



JAPAN PRIZE

2017 (33rd) Japan Prize Presentation Ceremony

Three scientists from Israel, France and the U.S. receive the prize
in the presence of Their Majesties the Emperor and Empress



The Japan Prize Presentation Ceremony was held on Wednesday, April 19th 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 2017 (33rd) Japan Prize was awarded in two fields, namely, "Electronics, Information and Communication" and "Life Science." Dr. Adi Shamir of Israel was recognized for laying the foundation for the information security of today through his pioneering research on cryptography. Meanwhile, Prof. Emmanuelle Charpentier of France and Dr. Jennifer A. Doudna of the U.S. were recognized for elucidating the genome editing mechanism by the CRISPR-Cas. 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 2017, the "Electronics, Information and Communication" field received 137 nominations, and the "Life Science" field received 187 nominations, from which the three 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 to create a prestigious international prize for

scientists from around the world as a token of gratitude to international society. With a cabinet endorsement, the Prize was first awarded in 1985. Since that year, the Japan Prize Foundation has awarded the Japan Prize to 88 laureates from 13 countries, to date.

"Electronics, Information and Communication" field

Contribution to information security through pioneering research on cryptography

Dr. Adi Shamir

Born: July 6, 1952
Professor, Weizmann Institute of Science



"Life Science" field

Elucidation of the genome editing mechanism by the CRISPR-Cas

Prof. Emmanuelle Charpentier

Born: December 11, 1968
Director, Max Planck Institute for Infection Biology (Berlin)



Dr. Jennifer A. Doudna

Born: February 19, 1964
Professor, University of California, Berkeley



 Message from the laureate

It is an immense honor to be here in the presence of their majesties the Emperor and Empress of Japan and all the other distinguished guests, and to receive the highly prestigious Japan Prize. I would like to thank the Japan Prize committee for their selection, and the Japan Prize Foundation for organizing this wonderful event.

I believe that my selection was not only due to my personal scientific achievements, but also due to the increasing importance of data and cyber security research.

Preventing attacks, preserving privacy, and safeguarding personal and national digital assets had become a critical part of our lives. I am proud to be one of the first few researchers who helped to establish

this area as a thriving scientific field, along with my colleagues Diffie, Hellman, Rivest, Adleman and others, and would like to thank them for the many years of fruitful collaboration.

Receiving the Japan Prize is particularly satisfying for me since I have so many Japanese colleagues and friends, many of whom are present here. In fact, some of my most important scientific discoveries were made possible by the very fruitful discussions I had with them during my many visits to Japan over the last 30 years.

Finally, I would like to take this opportunity to thank my supportive family, for always being there.

Adi Shamir

 Message from the laureate

Their Majesties, the Emperor and Empress of Japan, Distinguished dignitaries and scientists, Dear colleagues, ladies and gentlemen, I am deeply honoured to receive the Japan Prize from the Japan Prize Foundation. It is an extraordinary privilege for me to be considered among the esteemed laureates of this most prestigious of prizes.

I am very grateful to the members of the board of directors and the members of the selection committee who have supported the nomination of CRISPR-Cas9 for this prize recognizing international achievements in science and technology.

I would like to share this recognition with my former and present team members, colleagues and collaborators who have been involved in the discovery and development of CRISPR-Cas9, and who have trusted my vision for this project. The prize recognizes over a decade of hard work and dedication on the part of a team of young researchers with which it has been my pleasure to collaborate. I especially wish to thank Maria Eckert, Elitza Deltcheva, Krzysztof Chylinski and Martin Jinek.

I would also like to gratefully acknowledge my former mentors,

my colleagues, friends and family and all the passionate researchers who have strongly influenced my work and career over the years. I thank particularly Rodger Novak for his trust and support, and also Shaun Foy for co-founding ERS Genomics and CRISPR TX.

I will continue to advocate for research addressing fundamental biological questions, as this has been and will always be the foundation of innovation in biotechnology and medicine. It brings me delight to see that research on what were considered obscure regulatory mechanisms in a human pathogen has given rise to CRISPR-Cas9, a revolutionary genome editing and engineering technology. The curiosity, and the quest for knowledge and understanding that led to these discoveries have always been the driving forces in my career and my life. In receiving this honour tonight, I hope to encourage and inspire young scientists to cultivate curiosity, nurture a sense of wonder, and ask the fundamental questions.

