HIROSHIMA UNIVERSITY

HIROSHIMA UNIVERSITY UPDATE

Vol. 8 JULY 2019

RECENT NEWS

Hiroshima University Changes

The personnel system at Hiroshima University is about to change, and in fact in April 2020 we are going to introduce the new personnel system. This means that from April 2019, Hiroshima University (HU) starts making open job offers based on the new personnal system.

New Tenure Track system from 2020

In Japan, throughout universities it is widely recognized that many faculty members in junior-position are forced to move from one institution to another as they often are on a fixed-term employment (for a few years). This makes it difficult for them to feel secure and concentrate on mid-term and long-term research projects.

Another problem in higher education in Japan is that equal opportunities for promotion among recruited faculty members are not necessarily guaranteed because the terms and conditions for the promotion are not clearly defined and decisions for these matters are often made behind the curtain

It is expected that the new personnel system for the faculty members at HU will serve to bring about a change to the career-path environment of the researchers, especially that of junior-positioned faculty members, in Japan.

(More details on Page 4)

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 (SUMMER)

On June 30th 2019, the “Yukata Festival” was held at the Higashi-Hiroshima campus.

Hiroshima University students and the guests in colorful *Yukata*(*) brightened up the atmosphere on the campus!

*casual version of Japanese *Kimono*

CONTENTS

RECENT NEWS

RESEARCH FOCUS

HU's New Tenure Track System

In April 2020, the personnel system at Hiroshima University is going to change.

In principle, all the future faculty members including associated professors, lecturers, or assistant professors at Hiroshima University will be subject to a HU original new tenure track system.

This new system assumes that the recruited person will settle down in one place so that he/she can dedicate himself/herself to research and education, in accordance with his/her proposed research plan that is intended to bring about a breakthrough in the new research area.

Therefore, when processing an application for recruitment, we evaluate not only each applicant's performance on research/education, but also the contents and the future scope of his/her research plan. Thus, we check whether or not the applicant's research plan envisages a mid-to-long term (i.e. about 10 years) in scope, exceeding the tenure-track period. At the time of the examination for the tenured promotion, we evaluate the applicant's achievement during his/her term at HU and the future prospect of his/her research in a comprehensive manner.

With its open rules in place, Hiroshima University has also reformed its in-house promotion system.

★HU faculty's voices

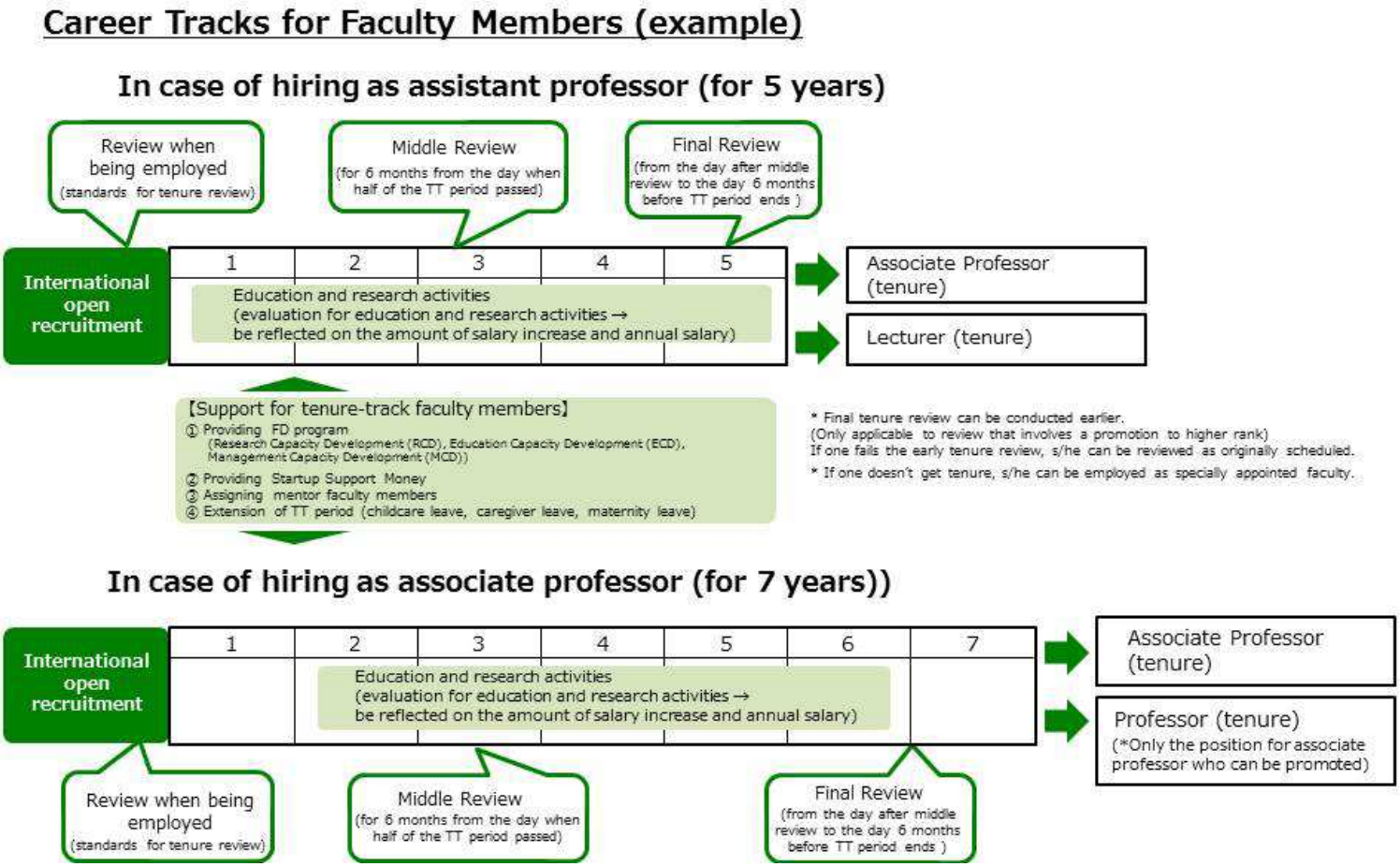
Find details about our new personnel system and voices from our faculty members from the following links!

