

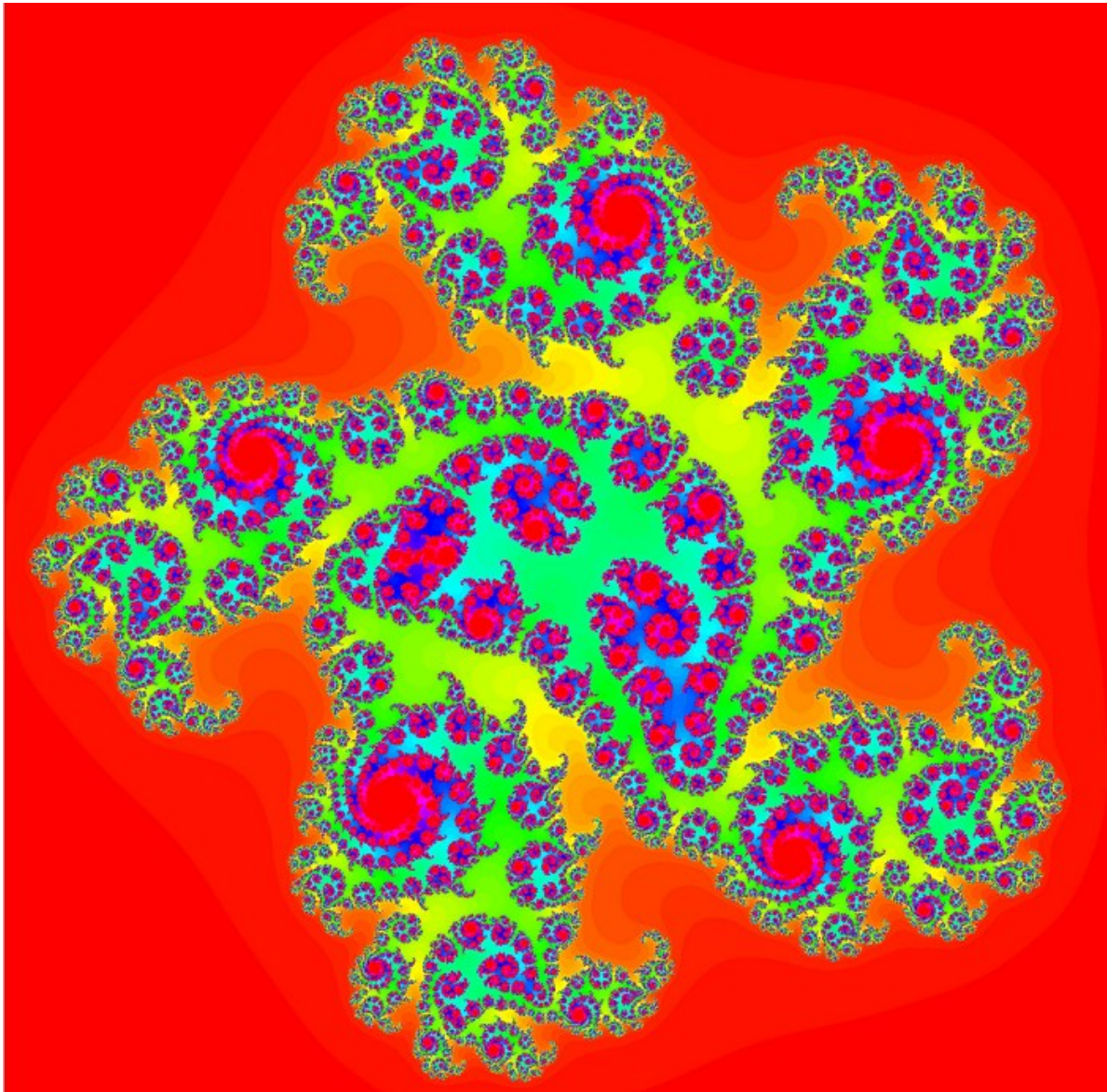
HIROSHIMA UNIVERSITY UPDATE



HIROSHIMA UNIVERSITY

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CREDIT: Masafumi Yoshino / Hiroshima University

Turning mathematical formulae into images

Professor Masafumi Yoshino (Graduate School of Science), whose research field is a dynamical system, came up with the idea of expressing the formulae in his research as images and sounds through the computer system called Mathematica.

For more latest news including high-impact research, please read on.



HIROSHIMA UNIVERSITY

Embodying its founding principle of “a single unified university, free and pursuing peace,” Hiroshima University is one of the largest comprehensive research universities in Japan. Today, HU is making steady progress as a global university, taking on worldwide challenges and strengthening its global educational network by signing international exchange agreements with universities around the world and opening overseas bases at strategic locations.






CAMPUS PHOTOS (AUTUMN)

In the first week of every November, the University Festival is held for two days on the Higashi-Hiroshima campus and Kasumi campus. To welcome and entertain the visitors, HU students plan and organize a wide range of events. Homecoming Day also takes place just for one day with many alumni of HU and their families in and outside Japan coming back to their home campus. Autumn leaves in beautiful colors welcome the visitors during the festival days.

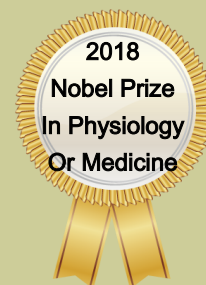


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Lecture by Nobel Laureate

Dr. Tasuku Honjo



At the commemoration ceremony for the establishment of two graduate schools: Graduate School of Integrated Sciences for Life, and Graduate School of Biomedical and Health Sciences

Serendipities of acquired immunity



talked about the history of molecular immunology research in relation to his discovery which led to the awarding of the 2018 Nobel Prize in Physiology or Medicine. He also encouraged the students in the audience by saying "It is important to figure out by yourself what is an important issue as well as what you want to know most".

After the lecture, President Ochi presented Dr. Honjo with the title of Honorary Professor of Hiroshima University, recognizing him for his many scientific achievements.

On July 20th, a commemoration ceremony and party were held at the local hotel in Hiroshima city for the two graduate schools established on April 1st: Graduate School of Integrated Sciences for Life and Graduate School of Biomedical and Health Sciences.

During the commemoration ceremony, President Ochi outlined the reorganization roadmap of the 11 Grad-

uate Schools including the establishment of the Graduate School of Integrated Sciences for Life and Graduate School of Biomedical and Health Sciences. He concluded his speech by saying, "To become a university of world-wide reputation and splendor for years into the future, each member of the university will be united as one and continue to commit himself/herself to university reforms."

Before holding the ceremony, Professor Tasuku Honjo (the Deputy Director-General and Distinguished Professor of Kyoto University Institute for Advanced Study and a Noble laureate of Physiology or Medicine in 2018) gave a lecture entitled "Serendipities of Acquired Immunity". About 400 people including high school students came to the venue, all listening to his lecture attentively.

