THE JAPAN PRIZE FOUNDATION
ARK Mori Building, East Wing 35th Floor, 1-12-32
Akasaka, Minato-ku, Tokyo, 107-6035, JAPAN
Tel: +81-3-5545-0551 Fax: +81-3-5545-0554
www.japanprize.jp

Japan Prize News
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JAPAN PRIZE

2016 (32nd) Japan Prize Presentation Ceremony

In the presence of Their Majesties the Emperor and Empress
Two researchers from Japan and the U.S. graciously accept the prize

The Japan Prize Presentation Ceremony was held on Wednesday, April 20th at the Tokyo International Forum in the presence of Their Majesties the Emperor and Empress. The Japan Prize is an international award presented to individuals whose original and outstanding achievements in science and technology have served to promote peace and prosperity for mankind.

The 2016 (32nd) Japan Prize was awarded in two fields, namely, "Materials and Production" and "Biological Production and Biological Environment." Dr. Hideo Hosono of Japan was recognized for pioneering new realms in materials science and contributing to its application in technology such as LCD displays.

Meanwhile, Dr. Steven D. Tanksley of the U.S. was recognized for contributing to the stable production of food crops by his pioneering work on molecular genetic analysis. A certificate of merit and a prize medal were presented to both laureates.

Each year, the Japan Prize Foundation receives nominations from prominent scientists and researchers worldwide, from which candidates are chosen through a rigorous year-long selection process. Of the fields eligible for the prize in 2016, the "Materials and Production" field received 204 nominations, and the "Biological Production and Biological Environment" field received 88 nominations, from which the two laureates were selected.

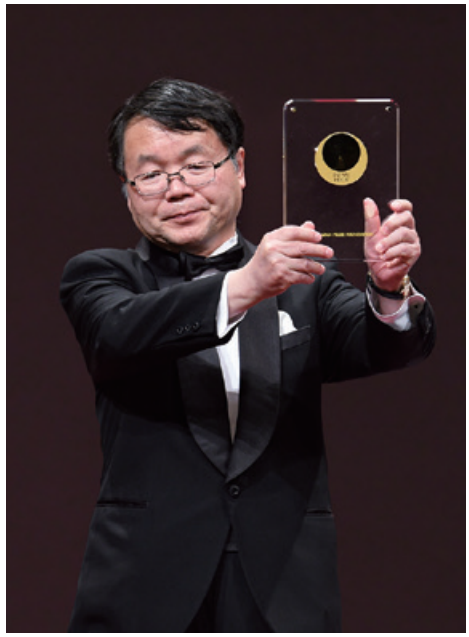
JAPAN PRIZE

The Japan Prize came into being after the late Mr. Konosuke Matsushita, the founder of Matsushita Electric Industrial Co., Ltd. (now known as Panasonic Corporation), responded in 1982 with a personal donation to the then government's wish for creating a prestigious international prize for scientists around the world as a token of gratitude for the international society. With a Cabinet endorsement, the Prize was first awarded in 1985.

While the prize encompasses all categories of science and technology, two fields of study are 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 prize medal. A cash prize of 50 million yen is also awarded to each prize field.

"Materials and Production"

Creation of unconventional inorganic materials with novel electronic functions based on nano-structure engineering



Dr. Hideo Hosono

Born: September 7, 1953
Professor, Laboratory for Materials and Structures, Institute of Innovative Research,
Tokyo Institute of Technology
Director, Materials Research Center of Element Strategy

Message from the laureate

I am extremely honored today to be awarded the Japan Prize in the presence of Their Majesties the Emperor and the Empress, distinguished guests, and ladies and gentlemen.

In the world around us, there exist countless substances but the total number of elements that make up those substances is merely 100 or so, about the same as the number of man's worldly desires. My motivation in pursuing materials research began with the surprising experiment, I made as a child, of the electrolysis of water, in which a fire extinguishing substance was turned into hydrogen, which is flammable, and oxygen gas which also facilitates burning.