■YouTube:

https://youtu.be/v6LG_b9HDSA

■Hiroshima University Website

https://www.hiroshima-u.ac.jp/en/employment/personnelsystem



Career Tracks for Faculty Members (example)

HU has Ranked High in University Rankings

▪ BRAND IMAGE RANKING OF UNIVERSITIES IN JAPAN

Hiroshima University has been ranked in:

1st place among universities in Japan for "Inter-personal Communication Skills and Pressure Resilience Skills" ranking (5th place in overall scores)

The survey was conducted by Nihon Keizai Shimbun and Nikkei Human Resources (a Japanese company specialized in recruitment support services), which intended to find out the "University Image Ranking" among the universities in Japan. According to the results, Hiroshima University came to the 1st place for the category of "Inter-personal Communication Skills and Pressure Resilience Skills". As for the overall scores, Hiroshima University ranked in the 5th place.

The survey asked 4779 companies to name the top ten universities whose new graduates have been recruited by them between April 2017 and March 2019, and to evaluate the images of the students from those ten universities in the following four categories: "An ability to take actions" "Inter-personal Communication Skills and Pressure Resilience Skills" "Intelligence/Learning Capabilities" and "Originality".

Overall brand image ranking scores based on the survey results collected from the staff at personnel departments of the companies in Japan

(Rank)	(University)	(Total Score)
1	Kyushu University	33.41
2	Kyoto University	32.78
3	Osaka University	32.16
4	Tohoku University	32.15
5	Hiroshima University	32.06
6	Utsunomiya University	31.88
7	Yokohama National University	31.87
8	University of Tsukuba	31.63
8	Tokyo University of Marine Science and Technology	31.63
10	Osaka Prefecture University	31.51

Source: Nihon Keizai Shimbun (5th and 6th June 2019). Part of the data from the ranking list printed on Nihon Keizai Shimbun has been omitted.

▪ TIMES HIGHER EDUCATION (THE) UNIVERSITY IMPACT RANKINGS 2019

Hiroshima University has been ranked in:

45th place in the world rank for "SDGs: Industry, innovation, and infrastructure"

The Times Higher Education, a weekly magazine based in the UK reporting specifically on news and issues related to higher education, has released its University Impact Rankings 2019 that assesses universities against the United Nations' Sustainable Development Goals (SDGs). These rankings are intended for visualizing universities' contributions to society.

The SDGs are a collection of 17 goals including "No Poverty," "Quality Education," and "Gender Equality," for the year 2030, which was adopted during the United Nations General Assembly in September 2015. They have been set by the UN as new development goals for the entire international society. Out of the 17 goals of the SDGs, 11 goals are highly relevant to higher education and hence have been used as indicators to assess universities' performance.

Individual goals of the SDGs	Hiroshima University's rankings
Goal 3: Good Health and Well-being	World rank: 201-300 (Country rank: 19th)
Goal 4: Quality Education	World rank: 201-300 (Country rank: 5th)
Goal 9: Industry, Innovation, and Infrastructure	World rank: 45th (Country rank: 7th)
Goal 16: Peace, Justice, and Strong Institutions	World rank: 101-200 (Country rank: 9th)
Goal 17: Partnerships for the Goals	World rank: 201-300 (Country rank: 13th)

HU Welcomes Summer Research Interns from Harvard University and the University of Chicago

On November 14th, 2017, HU concluded an International Exchange Agreement with Harvard University. This agreement was made possible through the Edwin O. Reischauer Institute of Japanese Studies (RIJS) at Harvard. As part of the new effort to promote educational and research collaborations between the two universities, HU welcomed six Harvard students from May to August 2018 for RIJS's Summer Science Undergraduate Research Program. These undergraduate interns were matched with 6 leading researchers at HU (Profs. Takahiro Chihara, Seiji Kawamoto, Masaki Mizunuma, Takashi Toda, Takashi Yamamoto, and Shigeto Yamawaki), undertaking their research in collaboration with their research teams. In addition to research, the interns from Harvard enjoyed cultural exchange with the researchers and students from their laboratories as well as those from outside the laboratories.

This year, Hiroshima University has welcomed four students from Harvard University as summer research interns (Hosting Researchers: Profs. Junko Tanaka, Shigeto Yamawaki, Yasumasa Okamoto, Takashi Toda, Takahiro Chihara), and also five students from the University of Chicago (Hosting Researchers: Profs. Yasushi Fukazawa, Takio Kurita, Tadashi Dohi). On July 9th, 2019, a welcome reception was held at Mermaid Café on the Higashi-Hiroshima campus, and the interns enjoyed getting to know each other, HU students and faculty members. (See photos)

Active International Exchange with Countries in Southeast Asia

Graduate School of Advanced Sciences of Matter

Prof. Junichi Kato

After the lecture at Srinakharinwirot University (Bangkok Campus)

We have been actively implementing international academic exchanges with researchers, especially those from Southeast Asian countries. For example, Asst. Prof. T. Tajima stayed in Indonesian Research Institute of Fiber Crops and Sweetener (Balittas) in Malang, Indonesia in March, 2019 to conduct screening novel lignin-degrading bacteria from environmental samples in Java Island. This research is based on the MoU (Memorandum of Understanding) between Hiroshima University and Balittas. During Prof. Tajima's stay in Balittas, Prof. Y. Nakashima and Prof. Y. Matsumura also visited Balittas to hold the 2nd Joint Workshop for efficient utilization of renewable bioresources. In April this year, seven Thai top researchers of applied microbiology and biochemistry (from Chulalongkorn University, Kasetsart University, Chiang Mai University and Khon Kaen University) visited our faculty to discuss international collaboration on applied microbiology and environmental biotechnology. We have more than 10-year collaboration history and will apply for a big international research exchange grant of Japan Society for the Promotion of Science (JSPS) and National Research Council of Thailand (NRCT) this year. What is more, Prof. J. Kato was invited to the 70th anniversary ceremony of Srinakharinwirot University, Thailand in this May this year and gave special lectures on environmental biotechnology (bacterial chemotaxis and quorum sensing) to the undergraduate students. More than hundred students from Faculty of Agricultural Product Innovation and Technology enjoyed his lectures (photo). We are now preparing to sign an MoU between Hiroshima University and Srinakharinwirot University to further promote student exchanges.