In his lecture, Professor Honjo



Students during Q&A time asking questions enthusiastically

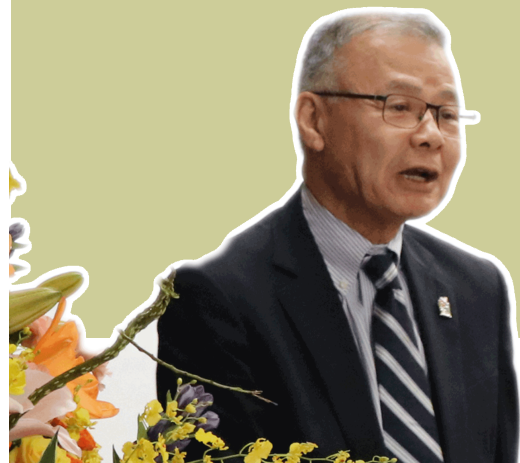


President Ochi delivering a speech in the commemoration ceremony



Professor Honjo receiving an award plaque for Honorary Professor of Hiroshima University

The 5th Peace Lecture Marathon



**H.E.
Mr. Sadayuki Tsuchiya**

Ambassador of Japan to Peru



“The War and Peace Experience of Japanese Peruvians en el Perú”

In order to fulfill its mission to create a diversified, free and peaceful global community, Hiroshima University aims to cultivate “peace-pursuing, cultured individuals with an international mindset and a challenging spirit”. We organized a series of lectures entitled “Peace Lecture Marathon” where government representatives and ambassadors in Tokyo are invited to give a lecture on peace from 2018.

On 4th October 2019, H.E. Mr. Sadayuki Tsuchiya, Ambassador of Japan to Peru, gave a lecture entitled “The War and Peace Experience of Japanese Peruvians en el Perú” at the Higashi-Hiroshima campus. The venue was filled with faculty, administrative members, and international students of Hiroshima University, attentively listening to his lecture.



Expanding Global Network 3 New Overseas Bases Opened

HU has established 22 overseas bases in 15 countries/regions (As of September, 2019).



**Changchun University
Special Needs Education
Research Center**
Place: in Changchun
University in China
Date: 8th Sep 2019

International Exchange Agreements (As of May, 2019)

University-level:

347 Agreements with **314** Organization
in **52** Countries/Regions

School/Institute level:

391 Agreements with **354** Organization
in **52** Countries/Regions



**International Education
Exchange Center**
Place: in Southwest University of Political Science & Law in Chongqing, China.
Date: 26th Aug 2019



Mexico Center
Place: in the National Autonomous University of Mexico (UNAM), Mexico
Date: 9th Sep 2019

Meeting with the President el-Sisi of Egypt



The meeting with President el-Sisi (middle) and President Ochi (third from the left)



On 28th August 2019, President Mitsuo Ochi and Executive Vice President Toshiyuki

Sato had a meeting with H. E. Mr. Abdel Fattah el-Sisi, President of the Arab Republic of Egypt at TICAD7 (Tokyo International Conference on African Development) held in Yokohama.

From the Arab Republic of Egypt, H.E. Professor Dr. Khaled Atef Abdel Ghaffar, Minister of Higher Education and Scientific Research, H.E. Mr. Ayman Aly Kamel, Ambassador of

Egypt to Japan, and Mr. Masaki Noke, Extraordinary and Plenipotentiary Ambassador of Japan to Egypt, joined the meeting.

In the meeting, President Ochi explained that Hiroshima University has been propelling the cooperation with Egypt since he became the president in 2015, and has had proven records of international exchange between Japan and Egypt. President el-Sisi expressed his expectations that HU will play a role in helping to further expand the academic exchange between the two

countries.

Now in Egypt, a project of establishing Galala University is underway with an initiative of the Egyptian President. Hiroshima University is planning to send some lecturers there and help designing curriculum at Galala University. HU intends to actively implement collaboration with higher education institutions in Egypt by largely focusing on academic and students exchanges with its counterparts in Egypt. To start with, HU is planning to receive annually about 100 students from Egypt.

Hiroshima University and two Rectors' Summit/Conference



The Japan-Mexico Rectors Summit



On 9th and 10th of September 2019, the 4th Japan-Mexico Rectors'

Summit was held in Mexico City with the participation of 23 universities from Japan and 38 from Mexico. From Hiroshima University, President Mitsuo Ochi, Executive Vice President Toshiyuki Sato, and Specially Appointed Professor Naotaka Hiramami attended the summit.

During the opening ceremony, President Ochi gave an address on behalf of all the delegates from Japan in which he emphasized that universities truly play major roles when it comes to seeking solutions to the issues that concern the world. In so doing, he reminded the participants that it is essential for them to see things from the viewpoint of "Peace" and "Sustainability". In such context, he explained that Hiroshima University inevitably assumes an important

role in human history as it was established in the city that suffered the world's first atomic-bomb attack.

After the opening ceremony and keynote speeches came four sessions with the following titles: "Society 5.0"; "The Role of Universities towards Sustainability"; "Natural Phenomena-related Hazards and Risks"; and "The Future of

the Universities". In each of these sessions, rectors representing from the two countries delivered presentations in which the participants were given opportunity to share the actual case examples and exchange development of the presenter's university. Following these sessions, the participants were engaged in an active exchange of opinions regarding the

issues taken up in these presentations.

At the end of the summit, the joint statement was read out in which it referred to the participants' intention to further expand academic exchanges between Japan and Mexico. The next Japan-Mexico Rectors' Summit is scheduled to be held in Japan.

The 5th Japan-Indonesia Rectors' Conference



On October 10th and 11th 2019, the 5th Japan-Indonesia

Rectors' Conference was held at Rihga Royal Hotel Hiroshima. A total of about 150 delegates from 32 Japanese universities/institutions and 37 Indonesian universities gathered to the conference venue in Hiroshima city.

The summit was held under the theme "Collaboration in Research and Education for Sustainable and Peaceful Society" to discuss research and education collaboration, as well as to promote exchange between universities in Japan and Indonesia.

At the conference, President Ochi began by referring to the current global situation where the rapid advancement of research into Big Data, Robotics, Artificial Intelligence and Regenerative Medicine are in parallel to the rise of world-wide issues concerning national particularism, social divide, act of terrorism, shortages in energy, food and water, fre-

quent natural disasters caused by extreme weather. He then pointed out that such issues cannot be addressed by one university nor one country, and hence it is essential for Indonesian and Japanese higher education institutions and government to tackle these issues together from the viewpoint of "Peace" and "Sustainability". He also stressed that what is expected of higher education institutions between the two countries is to fully realize the roles they should play and to live up to their responsibilities by undertaking advanced studies and cultivating talented individuals for future generations.

