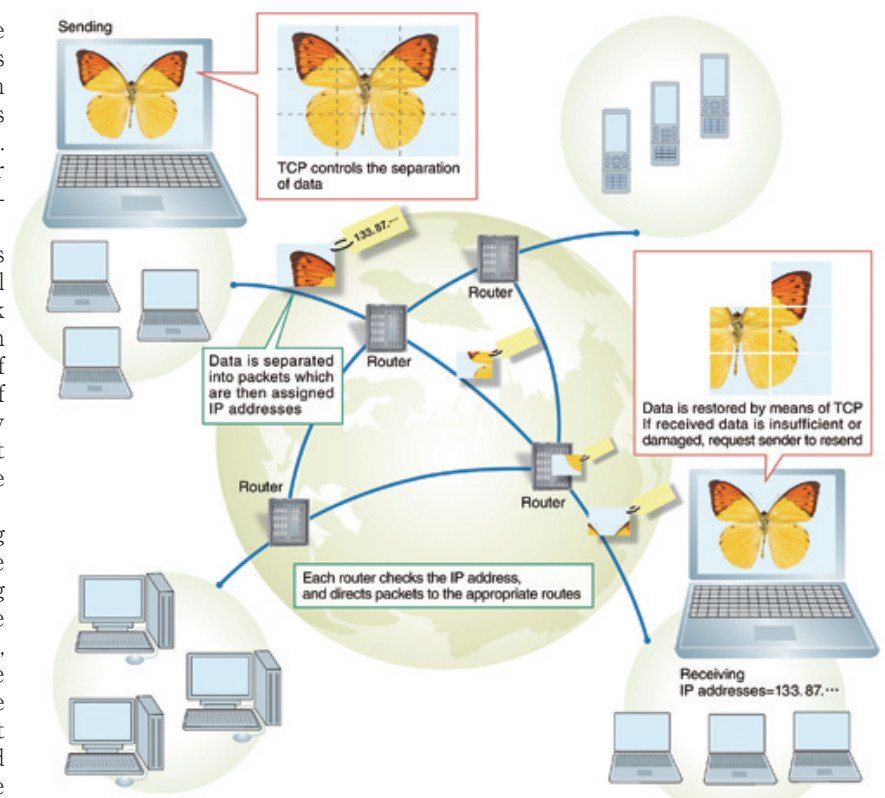
It all started back in 1972. A government-related agency had developed a computer network. Dr. Kahn, who worked at the agency, wondered if it could be possible to link a network connected by telephone line with a wireless communications network. However, the transmission speed, and the content and size of transmitted data differ with telephone and wireless connec-

### What are TCP and IP?

Every computer that is connected to the Internet is assigned a number which acts as its Internet Protocol address. All the data sent from one Internet-connected computer to another is broken down into packets of a predetermined size. Each of these packets of data is given a number when transmitted from the sender to the recipient.

The Internet connects the computer networks of companies, research institutes, etc. on a global scale and enables the establishment of a network of networks. A device known as a router, which connects the networks, identifies the address of the intended recipient and sends the packet of data to another router until the packet finally reaches the intended recipient. The recipient computer restores the original data based on the assigned number.

This mechanism can be likened to freight being transported by containers. The containers act like packets of data, while the router acts as a stopping off point, like a port or railway station. The containers are transported by ship, rail or road, but at the stopping off point, the contents of the containers are not checked and the containers are carried directly to the intended recipient. This set of rules (the rules that instruct the router to send packets to the designated IP address) is the



tions. In addition, compared to telephone connections, wireless transmissions were prone to problems and deemed unreliable.

To compound the problem, nobody had ever attempted to connect two different types of networks, and therefore there was no precedent or model to follow. Dr. Kahn decided to contact Dr. Cerf, who at the time was at Stanford University, and the pair set out to research the problem together. With a view to connecting different types of networks, they developed a communications protocol that could overcome the perceived problems, designated their protocol "TCP" and in 1974 presented the protocol in a joint paper. In the course of time, this TCP underwent further improvements and emerged as the TCP/IP of today.