The goal of my research is to seek out practical realization of useful functions in ordinarily abundant elements, just as nylon was created from water, air and coal. Substances have extraordinary potential beyond our imagination, and I believe that the exploration has only just begun. When a substance meets societal needs, it can be called a material. Luckily, my transparent glass semiconductor was adopted to power a new generation of displays. But we are only at the crucial beginning phase for electrides and iron-based superconducting substances to make the same leap forward and become materials. Having received this wonderful encouragement in the form of the Japan Prize, I would like to continue to strive ahead and dedicate myself to research.

Lastly, I would like to express my heartfelt gratitude to the Japan Prize Selection Committee for recognizing my research, to the colleagues with whom I collaborated, and to the Tokyo Institute of Technology and the Japan Science and Technology Agency for their extensive support.

Thank you.

"Biological Production and Biological Environment"

Contribution to modern crop breeding through research on development of molecular genetic analysis

Dr. Steven D. Tanksley

Born: April 7, 1954
Professor Emeritus, Cornell University

Message from the laureate

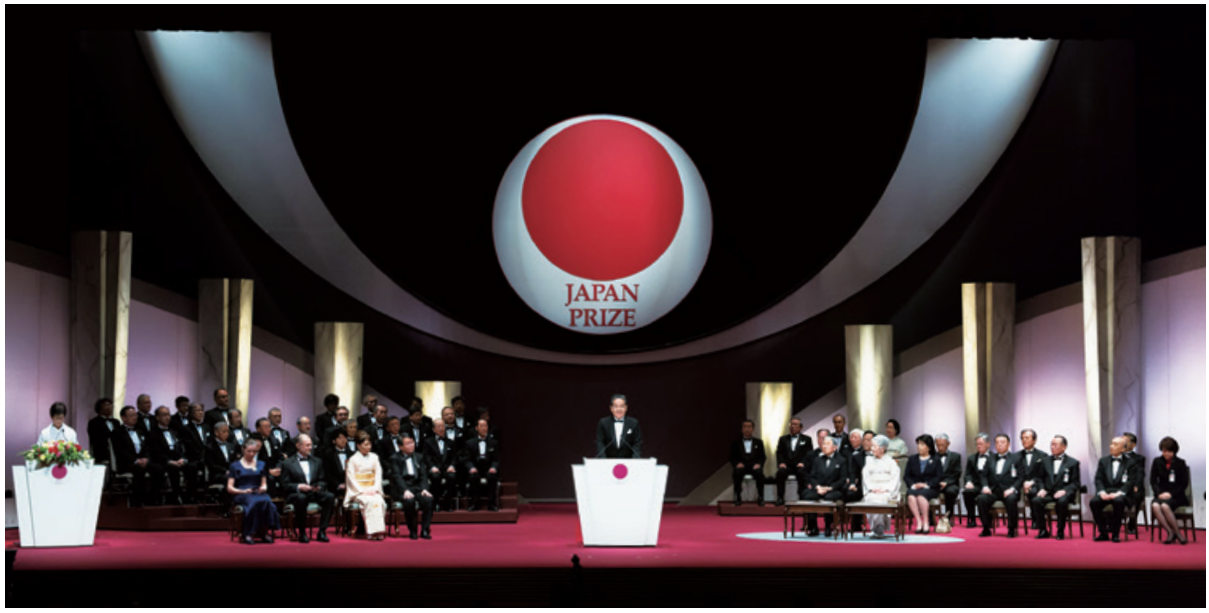
Dr. Steven Tanksley has made such important achievements as the generation of molecular linkage maps of crops using molecular technology, development of innovative techniques for identifying productivity related genes like those for fruit sizes, as well as the application of genetic markers to crop improvement.