President Ochi's speech was followed by the remarks of the following three distinguished guest speakers: Mr. Satonobu Matsunaga (Leader of International Strategy Team at Higher Education Bureau of MEXT); Mr. Mirza Nurhidayat (Consul General of the Consulate General of the Republic of Indonesia in Osaka) ; and Professor Ismunandar (Director General

for Learning and Student Affairs at the Ministry of Research, Technology, and Higher Education in Indonesia). After these remarks came a keynote speech by former prime minister of Japan, Yasuo Fukuda, who pointed out, "The development of Asian countries would not be possible without achieving their political stability." and "For achieving that, we also need to put a priority on cultivating talented individuals in the region."

Official website of the Conference:

https://www.hiroshima-u.ac.jp/en/Japan-Indonesia_rectors_conference2019



Mr. Yasuo Fukuda
Former prime minister of Japan



Cultural Exchange Event for "Enjoying the Authentic Flavor of Hiroshima Food!"



On 24th June, 2019, Hiroshima University held a cultural exchange event on the Higashi-Hiroshima campus.

We scheduled this event tailored to the ending of the Ramadan fasting month so that all of the international students, faculties, and staff members with various cultural and religious backgrounds could join the event and eat together. More than 300 participants including the international students and researchers, home students and faculty members of various die-

tary backgrounds, gathered at the University Hall, interacting with one another while enjoying the authentic Hiroshima food such as "Okonomiyaki" and "Momiji Manju" (small, maple-leaf-shaped sweets).

With the cooperation of General Incorporated Foundation Oconomiya-ki Academy, professional chefs served freshly cooked halal Okonomiyaki on the full-scale iron plates.

The sauce used for the event was "Halal Okonomi Sauce" sponsored by Otafuku Sauce Co. Ltd, a comprehensive collaboration agreement partner of HU. The company has developed this original "Halal Okonomi Sauce" in accordance with Islamic dietary rules and received Halal certification from an official certifying agency.

This year a new "Okonomiyaki Experiencing Booth" was set up where partic-

ipants can try making okonomiyaki on the iron plates using the metallic spatula with guidance from professional chefs.



A short video on YouTube:

<https://youtu.be/fVvDu2fdU0>

Hiroshima University Students Demonstrated Brilliant Performance at the HIRAKU 3MT (Three Minute Thesis) Competition 2019



Ms. Hanako Umehara (Graduate School of Biomedical and Health Sciences), HIRAKU 3MT 2019 Competition Winner

The 5th HIRAKU 3MT Competition was successfully held on 14th September 2019 at Higashi Hiroshima Arts & Culture Hall (Kurara).

In front of an audience of 270 people, 25 doctorate students from 6 universities in the West-Japan showcased their research with a single slide in a limited three minutes, in a language

appropriate to non-specialist audience. Ms. Hanako Umehara (Graduate School of Biomedical and Health Sciences) won the first prize and People's Choice Award, while other four students from Hiroshima University received the following awards:

- **Global Challenge Award:** Azusa Matsumoto Reardon (Graduate School for International Development and Cooperation)*
- **Runner-up (English Presentation):** Vu Ha Thu (Graduate School for International Development and Cooperation)
- **Runner-up (Japanese Presentation):** Miki Tanaka (Graduate School of Integrated Sciences for Life)
- **People's Choice (English Presentation):** Jade Dhapnee Zarate Compendio (Graduate School of Integrated Sciences for Life)

*As the Global Challenge Award Winner, Azusa will go on to represent HIRAKU at the Asia-Pacific 3MT Competition 2020 to be held at University of Queensland, Australia.

RESEARCH FOCUS

Graduate School of Integrated Arts and Sciences

Vest helps athletes keep their cool

Professor Hiroshi Hasegawa



The Games of the XXXII Olympiad Tokyo 2020 (24 Jul - 9 Aug) will take place in hot and humid weather conditions. Hot and humid ambient conditions limit athletes' heat dissipation capacity during exercise, thus impairing their exercise and cognitive performance, consequently increasing the risk of exertional heat illness such as heat cramps, heat exhaustion and heat stroke. The risk of heat-related illness can be reduced by adopting countermeasures such as heat acclimatization, body cooling, fluid intake strategies. We have recently developed a new type of cooling vest with a Japanese sportswear company Mizuno (photo). The cooling vest is filled with ice packs and features a collar that can also cool the neck. This cooling vest will help for athletes at the periods of warming-up, half-time interval, and

recovery of the event/competition.

Our laboratory is conducting research by focusing on the body mechanism during exercise from the viewpoints of exercise physiology. In particular, we are working on research on the body temperature regulation during exercise and practical cooling strategies for athletic field. Professor Hasegawa collaborates with a laboratory in Belgium where he has studied in the past, as well as with British and Canadian researchers, and invites these collaborators every year to hold seminars in Japan (photo).

We aim to introduce the evidence-based research results as a countermeasure against heat at the competition site. We would also like to

develop heat stroke prevention measures for the general population.

Find more detail on our homepage:

<https://home.hiroshima-u.ac.jp/hasehiro/>

Related recent research article:

<https://www.frontiersin.org/articles/10.3389/fphys.2019.00711/full>



Seminar inviting international collaborators



Push it to the limit. Hasegawa and Yudai Chaen measure the heart rate, sweat rate, muscle activity and temperature of the athlete while exercising in a hot and humid environment (35°C at 50% humidity). CREDIT: Hiroshima University