Thank you.

Emmanuelle Charpentier

 Message from the laureate

It is a great honor to stand here this afternoon in the presence of their Majesties the Emperor and Empress of Japan, with so many distinguished guests and several of my Japanese friends.

I would like to thank the Japan Prize Foundation president and foundation members as well as the members of the prize selection committee, for their support of fundamental science. I am greatly honored to receive the Japan Prize which honors the work of my collaborator Emmanuelle Charpentier and myself and our lab members, Martin Jinek, Kryz Chylinski, Michael Hauer and Ines Fonfara.

I consider the award a strong endorsement of curiosity-driven, fundamental discovery science. We are here because of the awesome power of bacteria! At a time when many countries are cutting back on funding for fundamental research, this award and the work that it honors serve to emphasize the intrinsic value of science to society.

There are many people that I am deeply grateful to, and I'd like to especially thank my mentors including Jack Szostak, Tom Cech, Sharon Panasenko, Fred Grieman, Tom Steitz, Joan Steitz,

Robert Tjian, Paul Alivisatos and Michael Botchan for their unwavering support and guidance at key points in my career.

I'd also like to thank my colleagues at UC Berkeley and elsewhere who have been constant supporters and just fabulous people to work with. I am of course also indebted to the many wonderful students and postdocs who have worked with me over the years including Martin Jinek, now a faculty member at the University of Zurich.

And I am most grateful to my supportive family members - my sisters Sarah and Ellen Doudna, and especially my husband Jamie Cate and my son Andrew, who have been steadfast supporters of my personal and professional journey in life.

Thanks again to all of you for being here and supporting science and the technologies that come from it, for the improvement of human health and the world we live in.

Jennifer A. Doudna

Presentation Ceremony



The 2017 (33rd) 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. Itsuro Terada, Chief Justice of the Supreme Court, Mr. Hirokazu Matsuno, Minister of Education, Culture, Sports, Science and Technology, Mr. Yosuke Tsuruho, 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 “Vltava” from Smetana’s “Má vlast” as requested by Dr. Shamir, the third movement of Brahms’ s Symphony No. 3, Op. 90 as requested by Prof. Charpentier, and Ravel’ s “Boléro” as requested by Dr. Doudna.



|| Dr. & Mrs. Adi Shamir



|| Prof. Emmanuelle Charpentier



|| Dr. & Mr. Jennifer A. Doudna



|| 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 Komiya, 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 Hotel New Otani 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. Shamir spoke on the importance of science education based on his own experience, and expressed his gratitude to the Weizmann Institute of Science for giving him a wonderful early introduction to science, and for later becoming his scientific home. Prof. Charpentier stated, “it is an extraordinary privilege for me to be considered among the esteemed laureates of this most prestigious of prizes,” and thanked her former and present research team members, colleagues, mentors, etc. as well as the Laboratory for Molecular Infection Medicine Sweden at Umeå University, with which she is affiliated, for enabling her to develop CRISPR-Cas9 from a bacterial immune system into a genome editing technology. Dr. Doudna expressed her appreciation to her family, particularly her husband, Jamie, for their steadfast support. She revealed that the countless discussions she had with her husband about experiments and data have inspired her and continue to motivate her in the lab and beyond. Finally, Dr. Doudna thanked all those who support science and the technologies that come from it, for the improvement of human health and the world we live in.



Toast by His Majesty the Emperor of Japan



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



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



Acknowledgment by Dr. Adi Shamir



Acknowledgment by Prof. Emmanuelle Charpentier



Acknowledgment by Dr. Jennifer A. Doudna

2017 (33rd) Japan Prize Commemorative Lectures

On Thursday, April 20th, the day after the presentation ceremony, commemorative lectures by Dr. Shamir, Prof. Charpentier and Dr. Doudna 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. Shamir spoke on the topic of “Cryptography: Past, Present, Future,” Prof. Charpentier on “Origins, Mechanisms and Evolution of the CRISPR-Cas9 Technology,” and Dr. Doudna on “A CRISPR World: From Biology to Technology of Genome Editing.”

Prior to the lecture, discussion meetings were held among the three laureates and young researchers. At the meeting with Dr. Shamir, four researchers selected from the participants presented their research topics on cryptography, and received advice and questions from Dr. Shamir. At the meeting with Prof. Charpentier and Dr. Doudna, all of the 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.

