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Japan Prize News
No. 60 May 2018

JAPAN PRIZE

2018 (34th) Japan Prize Presentation Ceremony

Three Scientists from Japan, the U.S. and Australia receive the prize in the presence of Their Majesties the Emperor and Empress

On Wednesday, April 18th, the Japan Prize Presentation Ceremony was held at the National Theatre 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 2018 (34th) Japan Prize was awarded in two fields; "Resources, Energy, Environment and Social Infrastructure" and "Medical Science and Medicinal Science".

Dr. Akira Yoshino (Japan) was recognized for his significant contributions to the development of lithium ion batteries, while Dr. Max D. Cooper (USA) and Dr. Jacques Miller (Australia) were jointly recognized for the establishment of the basic concepts underlying modern immunology. A certificate of merit and a prize medal were presented to each laureate.

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 2018, the "Resources, Energy, Environment and Social Infrastructure" field received 116 nominations, and the "Medical Science and Medicinal Science" field received 165 nominations.

JAPAN PRIZE

The Japan Prize came into being in 1982 after the late Mr. Konosuke Matsushita, the founder of Matsushita Electric Industrial Co., Ltd. (now known as Panasonic Corporation), made a personal donation in response to the then government's wish to create a prestigious international prize for scientists from around the world as a token of gratitude to the international community. With cabinet endorsement, the prize was first awarded in 1985. The Japan Prize honors those whose original and outstanding achievements are not only scientifically significant, but have also served to promote peace and prosperity for all mankind. Each year, the foundation designates two fields for award presentation 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 presented to each prize category.

"Resources, Energy, Environment and Social Infrastructure" field

Development of lithium ion batteries

Dr. Akira Yoshino

Born: January 30, 1948
Honorary Fellow, Asahi Kasei Corporation
Professor, Meijo University

"Medical Science and Medicinal Science" field

Discovery of B and T lymphocyte lineages and its impact on understanding disease pathology and therapeutic development

Dr. Max D. Cooper

Born: August 31, 1933
Professor, Emory University School of Medicine

Dr. Jacques Miller

Born: April 2, 1931
Professor Emeritus, Walter and Eliza Hall Institute of Medical Research

Message from the laureate

It is truly an honor to receive the Japan Prize in the presence of Their Majesties the Emperor and Empress, distinguished guests, and the many guests assembled here today.

Batteries are used as a matter of course in our daily lives and may at first seem to be an unspectacular product. Yet, the secondary battery in particular has an important function of storing electricity. Storing electricity in a secondary battery enables us to make various electronic devices portable. How to reduce the size and weight of the secondary battery had been a long-standing challenge.

Meanwhile, battery technology belongs to the academic field of electrochemistry. It is an interdisciplinary field encompassing electricity and chemistry, making it a complex and difficult academic field. Achieving advances in battery technology therefore requires broad expertise. I consider the lithium ion battery to be a fruit of such collective wisdom.

The lithium ion battery achieved the reduction in size and weight of the secondary battery, contributing immensely to the spread of mobile phones, smartphones, laptop PCs and other IT devices. This has resulted in the rise of the mobile IT society that has greatly transformed our world.

The application of the lithium ion battery to electric vehicles is advancing at a rapid rate today. This development takes place against the backdrop of global environmental problems, a major challenge facing all of humankind. I believe that the lithium ion battery's next mission is to present a solution to these problems. Encouraged by this prize, I will continue to dedicate myself to such research.

Finally, I would like to extend my deepest gratitude to the members of the Japan Prize Selection Committee, my collaborators who have devoted themselves to the research and development of the lithium ion battery, and all those who have supported my work.

Akira Yoshino

Message from the laureate

Their Majesties the Emperor and Empress, distinguished guests, and ladies and gentlemen, it is a very great honor for me to receive the Japan Prize with Jacques Miller for our work that described the two interacting lineages of lymphocytes called B and T cells as the central pillars of our adaptive immune system.