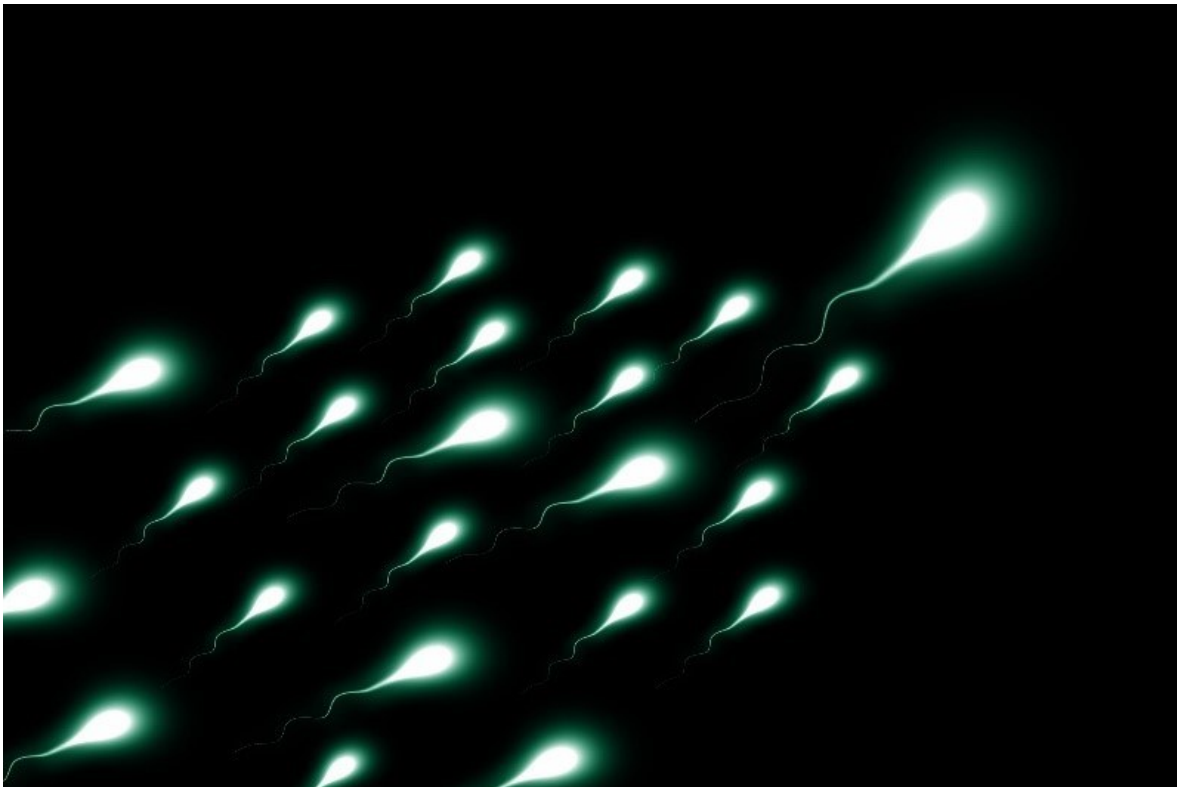
A Simpler Way to Choose the Sex of Offspring by Separating X and Y Sperm

Original text by PLOS Biology

Professor Masayuki Shimada

Assistant Professor Takashi Umehara

***Differential gene activity by the two sex chromosomes allows
X-bearing sperm to be slowed down***



Both X sperm and Y sperm swim to oocyte for fertilization. The probability to bind and penetrate to oocyte is same; however, under the specific condition, the ration of X sperm and Y sperm to reach to oocyte is changed.

Credit: Gerd Altmann from Pixabay

A simple, reversible chemical treatment can segregate X-bearing sperm from Y-bearing sperm, allowing dramatic alteration of the normal 50/50 male/female offspring ratio, according to a new study by Masayuki Shimada and colleagues at Hiroshima University, published on August 13 in the open-access journal PLOS Biology. The study was performed in mice, but the technique is likely to be widely applicable to other mammals as well.

Most cells from male mammals contain both an X and a Y chromosome, but during sperm development (spermatogenesis), the X and Y chromosomes are segregated into different cells so that an individual sperm will carry either one or the other, with an X chromosome giving rise to daughters and a Y chromosome to sons.

Unlike the Y chromosome, which carries very few genes, the X chromosome carries many, some of which remain active in the maturing sperm. This difference in gene expression between X- and Y-bearing sperm provides a theoretical basis for distinguishing the two.

The authors found that almost 500 genes are active only in X-bearing sperm, of which 18 genes encoded receptors; because of their functions to response to ligand stimuli this made them good candidates for manipulating the sperm. They focused on a pair of receptors called Toll-like receptor 7 and 8 (TLR7/8) and found that a chemical that bound to the receptors slowed sperm motility without impairing either sperm fertilization ability or viability. They showed the effect was due to impaired energy production within the sperm and could be reversed by removal of the chemical from the medium.

Treatment of mouse sperm with this X-retarding chemical, followed by in vitro fertilization with the fastest swim-

mers, led to litters that were 90% male. When the slower swimmers were used instead, the litters were 81% female.

There are other procedures that can be used to separate X and Y sperm, but they are cumbersome, expensive, and risk damaging the DNA of the sperm. The procedure developed by these authors has the potential to greatly simplify sex selection for either in vitro fertilization (in which sperm and egg join in a lab dish) or artificial insemination (in which sperm are implanted into the female reproductive tract). Such techniques are widely used in the agricultural animal breeding field, as well as in human assisted reproduction.

“The differential expression of receptor genes by the two sex chromosomes provides the basis for a novel and potentially highly useful method for separating X and Y sperm and we have already succeeded the selectively production of male or female in cattle and pig by this method,” Shimada said.

“Nonetheless, use of this method in human reproductive technology is speculative at the moment, and involves significant ethical issues unaffected by the utility of this new technique.”

Funding:

This work was supported in part by Livestock Promotional Funds of Japan Racing Association (JRA) and by Hiroshima Cryopreservation Service Co. (to MS).

Reference article:

Umehara T, Tsujita N, Shimada M (2019) Activation of Toll-like receptor 7/8 encoded by the X chromosome alters sperm motility and provides a novel simple technology for sexing sperm. PLoS Biol 17 (8): e3000398

LINK: <http://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.3000398>

Math shows why animals see at night

Associate Professor S. Seirin-Lee
Lecturer Hiroshi Ochiai

Biological experiments confirm mathematical modeling of retina development in mice



Changes in the shape of DNA structure affect the nuclei of nocturnal animals. These findings in PLOS Computational Biology could help explain how nocturnal animals, such as mice, see at night.

By combining mathematics with science, an interdisciplinary team at Hiroshima University (HU) found how changes in the shape of DNA structure affect the nuclei of nocturnal animals. Their findings could help explain how nocturnal animals, such as mice, see at night.

Nocturnal and diurnal mammals see the same – but only for a brief time. When mice are born, the chromatin in the cells of their eyes has a diurnal structure. Day by day, the layout of this chromatin slowly inverts, allowing the mice to see at night. How this change happens was a mystery.

Sungrim Seirin-Lee, Associate Professor, and Hiroshi Ochiai, Lecturer, in the Graduate School of Integrated Sciences for Life at HU, suspected that the chromatin was making the shape of the nuclei change shape. “When we started this research, our hypothesis was based 100 percent on mathematics,” Seirin-Lee said. “Because of our mathematical modeling, we found that nuclear deformation might be a key point in DNA’s structure change.”

If we could see inside of the nucleus, we would see that chromatin comes in different types and territo-

ries. Around the center of the nucleus is euchromatin, or DNA that is largely active. Heterochromatin, on another hand, is a kind of DNA that lies around the envelope or ceiling of the nucleus. Unlike euchromatin, the gene activation of heterochromatin is low.

Between nocturnal and diurnal animals, though, the differences in nuclear architecture get bigger – especially around the retina. The DNA is in the center of the nucleus in nocturnal mammals. Usually, heterochromatin stays put in the nuclear envelope. In the case of nocturnal animals, though, Seirin-Lee and Ochiai found it can be moved by the nucleus changing shape.

