2015 Japan Prize Honors Innovator in River Engineering and Gene Therapy Pioneers

Dr. Yutaka Takahasi helped reduce water-related disasters, Drs. Theodore Friedmann and Alain Fischer were the world’s firsts to propose and clinically prove gene therapy concept

TOKYO (January 29, 2015) - The Japan Prize Foundation today announced that it has selected three distinguished scientists as winners of the Japan Prize, now in its 31st year, that is awarded annually to scientists and researchers in two categories who, regardless of nationality, made substantial contributions to their fields and advancement of science and technology as well as serving the cause of peace and prosperity of mankind.

Dr. Yutaka Takahasi of Japan won the Japan Prize in the field of “Resources, Energy and Social Infrastructure” for his contribution to “development of innovative concept on river basin management and reduction of water-related disasters” as noted in the prize citation. Dr. Theodore Friedmann of the United States and Dr. Alain Fischer of France were recognized in the field of “Medical Science and Medicinal Science” for their “proposal of the concept of gene therapy and its clinical applications.”

Dr. Takahasi, Professor Emeritus of the University of Tokyo, drew his attention early on to the relation between water-related disasters and society. Based on his extensive fieldwork and data analysis on floods, he urged in the 1970s a drastic change in water control policies that were focused on physical infrastructure such as banks. He proposed an integrated flood management approach that includes rivers as well as environment and human communities in river basins. His concept laid the foundation for the 1997 amendment to Japan’s River Act, which is still known as one of the most advanced river-related legislations in the world. Overseas, Dr. Takahasi dedicated himself to fostering regional cooperation and development of human resources in the Asian monsoon region, where the environment and social structures are similar to Japan. His ideas were incorporated into concrete measures in the region and led to significant reduction in flood disasters and improvement of the river environment.

Dr. Friedmann, currently Professor of Pediatrics at the University of California San Diego, School of Medicine, proposed the concept of gene therapy in the 1970s and pioneered the
early phase of basic research in the field. Regarded internationally as the “father of gene therapy,” he has also been at the vanguard of ethical issues surrounding this field as an opinion leader for the past 40 years. On the other hand, Dr. Fischer used hematopoietic stem cell gene therapy to treat children with a fatal genetic disorder called X-linked severe combined immunodeficiency, or X-SCID, and has clinically demonstrated efficacy of gene therapy with dramatic effectiveness for the first time in the world - realizing what was once thought to be a miracle cure. Dr. Fischer has been Director of Institut Imagine in Paris, a leading research institute on genetic diseases, since 2007 and Professor at Collège de France since 2014.

The Foundation will host an award ceremony to honor the laureates of the 2015 Japan Prize on April 23 in Tokyo. Each of them will receive a certificate of recognition and a commemorative gold medal. A cash award of 50 million Japanese yen (approximately US$420,000) will also be given to each prize field.

Currently, the Foundation is in the initial stage of the nomination process for the 2016 Japan Prize, asking its selected nominators across the globe to turn in the names and achievements of the candidates who they think deserve the prestigious international prize in the fields of “Materials and Production” and “Biological Production and Biological Environment.” The submission deadline is the end of February 2015.

About Japan Prize Foundation
Since its inception in 1985, the Japan Prize Foundation has awarded the Japan Prize to 83 people from 13 countries. In addition to awarding the Japan Prize, which is endorsed by the Japanese government, the Foundation has been hosting "Easy-to-Understand Science and Technology" seminars and awarding research grants to help nurture young scientists and further promote the advancement of science and technology. For additional details about the Japan Prize Foundation and its activities, please visit http://www.japanprize.jp/en/.

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Citation: “Resources, Energy and Social Infrastructure” Field

Yutaka Takahasi, Ph.D. (Japan)

Achievement: Contribution to development of innovative concept on river basin management and reduction of water-related disasters

Award Citation:

By conducting extensive fieldwork and data analysis on floods since the mid 1940s, Dr. Takahasi scientifically proved that the increase of flood discharge in Japan is due to the change of river basins by urbanization and the construction of levees from the Meiji era onward. From the findings, he drew his attention to the relation between water-related disasters and society, and in his publication “Transformation of National Land and Water-related Disasters” (1971) proposed that river improvement policies should be pursued in consideration of the river basin, rather than focusing only on physical infrastructure such as banks as had been the case traditionally.

Based on Dr. Takahasi’s concept, comprehensive flood control such as placement of regulation reservoirs and underground infiltration facilities in river basins began to be implemented in 1980 across 17 river basins in urban areas, where water-related disasters were intensifying due to the development. The new policies have since been implemented in many river basins throughout Japan, resulting in significant reduction of water-related disasters.

Furthermore, in his book “River Engineering” (1990), Dr. Takahasi pointed out the importance of taking into consideration historical and environmental aspects of river and hydrological cycle as well as public involvement in river planning, and established a new field of river engineering that incorporates flood control, water resources and environment, thereby leading to an innovative concept of water-based national land management. This laid the foundation for the 1997 amendment to Japan’s River Act, which not only added the concept of the water environment to traditional flood control and water resources, but also included provisions for public involvement, and went on to produce significant results by invoking the national government to take action. Even today, this River Act is known as one of the most advanced river-related legislations in the world.

In overseas, Dr. Takahasi built a cooperative framework with participation from 13 countries in the Asian monsoon region, where the environment and the social structures are similar to Japan, and dedicated himself to fostering regional cooperation and development of human resources. As a result, those countries incorporated his ideas into concrete measures, significantly reducing flood disasters and improving the river environment. In particular, Dr. Takahasi recommended in the UN report on the 1991 Bangladesh cyclone and storm surge, which caused approximately 140,000 casualties, that provision of information on evacuation and preparation of shelters were more important than construction of banks in that region. His recommendations were implemented with Official Development Assistance by several countries. As a result, the number of casualties from the 2007 storm surge disaster of the same magnitude in that area was confined to about 4,000.