"Electronics, Information and Communication" field

Topic

Cryptography: Past, Present, Future

(Dr. Adi Shamir)



Dr. Shamir pioneered the field of cryptography using mathematical methodology, and elevated it to the status of an academic discipline, “cryptology.” He opened the lecture by describing the thriving state of present-day cryptology, saying, “today, cryptology is studied at most major universities in the world, and thousands of papers are submitted and hundreds of conferences held every year.” He then went on to reflect on his past.

For many years, cryptography was a domain limited to the select few, such as government, military, diplomatic personnel and spies, and studied by very few researchers. The situation changed dramatically in the 1970s. The advent of the internet, the growing availability of personal computers, and the installation of ATMs by banks created a need to check account numbers and other secret information of individuals and groups. Thus, cryptography became an essential component of digital networks.

1977 was a watershed year. Having obtained his Ph. D. from the Weizmann Institute of Science in Israel, Dr. Shamir took up his first academic post as a young researcher in the Department of Mathematics at the Massachusetts Institute of Technology (MIT) in the U.S. in January of that year. In that first month, he took a sudden interest in the world of cryptography, about which he knew nothing. He was intrigued by a new method called the “public key cryptography” proposed by young researchers at Stanford University. Working on the proposal with his colleagues at MIT, Dr. Rivest and Dr. Adleman, Dr. Shamir co-invented the “RSA cryptosystem,” the world’s first public key cryptosystem in April. This was to become a landmark achievement in the field of cryptography.

In the 1980s, Dr. Shamir returned to the Weizmann Institute of Science, where he established a cryptographic research group. Initially, there were only about fifty cryptography researchers worldwide, but their numbers increased steadily, leading to a succession of remarkable research accomplishments, including Dr. Shamir’s “identification scheme.” At the same time, the divergence of mathematical theory from practice became an issue. For example, theory could not provide an answer to the question, “is the RSA public key cryptosystem and the DES common key cryptosystem really secure?”

Shortly after his first visit to Japan in 1988, Dr. Shamir shifted the focus of his research to tackle practical questions. In 1990, he proposed “differential cryptanalysis,” a general method to decipher common key cryptosystems. Dr. Shamir reflected that, “through discussions with Japanese researchers, I was able to find a new path.”

"Life Science" field

Topics

Origins, Mechanisms and Evolution of the CRISPR-Cas9 Technology

(Prof. Emmanuelle Charpentier)

A CRISPR World: From Biology to Technology of Genome Editing

(Dr. Jennifer A. Doudna)



Genome editing by the CRISPR-Cas9, achieved by the joint research between Prof. Charpentier and Dr. Doudna, has been rapidly adopted in a wide range of fields as a revolutionary new technology in genetic engineering that can be applied to any cell in any organism.

Only five years have passed since their first paper was published in 2012. The two researchers marvel at the momentum it has taken on, finding it “remarkable that it has already reached the clinical research stage.” Receiving extensive coverage even in media geared to the general public, the impact and anticipation surrounding the technology places it among the top achievements in life science research in recent years.

The catalyst for the realization of this technology was the curious repeating sequences observed in bacterial DNA. Although Dr. Yoshizumi Ishino and his team at Osaka University first reported a repeating sequence in an E. Coli genome in 1987, its significance remained a mystery for many years. It was later discovered that this sequence, named CRISPR, is a structure made up of the DNA of invaders, such as viruses, which have been cut out and stored in the bacterium’s DNA, and is involved in the adaptive immunity of bacteria. It is an ingenious system which memorizes the invader, stores it, and detects it upon the next infection so that it can be destroyed instantly.

Prof. Charpentier, a microbiologist who was studying the regulatory functions of RNA molecules at the University of Vienna, became interested in CRISPR early on. In 2009, through her work with streptococcus pyogenes, she hypothesized that Cas9 and two RNA enzymes play an important role in a bacterium’s immune system. Meanwhile, Dr. Doudna, a researcher studying RNA at the University of California, became aware of the hypothesis, and sought to elucidate RNA’s molecular mechanism by further exploring its function.

As a result of the research collaboration between their research groups that arose out of their meeting at an academic conference in 2011, they elucidated the detailed mechanism of how the complex formed by the Cas9 enzyme and two types of RNA that have been transcribed from the stored viral DNA fragment cleaves the two DNA strands of a re-invading virus with pin-point accuracy.