To describe the movement of chromatin, Seirin-Lee and her colleagues used a type of mathematical modeling called phase-field modeling. A method commonly used in material science; phase-field modeling can be used to do things like telling apart ice from water. However, according to Seirin-Lee, “it is not common in the biological sciences. In chromatin dynamics, it is the first trial in the world!” Using this function, the group could see the movement of chromatin and nucleus by determining and defining the inside and outside of the nucleus, as well as euchromatin versus heterochromatin.

When the group observed heterochromatin in the mouse’s eyes, they found

that conditional architecture triggered dynamic deformation, which resulted in an inverted nuclear architecture. In the inverted architecture case, two proteins are removed, which allows heterochromatin to move.

Then, with the assistance Ochiai, they put their model to the test on neural stem cells, which mimic retinal cells. After treating the cells with proteins that keep heterochromatin at the nuclear periphery, deformation stopped. Chromatin clustering increased, and nuclear architecture could not finish inverting. This finding was consistent with Seirin-Lee’s mathematical modeling.

Ultimately, Seirin-Lee and her colleagues want to see if their findings are universal to mammal cells. “At this stage, we think it is just mouse eyes,” Seirin-Lee said, “but we don’t know! Maybe humans could have such structures by dynamic nuclear deformation.” Next, Seirin-Lee is looking to tackle the intermediate structure, or a sort of hybrid between conventional and inverted architecture of the nucleus.

Reference article:

Seirin-Lee S, Osakada F, Takeda J, Tashiro S, Kobayashi R, Yamamoto T, et al. (2019) Role of dynamic nuclear deformation on genomic architecture reorganization. *PLoS Comput Biol* 15 (8): e1007289. DOI: <https://doi.org/10.1371/journal.pcbi.1007289>

Funding:

This work was supported by JSPS KAKENHI Grant Numbers JP18H05531 and JP19K06612 to H.O.; JP16K17643 to S.S.L.; JP15K15631 to F.O., and by JST, PRESTO Grant Number JPMJPR16E2 to S.S.L.; JPMJPR14F6 to F.O.; and JPMJPR15F2 to H.O., Japan.

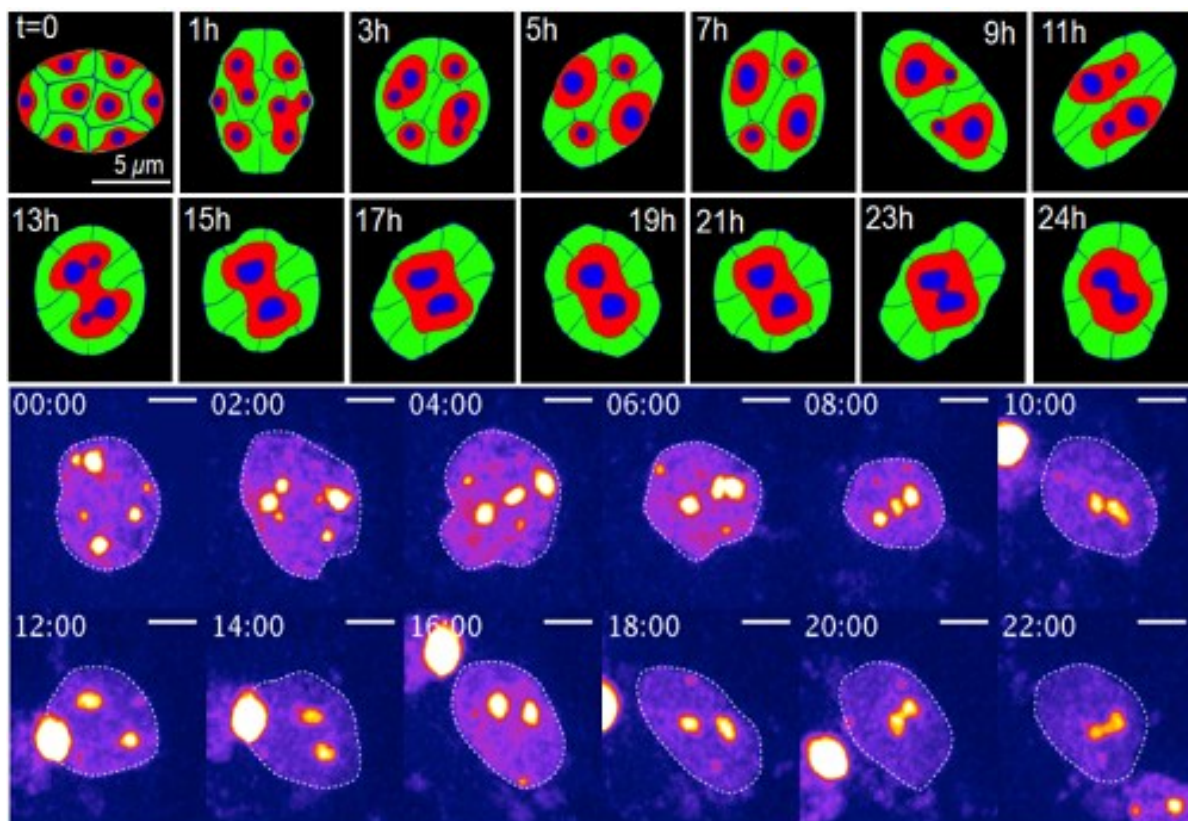
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[@HU_Research](https://twitter.com/HU_Research)



Change of chromatin structure induced by dynamic nuclear deformation

Upper: simulation result by mathematical model, Below: live imaging data of experiment

Images of the surface of asteroid Ryugu from Hayabusa2's MASCOT lander

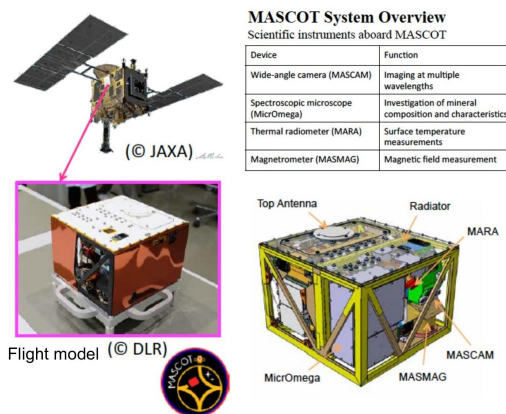
Professor Hikaru Yabuta
on behalf of Hayabusa2 Project Team

A small lander of Japanese Aerospace Exploration Agency (JAXA)'s spacecraft Hayabusa2, the Mobile Asteroid Surface Scout (MASCOT), has successfully landed on and acquired the images of the surface of asteroid Ryugu. The achievements have been published in Science vol 365 on August 23, 2019.