We are especially grateful to the Japan Prize Foundation for this opportunity to represent immunologists world-wide, whose work has led to many protective vaccines and to recent success in treating previously-intractable diseases, including chronic inflammatory and autoimmune disorders, immune deficiencies and cancers.

I would personally like to thank my mentors, Drs. Ralph Platou and Robert Good, many wonderful colleagues and students for their advice, encouragement and fruitful collaboration.

I also thank my wife, Rosalie, and our family for their unwavering love and support.

Max D. Cooper

Message from the laureate

I am very honored to be here today, standing in front of Their Majesties, the Emperor and Empress of Japan, on the occasion of the 2018 Japan Prize award for Medical Science and Medicinal Science, and it is with great humility that I accept this most prestigious prize. I thank the Japan Prize Foundation, the Selection Committee for choosing me, and whoever nominated me.

One of medicine's greatest quests has been how to eradicate infectious diseases and various types of cancer. When I started to work in cancer research in the late 1950s, nothing was known about the thymus, which was for centuries believed to be a useless organ that had become redundant during the course of evolution. Due to my work on mouse leukemia, I had results that proved that the thymus in young mice was essential to life because it produced cells, T cells, that not only could destroy infected cells, but helped another type of cell coming from bone marrow, B cells, to make antibody. I also showed that mice without T cells were much more prone to develop all types of cancer than normal mice.

Thanks to these findings and to the work done worldwide by many, we now understand what happens in many immunological diseases, and we have the ability to deal with them. Most spectacularly, T cells can be activated to destroy some types of cancer, and present research is focused on how to eradicate infectious diseases like HIV AIDS and tuberculosis, autoimmune diseases like diabetes and multiple sclerosis, and other types of cancer.

Thank you again for awarding me this prestigious prize!

Jacques Miller

Presentation Ceremony

The 2018 (34th) Japan Prize Presentation Ceremony was held at the National Theatre 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. Chuichi Date, President of the House of Councillors, Mr. Naoto Otani, Chief Justice of the Supreme Court, Mr. Yoshimasa Hayashi, Minister of Education, Culture, Sports, Science and Technology, Mr. Masaji Matsuyama, Minister of State for Special Missions, as well as prominent academic and business figures.

At the presentation ceremony, which opened with a glorious rendition of "Overture to the Japan Prize Ceremony - Overture Japan," family and friends watched as the laureates were presented with a certificate of merit and a prize medal by Chairman Hiroyuki Yoshikawa of the Japan Prize Foundation. The three laureates received warm applause from the audience as they held up the prize medals and expressed their joy in their acceptance speeches.

The ceremony was followed by a commemorative concert, in which Tokyo Geidai Symphony Orchestra performed Chiaki Yoshida's "The Journey around Lake Biwa" as requested by Dr. Yoshino, the 7th and the 8th movement of Copland's "Appalachian Spring" as requested by Dr. Cooper, and Beethoven's "Coriolan Overture" as requested by Dr. Miller.

Dr. and Mrs. Yoshino

Dr. and Mrs. Cooper

Dr. Miller and his niece

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 Tokyo. In response to a toast given by His Majesty the Emperor, over 300 guests raised their glasses to congratulate the three laureates on their achievements 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 Date of the House of Councillors and acknowledgement speeches from the laureates.

Dr. Yoshino spoke on the significance of the realization of lithium ion batteries that spurred amazing developments during the IT revolution, which was unimaginable just 25 years ago. He also expressed his gratitude for recognition and stated that it will be a huge encouragement for scientists and researchers who face the great challenge of taking this technology into future in the coming 25 years.

Dr. Cooper stated that their work in immunology was built on the pioneering research efforts of numerous researchers on cellular and humoral immunity. He also expressed his gratitude by noting that this prize is a recognition for the hard work of immunologists worldwide who have contributed to the development of therapies that use B cell derived antibodies and T cells for autoimmune diseases, chronic inflammation and certain cancers.