After the lecture at Srinakharinwirot University (Ongkharak Campus)

Three Minute Thesis Competition (HIRAKU 3MT 2018)

Hiroshima University organized Three Minute Thesis Competition (HIRAKU 3MT 2018) on September 15, 2018 in Higashi-Hiroshima. A total of 31 doctorate students from 9 universities showcased their research in front of 300 people as public audience, using a single slide to complete a presentation within the time limit of three minutes. The Winner, Hossain MD Shahadat from the United Graduate School of Agricultural Sciences, Ehime University, also won the People's Choice as well as the Sponsor Award from Springer Nature. Sachi Asano from Gifu University won the Global Challenge Award, which entitled her to represent our consortium to join the Asia-Pacific 3MT Competition 2019. Reiko Kobatake from Graduate School of Biomedical and Health Sciences, Hiroshima University, won the Runner-Up and one of the sponsor award and participated in the internship at Medical University of Vienna, as a part of the prize.

The 3MT competition this year will take place on September 14, 2019.

Reference

- HIRAKU 3MT 2018 Report:

https://home.hiroshima-u.ac.jp/hiraku/en/event_fy2018/competition_2018/report/

- Asia-Pacific 3MT:

https://threeminutethesis.uq.edu.au/asia-pac/2018

HIRAKU International Symposium 2019

An international symposium entitled "Global Trends in Researcher Development" was held on February 8, 2019 in Higashi-Hiroshima campus with Hiroshima University hosting the event. Four leading experts on researcher development were invited from overseas countries including the U.S., the U.K., Australia as well as from Japan.

During the symposium, each speaker gave his/her successful examples of the practices and strategies in their home countries, while discussing the future directions to be taken in order to tackle challenges each country faces.

- Yuko Harayama, Ph. D.

Professor Emeritus of Tohoku University, Former Executive Member of the CSTP, Cabinet Office of Japan

- Kellina M Craig-Henderson, Ph. D.

Deputy Assistant Director, U.S. National Science Foundation, Former Director for NSF's Tokyo Regional Office

- Janet Metcalfe, Ph. D.

Head of Vitae, the United Kingdom

- Alastair McEwan, Ph. D.

Pro-Vice Chancellor (Research Training) of the Graduate School, University of Queensland, Australia

RESEARCH FOCUS

Graduate School of Science

Sequence in Polymer Chains Self-sorted

Prof. Takeharu Haino

Polymer properties are determined by their primary structures. Material properties can vary from one polymer to another even if they possess identical monomer composition. Achieving perfect precision in primary structures has been limited, as scientists conventionally rely on simple mixing monomer solutions and just observe the polymer being formed.

Dr. Takeharu Haino and his coworkers at Hiroshima University have succeeded in developing the way to control the sequence of monomers in a polymer chain with high precision. Sequence-controlled terpolymerization has been demonstrated by relying on the self-sorting behavior of three sets of heteromonomers in a supramolecular method. Unique guest-binding sites are located at opposite ends of the monomers. A particular sequence of the monomers in a polymer chain is determined in a self-sorting manner that relies on specific host-guest pairings. The figure below describes the conceptual image of the self-sorting behavior in polymerization. Monomers A, B, and C are chained up with three unique host-guest complexes: C_{60}–biscalix[5]arene complex, Hamilton's complex, and TNF–bisporphyrin complex, respectively.

Haino adds, 'When monomers A, B, and C are mixed together, no scramble occurs, and each complementary host-guest pair is formed without any mismatched pairs. This supramolecular terpolymer chain is perfectly formed.' This methodology opens up a possibility of developing functional polymer materials that show attractive functions such as shape memory and self-healing.

★See the following website for more details.

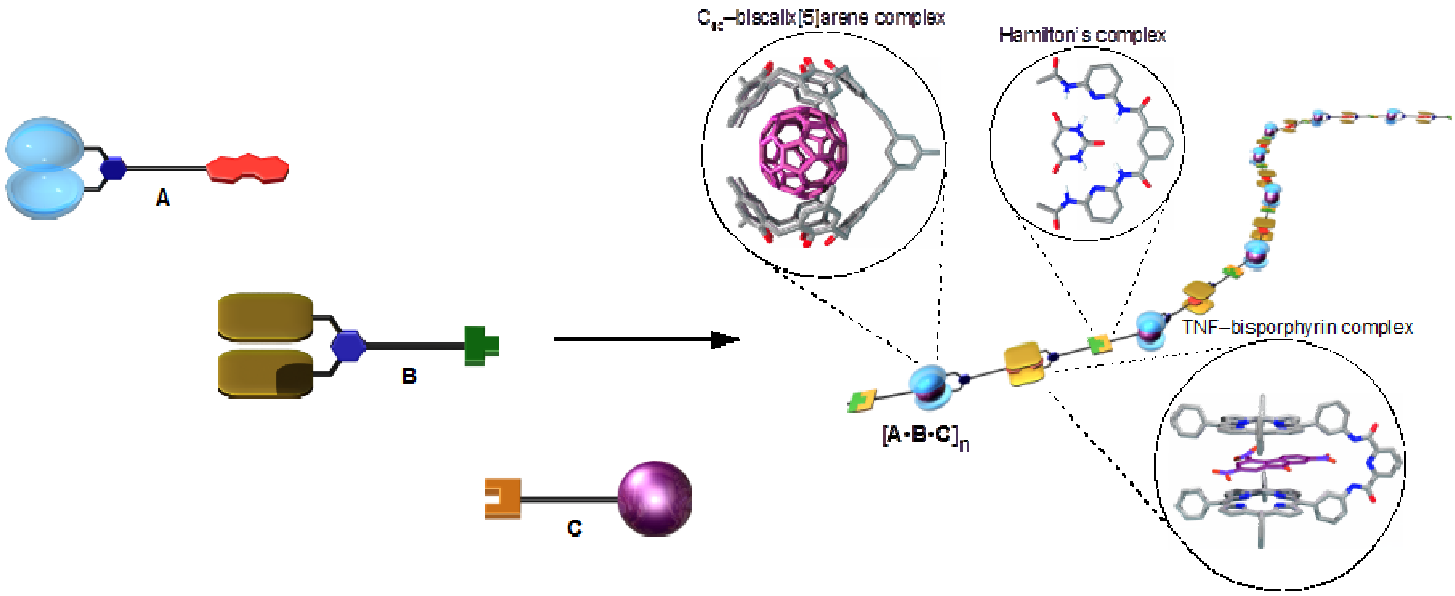
Group of Structural Organic Chemistry, Hiroshima University Website