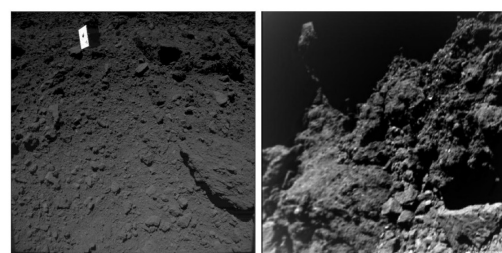
The MASCOT lander was developed by German Aerospace Center (DLR) and the National Centre for Space Studies (CNES), the international partners of Hayabusa2. It is a cuboid lander (0.275 x 0.290 x 0.195 m) whose mass is ~9.8 kg. MASCOT is equipped with the four scientific instruments, a camera (MASCAM), a radiometer (MARA), an infrared spectroscopic microscope (Micromega) and a magnetometer (Mag). It moves by hopping with a motor rotating within the lander.

On Oct 3, 2018, Hayabusa2 spacecraft descended to the altitude of 54 m and then MASCOT was separated from Hayabusa2. The lander operation was originally scheduled to last 16 hours, but actually achieved a 17-hour successful survey. According to images of the Ryugu surface acquired by MASCAM, the surface is covered with boulders of meter to several tens of centimeters. On the other hand, unexpectedly, there was no regolith. The observation revealed that the boulders have two types of morphologies: One has a bright and smooth texture, and another has a dark and cauliflower-like texture. From the dark boulders, a number of inclusions which are similar to those of carbonaceous meteor-

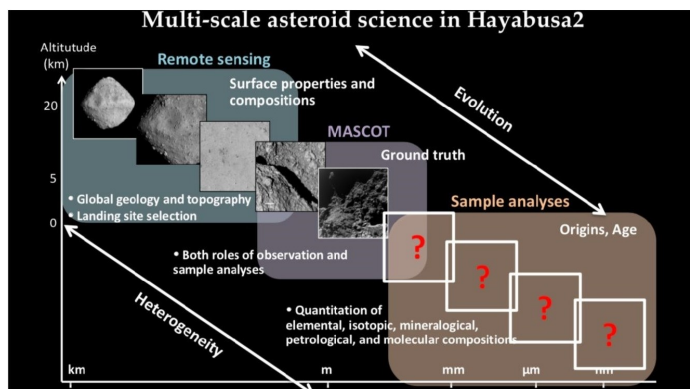
ites, were identified. These results will provide new insights into the formation of asteroid Ryugu and will help understanding the data from chemical analyses of the returned samples. Before releasing the result, the first results obtained by the remote sensing instruments have been published in Science vol 364 on March 19, 2019. Professor Hikaru Yabuta, Department of Earth and Planetary Systems Science, Hiroshima University, is a science team member of Hayabusa2. Last year she participated in the landing site selection for the first touchdown of the spacecraft with engineering and observation teams. She also leads a working group of multi-scale asteroid science that aims to integrate the results from remote sensing instruments, landers, and sample analyses in the project. As her main mission, she will lead the chemical analyses of organic materials in the returned asteroid samples during the initial analyses, after the sample return in the end of 2020.



Overview and system overview of MASCOT lander. (From JAXA press conference materials (Oct 11, 2018))



(Left) Image of MASCOT captured with an optical navigation camera (ONC-Wide angle camera 2) on October 3, 2018. (Right) Image of the surface of asteroid Ryugu taken by MASCOT just before its landing. (Credit: DLR, JAXA, Univ. of Tokyo)



Concept of multi-scale asteroid science in Hayabusa2. (Credit of images of Ryugu: JAXA, Univ. of Tokyo, Kochi Univ., Rikkyo Univ., Nagoya Univ., Chiba Inst. of Tech., Meiji Univ., Aizu Univ., AIST)

Paper information:

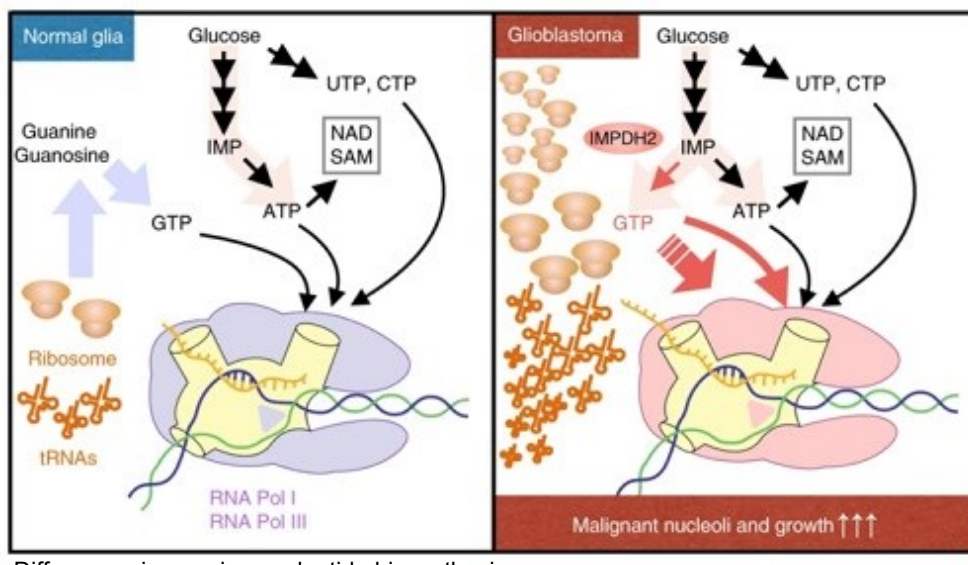
Jaumann, R. et al. (2019) Images from the surface of asteroid Ryugu show rocks similar to carbonaceous chondrite meteorites. Science 365, 817-820. DOI: 10.1126/science.aaw8627

Tumor energy source found by scientists at Hiroshima University, University of Cincinnati and Keio University

Assistant Professor Satoshi Kofuji

Highlights

- Nucleolar hypertrophy is induced by elevated *de novo* GTP biosynthesis in the highly lethal brain cancer glioblastoma.
- *De novo* GTP biosynthesis is activated by upregulation of IMP dehydrogenase-2 in glioblastoma.
- Inhibition of *de novo* GTP biosynthesis in glioblastoma decreases cell proliferation and tumorigenesis.



Differences in guanine nucleotide biosynthesis.

Glioblastoma activates *de novo* guanine nucleotide biosynthesis, while normal glial cells provide guanine nucleotides through the salvage pathway.