Dr. Miller spoke of the quest for curiosity that drove him to study and better understand the healthy physiological functions and pathological conditions. He also expressed joy that in recent years it has become possible to treat cancer using the patient's own T cells without the need for chemotherapy or radiotherapy, and ended by thanking his past research colleagues and mentors who had guided him over the years.

Toast by His Majesty the Emperor of Japan

Congratulatory address by H.E. Mr. Chuichi Date, President of the House of Councillors

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

Acknowledgment by Dr. Akira Yoshino

Acknowledgment by Dr. Max D. Cooper

Acknowledgment by Dr. Jacques Miller

2018(34th) Japan Prize Commemorative Lectures

On Thursday, April 19, the day after the presentation ceremony, commemorative lectures by Dr. Akira Yoshino, Dr. Max Cooper and Dr. Jacques Miller were held at the Ito International Research Center, the University of Tokyo. In front of 300 members of the audience, comprised of researchers and the general public, Dr. Yoshino spoke on the topic of “Lithium ion battery: From research and development to commercialization”, Dr. Max D. Cooper on “B and T Lymphocytes: Integral Pillars of Adaptive Immunity” and Dr. Jacques Miller on “T Cells: from discovery to cancer immunotherapy”.

Prior to the lectures, discussion meetings were held among the three laureates and young researchers. In their sessions with Dr. Yoshino, Dr. Cooper and Dr. Miller, all of the young researchers in attendance introduced themselves and their research topics, after which the floor was open to questions to the laureates. Both meetings resulted in heated discussions, through which the laureates gave their heartfelt encouragement to the young up-and-coming researchers.

"Resources, Energy, Environment and Social Infrastructure" field

Topic

Behind the success of lithium ion battery development

(Dr. Akira Yoshino)

Lithium ion batteries, made of carbon-based anode, lithium cobalt oxide cathode and organic electrolyte solution, have seen widespread adoption in numerous applications, from smartphones and laptop PCs that we use every day to electric vehicles that are on the verge of popularization. The development and commercialization of this battery were led by Dr. Akira Yoshino.

Dr. Yoshino began his commemorative lecture by explaining the structure of the lithium ion battery using a handcrafted model, then went on to reflect on the long path of development to commercialization. In 1981, Dr. Yoshino began researching polyacetylene, a material that was discovered to be conductive by Dr. Hideki Shirakawa. As he studied its characteristics, he realized it could be a suitable electrode material for secondary batteries.

At the time, small-lightweight primary batteries that used metallic lithium anode had just been commercialized, and a lot of research efforts were going into developing a secondary battery based on this design. Its practical realization, however, faced many difficulties, as repeated charging-discharging caused the metallic lithium to become highly flammable. Seeing this situation, Dr. Yoshino came up with the idea of using polyacetylene for the anode.

This idea, however, was not without its drawbacks. Unlike metallic lithium, polyacetylene did not contain lithium ions needed to traverse between the cathode and the anode to generate electricity. A breakthrough came when Dr. Yoshino came across lithium cobalt oxide (LiCoO2) which was discovered by Dr. John Goodenough (the 2001 Japan Prize Laureate) in 1980. This was the world’s first cathode material to contain lithium ions. In 1983, Dr. Yoshino combined lithium cobalt oxide cathode and polyacetylene anode and demonstrated its viability as a secondary battery.

But when Dr. Yoshino gathered opinions regarding its commercial viability, he discovered that the industry was seeking smaller-sized batteries. He realized that polyacetylene’s low specific gravity did allow for weight reduction but not smaller-size. At this point, Dr. Yoshino switched to a carbon-based anode material, developed by Asahi Kasei, and in 1985, successfully came up with the prototype of lithium ion batteries that we now use.

In achieving commercialization, Dr. Yoshino first tackled safety issues. He conducted experiments in which metal balls were dropped on the battery outdoors to make sure that it would not ignite. Numerous improvements were achieved as the development progressed. Despite facing a lot of negativity caused by fire-incidents that were happening around secondary batteries with metallic lithium anode, Dr. Yoshino persevered, and in the early 1990s he successfully achieved the commercialization of lithium ion batteries for compact video cameras. Sales were initially slow, but since the IT revolution of 1995, the market has seen explosive growth that continues to this day.