### **The Roles of the Laureates in the Widespread Dissemination of TCP/IP**

After finally completing the TCP/IP protocols, Dr. Cerf and Dr. Kahn set about discovering how to put the protocols to more widespread use. Dr. Cerf went to work for a private-sector communications company, while Dr. Kahn founded the Corporation for National Research Initiatives (CNRI), a non-profit organization, to research and develop a national communications infrastructure. With their joint efforts to promote the protocols

from their respective positions in both the public and private sectors, TCP/IP became the standard protocols in the United States. At that time, the US led the world in the field of computer sciences, and attracted a large pool of talented researchers from around the globe. These researchers played a prominent role in introducing TCP/IP to their own countries, and the two protocols soon became the global standard.

At around the same time as TCP/IP was completed, several other communication protocols with similar objectives were being developed. However, owing to their stunning simplicity and consequent superiority, TCP/IP was widely adopted as the global standard. Even in the 1970s when the performance of computers was still in its relative infancy, the protocol was of valuable use. Without the foresightedness and creative genius of these two dedicated researchers, the speed of the dissemination and global scale of the Internet as we now know it may not have been possible. Today, the world has come to rely almost totally on the Internet for the communication of information. After laying the basic foundations for the miracle of the Internet, Dr. Cerf, as the Vice-president of Google and, Dr. Kahn, as the Chairman, CEO and President of CNRI, continue to lead the world of information communications.

## Medical Genomics and Genetics

### Achievement

## Establishment of medical genetics and contributions to its development

### Dr. Victor A. McKusick (U.S.A.)

University Professor of Medical Genetics, the McKusick-Nathans Institute of Genetic Medicine at the Johns Hopkins University

#### OUTLINE:

With the completion of the human genome project, we have come to understand almost all of the genetic information contained in DNA, which is encoded in a series of letters. However, we are still some way from fully identifying those parts which are related to the treatment of diseases. Dr. Victor A. McKusick, recipient of the current fiscal year's Japan Prize

in the category of "Medical Genomics and Genetic", has spent over half a century compiling related knowledge, and advocating the importance of the formulation of a genomic map for genetic disorders. Today, researchers and clinicians around the world are sharing the fruits of Dr. McKusick's labors which have become indispensable to the world of genetic medicine.

In the Human Genome Project, which commenced in 1990 and was completed in 2003, the DNA sequence of every single chromosome was determined. Within the determined genomic information, it was discovered that there are in vivo parts that perform vital functions. However, there are also parts of which the function is unclear, and these parts remain merely an undetermined series of letters. From among this seemingly meaningless series of letters, it is important to identify the parts with genetic functions, decode the series of letters and thus clarify the function of the protein. Understanding the relationship between genomic function and genetic diseases is vital to accurate interpretation of the human genome. Dr. Victor A. McKusick has spent over half a century investigating which DNA sequences of which DNA loci cause genetic disorders, and has been steadily compiling related information.

#### From cardiovascular diseases to genetic medicine

Dr. McKusick was born in 1921 into a dairy farming family in a town with a population of approximately 500 residents in the northeastern US state of Maine. In 1943, he was accepted to the Johns Hopkins University, famous for its medical research, where he studied medicine. Specializing in heart-related diseases, Dr. McKusick became interested in Marfan syndrome, a genetic disorder that causes cardiovascular abnormalities. Later he established a field of medical study, known as medical genetics to study the genetic causes, treatments and prevention of inherited diseases, and feverishly set about a genetic mapping (chromosome mapping) project.

#### Laying the foundations for genetic medicine

Marfan syndrome is a genetic disorder of the connective tissue which maintains the shape of the body (e.g. gaps between cells, cartilages, etc.), and is characterized by disproportionately long limbs and fingers. It also affects the heart and cardiovascular valves and vessels, as well as the eyes. It had been known for some time that this was a genetic disease, but as patients were affected in different parts of the body it was not thought to be related to the mutation of a single gene. However, through analyses of vast amounts of data related to Marfan syndrome, Dr. McKusick and his research team at the Johns Hopkins University identified Marfan syndrome as a condition caused by the mutation of a single gene.

In 1956, Dr. McKusick published *Heritable Disorders of Connective Tissues*. Through his clinical experience of patient examination, he realized the importance of identifying the roles of genes in human diseases, and in 1957 he set up the world's first Division of Medical Genetics, a new branch of clinical medicine at the Johns Hopkins University. Today, this research center has been

designated the McKusick-Nathans Institute of Genetic Medicine in commemoration of the achievements of Dr. McKusick. It was here that he devoted his energies to researching various genetic diseases besides Marfan syndrome, and where he became the first person to clarify the genetic role in several diseases including cartilage-hair hypoplasia and McKusick-Kaufmann syndrome.