In 2009, the International Journal of Water Resources Development, the most authoritative journal in the field of water resources, applauded Dr. Takahasi for his enormous contribution towards water resources management and flood control across the Asian monsoon region, in its first ever article featuring an individual.
Dr. Takahasi thoroughly reexamined the policies in Japan that had relied solely on physical infrastructure such as banks and dams, and ultimately established a globally applicable concept of river basin management in a frame of a social system, that includes such as rainwater storage, infiltration technology, and information systems. Furthermore, Dr. Takahasi developed his concepts into concrete measures internationally, thereby contributing to the peace and prosperity of our society through the reduction of water-related disasters. It is for these outstanding achievements that Dr. Takahasi is deemed most eminently deserving of the 2015 Japan Prize given to honor contributions in the fields of “Resources, Energy and Social Infrastructure”.
Yutaka Takahasi, Ph.D.
Professor Emeritus, University of Tokyo

Nationality: Japan

Date of Birth: January 28, 1927 (88 years old)

Academic Degrees:
1950 University of Tokyo, B.E. in Engineering
1964 University of Tokyo, Ph.D. in Engineering

Professional Career:
1955 Lecturer, Faculty of Engineering, University of Tokyo
1961 Associate Professor, Faculty of Engineering, University of Tokyo
1968 Professor, Faculty of Engineering, University of Tokyo
1987 Professor emeritus, University of Tokyo
1987-1998 Professor, Faculty of Engineering, Shibaura Institute of Technology
2000-2010 Senior Academic Adviser, United Nations University

Affiliation:
La Société Franco Japonaise des Technique Industrielles
Association for Rainwater Storage and Infiltration Technology
Natural Environment Coexistence Technology Association

Major Publications:

Major Awards:
1978 Nepal Suprabal Gorakha Dakshin Bafu
1981 L’Ordre des Palmes Académiques, Chevalier (France)
1987 National Land Agency Achievement Award for Water Resources
1994 Meijimura Award
1998 JSCE (Japan Society of Civil Engineers) Achievement Award
2000 IWRA (International Water Resources Association) Crystal Drop Award
2007 The Order of the Sacred Treasure, second class
2011 JAGH (Japanese Association of Groundwater Hydrology) Academic Award

(January 2015)
Citation: “Medical Science and Medicinal Science” Field

Theodore Friedmann, M.D., MA (Oxon) (U.S.)
Alain Fischer, M.D., Ph.D. (France)

Achievement: Proposal of the concept of gene therapy and its clinical applications

Award Citation:

Gene therapy for genetic diseases and numerous refractory diseases is one of the most revolutionary and advanced medical treatments of the 21st century. In recent years, its dramatic clinical effectiveness on various refractory and fatal diseases is increasingly being reported. Amongst the trend of successful clinical applications, it was Dr. Friedmann and Dr. Fischer who made history by playing a crucial role in its development.

During the 1970s, Dr. Friedmann became the first to propose the concept of gene therapy and, with his colleagues, to provide the first proof of the concept in disease models and to show the potential effectiveness of hematopoietic stem cell gene therapy through animal experimentation. He and his co-workers contributed to the development of core technologies surrounding today’s transgenic vectors, thereby pioneering the way for basic development research on gene therapy. Furthermore, Dr. Friedmann has been at the forefront of ethical issues surrounding this field, for he has been an opinion leader for the past 40 years and is called the “father of gene therapy”.

Dr. Fischer, on the other hand, was the world’s first to clinically prove the dramatic effectiveness of gene therapy. He conducted hematopoietic stem cell gene therapy on children with fatal X-linked severe combined immunodeficiency (X-SCID), and in 2000, the announcement of its dramatic effectiveness sent a shockwave throughout the world’s clinicians and medical researchers. While the progress of this gene therapy was held back for causing leukemia in certain cases, Dr. Fischer and his colleagues identified the cause and devised a safety measure, and through long-term follow-up, the effectiveness of gene therapy was shown to surpass the traditional hematopoietic stem cell transplantation. Furthermore, Dr. Fischer and his colleagues discovered that hematopoietic stem cell gene therapy with a lentiviral vector is able to suppress the progression of the clinical symptoms of adrenoleukodystrophy.

In addition to these successful cases, hematopoietic stem cell gene therapy is now enabling children with adenosine deaminase deficiency to live normal lives. There has also been a string of reports on the effectiveness of gene therapy with an adeno-associated virus vector on diseases such as Leber’s congenital amaurosis, Parkinson’s disease, haemophilia B and lipoprotein lipase deficiency.

As described, Dr. Friedmann overcame numerous difficulties to propose the concept of gene therapy, which has now flourished, and pioneered the early phases of basic research on gene therapy. Dr. Fischer, on the other hand, clinically proved the dramatic effectiveness of gene therapy on fatal genetic diseases and realized what was once thought to be a miracle treatment. It is for these outstanding achievements that Dr. Friedmann and Dr. Fischer are deemed most eminently deserving of the 2015 Japan Prize given to honor contributions in the fields of “Medical Science and Medicinal Science”.