From the 1980s to the 90s, Dr. Tanksley opened new horizons in the development of chromosome maps for crops by applying molecular biology techniques to tomato and rice plants. He then developed a method to associate chromosome region information (DNA markers) with Quantitative Trait Loci (QTL), even though analysis of QTL, such as seed numbers, coldresistance and flowering time, was too complex to be solved due to the intricate effects of multiple genes and environmental factors. Furthermore, Dr. Tanksley demonstrated through the isolation of QTL that a particular mutation that occurs during the domestication process of a wild species of tomato contributes to its fruit size. He also pointed out the importance of spontaneous mutation amongst wild species for the future crop development, and devised a method for evaluating the genes of wild germplasm resources. These highly original achievements by Dr. Tanksley have since contributed to wideranging and rapid progress in related research areas, such as in the development of molecular linkage maps for crops and livestock, the identification of agriculturally useful QTL, and the sequence determination of whole genomes.

After Dr. Tanksley's research achievements, crossbreeding was transformed from realm of experience, intuition and luck to predictive science. Triggered by his research, a breakthrough technology known as Marker Assisted Selection (MAS) was developed, enabling systematic improvement of crops based on DNA markers derived from genome information. This technique that combines genetic information and breeding offers seminal advantages such as significant shortening of the breeding period and reliability of superior offspring selection. It has drawn researchers from around the globe, and is being applied for a wide variety of crops. Today, MAS has become an indispensable method of crop development and livestock breeding, and is therefore considered to be an outstanding contribution to the agricultural industry.

Dr. Tanksley's research established the theoretical bases for understanding the genetic information of crops which has been widely adopted in the field of modern crop breeding, thereby contributing profoundly to the stable production of food crops in the world. It is for these outstanding achievements that Dr. Steven Tanksley is deemed most eminently deserving of the 2016 Japan Prize given to honor contributions in the fields of "Biological Production and Biological Environment."

Presentation Ceremony



The 2016 (32nd) Japan Prize Presentation Ceremony was held at the Tokyo International Forum in the presence of Their Majesties the Emperor and Empress. The magnificent occasion was celebrated by approximately 1,000 attendees, including distinguished guests such as Mr. Tadamori Oshima, Speaker of the House of Representatives, Mr. Masaaki Yamazaki, President of the House of Councillors, Mr. Itsuro Terada, Chief Justice of the Supreme Court, Ms. Aiko Shimajiri, Minister of State for Special Missions, as well as prominent academic and business figures. At the opening of the ceremony, President Yoshio Yazaki of the Japan Prize Foundation expressed his sympathies to those affected by the earthquake that struck the Kyushu region in April 2016.

Following the announcement of the selection results by Dr. Hiroshi Komiyama, Chairman of the Selection Committee, Dr. Hideo Hosono and Dr. Steven D. Tanksley watched over by family and friends, were presented with a certificate of merit and a prize medal on stage by Chairman Hiroyuki Yoshikawa of the Japan Prize Foundation. The laureates received warm applause from the audience as they held up the prize medals and expressed their joy in their acceptance speeches. Representing the honorable guests, congratulatory address was given by H. E. Mr. Tadamori Oshima.

The ceremony was followed by a commemorative concert, in which Tokyo Geidai Symphony Orchestra performed “Spring” from Vivaldi's “the Four Seasons” as requested by Dr. Tanksley, and “Mars” and “Jupiter” from Holst’s “the Planets” as requested by Dr. Hosono.

Dr. & Mrs. Hideo Hosono

Dr. & Mrs. Steven D. Tanksley

Their Majesties the Emperor and Empress attending the presentation ceremony

Congratulatory address by H.E. Mr. Tadamori Oshima, Speaker of the House of Representatives

Opening remarks by Dr. Yoshio Yazaki, President of the Japan Prize Foundation

Selection results by Dr. Hiroshi Komiyama, Chairman of the Selection Committee

Commemorative concert by the Tokyo Geidai Symphony Orchestra

Banquet

Following the presentation ceremony, a banquet in honor of the laureates was held at a hotel in the city. In response to a toast given by His Majesty the Emperor, over 300 guests raised their glasses to congratulate Dr. Hideo Hosono and Dr. Steven D. Tanksley on their achievement once again. Amid the beautiful strains performed by a string quartet and a harp, Their Majesties the Emperor and Empress engaged in pleasant conversation with the laureates and their partners seated by their side. The banquet which spanned an hour and a half came to a close with a congratulatory message from President Yamazaki of the House of Councillors and acknowledgement speeches from both laureates.