https://home.hiroshima-u.ac.jp/orgchem/English/research.html

References

1. Hirao T., Kudo H., Amimoto T. and Haino T.: Sequence-controlled supramolecular terpolymerization directed by specific molecular recognitions. Nature Communications, 8: 634, 2017: https://doi.org/10.1038/s41467-017-00683-5.

2. Nadamoto K., Maruyama K., Fujii N., Ikeda T., Kihara S.-i. and Haino T.: Supramolecular Copolymerization by Sequence Reorganization of a Supramolecular Homopolymer. Angewandte Chemie International Edition, 57: 7028-7033, 2018: https://onlinelibrary.wiley.com/doi/abs/10.1002/anie.201800980.



Succeeded in Unravelling the Mechanism of Molecules that Guarantee the Precise Transfer of Genetic Information

Assistant Prof. Masashi Yukawa

& Specially-appointed Prof. Takashi Toda

Study Findings:

- Revealed behavior of Kinesin-6, a type of protein which plays an important role in accurate chromosome segregation, at the single molecule level by using an analysis method called TIRFM (Total Internal Reflection Fluorescence Microscope).
- Revealed that Kinesin-6 collaborates with Kinesin-5 within the cell so as to guarantee the precise transfer of genetic information.
- First report in the world that Kinesin-6 has two independent functions.

Behavior of fission yeast motor protein Kinesin-6, important for transferring genetic information (chromosome), has been successfully observed at the single molecule level through a collaborative research between a group led by Dr. Takashi Toda (Specially Appointed Professor) at Hiroshima Research Center for Healthy Aging of Hiroshima University and Dr. Masashi Yukawa (Assistant Professor) from the Graduate School of Integrated Sciences for Life at Hiroshima University and Dr. Ken'ya Furuta from Advanced ICT Research Institute, National Institute of Information and Communications Technology.

Professor Toda and his collaborative research teams have also found that Kinesin-6 has two important roles in the cell. One is to collaborate with Kinesin-5 and require its kinesin motor; the other is to serve to stabilize microtubule structure that drives spindle elongation independent of its kinesin motor activity. In the previous research, it was known that multiple Kinesin motor proteins are needed for chromosome segregation; however, their exact roles in the process was not known. The collaborative research has revealed the interplay relationship between Kinesin-5 and Kinesin-6.

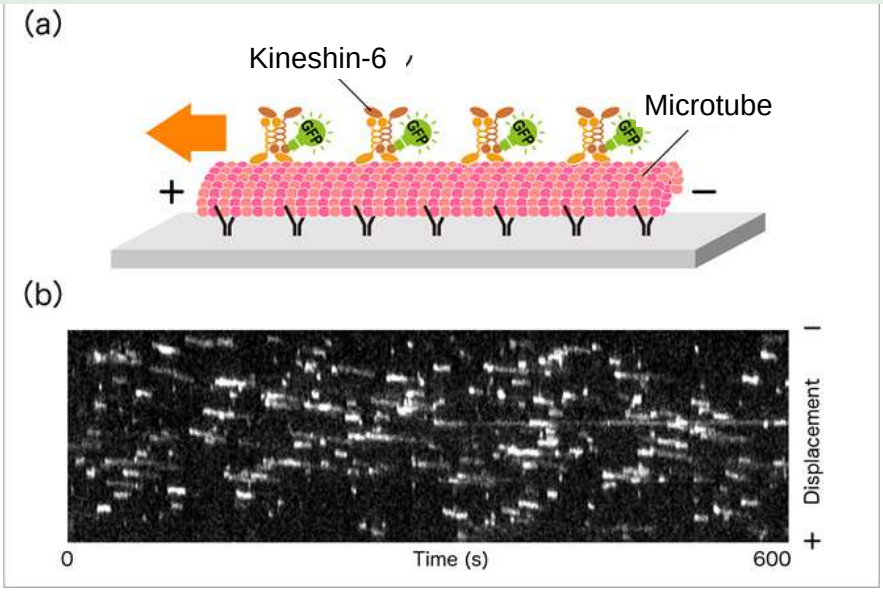


Figure: Analyzing the behavior of Kinesin-6 at the single molecule level using TIRFM (Total Internal Reflection Fluorescence Microscope). (a) Scheme of the *in vitro* microtubule gliding assay measurement (b) The actual behavior of Kinesin-6.

Kinesin motor proteins, whose mechanism has been identified in this research, are highly conserved across eukaryotic species including yeast and human body. Thus, it is thought that similar mechanism of Kinesin motor proteins found in fission yeast may also be found in higher eukaryotes.

The research was published in "Scientific Reports (Online)" on May 14, 2019.