Theodore Friedmann, M.D., MA (Oxon)
Professor of Pediatrics
University of California San Diego, School of Medicine

Nationality: United States of America

Date of Birth: June 16, 1935 (79 years old)

Academic Degrees:
1956 A.B. in Chemistry from University of Pennsylvania
1960 M.D. from University of Pennsylvania
1995 M.A. from University of Oxford

Professional Career:
1960-1962 Children's Hospital Medical Center, Boston, Massachusetts
1962-1963 U.S. Air Force, Captain, 10th Tac., Hospital, Alconbury, England
1963-1964 University of Cambridge, England, Research Fellow in Colloid Science
1964-1965 Children's Hospital Medical Center, Boston, Massachusetts, and Teaching and Research Fellow, Harvard University
1965-1968 National Institutes of Health, Bethesda, Maryland
1969-1973 University of California, San Diego, Assistant Professor of Pediatrics
1973-1981 University of California, San Diego, Associate Professor of Pediatrics
1981-Present University of California, San Diego, Professor of Pediatrics

Affiliation: University of California, San Diego
Department of Pediatrics
9500 Gilman Drive, La Jolla, CA 92093-0634, U.S.A.
Phone: 858-534-4268 or 858-822-1013

Major Publications:

Major Honors:
1984-85 UCSD’s Faculty Research Lecturer Award
1992 University of California, Chancellor’s Associates Award for Excellence in Research
1995 The 1995 H.C. Jacobæus Prize of the Nordic Research Committee and Nordic Insulin Foundation, Lund, Sweden
1996 The 1996 Cross of Honor for Science and the Arts, Republic of Austria
1996 Salvador Zubiran Medal of Mexico
1996 The Newton-Abraham Visiting Professorship at the University of Oxford
2003 The Award of Merit from National Institutes of Health (NIH)
2006 Distinguished Graduate Award from the University of Pennsylvania
2006 President of American Society of Gene Therapy
Alain Fischer, M.D., Ph.D.
Professor at Collège de France
Director of Institut Imagine, Hôpital Necker-Enfants malades

Nationality: Republic of France

Date of Birth: September 11, 1949 (65 years old)

Academic Degrees:
1979  M.D. from Université Paris Descartes
1979  Ph.D. from Université Paris Jussieu

Professional Career:
1980-1981 Postdoctoral fellowship in Immunology at University College London
1984-1988 Tenured clinical position in the Pediatric Immunology Department, Hôpital Necker-Enfants malades
1988-2013 Professor of Pediatric Immunology (Université Paris Descartes)
1991-2013 Director of INSERM Unit 768 for “Développement Normal et Pathologique du Système Immunitaire (Normal and pathological development of the immune system),” Hôpital Necker-Enfants malades, Université Paris Descartes
1996-2012 Director of Pediatric Immunology Department, Hôpital Necker-Enfants malades
2006-present  Professor at Institut Universitaire de France
2007-present  Director of Institut Imagine (Institut des maladies génétiques), Hôpital Necker-Enfants malades, Université Paris Descartes, Inserm U1163
2014-present  Professor at Collège de France (chaire de médecine expérimentale)

Affiliation: Institut Imagine
24 Boulevard Montparnasse
785015 Paris, France

Major Publications:


Major Honors:
1984 Halpem Prize
1992 Prix Behring-Metchnikoff
1994 Prix du Comité du Rayonnement français
1998 Jung Prize for Medicine (Hamburg)
2000 Prix Pierre Royer
2000 NRJ Foundation – Institut de France – Award
2001 Joint winner of the Louis-Jeantet Prize for Medicine
2001 Novartis Prize for Clinical Immunology
2003 A. Philipson Prize (Stockholm)
2005 Honorary Degree of the University of Zurich
2005 Descartes Prize (European Community)
2008 INSERM Grand Prix
2010 Officier de la Légion d’honneur
2011 Senior advanced grant from ERC (European Research Council)
2012 Avery Landsteiner prize
2013 Grand prix Claude Bernard de la ville de Paris
2013 Sanofi-Pasteur prize
2014 Robert Koch prize

Memberships:
2002 Member of the European Molecular Biology Organization
2002 Member of the French Academy of Science
2009 Member of the Academia Europea

(As of January 2015)
2015 Japan Prize Week
Main Events (Tentative)

Tuesday, April 21
• Courtesy Visit to the Japan Academy
• Commemorative Lectures at the Ito International Research Center, the University of Tokyo

Wednesday, April 22
• Academic Roundtable Discussions

Thursday, April 23
• Award Presentation Ceremony at Tokyo International Forum
• Banquet at Palace Hotel Tokyo

Friday, April 24
Move to Kyoto

Saturday, April 25
Sightseeing in Kyoto

(January 2015)
Press Conference
Announcing 2015 Japan Prize Laureates

January 29, 2015
ARK HILLS CLUB, Tokyo

<Program>

1. Introduction  
Mr. Hiroshi Nakamura  
Senior Executive Director, The Japan Prize Foundation

2. Opening Remarks  
Dr. Yoshio Yazaki  
President, The Japan Prize Foundation

3. Announcement of 2015 Japan Prize Laureates  
Prof. Hiroshi Komiyama  
Chairman, 2015 Japan Prize Selection Committee

4. Introduction of 2015 Japan Prize Laureates

Field: Resources, Energy and Social Infrastructure  
Prof. Makoto Misono  
Chairman, Selection Subcommittee  
Acceptance speech by the 2015 Japan Prize Laureate in the Field

Field: Medical Science and Medicinal Science  
Prof. Takehiko Sasazuki  
Chairman, Selection Subcommittee  
Acceptance speeches by the 2015 Japan Prize Laureates in the Field

5. Q&A

6. Photo Session
Nominations and Selection Process

- Every November, the Field Selection Committee of The Japan Prize Foundation designates and announces two fields in which the Japan Prize will be awarded two years hence. At the same time, the Foundation calls for over 10,000 nominations, which are evaluated from around the world invited by the Foundation, to nominate the candidates through the web by JPNP (Japan Prize Nomination System).
- The deadline for nominations is in the end of February of the following year:
- For each field, a Selection Subcommittee conducts a rigorous evaluation of the candidates’ academic achievements. The conclusions reach the Foundation’s Selection Committee, which conducts evaluations of candidates’ achievements from a wider perspective, including contributions to the progress of science and technology, and significant advancement towards the causes of world peace and prosperity, and finally the selected candidates are recommended for the Prize.
- The recommendations are then sent to the Foundation’s Board of Directors, which makes the final decision on the recipients.