Dr. Hosono explained that it is the joy he feels upon making an enlightening discovery that keeps him motivated in his daily research work. He shared his belief that the mission of materials research is to transform simple substances into useful materials with practical applications in society. He also expressed his gratitude to his mentors who have guided him and the many fellow researchers with whom he has collaborated.

Dr. Tanksley spoke of his meeting with Prof. Takumi Tsuchiya, a professor of plant genetics during his time at Colorado State University, who influenced him to pursue a career in plant genetics. He expressed his joy in receiving an award in the country where Prof. Tsuchiya's career began and thanked those who have supported him over the years.

Toast by His Majesty the Emperor of Japan

Congratulatory address by H.E. Mr. Masaaki Yamazaki, President of House of Councillors

Opening address by Prof. Hiroyuki Yoshikawa, Chairman of the Japan Prize Foundation

Acknowledgment by Dr. Hideo Hosono

Acknowledgment by Dr. Steven D. Tanksley

2016 (32nd) Japan Prize Commemorative Lectures

Element Strategy and Future Materials Modern Crop Breeding Through the Development of Genome Analysis Techniques

On Thursday, April 21st, the day following the presentation ceremony, commemorative lectures by Dr. Hosono and Dr. Tanksley were held at Tokyo Institute of Technology's Kuramae Hall. In front of 300 members of the audience, comprised of researchers and the general public, Dr. Hosono discussed materials he has created and their mechanisms, including IGZO-TFT, electrically conductive cement and iron-based superconductors, all of which are fruits of his commitment to "creating new functional materials in areas that no one has yet succeeded in." He also spoke of the rewarding nature of research and the sense of accomplishment it has brought.

Dr. Tanksley gave an account of the creation of chromosomal maps for tomatoes through genome analysis and of the elucidation of Quantitative Trait Loci(QTL) located on it. He also mentioned that advancement in plant genetics and selective breeding will become the major force to help meet the growing demand for crops across the globe.

Prior to the lecture, discussion meetings were held between the laureates and young researchers, in which the laureates were showered with numerous questions on topics such as one's attitude towards research. Some questions were so challenging that the laureates had to pause and think. Through these heated discussions, the laureates gave their heartfelt encouragement to the young up-and-coming researchers.

"Materials and Production" field

Theme

Element Strategy and Future Materials

(Dr. Hideo Hosono)

All substances around us are made of merely 100-odd elements from the periodic table. To put it the other way around, an infinite variety of materials can be created through different combinations of elements. This fact deeply inspired Dr. Hosono as a high school student. Dr. Hosono says of element strategy that, "I aspire to the kind of materials development by which I can overturn traditionally held notions about elements by giving them completely new functions."

What lies at the root of Dr. Hosono's research is the glass-like transparent oxide. Although it is a fundamentally insulating material due to its "wide band gap" property, he dared to challenge this common assumption. In 1994, he began research on transparent conductive materials and in 1997, successfully developed the world's first "p-type transparent oxide semiconductor." Furthermore, In-Ga-Zn-O thin film transistor (IGZO-TFT), which Dr. Hosono was the first to develop, boasts high transparency, high electron mobility and greater energy efficiency. Today, it is used in a wide range of displays from PC monitors to tablet devices.

Dr. Hosono also took up the challenge of searching for electronic functions of calcium aluminum oxide C12A7, the main ingredient in cement. Cement is an insulator by nature, but replacing the oxide ions inside the nano-sized cage structure of C12A7 with electrons causes it to become electrically conductive like a metal. Furthermore, Dr. Hosono created "electrides," which become superconductive at low temperatures.