Source: Kofuji *et al.*, *Nature Cell Biology*, 21(8):1003-1014, 2019

Rapid growing cells increase various metabolic activities to meet their demands for energy. Nucleolar hypertrophy is a hallmark of malignant tumors. However, the underlying mechanisms linking increased metabolism, nucleolar enlargement and tumorigenesis are not understood well. Dr. Satoshi Kofuji (Assistant Professor at Hiroshima University), Dr. Atsuo T. Sasaki (Associate Professor at the University of Cincinnati College of Medicine, Visiting Professor at Hiroshima University and Spe-

cially Appointed Professor at Keio University) and their international collaborative research teams have found that the highly lethal brain cancer glioblastoma activates *de novo* guanine nucleotide biosynthesis by upregulating IMP dehydrogenase-2 (IMPDH2). Pharmacological or genetic inactivation of IMPDH2 decreases cell proliferation and tumorigenesis, suggesting the importance of *de novo* guanine nucleotide biosynthesis in glioblastoma. The research group also has found that the activation of *de*

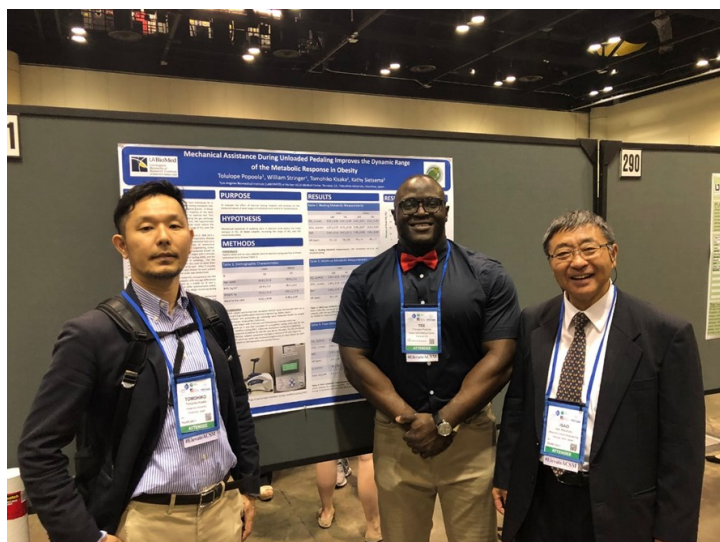
de novo guanine nucleotide biosynthesis leads to nucleolar hypertrophy through the ribosomal RNA synthesis. Taken together, upregulation of IMPDH2 causes aberrant nucleolar function and increases anabolic processes in glioblastoma. This finding would pave the way for developing an effective cancer treatment.

The full paper is available from the following link:

<https://www.ncbi.nlm.nih.gov/pubmed/31015410>

Research Activities at Hiroshima University Biodesign (HUB)

Associate Professor Tomohiko Kisaka



American College of Sports Medicine Annual Meeting



HUB team

World's First Invention that Helps Activity and Exercise for Patients with Heart Failure

In 2019, Hiroshima University Biodesign (HUB) has been involved with two major international collaborations.

On May 31, Dr. Tomohiko Kisaka, MD, PhD brought the medical device he invented, "Strength Ergometer 8TM" to Harbor-UCLA Medical Center, California. Dr. Kisaka as Research Fellow obtained the Intellectual Property rights together with Dr. Mizukura from Mitsubishi Engineering Inc. through 2013 to 2016. This invention holds patents acquired both in Japan and US in 2018. This patented invention has been put into practice at medical institutions in Japan. LA Biomedical Research Institute, our collaborator, delivered a presentation based on our collaborative study findings entitled "Mechanical Assistance During Unloaded Pedaling Improves the Dynamic range of Metabolic Response in Obesity" at American College of Sports Medicine Annual Meeting.

On July 30th and 31st, HUB team attended BME-IDEA APAC (<http://bmeideaaapac.org/>) at University of Tokyo where we gave a presentation on our 2017-2019 Program Summary. Dr. Kisaka supports Indo-Japan Team "Inochi Care Pvt Ltd" as a board member. The team participated in the MedTech Innovator Accelerator and Venture Competition in Tokyo. The team remained in the finalist group among 170 international startups (<https://medtechinnovator.org/inochi-care-wins-tokyo-travel-award/>).

Dr. Shivani Gupta, CEO of Inochi Care, flew to Hiroshima University Hospital and gave a talk to Hiroshima Biodesign Fellows. Dr. Kisaka delivered a lecture on "International Collaboration in Healthcare: Experiences in US, Japan and India & the Way Forward" in the Certificate Course on Medical Innovation and Design Thinking through e-lecture. Dr. Gupta and Dr. Yasuyuki Matsuura served as co-presenters. This

course is jointly conducted by BITS-Pilani, Hyderabad, Cardiff University, UK and HU at BITS-Pilani Hyderabad Campus.



Dr. Shivani Gupta visiting Hiroshima University Hospital

Schools and Graduate Schools

Schools(Undergraduate)

For undergraduate level, Hiroshima University consists of 12 schools which provide undergraduate courses including majors in the natural sciences, humanities, the social sciences, and many others.

School of Integrated Arts and Sciences
School of Letters
School of Education
School of Law
School of Economics
School of Science
School of Medicine
School of Dentistry
School of Pharmaceutical Sciences
School of Engineering
School of Applied Biological Science
School of Informatics and Data Science

Advanced Course

Special Education Major Program

Graduate Schools

Graduate level studies at Hiroshima University consist of 11 graduate schools below. In addition, three unique program offered as Interdisciplinary Graduate Educational Program.

Graduate School of Integrated Arts and Sciences
Graduate School of Letters
Graduate School of Education
Graduate School of Social Sciences
Graduate School of Science
Graduate School of Advanced Sciences of Matter
Graduate School of Engineering
Graduate School for International Development and Cooperation
Graduate School of Integrated Sciences for Life
Graduate School of Biomedical and Health Sciences