The nominations and selection process takes almost one year from the time that the fields are decided. Every January, the winners of that year’s Japan Prize are announced. The Foundation Committee in April is held in Tokyo. The Japan Prize Ceremony is held on April 23, 2015. The Fields Selection Committee for the 2016 Japan Prize will be held in October 2014.

Fields Eligible for the 2016 Japan Prize

Materials and Production

Background and rationale:

The 2016 Japan Prize in the fields of “Materials and Production” will be awarded to individuals who have made significant contributions to society by achieving momentous scientific and technological breakthroughs that improve the quality and safety of people’s lives while ensuring the efficiency of production processes.

Achievement eligible:

In order to realize effective use of large amounts of biomass in a sustainable society, for the future, a novel paradigm for the development of materials and production technologies with functions and governing techniques for industrial design, production, and operation are necessary.

Biological Production and Biological Environment

Background and rationale:

The existence of human beings is completely dependent on the continuous and diverse use of Earth’s biological resources. In recent years, however, the biological environment of our planet, which constitutes indispensable biological resources, is deteriorating rapidly. Despite many technological innovations that have dramatically increased our food production capacity, our homo sapiens is yet to recognize the capacity of the earth to produce food and environmental issues are on the rise.

Achievement eligible:

The 2016 Japan Prize in the fields of “Biological Production and Biological Environment” will be awarded to individuals who have made significant contributions to the safety of the earth’s surface by achieving momentous scientific and technological breakthroughs in the improvement of biological production of food and other useful materials to create a healthier and safer world as well as to ensure their safety, or in the development of technologies that will maintain and enhance the health of our society in the environment as an essential environmental cornerstone. This helps in protecting and restoring the biological environment and biodiversity.

Fields Selection Committee for the 2016 Japan Prize

Materials Production and Production Processes

Chairman: Professor Keiko Sasaki

Member: Senior Corporate Advisor, Hitachi Maxell, Ltd., Hiroshi Kuwahara

Member: Advisor to Ministry of Education, Culture, Sports, Science and Technology, Kazuhito Hashimoto

Member: Journalist, Op-Ed Section, The Asahi Shimbun, Masakatsu Shibasaki

Biological Production and Biological Environment

Chairman: Professor Shinichiro Ohgaki

Member: Director of Institut Imagine, Professor Hiroshi Komiyama

Member: Associate Professor of University of Tokyo, Dr. Kazuhito Hashimoto

Member: President of The University of Tokyo, Professor Yutaka Takeda

Field Recommendation

Field for Materials and Production

Field for Biological Production and Biological Environment

The fields eligible for the Japan Prize (2016 to 2018) have been decided for the two research areas, respectively. These fields rotate every three years, basically. Every year the Fields Selection Committee announces the eligible field for the next three years.

Schedule (2016-2018)

Year | Eligible Field
--- | ---
2016 | Materials Production
2017 | Biological Production and Biological Environment
2018 | Materials Production

The Japan Prize Foundation has decided the recipients of the 2015 (15th) Japan Prize. In the field of “Resources, Energy and Social Infrastructure,” Dr. Theodore Friedmann and Prof. Alain Fischer, who have proposed and demonstrated that “the production of innovative concepts on river basin management and reduction of water-related disasters,” has led to significant reduction of water-related disasters and improvement in river transport in Japan and overseas, especially in the Asian monarch regions.

In the field of “Medical Science and Medical Science,” Dr. Theodore Friedmann of the United States and Prof. Alain Fischer of France were selected for the “proposition of the concept of gene therapy and its clinical applications.” During the 1970s, Dr. Friedmann became the first to propose the concept of gene therapy, and Prof. Fischer was the world’s first to clinically demonstrate effective use of genetic therapy.

To honor the three distinguished scientists, an award-presentation ceremony will be held in Tokyo on April 23, 2015.

The Japan Prize Foundation

JAPAN PRIZE

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Transition in the damage costs due to post-war floods (trillion yen)

Example of the comprehensive flood control measures of Tsurumi River

This is an example of the present “comprehensive flood control measures,” which is a realization of Dr. Takahasi’s river philosophy. Not only river improvement the goal, but also through non-structural measures such as water source preservation and maintenance of a sound water cycle, the reduction of flood disaster risks as well as protection of lives in the event of a disaster are targeted.

Summary of comprehensive flood control measures

Structural measures
- River improvement
- Basin management
- Land use adjustment
- Flood control reservoir

Non-structural measures
- Water source preservation
- Water proofing of facilities
- Warning / evacuation system
- Flood information support

Transition in the damage costs due to post-war floods (trillion yen)
Dr. Takahasi became assistant professor of the Faculty of Engineering at the University of Tokyo in 1961 and took up a professorship there in 1968. He inspired his students to study by often telling them to “look closely at the rivers.” That meant not only observation of the river itself, but also the geographical features of the river basin and flora, and furthermore the lives of the people living there. Dr. Takahasi’s research can be said to be the origin of “interdisciplinary research,” not confined to a specific discipline.