Electrides have the potential for a variety of applications but as Dr. Hosono's ultimate goal is to create materials that are "essential for life," he is currently developing a technique to use electrides as a catalyst in ambient pressure synthesis of ammonia, an indispensable substance for industry.

Another of Dr. Hosono's research achievements that caused a worldwide sensation is the iron-based high-Tc superconducting material. Up till then, iron was deemed unsuitable for superconductivity due to being a magnetic element. However, when an original crystal structure was introduced, this long held belief was overturned. In 2006, Dr. Hosono reported his discovery of the superconductive nature of iron-based compounds (LaFePO). Today, development is underway for their practical application.

Dr. Hosono set forth three keywords, namely, "sustainability", "cross-disciplinary" and "materials design," as the future direction of materials research. He also stressed that in order for discoveries to mature to the point that they can benefit society, it is important to bring together knowledge from various fields. In fact, Dr. Hosono engages researchers from various fields to work with him on the development of nitride semiconductors, such as making use of mathematics to design materials. Dr. Hosono concluded the lecture by sharing his vision for the future, with these words: "In the days ahead, the fusion of the theoretical and the experimental will usher in a new age in materials science."

"Biological Production and Biological Environment" field

Theme

The Molecular Basis of Natural Variation and the Implications for Plant Improvement

(Dr. Steven D. Tanksley)

Today's crops are the product of many years of selective breeding. Selective breeding had once relied largely on experience and intuition, but advancements in genome analysis techniques since the 1980s have brought about a transformational change. Dr. Steven D. Tanksley has been at the forefront of the field throughout this development.

Many of the traits we desire in crops such as "larger size" and "greater yield" are not determined by a single gene but by a complex interplay of multiple genes on the chromosome with environmental factors. Therein lay the difficulty of selective breeding. Genes of this nature are called QTL (Quantitative Trait Loci).

In the 1980s, Dr. Tanksley developed a technique to locate the position of important QTL on the chromosome of crops like tomatoes and rice, using the RFLP (Restriction Fragment Length Polymorphism) method. In the lecture, Dr. Tanksley described his technique by likening it to a road map. The roads on this map were separated by important landmarks and locations could be understood as, "the destination is between C and D." To apply the RFLP method to this analogy, one can think of the landmarks as the difference in length of DNA fragments cut by the restriction enzyme. Then the fragment with a differing length becomes the DNA marker and reveals the location of important QTL on the chromosome. Using this method, a chromosome map that identifies the positions of QTL on the chromosome could be created.

Today, selective breeding that utilizes DNA markers in this way are used extensively throughout the industry. At the same time, anticipation on the potential of selective breeding is greater than ever. Dr. Tanksley says that "since the 1960s, the area of arable land per person has halved as the global population has increased rapidly. We have so far managed to meet the demand for food production through innovations in agricultural techniques, but new techniques in selective breeding will become indispensable in the future."

The driving force behind the next generation of selective breeding will come from advancements in molecular genetics. Dr. Tanksley points out the dramatic fall in the cost of DNA base sequence analysis over the last decade. He says, "our latest challenge is how to utilize all of the information we obtain." There has been great diversification in available genetic information which is resources for selective breeding. "Untapped natural genetic diversity" is certainly crucial. But more recently, genes attained from "genetically modified crops" and "artificially induced mutations and gene editing" are also becoming important resources. These were described by Dr. Tanksley as a "gene pool."

Dr. Tanksley shared his desire that, in the future, he would like to research methods for gene resource utilization in cooperation with researchers not only of agriculture and biology but also of mathematics and other disciplines, and contribute to the creation of selective breeding for the next generation.

Japan Prize Week

4/18 (Mon.)

Welcome Reception

4/19 (Tue.)

Courtesy Call on the Japan Academy

Courtesy Call on the Prime Minister

Academic Roundtable Discussion

4/20 (Wed.)