In 1968, a research team he was leading identified a gene that determines the assignment of a blood type, known as the Duffy blood group locus, or Duffy antigen system, to chromosome 1. This was a landmark discovery that identified the exact location of the specific gene in autosomes, excluding the sex chromosomes, and this led to the world's first attempt at a genetic map. A genetic map gives a detailed depiction of which genes exist on which chromosomes, and on which exact part of each particular chromosome they are located. At the time, the mapping project required a massive amount of research on family lineage and hereditary diseases, and close observations of chromosomes. It was indeed a project on a grand scale that necessitated both a great deal of experience and instinct.

#### The creation of a comprehensive database of genetic diseases

In 1969, Dr. McKusick proposed that the utmost efforts be exerted to identifying the genetic sequence of human chromosomes at the International Conference on Congenital Disease where he reported on his discovery of the Duffy antigen system.

In 1973, Dr. McKusick's team led a Human Gene Mapping Workshop which included several other research groups. The aims of the workshop included information exchanges and the formulation of a system for consistent genetic designation. This workshop later developed into the Human Genome Organization (HUGO).

Dr. McKusick's greatest achievement was his publication of the reference work *Mendelian Inheritance in Man*. First published in 1966, 12 editions of this reference work were printed until 1998, and constitute a comprehensive cataloging of the relations between human genes and genetic disorders.

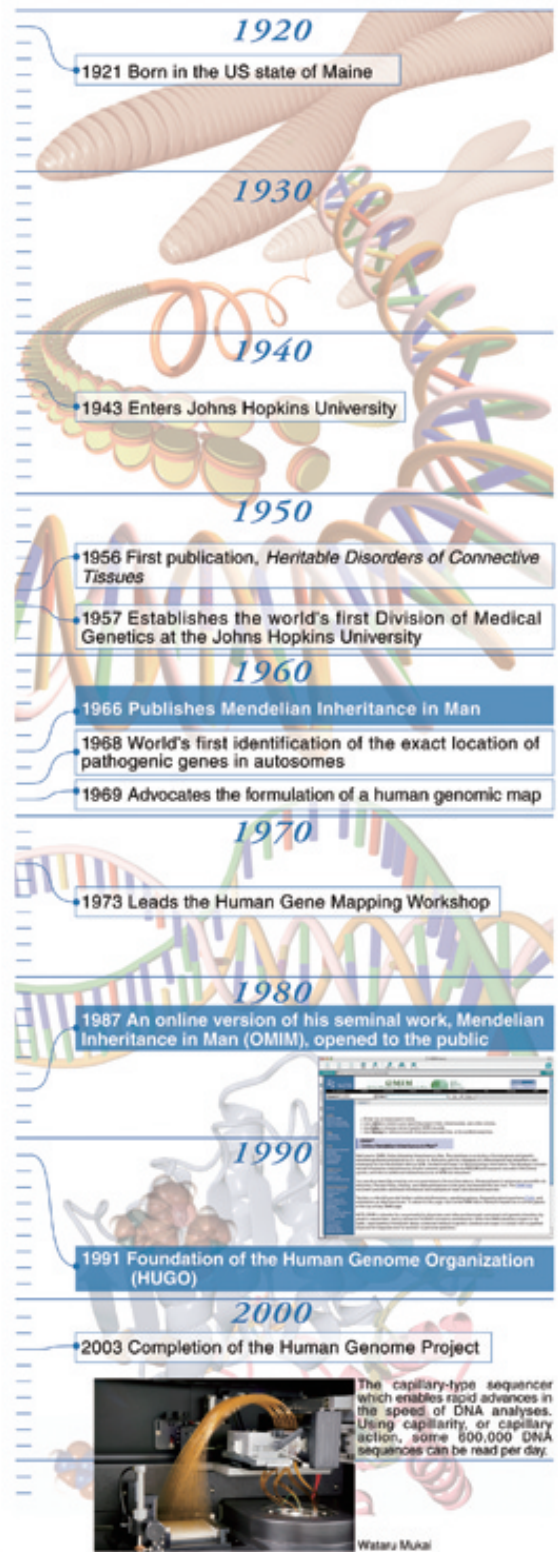
In 1987, an online version of *Mendelian Inheritance in Man* (OMIM) was opened to the public. This online version obtains the latest research data before it is published in scientific journals, and allows researchers and clinicians around the world to access the very latest available information. It is even said that there is no genetic clinician in the world today who has not referred to *Mendelian Inheritance in Man* at some point. Undaunted by the perseverance and endurance necessary for the collecting of such a huge amount of data, Dr. McKusick set about the creation of a framework for the systematic collection of data.