Paper Information

Scientific Reports

Kinesin-6 Klp9 plays motor-dependent and -independent roles in collaboration with Kinesin-5 Cut7 and the microtubule crosslinker Ase1 in fission yeast

Masashi Yukawa[1,2*] and Masaki Okazaki[2], Yasuhiro Teratani[2], Ken'ya Furuta[3] and Takashi Toda[1,2*]

1. Hiroshima Research Center for Healthy Aging, Hiroshima University

2. Graduate School of Advanced Sciences of Matter, Department of Molecular Biotechnology.

3. Advanced ICT Research Institute, National Institute of Information and Communications Technology

DOI: 10.1038/s41598-019-43774-7

* Co-corresponding author

Role of Inner Nuclear Membrane Protein Lem2 in Regulating Nuclear Size Scaling

Assistant Prof. Kazunori Kume

The size of the membrane-bound nucleus, often described as the command center of a cell, scales with cell size in a wide range of cell types from yeast to animal cells, but the mechanisms determining overall nuclear size remain largely unknown. Dr. Kazunori Kume (Hiroshima Unive rsity) and his collaborators, Sir Paul Nurse and his lab member (The Francis Crick Institute) investigated the role of fission yeast inner nuclear membrane proteins in determining nuclear size. The authors proposed that the Lap2-Emerin-Man1 domain protein Lem2, conserved from yeast to human, acts as a barrier to membrane flow between the nucleus and other parts of the cellular membrane system. Deletion of Lem2 increases membrane flow into and out of the nuclear envelope in response to changes in lipid synthesis and nucleocytoplasmic transport, altering nuclear size. The endoplasmic reticulum protein Lnp1 acts as a secondary barrier to membrane flow, functionally compensating for lack of Lem2. The authors proposed that this is part of the mechanism that maintains nuclear size proportional to cell size. Similar regulatory system may apply to other organelles in the eukaryotic subcellular membrane network.

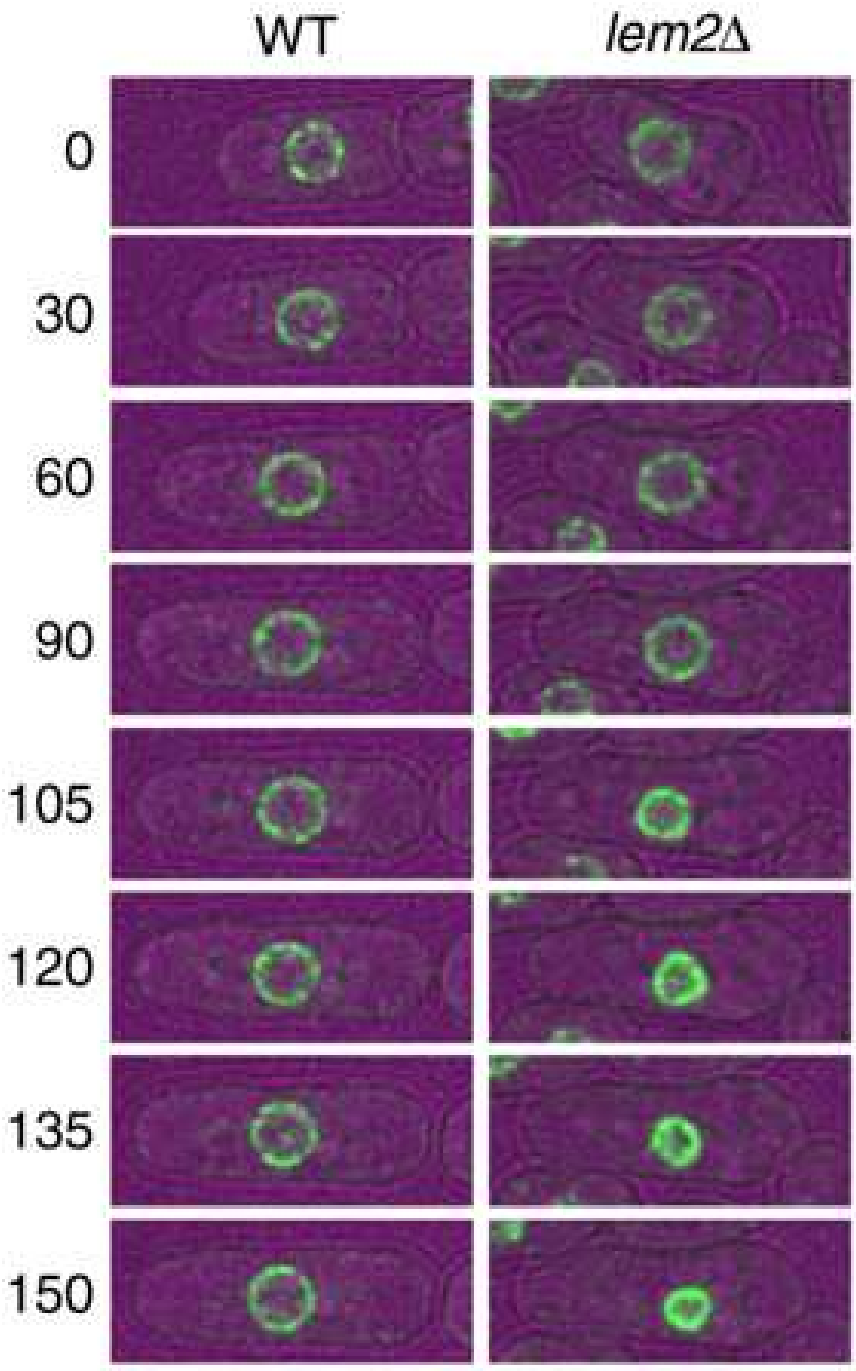
★The full paper is available from the following link:

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

Figure:

Difference in nuclear size of normal and mutant Lem2-deficient cells when treated with cerulenin.

The nucleus (green) of cells (magenta) with and without Lem2 (WT and lem2Δ) reacting to cerulenin, a compound that inhibits membrane synthesis. The cells without Lem2 shrank 105 minutes after the addition of cerulenin while the nucleus of the WT cells did not, showing that Lem2 is involved in maintaining appropriate nuclear size.