Presentation Ceremony

Banquet

4/21 (Thu.)

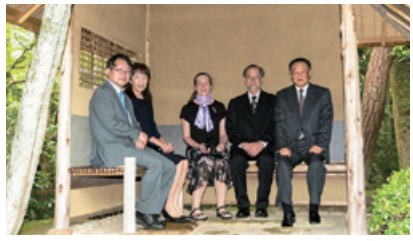
Courtesy Call on the U.S. Embassy

Commemorative Lectures

4/23 (Sat.)

Sightseeing in Kyoto

In Sento Imperial Palace



In Matsushita Shinshin-An

Fields Eligible for the 2017 Japan Prize

Area of Physics, Chemistry and Engineering

Electronics, Information and Communication

Background and rationale:

In recent years, we have seen new waves of technological development from devices to systems, in various fields of electronics, information and communication, such as artificial intelligence, big data, IoT, next generation network, robotics and energy utilization. In particular, innovation derived from the rapid and efficient utilization of large data generated across broad areas is anticipated to spawn new cultures, lifestyles and types of manufacturing, thereby contributing enormously to the advancement of our society.

Meanwhile, the various incidental phenomena that are threatening the safety and security of our lives can no longer be ignored, making the development of technological solutions an urgent matter.

Achievement eligible:

The 2017 Japan Prize in the field of "Electronics, Information and Communication" will be awarded to an individual(s) who has achieved scientific and technological breakthroughs, such as development of essential technologies or systems that contribute significantly and widely to the creation of new industries, to the innovation of manufacturing technologies, to the advancement of information and knowledge driven society, and to the assurance of our society's safety and security, as well as basic research and development that is highly likely to drive the future advancement of our society.

Area of Life Science, Agriculture and Medicine

Life Science

Background and rationale:

The field of life science has been increasingly expanding and deepening in recent years, leading to remarkable advances in our understanding of life itself.

For example, genome and epigenome analysis using next-generation sequencing, OMICs analysis using mass spectrometry, molecular and morphological analysis using super-resolution microscopy or three-dimensional electron microscopy, and various analyses using genome editing techniques are progressing at an incredible pace. Such innovative analysis technologies have contributed to numerous revolutionary discoveries.

While we must respect bioethics and handle personal information very carefully, the advancement of our understanding of the life phenomenon will be of tremendous benefit to humanity and lead to the creation and spread of new fields of medicine in the future.

Achievement eligible:

The 2017 Japan Prize in the field of "Life Science" will be awarded to an individual(s) who has achieved scientific and technological breakthroughs, such as the discovery of new life phenomena and innovation in analysis techniques that facilitate the elucidation of biological functions, thereby contributing significantly to our society.

The Japan Prize Foundation

The Japan Prize Foundation was established in 1982, with the aim of contributing to the further development of science and technology. In addition to recognizing outstanding achievements with the Japan Prize, the Foundation has been promoting science and technology by hosting the "Easy-to-understand Science and Technology Seminars" and awarding Research Grants to help nurture young scientists.

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 2015, studies in "Clean & Sustainable Energy" were added as an eligible field of study to the two fields designated for the 2015 Japan Prize. Including the 20 recipients in 2015, the Foundation awarded research grants to 204 young scientists since the program's inception in 2006.

"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 Research Grant recipients as lecturers. They explain state-of-the-art technologies in plain terms. The program began in March 1989 and has since executed 269 seminars across Japan by the end of 2014.

Stockholm International Youth Science Seminar (SIYSS)

Each year, the Japan Prize Foundation provides an opportunity for young scientists to exchange opinions with their peers on an international level by sending two students to the Stockholm International Youth Science Seminar hosted by the Swedish Federation of Young scientists with the support of the Nobel Foundation. Young scientists from Japan and elsewhere in the world attend various events during Nobel Week in Stockholm. Since the program started in 1987, the Japan Prize Foundation has provided this valuable opportunity to 56 undergraduate/ graduate students.