In 1971, Dr. Takahasi published a new perspective obtained from such extensive field surveys in a book entitled “Land Transformation and Flood Disasters.” In his writing, proposals to implement flood control measures in relation to the river basin were incorporated, and not merely flood control with structures such as banks.

This new concept led to major changes in national flood control projects. From 1980 onward, “integrated flood control” measures were implemented to suppress flood runoff by building retarding basins and regulating reservoirs in areas where rainwater flows into major rivers. In particular, this approach was implemented nationwide starting with urban areas with major rivers running through them, which suffered intensified flood damage due to post-war development. These measures brought about far reaching effects on the mitigation of flood damage.

Efforts to counter flood disasters in the monsoon region
Changing the world through renewed river philosophy

Dr. Takahasi has been peering into Japanese rivers since the end of World War II. In 1990, he wrote a university text book entitled “River Engineering,” in which a renewed river philosophy, not seen in conventional river engineering, was incorporated in many areas. Conventionally, emphasis was placed on flood control and water utilization along the river course (the course to which water runs), but more important is to widen one’s perspective to the river basin. Additionally, suggestions were made to contemplate the effects that river projects have on the environment and to consider public involvement in river planning. A new river engineering system was created that integrates the river, the natural environment and residents’ living space into one.

Furthermore, Dr. Takahasi proposed to protect the “sound water cycle” in the nation’s water administration. Before that time, water was categorized into rivers, underground water and agricultural water, and managed independently by respective administrative sectors. However, in order to efficiently utilize this precious resource, he asserted the need for law that allows for a unified management in the light of the water cycle of the river basin. His idea was reflected in the “basic water cycle law” sponsored by a cross-party group of lawmakers that was enacted in 2014.

As an overseas endeavor, Dr. Takahasi developed a cooperation system of 13 countries in the Asia monsoon region, where the natural and social environment is similar to that of Japan, and has exerted himself to establish regional cooperation and human resource development in this field. As a result, flood damage in this region has been mitigated and improvements in the river environment have been achieved. In particular, regarding the cyclone disaster in Bangladesh which claimed approximately 140,000 lives in 1991, he authored the United Nations report that proposed to “improve the provision of information and shelter for evacuation over bank improvement.” Based on the proposal, improvements with ODA assistance also progressed, so that in a similar-scale storm surge disaster which occurred in 2007, the victims were reduced to approximately 4,000.

In 2009, the International Journal of Water Resources Development, the most prestigious specialized international journal in the water resources sector, issued a special issue dedicated to Dr. Takahasi, featuring an individual for the first time in the journal’s 25-year history to praise his great contributions in the field of water resources and flood control.

In recent years, amid frequent occurrences worldwide of large scale flood disasters deemed attributable to global warming, new flood control measures and water resource management are sought after. The river philosophy advocated by Dr. Takahasi will no doubt live on as the foundation of flood control measures of the next generation.
**Achievement : Proposal of the concept of gene therapy and its clinical applications**

**Dr. Theodore Friedmann**  
Born: June 16, 1935 (Age: 79)  
Professor of Pediatrics, University of California San Diego, School of Medicine

**Prof. Alain Fischer**  
Born: September 11, 1949 (Age: 65)  
Professor at Collège de France, Director of Institute Imagine, Hôpital Necker-Enfants malades

**Summary**

“Injecting genes or gene-transduced cells into a human body for the purpose of treating diseases” is called gene therapy. In the last few years, there has been a series of reports on confirming clinical efficacy of gene therapy in patients suffering from difficult-to-treat diseases, such as congenital diseases and intractable neurological diseases. The origin of gene therapy can be traced back about 40 years ago to 1972, when Dr. Theodore Friedmann published an article on the revolutionary therapeutic concept and research procedure in a scientific journal. In the years following that event, many researchers carried out fundamental research. Clinical studies started in 1990, but no convincing clinical efficacy could be established. After a period of trial and error, in 1999, Prof. Alain Fischer successfully implemented a hematopoietic stem cell gene therapy on patients with X-linked severe combined immunodeficiency disease with dramatic results, proving the efficacy of gene therapy. The vision of gene therapy as portrayed by Dr. Friedmann and the empirical study carried out by Prof. Fischer paved the way for the present gene therapy.

**Delivering a normal, therapeutic gene into a defective cell by using a virus as a carrier**

Humans differ in many properties, such as height, hair color, and some have a tendency to be overweight while others don’t. The reason is that the information inscribed in our genes differs slightly from person to person. Sometimes an abnormality in the gene can cause an inherent disease (congenital disease). For example, if the gene producing adenosine deaminase (ADA), an enzyme related to nucleic acid metabolism in the cell, has an abnormality, lymphocytes which control the immune system cannot proliferate even after birth, so that without treatment, the individual would have severe immunodeficiency. Hemophilia and muscular dystrophy are also examples of typical congenital diseases.

In treating such diseases with few effective treatment options, progress in the field of “genetic engineering” provided a ray of hope. In the early 1970’s, the technology of isolating desired genes and transducing them to cells was developed. Many clinicians anticipated that “inserting normal genes to patients would lead to a fundamental cure for congenital diseases.”

Amid such a climate, it was Dr. Theodore Friedmann, an assistant professor at the University of California, San Diego, who set the course for the realization of gene therapy based on scientific data.

For example, what is required in gene therapy is “safely transducing the target gene into the patient’s body” and “long-term stable gene expression within the body.” In 1972, Dr. Friedmann and his colleague, Dr. Richard Roblin, co-authored an article in the Science journal. In the article, they explained the concept and importance of gene therapy, as well as the importance of the method using a virus as a gene delivery vector in injecting normal genes into the patient. They also indicated that there were many obstacles to be cleared before it could be put into clinical application.