Prolyl Isomerase Pin1, Playing a Critical Role in Obesity Development, Suppresses Adipose Thermogenic Programs which Promote Degradation of Transcriptional Co-activator PRDM16

Associate Prof. Yusuke Nakatsu and Prof. Tomoichiro Asano

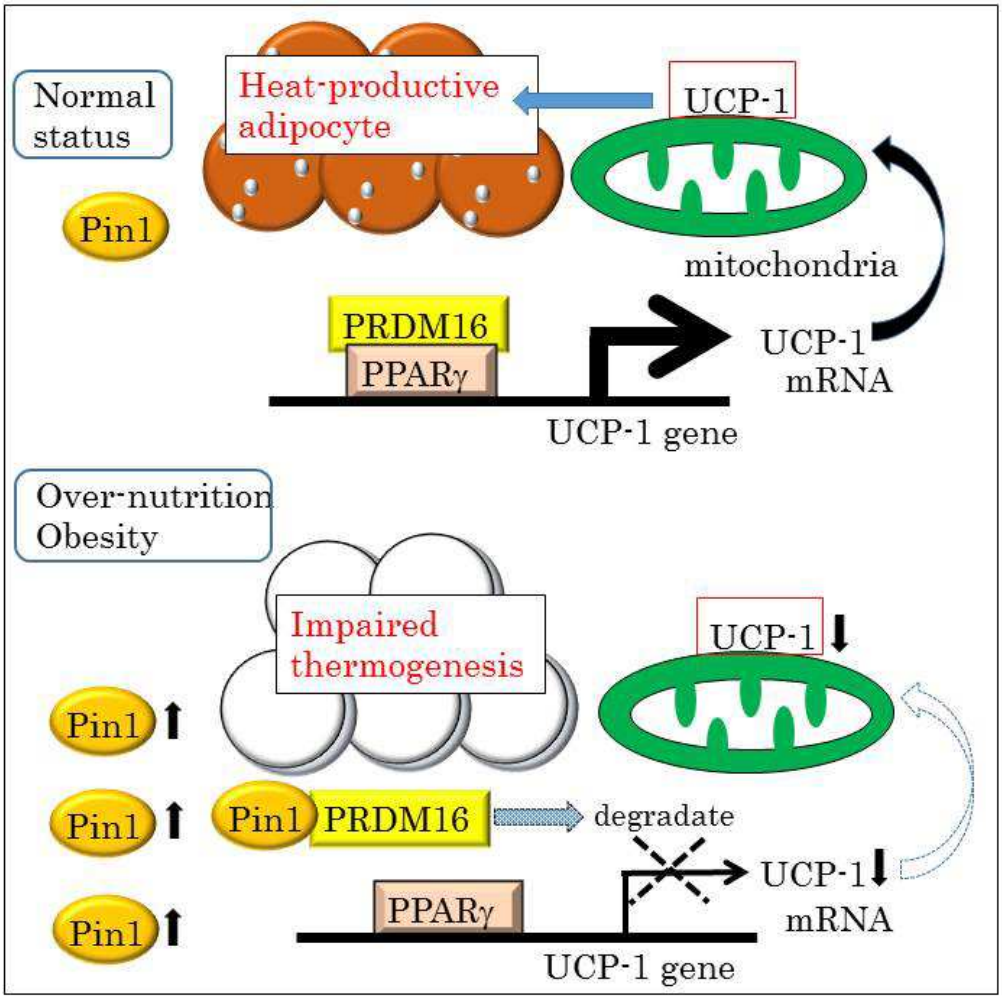
Obesity, the main cause of metabolic syndrome, is brought about by excessive food intake and insufficient energy expenditure. Thermogenesis in adipocytes increases basal energy expenditure and reportedly provides defense against obesity development. However, the molecular mechanism underlying its reduction in the obese subjects has remained unclarified.

We saw marked increase of Pin1 expression in the adipocytes of mice which are either fed high-fat diet or genetically obese. In addition, adipose-specific Pin1 KO (adPin1 KO) mice showed marked resistance to obesity development as well as tolerance to hypothermia when exposed to cold (temperature at 4℃). Therefore, we speculated that adipocyte Pin1 might play an important role in thermogenic programs.

Non-shivering thermogenesis in adipocytes largely depends on uncoupling protein 1 (UCP-1), and this protein produces heat through ablation of the mitochondrial proton gradient. The UCP-1 expression level is controlled by transcription levels, and transcriptional co-activator PRDM16 reportedly plays a key role in this regulation.

Searching for Pin1 binding proteins as well as subsequent over-expression and gene silencing experiments revealed that Pin1 binds to PRDM16, and thereby promotes its degradation through the ubiquitin-proteasome system. Consistent with these results, Pin1 deletion in differentiated adipocytes showed enhancement of thermogenic programs through upregulation of PRDM16 proteins.

Taken together, these observations indicate adipose Pin1 to be upregulated in the over-nutrient condition and acts as a negative regulator of thermogenesis leading to the reduction of basal metabolic rate, resulting in obesity development. Pin1 inhibition may be an attractive mechanism for developing anti-obesity drugs.