**Leading the Human Genome Project**

Dr. McKusick also worked assiduously toward the foundation of the Human Genome Organization (HUGO), a development of the aforementioned Human Genome Mapping Workshop, in order to bring together researchers on the Human Genome Project to exchange information and to coordinate operations. Dr. McKusick himself served as the first president of the organization. From the production of the very first genetic mapping prototypes through to today's genomic map that is able to determine the entire human genome sequence, Dr. McKusick has been an instrumental figure, constantly playing a leading role in international genetic research.

Dr. McKusick is a man of remarkable foresight. As long as over half a century ago, he strongly advocated giving full recognition to the critical roles played by genes, and this has resulted in the compilation of a vast amount of genetic data that, given the technological innovations in recent years, continues to increase in importance. Dr. McKusick has been instrumental in the establishment of a new field of medical study which is able to utilize genetic data and ascertain the role of genetics in a variety of disorders, and even enables personalized medicine for patients suffering from cancer or diabetes through the ability to determine the slight genetic differences of each individual.

Dr. McKusick has published some 760 academic papers, and his extensive output is further testament to his boundless human compassion and dedication to eradicating genetic disorders in children. Even today, he continues to stand at the forefront of the latest developments in clinical genetics, and the immense respect with which he is accorded around the world makes Dr. McKusick an extremely worthy recipient of the Japan Prize.



## Members of the 2008 (24th) Japan Prize Selection Committee

	Name	Post
Chairman	Nobuaki Kumagai	President of University of Hyogo, Professor Emeritus of Osaka University
Field I Information Communication Theory and Technology		
Panel Chairman	Yasuharu Suematsu	Adviser, National Institute of Informatics
Acting Chairman	Yasuhiko Yasuda	Professor Emeritus, Waseda University
Members	Setsuo Arikawa	Executive Vice President, Kyushu University
//	Kohroh Kobayashi	Professor, Precision and Intelligence Laboratory, Tokyo Institute of Technology
//	Tetsuya Miki	Professor, Department of Information and Communication Engineering, University of Electro-Communications
//	Shojiro Nishio	Dean and Professor, Graduate School of Information Science and Technology, Osaka University
//	Kazuo Tsubouchi	Professor, Research Institute of Electrical Communication, Tohoku University
//	Hiroshi Yasuda	Professor, School of Science Technology for Future Life, Tokyo Denki University
Field II Medical Genomics and Genetics		
Panel Chairman	Kenich Matsubara	President, DNA Chip Research Inc., Professor Emeritus of Osaka University
Acting Chairman	Toshihisa Takagi	Professor, Graduate School of Frontier Sciences, The University of Tokyo
Members	Hiroo Imura	Professor Emeritus, Kyoto University, Chairman, Foundation for Biomedical Research and Innovation
//	Yuji Kohara	Executive Director, Research Organization of Information and Systems
//	Michio Oishi	Chairman, Kazusa DNA Research Institute, Emeritus Professor of the University of Tokyo
//	Kumao Toyoshima	Science Advisor, RIKEN, Member of the Japan Academy
//	Shoji Tsuji	Professor, Graduate School of Medicine and Faculty of Medicine, The University of Tokyo
//	Mitsuaki Yoshida	Visiting Professor, Graduate School of Frontier Sciences, The University of Tokyo, Emeritus Professor of the University of Tokyo

(Title when serving on the committee)

## Categories Selected for the 2009 (25th) Japan Prize

The Science and Technology Foundation of Japan announced the two categories for the 2009 (25th) Japan Prize, and determined their definition as follows.

Letters have been sent to scholars and researchers throughout the world, requesting nominations in the fields in which the award is being made. The selection committee will then recommend candidates to the Board of Directors of the Foundation, and make their decisions.

### Field I: Environment / Infrastructure

"The transformation towards a sustainable society in harmony with nature"

The limits of the global environment have brought us to a point in time when a reassessment is needed of modern technological society rooted in a social foundation of large-scale consumption of energy and resources. As we turn towards a sustainable society in harmony with nature that satisfies basic human needs, confers safety and security, fosters humanitarian qualities and conserves energy while emitting low levels of carbon dioxide, we will need to be able to synthesize knowledge from various fields, including scientific knowledge about the natural world and human activity and highly-evolved information science, together with insights about human societies, in order to achieve social change and re-create a new foundation for society. People are needed who can make a significant contribution to any of the requisite tasks, such as awakening people to the need for change, expressing a vision of the new technological society, creating a social foundation, developing key technologies needed to transform society, or promoting mutual awareness and integration of information and public opinion.