The word “vector” originates from a Latin word meaning “carrier.” A virus multiplies by transducing its genes into the cell it infects and using the cell’s function. The idea is to use this virus as a carrier to deliver the desired therapeutic gene into the defective cell in order to recover the lost function. Among such viruses, retrovirus has the characteristic to be able to insert a gene into the cell chromosome, enabling a relatively stable gene expression to take place. Thus, retroviruses were thought to be the most promising as a gene delivery vector.

**First dramatic clinical effect demonstrates efficacy of gene therapy**

With the advocacy of gene therapy by Dr. Friedmann and his colleagues, researchers worldwide embarked on the study, and anticipation toward clinical application was heightened. In 1982, the U.S. presidential commission for the study of ethical problems in medicine and biomedical research published a report on the social and ethical issues of genetic engineering with human beings, and in 1986, gene therapy guidelines were announced by the U.S. National Institute of Health (NIH).

It seemed as if the time was ripe for gene therapy; in the 1990’s researchers worldwide were competing to conduct clinical studies. In 1990, the world’s first gene therapy was carried out on patients with ADA deficiency, a severe inherited immune system disorder, by a research group headed by the NIH in the United States. In 1995, Hokkaido University in Japan performed gene therapy for the same disease.

However, the initial results of such therapy did not live up to expectations. In 1997, Dr. Friedmann wrote in a scientific journal: “So far no approach has definitively improved the health of a single one of the more than 2,000 patients who have enrolled in gene therapy trials. This lack of a convincing therapeutic benefit is sobering.” Reasons cited for the ineffectiveness included that genes introduced into the patients did not reach enough of the appropriate cells and that with time, the transduced genes shut off protein synthesis in the target cell.

While the researchers felt they’re at an impasse, a research group headed by Prof. Alain Fischer, Director of the Department of Pediatric Immunology at Hôpital Necker-Enfants malades in France, achieved a breakthrough. He successfully performed gene therapy on patients with X-linked severe combined immunodeficiency disease (X-SCID), an inherent immune system disorder caused by a defect on the X chromosome.

There was a difference in the target cells between the first gene therapy carried out in 1990 in the U. S. and Prof. Fischer’s method used in 1999. In the 1990 trial, genes were transduced to lymphocytes extracted from the body and the genes had to be administered many times to maintain a therapeutic level. On the contrary, Prof. Fischer first isolated hematopoietic stem cells of the bone marrow, the source of lymphocytes, and inserted genes into the stem cells. Thus, even with a single administration, the hematopoietic stem cells continue...
The article presented by Prof. Fischer in 2000 provided a strong impact and courage to researchers worldwide. It instilled confidence that when the biological characteristics of the target cells and the transduction vectors were thoroughly examined, there was great potential for gene therapy to play a major part in next-generation medicine.

**Overcoming twists and turns, gene therapy making strides towards practical application**

Even after that time, gene therapy had many twists and turns. Prof. Fischer himself suspended the therapy temporarily in 2002. His patients who were undergoing the therapy were diagnosed with leukemia one after another. In addition, in an altogether different type of gene therapy, there was a fatal incident related to gene therapy in the United States in 1999.

Due to such circumstances, gene therapy had to be carried out with further discretion. Prof. Fischer and his colleagues identified the cause of the problem and implemented safety measures. By means of long-term follow-up on patients, they established the scientific evidence that “regarding severe immunodeficiency, gene therapy has shown efficacy equal to conventional hematopoietic stem cell transplant treatment, and is a safer option of the two.”

After fatal side-effect incidents, clinical studies on gene therapy were stagnant. However, from around 2008, successful cases of gene therapy were successively made public. One new trend of research was the active implementation of gene therapy using an adeno-associated virus (AAV) vector.

In addition, not only were inherent diseases, which were the original target of gene therapy, but it is also noteworthy that the scope of gene therapy was now expanded to include acquired diseases as well. Thus, the idea shifted from “curing the gene” (ultimate gene therapy) to “curing with the gene” (the majority of present gene therapy). In other words, this means not to make abnormal genes normal, but to transduce genes with the desired therapeutic functions.

One example of this is gene therapy for Parkinson's Disease. AAV vectors are capable of gene delivery to terminally differentiated cells such as nerve cells which do not divide, thus enabling long-term gene expression. In a clinical study which transduced genes synthesizing a neurotransmitter called dopamine, which is lacking in Parkinson’s patients, improvement in symptoms was verified in patients.

Gene therapy is now making significant progress. To get to this point, Dr. Friedmann’s foresight with his scientific vision of gene therapy and Prof. Fischer’s achievements in realizing that vision both proved to be indispensable.
Nominations and Selection Process

- Every November, the Field Selection Committee of The Japan Prize Foundation designates and announces two fields in which the Japan Prize will be awarded two years hence. At the same time, the Foundation calls for over 10,000 nominations, strictly comprised of prominent scientists and researchers from around the world invited by the Foundation, to nominate the candidates through the web by JPNP (Japan Prize Nomination System). The deadline for nominations is the end of February of the following year.

- For each field, a Selection Subcommittee conducts a rigorous evaluation of the candidates' academic achievements. The conclusions reached by the Selection Subcommittee, which conducts evaluations of candidates' achievements from a wider perspective, including contributions to the progress of science and technology, and significant advancement towards the causes of world peace and prosperity, finally the selected candidates are recommended for the Prize.

- The recommendations are then sent to the Foundation's Board of Directors, which makes the final decision on the recipients.

- The nomination and selection process takes almost one year from the time that the fields are decided. Every January, the winners of that year's Japan Prize are announced. The Presentation Ceremony is held in April in Tokyo.