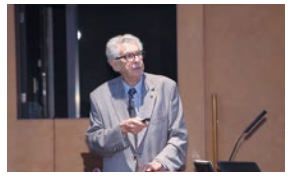
The widespread adoption of lithium ion batteries took altogether 15 years; 5 years for research and development to the creation of a prototype, 5 years for prototype to commercialization and 5 years for commercialization to market expansion. “One must consider the market needs when undertaking research and development”, says Dr. Yoshino. It can be said that this attitude towards development led to the invention of a product that successfully met the needs of the times.

"Medical Science and Medicinal Science" field

Topics

Discovering the existence of T and B lymphocytes: the basics of modern immunology

(Dr. Max D. Cooper & Dr. Jacques Miller)



At the Japan Prize Commemorative lectures, the laureates Dr. Jacques Miller and Dr. Max Cooper gave a talk titled “T Cells: from discovery to cancer immunotherapy” and “B and T Lymphocytes: Integral Pillars of Adaptive Immunity” respectively.

When Dr. Miller began his research back in the late 1950s, the function of the thymus was still unknown. At the time, he was studying lymphocytic leukemia in mice and became curious about the function of the thymus upon realizing that disease was spreading from this organ and began research.

It turned out, a mouse with its thymus removed at birth would develop leukemia when injected with the virus. However, a mouse with its thymus removed after adulthood would not develop leukemia. Furthermore, when a mouse with its thymus removed at birth was grafted skin from a different species of mouse, it adhered successfully without rejection. When Dr. Miller marked the lymphocytes to see what was going on, he discovered that it propagated from the thymus to the whole body. From this, he concluded that the thymus was an immune organ responsible for the production and propagation of lymphocytes, naming it the thymus derived lymphocytes. Today, we know it as the “T lymphocyte”.

Meanwhile, Dr. Max Cooper, who was a pediatrician, became interested in the “bursa of Fabricius”, an organ unique to birds, and began researching it from 1963. At the time, it was speculated that this organ was responsible for the production of antibodies. One year prior, Dr. Miller had published his findings on the immune functions of the thymus, therefore people at the time believed there was only one immune cell lineage.

Dr. Cooper noticed that certain young male patients with hereditary immunodeficiencies had little lymphocytes but a lot of antibodies, and from such clinical experience, had foreseen that there was more than one immune cell lineage. To confirm this, Dr. Cooper studied the immune system of two newly hatched chicks, one with the bursa of Fabricius removed and the other with the thymus removed.

The results were the chick with no bursa of Fabricius would not produce antibodies but had normal levels of lymphocytes, and the chick with no thymus had reduced ability to reject skin grafts. Having confirmed that the bursa of Fabricius derived cells were necessary for the antibody response, and thymus derived cells played a role in graft rejection, he called the former the “B lymphocyte” after the bursa.

In 1968, Dr. Miller and his research team discovered that T lymphocytes assist B lymphocytes in antibody production. Dr. Miller concluded his lecture by explaining how basic research surrounding T lymphocytes led to the development of modern immunotherapy, such as immune checkpoint inhibitors and T lymphocyte modified immunotherapy

Dr. Cooper and his team, on the other hand, pursued research on the evolution of adaptive immunity and discovered that the two lymphocyte lineages had been preserved through various forms of life from jawless vertebrates to humans.

For the young upcoming scientists, the laureates left the following advice; “Find a field of research that fascinates you and find yourself a good mentor. Stay on course even when the results begin to look doubtful. Don't be discouraged if they cannot be translated into clinical practice immediately because it takes years from bench to bedside.”