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Yusuke Nakatsu, Yasuka Matsunaga, Takeshi Yamamotoya, Koji Ueda, Masa-ki Inoue, Yu Mizuno, Mikako Nakanishi, Tomomi Sano, Yosuke Yamawaki, Akifumi Kushiyama, Hideyuki Sakoda, Midori Fujishiro, Akihide Ryo, Hiraku Ono, Tohru Minamino, Shin-Ichiro Takahashi, Haruya Ohno, Masayasu Yoneda, Kei Takahashi, Hisamitsu Ishihara, Hideki Katagiri, Fusanori Nishimura, Takashi Kanematsu, Tetsuya Yamada, Tomoichiro Asano

Cell Reports 2019 26(12), 3221-3230 doi: 10.1016/j.celrep.2019.02.066

Research Institute for Radiation Biology and Medicine

Effects of Coffee with a High Content of Chlorogenic Acids and Low Content of Hydroxyhydroquinone on Endothelial Function

Prof. Yukihito Higashi

Investigators group of Research Institute for Radiation Biology and Medicine, Hiroshima University (Prof. Yukihito Higashi) and Health Care Food Laboratories, Kao Corporation evaluated acute effects of coffee with a high content of chlorogenic acids and different hydroxyhydroquinone contents on postprandial endothelial dysfunction in Japanese patients with borderline or stage 1 hypertension using a single-blind, randomized, placebo-controlled, crossover-within-subject clinical trial. Endothelial function assessed by flow-mediated vasodilation and plasma concentration of 8-isoprostanes as an index of oxidative stress were measured at baseline and at 1 hour and 2 hours after coffee intake. Compared with baseline values, a single intake of coffee with a high content of chlorogenic acids and low content of hydroxyhydroquinone, but not coffee with a high content of chlorogenic acids and high content of hydroxyhydroquinone or placebo coffee, significantly improved postprandial flow-mediated vasodilation and decreased circulating 8-isoprostane levels. We demonstrated that a single intake of coffee with a high content of chlorogenic acids and low content of hydroxyhydroquinone is effective for improving postprandial endothelial dysfunction by decreasing in oxidative stress. These results have been presented in the American Heart Association Scientific Meeting (2017, Nov. 12, Anaheim, California) and the Japanese Circulation Society Scientific Meeting (2019, March 30, Yokohama) and published in European Journal of Nutrition (2019; 58: 989-996.).

Contact Information

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Kao Website

https://www.kao.com/global/en/

Individual Differences in the Increase of Chromosomal Aberrations after an Exposure to a Low Dose Irradiation

Prof. Satoshi Tashiro

It is thought that exposure to high dose ionizing radiation among A-bomb survivors induces chromosomal aberrations, leading to the development of conditions such as cancer and leukemia. On the other hand, radiological examinations using low dose exposure, such as CT scan, play important roles in the medical field. However, the health impacts of low dose radiation still remain unclear even after years of the extensive epidemiological studies on A-bomb survivors. The accumulation of DNA damage caused by ionizing radiation can affect the human body, leading to the development of conditions including carcinogenesis. Therefore, the evaluation of DNA damage is important to estimate the effect of ionizing radiation to the human body.

A research group of the Department of Cellular Biology at Research Institute for Radiation Biology and Medicine used a fluorescence *in situ* hybridization analysis method using centromere and telomere PNA probes (PNA-FISH) to show the individual differences in the induction of chromosome aberrations when exposed to low dose irradiation from a CT scan examination. The PNA-FISH analysis on lymphocytes collected from 60 patients revealed wide individual variations in the increment of chromosome aberrations after a CT scan examination. The inverse correlation between the numbers of abnormal chromosomes before a CT scan and the increment of them after the examination was observed. These findings suggest the presence of individual differences in radiation sensitivity to low dose irradiation, including that from CT scans. The PNA-FISH analysis of lymphocytes may prove useful for the management of low-dose irradiation of medical radiation exposures including that from CT scans.

Reference

1) Chromosomal Abnormalities in Human Lymphocytes after Computed Tomography Scan Procedure.

Shi L, Fujioka K, Sakurai-Ozato N, Fukumoto W, Satoh K, Sun J, Awazu A, Tanaka K, Ishida M, Ishida T, Nakano Y, Kihara Y, Hayes CN, Aikata H, Chayama K, Ito T, Awai K, Tashiro S.

Radiat Res. 2018 :190(4):424-432

2) A Modified System for Analyzing Ionizing Radiation-Induced Chromosome Abnormalities.

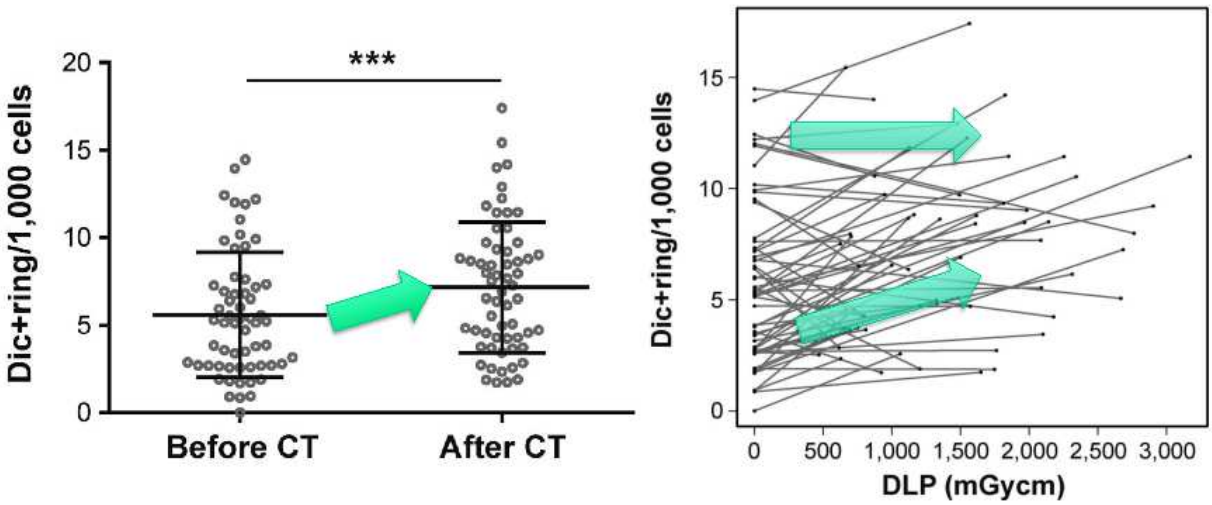
Shi L, Fujioka K, Sun J, Kinomura A, Inaba T, Ikura T, Ohtaki M, Yoshida M, Kodama Y, Livingston GK, Kamiya K, Tashiro S.