Members of the 2015 Japan Prize Selection Committee

- The Japan Prize Selection Committee is organized into three Selection Subcommittees: the “Resource, Energy and Social Infrastructure” Field, the “Medical Science and Medicinal Science” Field, and the “National Science and Technology” Field.

- The Selection Subcommittees consist of internationally prominent scientists and researchers from various fields, who are selected by a number of academic institutions and societies.

- The Selection Subcommittees for the “Resource, Energy and Social Infrastructure” Field consists of experts in fields related to the environment, energy, and infrastructure.

- The Selection Subcommittees for the “Medical Science and Medicinal Science” Field consists of experts in fields related to medicine, pharmacology, and healthcare.

- The Selection Subcommittees for the “National Science and Technology” Field consists of experts in fields related to various aspects of science and technology.

- The Selection Subcommittees are responsible for selecting the candidates for the Japan Prize from the nominations received.

2015 Japan Prize Laureates Announced

Dr. Yutaka Yokota, river engineer who helped reduce disasters with his comprehensive flood control concept, and Dr. Theodore Friedmann and Prof. Alain Fischer, the first to propose and clinically prove gene therapy concept.
Members of the 2015 Japan Prize Selection Committee

- Dr. Katsuhiko Shirai
- Dr. Makoto Misono
- Dr. Hiroshi Komiyama

Selection Subcommittee for the “Medical Science and Medicinal Science” field

- Dr. Hiroshi Honda
- Dr. Takehiko Sasazuki
- Dr. Shunsuke Ikeda

Selection Subcommittee for the “Resources, Energy and Social Infrastructure” field

- Dr. Toru Nakano
- Dr. Kazunari Domen
- Dr. Akira Yabe

Selection Subcommittee for the “Physics, Chemistry and Materials Science” field

- Dr. Osamu Yamanaka
- Dr. Sumio Sugano
- Dr. Akira Yabe

Selection Subcommittee for the “Engineering and Science of Manufacturing” field

- Dr. Toru Nakano
- Dr. Kazunari Domen
- Dr. Akira Yabe

Selection Subcommittee for the “Information Science and Technology” field

- Dr. Chen-Phang Guo
- Dr. Hiroshi Honda
- Dr. Masakatsu Shibasaki

Selection Subcommittee for the “Social Sciences and Humanities” field

- Dr. Shinichiro Ohgaki
- Dr. Makoto Misono
- Dr. Hiroshi Komiyama

Judges

- Dr. Hiroshi Honda
- Dr. Takehiko Sasazuki
- Dr. Shunsuke Ikeda

Selection Committee

- Dr. Toru Nakano
- Dr. Kazunari Domen
- Dr. Akira Yabe

Nominations and Selection Process

- Every November, the Selection Subcommittee of The Japan Prize Foundation designates and announces two fields in which the Japan Prize will be awarded two years hence. At the same time, the Foundation calls for over 10,000 nominations from all over the world. This round of nominations and selection will therefore be conducted from around the world received by the Foundation, to nominate the candidates through two processes: JPNS (Japan Prize Nomination System). The deadlines for nominations are the end of the following year:

- For each field, a Selection Subcommittee conducts a rigorous evaluation of the candidates' academic achievements.
- The conclusions reached by the Selection Committee, which conducts evaluations of candidates' achievements from a wider perspective, including contributions to the progress of science and technology, and significant advancements towards the causes of world peace and prosperity, and finally the selected candidates are recommended for the Prize.
- The recommendations are then sent to the Foundation's Board of Directors, which makes the final decision on the recipients.

The nomination and selection process takes almost one year from the time that the fields are decided. Every January, the winners of that year’s Japan Prize are announced. The Presentation Ceremony is held in April in Tokyo.

Fields Eligible for the 2016 Japan Prize

- The nomination and selection process is continued on an ongoing basis.

Materials and Production

- New processes and new materials with innovative functionality and characteristics as well as advanced production technologies have brought about numerous technological innovations, thereby contributing greatly to the advancement of society. For instance, technologies developed and successfully commercialized in the fields of electronics, nanomaterials, and ceramics, and diversified natural products. We have also developed highly functional materials such as design and manufacturing technologies supported by high-performance computer, precision measurement technologies, and software that contribute to the establishment of society. In order to make effective use of such resources and build a sustainable society, for the future, a new paradigm for the development of materials and production technology and manufacturing technology is necessary.

Achievement eligible:

- The 2015 Japan Prize in the field of “Materials and Production” will be awarded to individuals who have made significant contributions to society; by achieving fundamental science and technologies that enable people to live in harmony and ensure the stability and safety of society.

Biological Production and Biological Environment

- The existence of human beings is completely dependent on the continuous and diverse use of Earth’s biological resources. In recent years, however, the biological environment of our planet, which sustains indispensable biological resources, is deteriorating rapidly. Despite many technologies that have drastically increased our food production capacity, the future looks tenuous in securing that capacity at an ever-greater pace and environmental costs.

Achievement eligible:

- The 2015 Japan Prize in the field of “Biological Production and Biological Environment” will be awarded to individuals who have made significant contributions to the survival of society; by achieving scientific and technological breakthroughs in the improvement of biological production of food and other useful materials to ensure harmonic and secure societies.

Fields Selection Committee for the 2016 Japan Prize

- The fields eligible for the Japan Prize (2016-2018) have been decided for the two research areas, respectively. These fields change every three years, basically.

Schedule (2016-2018)

- Every year the Selection Subcommittee announces the eligible field for the next three years.