### Field II: Health Care / Therapeutic Technology

"Technological integration of medical science and engineering"

Recent remarkable advances in clinical medicine have been achieved by integration of medicine, engineering, and related fields, enabling progress in the prevention, diagnosis and treatment of disease. Progress has been made in various areas, including imaging techniques, drug discovery, drug delivery systems, telemedicine, regenerative medicine, and simplified diagnostic techniques.

The prize for 2009 will be awarded for innovative contributions to health and health care through the development and application of technological integration of medical science and engineering.

## Members of Fields Selection Committee

	Name	Post
Field I Environment/Infrastructure		
Chairman	Shuzo Nishioka	Advisor, National Institute for Environmental Studies
Members	Tsuneo Katayama	Professor, School of Science and Technology for Future Life, Tokyo Denki University
//	Ryuji Matsuhashi	Professor, Graduate School of Frontier Sciences, The University of Tokyo
//	Shigeru Morichi	Professor, National Graduate Institute for Policy Studies
//	Kotaro Nawa	Research Fellow, Institute of Information Security
Field II Health Care/Therapeutic Technology		
Chairman	Makoto Asashima	Managing Director, Executive Vice President, The University of Tokyo
Members	Mitiko Go	President, Ochanomizu University
//	Setsuo Hirohashi	President, The National Cancer Center
//	Masaki Kitajima	Vice President and Professor, International University of Health and Welfare Director, International University of Health and Welfare Mita Hospital
//	Shigetada Nakanishi	Director, Osaka Bioscience Institute

(Title when serving on the committee)

## Japanese Students Attend the Nobel Prize Award Ceremony

In 1987, the Science and Technology Foundation of Japan (JSTF) instituted a program which began sending two Japanese students to the annual Stockholm International Youth Science Seminar (SIYSS). The event is held during Nobel Prize Week as a means of promoting the international exchange of young scientists, and is conducted under the auspices of the Swedish Federation of Young Scientists and with the support of the Nobel Foundation.

This year, it sent Ms. Yuki Nakata of Sophia University and Mr. Hiroki Nakao of The University of Tokyo to the 32nd SIYSS. Their report follows;

We attended the 32nd Stockholm International Science Seminar (SIYSS) during Nobel week, which was from December 4-10, 2007. SIYSS is held by the Swedish Federation of Young Scientists in connection with the Nobel Foundation. This year we were able to meet 23 other participants from 15 different countries. They were very talented young scientists, who had won competitions in their own countries. All the participants received a kind and warm reception from 11 coordinators from Sweden.

In the program, we had a chance to present our own research in front of a lot of listeners. There were other participants, students in Sweden, and professors who are interested in our research. We have to admit that giving a presentation in English is tough, but it was a great experience. We got some feedback from the audience. They told us that they were interested in our projects and asked us to talk to them in detail. It was a great honour.

Besides, we attended Nobel festivities such as the Press Conference, the Nobel lecture, The Nobel Foundation's reception, and the Nobel Prize Award Ceremony. We also visited the Nobel museum, and several universities and institutions which are world-renowned. It is great to visit such prestigious places. What is more, we were able to talk with several prize winners directly. They were humble and pleasant people, who were modest about their big prizes. In fact, they were so kind and sociable as to talk with us. We were deeply impressed by them.



Research presentation



The ladies dressed in National costumes



All the participants of the 32nd SIYSS

The climax of the seminar was attending the Nobel Award Ceremony. It was an unforgettable experience for us to participate in the formal (award ceremony and Nobel banquet) and informal (night cap) parts of this celebration. We were proud to be present at this historic moment. Not only did we attend the ceremony but we learned about different cultures. During the event, we wore Japanese traditional attire, that is, kimono and hakama. Our fellows showed a great interest in our costumes and asked us about them. We in turn asked them about theirs. It was a great pleasure to share our traditions.

SIYSS has been a precious experience. We studied socially and culturally, as well as academically. We are grateful to The Science and Technology Foundation of Japan (JSTF) for offering us this opportunity, which will have a great influence on our careers and development.