Hiroshima University Law School

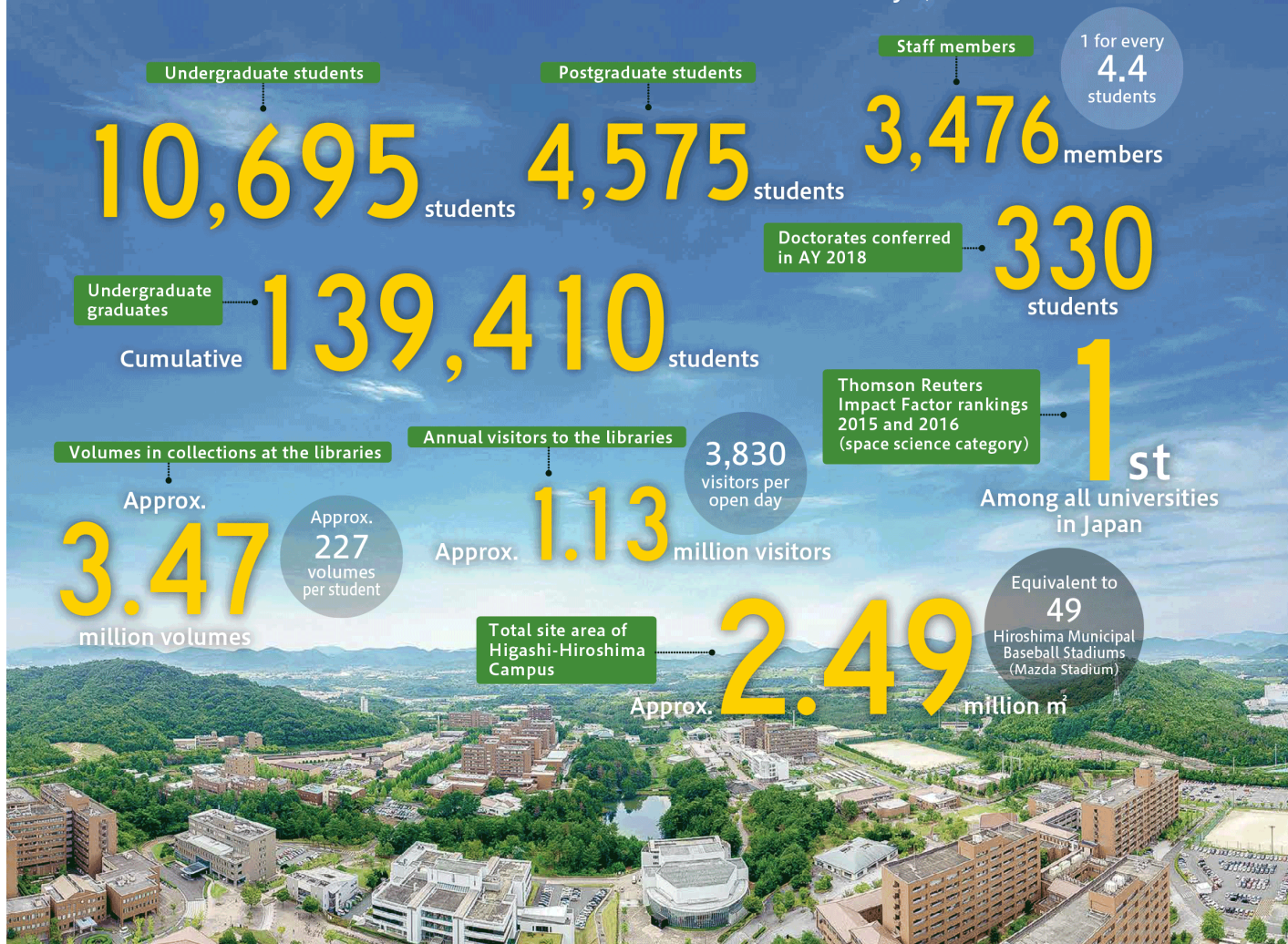
——Opning in April 2020——
Graduate School of Humanities and Social Sciences
Graduate School of Advanced Science
and Engineering

Interdisciplinary Graduate Educational Program

Phoenix Leader Education Program (Hiroshima Initiative) for Renaissance from Radiation Disaster
TAOYAKA PROGRAM for creating a flexible, enduring, peaceful society
The Frontier Development Program for Genome Editing



HIROSHIMA UNIVERSITY IN FIGURES (as of May 1, 2019)



Campus Location



- ① 〈Hiroshima City (Midori District)〉
Elementary School
Junior High School
Senior High School
- ② 〈Higashi Hiroshima City〉
Kindergarten
- ③ 〈Hiroshima City (Shinonome District)〉
Elementary School
Junior High School
- ④ 〈Mihara City〉
Kindergarten
Elementary School
Junior High School
- ⑤ 〈Fukuyama City〉
Junior High School
Senior High School



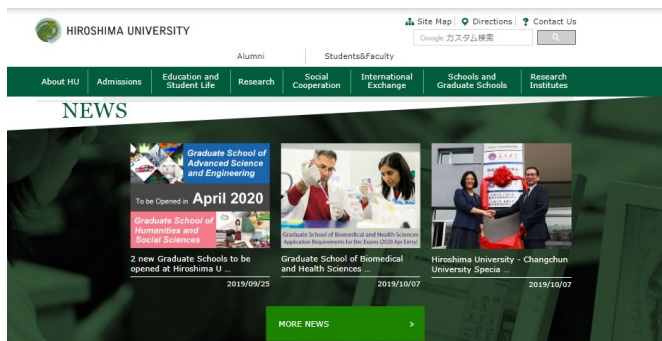
Find more about HU

Please visit our website for more details!

■HU Official Website

(English) <https://www.hiroshima-u.ac.jp/en>

Latest News, Events and Research as well as links to each university section are available from this webpage.



■Updates from our Laboratory

This webpage is the source for visitors worldwide to stay updated about what happens in the lab at HU.

<https://huscf.hiroshima-u.ac.jp>

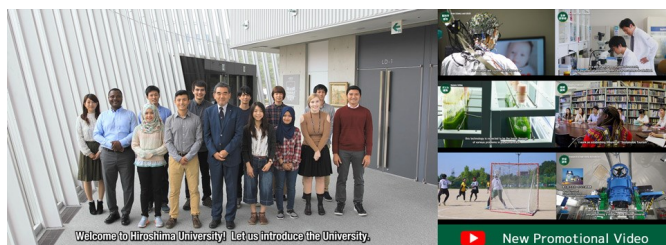


Meet Ms. Emma Buchet, Our Sci-Com Fellow! (Feb 2019-)

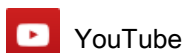
The Office of Academic Research and Industry-Government Collaboration at Hiroshima University has hired professional science writers through the Science Communication Fellowship. Fellows represent the interface between the campus research community and the nonacademic world. They publish science news in English on the Research Updates website and Social Media. Other works include Q&A interviews with researchers, photo essays, and short videos.

Contact information:
pr-research@office.hiroshima-u.ac.jp

HU Promotional Video



Visit the following webpage to watch this video.



<https://youtu.be/OzZ4YBex8Ps>

Hiroshima University Promotional Video is available on our YouTube channel!

This video features the university's leading research including "Genome Editing," "Research on High-Energy Astrophysics," "Regional Promotion," "Brain Science and KANSEI," and "Live-Donor Liver Transplant" as well as everyday campus scenes. Please also enjoy the beautiful drone footage of our campuses!

HU SNS Accounts



HU Facebook

<https://www.facebook.com/HiroshimaUniv.en>

HU Research Facebook

<https://www.facebook.com/HiroshimaUniversityResearch>



HU YouTube

<https://www.youtube.com/user/HiroshimaUniv>



HU Instagram

https://www.instagram.com/hiroshima_univ



HU Research Twitter

https://twitter.com/HU_Research

UNIVERSITY OF WORLD-WIDE REPUTE AND SPLENDOR
FOR YEARS INTO THE FUTURE



HIROSHIMA UNIVERSITY