2016 Japan Prize Laureates Announced

Dr. Yutaka Takehaki, river engineer who helped reduce disasters with his comprehensive flood control concept, and Prof. Alain Fischer, the firsts to propose and clinically prove gene therapy concept

The Japan Prize Foundation has decided the recipients of the 2015 (31st) Japan Prize. In the field of “Resources, Energy and Social Infrastructure,” Dr. Theodore Friedmann was awarded for his “contribution to development of innovative concept on river basin management and reduction of water-related disasters.” His comprehensive concept of river basin management, which involves not only the development of information infrastructure, has led to significant reduction of water-related disasters and improvement in river operations in Japan and overseas, especially in the Asian monsoon region.

In the field of “Medical Science and Medical Science,” Prof. Theodore Friedmann of the United States was awarded for his “proposed of the concept of gene therapy and its clinical applications.” During the 1980s, Dr. Friedmann became the first to propose the concept of gene therapy, and Prof. Fisher was the world’s first to clinically demonstrate the effective use of gene therapy.

To honor the three distinguished scholars, an award-presentation ceremony will be held in Tokyo on April 23, 2015.
<Fact Sheet>

Japan Prize Foundation

Foundation:  • November 1, 1982 - Formed as the Japan Prize Preparatory Foundation with the goal of establishing the Japan Prize.

  • May 5, 1983 - Renamed the Science and Technology Foundation of Japan with an added objective of raising public awareness and interest in the fields of science and technology.

  • October 28, 1983 - Given the Cabinet’s decision that relevant government ministries and agencies provide support for implementing the Japan Prize.

  • April 1985 - Held the first prize presentation ceremony in Tokyo.

  • October 1, 2010 - Authorized as a “Public Interest Incorporated Foundation” by the Cabinet Office, and renamed the Japan Prize Foundation.

Chairman:  Prof. Hiroyuki Yoshikawa Dr. Eng.
Director-General, Center for Research and Development Strategy, Japan Science and Technology Agency

President:  Yoshio Yazaki, M.D., Ph.D.
Chancellor, International University of Health and Welfare

Location:  Ark Mori Bldg., East Wing 35th Floor
1-12-32 Akasaka, Minato-ku, Tokyo 107-6035, Japan
Tel: 81-3-5545-0551  Fax: 81-3-5545-0554  URL: www.japanprize.jp

Activities:  1) Recognize and honor outstanding achievements in science and technology with the Japan Prize.

  2) Encourage the study of science and technology through research grants and promotional activities

  3) Promote diffusion of knowledge and philosophy in science and technology through various activities including dissemination of information materials and research papers, and seminars.

  4) Other activities to fulfill objectives of the Foundation

Main Activities:

1) Japan Prize

The Japan Prize Foundation honors individuals whose original and outstanding achievements in science and technology are recognized as having advanced the frontiers of knowledge and served the cause of peace and prosperity for mankind.

Every year, the Foundation chooses two fields eligible for the prize, one each from the two areas of the “Physics, Chemistry and Engineering” and “Life Science, Agriculture and Medicine” and selects winners - one winner for each field in principle - after almost 10 months of fair and careful evaluation. Achievements of the candidates nominated by approximately 13,000 nominators in the world, prominent intellectuals, researchers and scientists selected by the Foundation, are assessed from both academic and social perspectives. The Foundation’s Board of Directors wraps up the selection process by making the final decision on the candidates. The new Japan Prize laureates are announced every January.
To date, 83 laureates from 13 countries have received the Japan Prize since the first prize was given in 1985. Each laureate receives a certificate of merit and a commemorative medal. A cash prize of 50 million Japanese yen is also awarded in each prize field.

Japan Prize laureates include Dr. Charles K. Kao (U.S.), Dr. Frank Sherwood Rowland (U.S.), Dr. Elias James Corey (U.S.), Prof. Dr. Gerhard Ertl (Germany), Dr. Arvid Carlsson (Sweden) and Dr. Luc Montagnier (France), all of whom were awarded the Nobel Prize after receiving the Japan Prize. A selection of laureates received the Japan Prize and Nobel Prize in the same year, including Dr. Kary B. Mullis (U.S.), Prof. Albert Fert (France) and Prof. Dr. Peter Grünberg (Germany), while Dr. Leo Esaki (Japan) was awarded the Japan Prize after winning the Nobel Prize.

2) “Easy-to-Understand Science and Technology” Seminars

For junior and senior high school students, the Foundation holds a series of seminars on advanced technologies commonly used in everyday life by inviting recipients of the Research Grants (explained below) as lecturers. Plain language lectures and presentations and hands-on experiments develop students’ awareness in science and technology. The program began in March 1989 and has since executed more than 250 seminars across Japan by the end of 2014.

3) Stockholm International Youth Science Seminar (SIYSS)

Each year, the Japan Prize Foundation provides an opportunity for young scholars to exchange opinions with their peers on an international level by sending two students to the Stockholm International Youth Science Seminar (SIYSS) hosted by the Swedish Federation of Young Scientists with the support of the Nobel Foundation. Young students from Japan and elsewhere in the world participate in various events during Nobel Week in Stockholm, including the Nobel Prize award presentation ceremony as well as giving lectures themselves. The series of events during the week give students a chance to learn about ethics and morality as a scientist and help renew their enthusiasm for a career in science. Since the program started in 1987, the Japan Prize Foundation has provided this valuable opportunity to 54 undergraduate/graduate students.

4) Research Grants

The Foundation provides research grants to scientists and researchers under 35 years of age. Every year, the Foundation selects projects in the same fields as the corresponding Japan Prize and gives one million Japanese yen for a project. In 2014, studies in “Clean & Sustainable Energy” were added as an eligible field of study to the two fields designated for the 2014 Japan Prize. Including the 22 recipients in 2014, the Foundation awarded research grants to 161 young scientists since the program’s inception in 2006.

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