Their research extended beyond elucidating the mechanism, proposing that when a synthesized RNA that corresponds to the target DNA locus is introduced into the cell together with Cas9, it could cut DNA at arbitrary locations, paving the way to a new form of genome editing. In 2013, Dr. Doudna and her team reported on genome editing in a live mammalian cell.

Their research has brought about a speedy, simple and low cost technology to freely edit genomes, much as one rewrites part of text on a computer. The fields of application span medicine, pharmaceutical development, agriculture, livestock breeding, etc. A wide range of applications have been reported, including the development of hornless cattle, mosquitos resistant to the dengue virus, treatment of genetic blood disorders and attempts to develop pigs that can serve as organ donors to humans.

Yet, the development of such a powerful tool gives rise not only to possibilities but also to the danger of producing unexpected results. The manipulation of germline cells that would be passed down to future generations and genome editing that threatens biodiversity are some of the ethical issues that abound. The first international conference to discuss the ethical issues associated with genome editing was held in 2015.

The laureates concluded the lecture with the following message to young scientists. “Follow your instincts, explore with an open mind, and place importance on fundamental questions. Science is fun.”

Japan Prize Week

JAPAN PRIZE WEEK PHOTOS

4/17
(MON)

Welcome Reception



Welcome Reception at French Embassy



4/18
(TUE)

Academic Roundtable Discussion



Courtesy Call on the Prime Minister Abe



Courtesy Call on the Japan Academy



4/19
(WED)

Presentation Ceremony



Banquet



4/20
(THU)

Commemorative Lectures



4/22
(SAT)

Sightseeing in Kyoto



|| In Katsura Imperial Villa



|| In Matsushita Shinshin-An

Fields Eligible for the 2018 Japan Prize

The fields eligible for the 2018 (34th) Japan Prize are "Resources, Energy, Environment and Social Infrastructure" and "Medical Science and Medicinal Science."

The Japan Prize Foundation has received numerous nominations from the 13,000 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 2018, followed by a presentation ceremony in April.

Area of
Physics, Chemistry and Engineering

Resources, Energy, Environment and Social Infrastructure

Background and rationale:

A major goal for humankind is the realization of the sustainable development of our society while overcoming various limitations in resources, energy, and the environment, as affirmed by the United Nations' Sustainable Development Goals (SDGs) in 2015. Widening social disparity and the increasing number of communities vulnerable to disasters are of growing concern, as the impact of climate change accumulates and urbanization intensifies.

Thus, we are in serious need of further innovation in the effective development, utilization and recycling of water and resources, various energy-related technologies, and social infrastructure technologies for cities and transportation systems. Another key challenge is to spur innovation in fundamental technologies for the realization of a resilient society capable of predicting and responding to environmental changes, as well as of preventing and mitigating natural and human made disasters.

Achievement eligible:

The 2018 Japan Prize in the field of "Resources, Energy, Environment and Social Infrastructure" is awarded to an individual(s) who has achieved breakthroughs in the creation, innovation, development or dissemination of science and technology, thereby contributing towards the sustainability of human society and the improvement of the global environment.

Area of
Life Science, Agriculture and Medicine

Medical Science and Medicinal Science

Background and rationale:

In recent years, developments in modern science have brought about remarkable advancements in the field of medical science and medicinal science. Revolutionary medical technologies like individually optimized precision medicine driven by personalized diagnosis and genomic medicine, and regenerative medicine have been established one after another, alongside the elucidation of pathological mechanisms for various diseases. While diseases associated with aging and changes in lifestyle are on the rise, emerging infectious diseases and resistant bacteria, fueled by globalization, have also become a worldwide issue.

In such times of change, it is highly anticipated that medical science and medicinal science, integrated with other disciplines like engineering and information science, will make a greater contribution towards healthy living. These include the creation and spread of new medical treatments, the development and production of new drugs as well as the development of drug delivery systems.

Achievement eligible:

The 2018 Japan Prize in the field of "Medical Science and Medicinal Science" is awarded to an individual(s) who has achieved scientific and technological breakthroughs, such as new discoveries or the development of innovative technologies on the "prevention", "diagnosis", "treatment" or "prognosis" of diseases, thereby contributing towards the health and well-being of mankind.

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. The Foundation awarded research grants to 250 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 295 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 60 undergraduate/graduate students.