Japan Prize Week

4/16 (MON)

Welcome Reception

Courtesy Call on the Australian Embassy

4/17 (TUE)

Academic Roundtable Discussion

Courtesy Call on the Japan Academy

Courtesy Call on the Japan Prize Foundation

4/18 (WED)

Presentation Ceremony

Banquet

4/19 (THU)

Courtesy Call on the residence of the U.S. Embassy Tokyo Deputy Chief of Mission

Commemorative Lectures

4/21 (SAT)

Sightseeing in Kyoto

At Katsura Imperial Villa

At Sento Imperial Palace

Fields Eligible for the 2019 Japan Prize

The fields eligible for the 2019 (35th) Japan Prize are “Materials and Production” and “Biological Production, Ecology.” The Japan Prize Foundation has received numerous nominations from the 15,000 registered nominators worldwide, and the rigorous selection process by the foundation's Japan Prize Selection Committee has already begun. The announcement of winners is scheduled to take place in January 2019, followed by a presentation ceremony in April.

Area of
Physics, Chemistry, Informatics, Engineering

Materials and Production

Background and rationale:

The discovery and development of new materials with non-conventional properties and the development of advanced production technologies have brought about numerous innovations, thereby contributing greatly to the sustainable development of our society and to the improvement of safety in social infrastructure.

For instance, we have designed and synthesized artificial materials, such as semiconductors, polymers, nanomaterials, catalysts and magnetic materials with new functions, as well as new types of super heat-resistant materials and high-specific-strength structural materials.

We have also developed new industrial technology, such as design and manufacturing technologies supported by computational and data science, high-resolution/high-precision measurement techniques and nanostructured precision control processes, along with robot technology that improves the efficiency of production processes.

In order to make effective use of finite resources and build a sustainable society for the future, we are in need of epoch-making innovations in the development of new functional and structural materials, as well as in industrial design, production and operation technologies.

Eligible achievement:

The 2019 Japan Prize in the field of “Materials and Production” is awarded to an individual(s) who has made momentous scientific and technological breakthroughs by developing materials with new functions, developing new structural materials that support social infrastructure or improving technologies for industrial design, production and operation, which enable the creation of new products, services and industries that improve the quality, safety and security of people’ s lives, thereby making a significant contribution to the sustainable development of society or to its potential for great advances in the future.

Area of
Life Science, Agriculture and Medicine

Biological Production, Ecology

Background and rationale:

As we experience a population explosion and face global environmental changes, most notably global warming, overcoming environmental and food problems is critical for the sustainable development of our society. To achieve this, we must protect the environment, which is the cradle for biological production, and at the same time, increase its bioproductivity and ensure the ecologically harmonious use of biological resources.

Developments thus far have included advances in production technologies, the creation of environmentally adaptive breeds, the realization of environmentally harmonious biological production, as well as harnessing the ability of organisms to produce useful substances, and the enhancement of functionality in foods.

There is also a great need for the advancement of basic science and technological innovation in such areas as the conservation and restoration of the environment and ecosystems, sustainable utilization of ecosystem service, and ecological forecasting.

In the future, collaboration across various fields, such as geoscience, the social sciences and the health/human life sciences, will be crucial in tackling the issues of biological production and utilization, ecology and the environment, which cannot be solved independently by any one discipline.

Eligible achievement:

The 2019 Japan Prize in the field of “Biological Production, Ecology” is awarded to an individual(s) who has contributed significantly to the sustainable development of a society in harmonious coexistence with life and the environment, or to its potential for great advances in the future, through the establishment of innovative new concepts and the creation, development and dissemination of scientific and technological breakthroughs pertaining to biological production, as well as through advances in the basic sciences in ecology and the environment.

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. The Foundation awarded research grants to 247 young scientists since the program’ s inception in 2006. By supporting the research career of young scientists and researchers, the Foundation hopes to contribute to the advancement of science and technology and to the peace and prosperity of mankind. From 2014, studies in “Clean & Sustainable Energy” were added as an eligible field.

“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 through lectures, experiments and laboratory visits. The program began in March 1989 and with 15 seminars per year, the foundation has so far held 310 seminars across Japan.

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 between the age of 18 to 24 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 62 undergraduate and graduate students.