Radiat Res. 2012:177(5):533-538

Original Website

Department of Cellular Biology
Research Institute for Radiation Biology and Medicine

https://www.hiroshima-u.ac.jp/en/rbm/research/lab/Cellular_Biology



Figures: Increase of dicentric and ring chromosomes (Dic +ring) in lymphocytes from 60 patients after a CT scan. DLP: Dose-Length Product is an index of the estimated radiation dose by CT scan.

Ultimate Angle-resolved Photoemission Microscopy System

Specially-appointed Associate Prof. Hideaki Iwasawa

Electrons in materials govern electric and magnetic properties. Angle-resolved photoemission spectroscopy (ARPES) is a powerful probe to directly characterize electronic structures in energy and momentum spaces. Traditionally, the development of ARPES system has been centered around the improvement of its energy and momentum resolutions, often called "high-resolution ARPES system". However, little attention has been paid to a spatial resolution of the system, making it difficult to measure tiny samples or samples having spatial inhomogeneity. The research group led by Specially-appointed Associate Professor Hideaki Iwasawa, Hiroshima University, developed a new ARPES system at Hiroshima Synchrotron Radiation Center (HiSOR), in collaboration with National Institute of Advanced Industrial Science and Technology. They developed the state-of-the-art ARPES system having not only ultimate energy and angular resolutions (<260 μeV and <0.05 deg) but also micro-scale spatial resolution (<5 μm). New system enabled us to map out a spatial distribution of ARPES signals on a sample surface, and to perform a point-probe ARPES measurement, providing excellent quality ARPES spectra. They have also developed new software and acquisition methods for increasing accuracy and speeding up high-resolution ARPES microscopy experiments in automated manner. The system is now ready for international collaborative projects, and have already been applied to advanced materials science research.

Reference

(1) Title: Development of laser-based scanning μ-ARPES system with ultimate energy and momentum resolutions

Journal: Ultramicroscopy

Authors: Hideaki Iwasawa, Eike F. Schwier, Masashi Arita, Akihiro Ino, Hirofumi Namatame, Masaki Taniguchi, Yoshihiro Aiura, Kenya Shimada

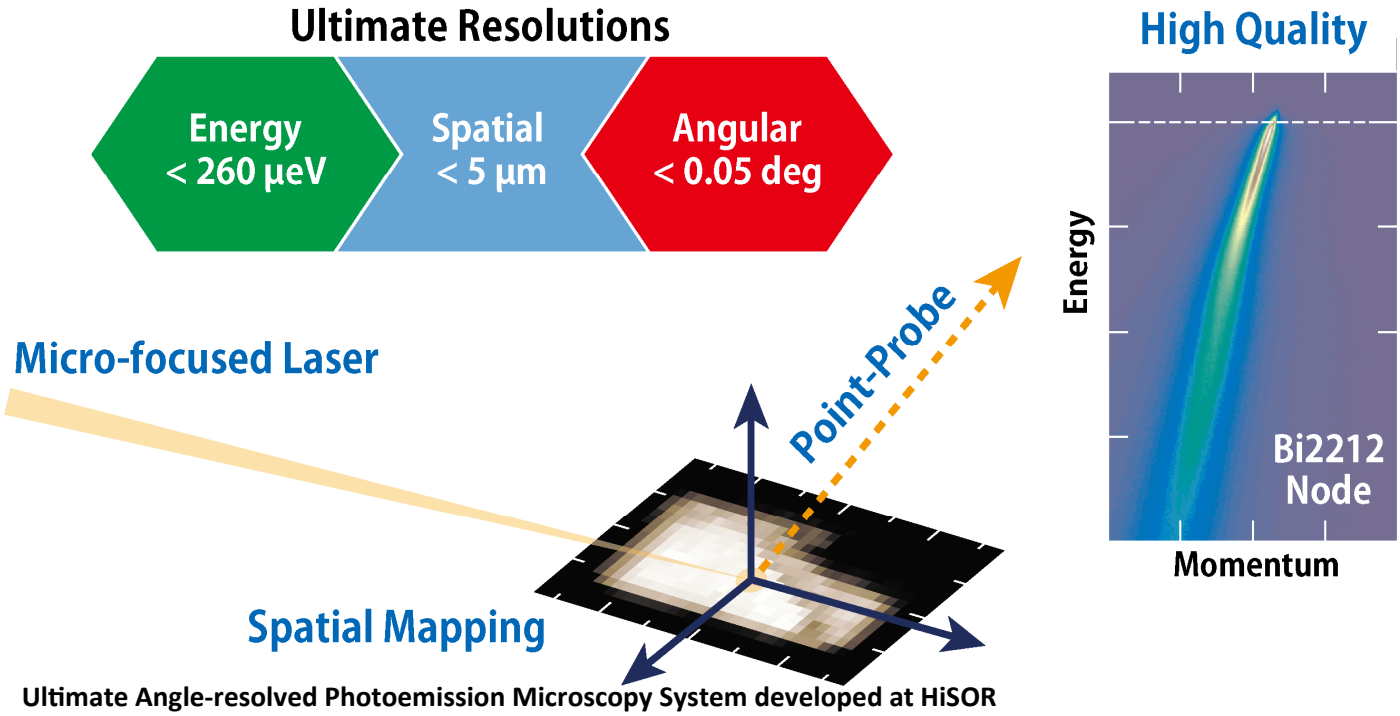
DOI: 10.1016/j.ultramic.2017.06.016

(2) Title: Accurate and efficient data acquisition methods for high-resolution angle-resolved photoemission microscopy

Journal: Scientific Reports

Authors: Hideaki Iwasawa, Hitoshi Takita, Kazuki Goto, Wumiti Mansuer, Takeo Miyashita, Eike F. Schwier, Akihiro Ino, Kenya Shimada, and Yoshihiro Aiura

DOI: 10.1038/s41598-018-34894-7



Ultimate Angle-resolved Photoemission Microscopy System developed at HiSOR

Astronomers Capture First Image of a Black Hole

Specially-appointed Associate Prof. Mahito Sasada

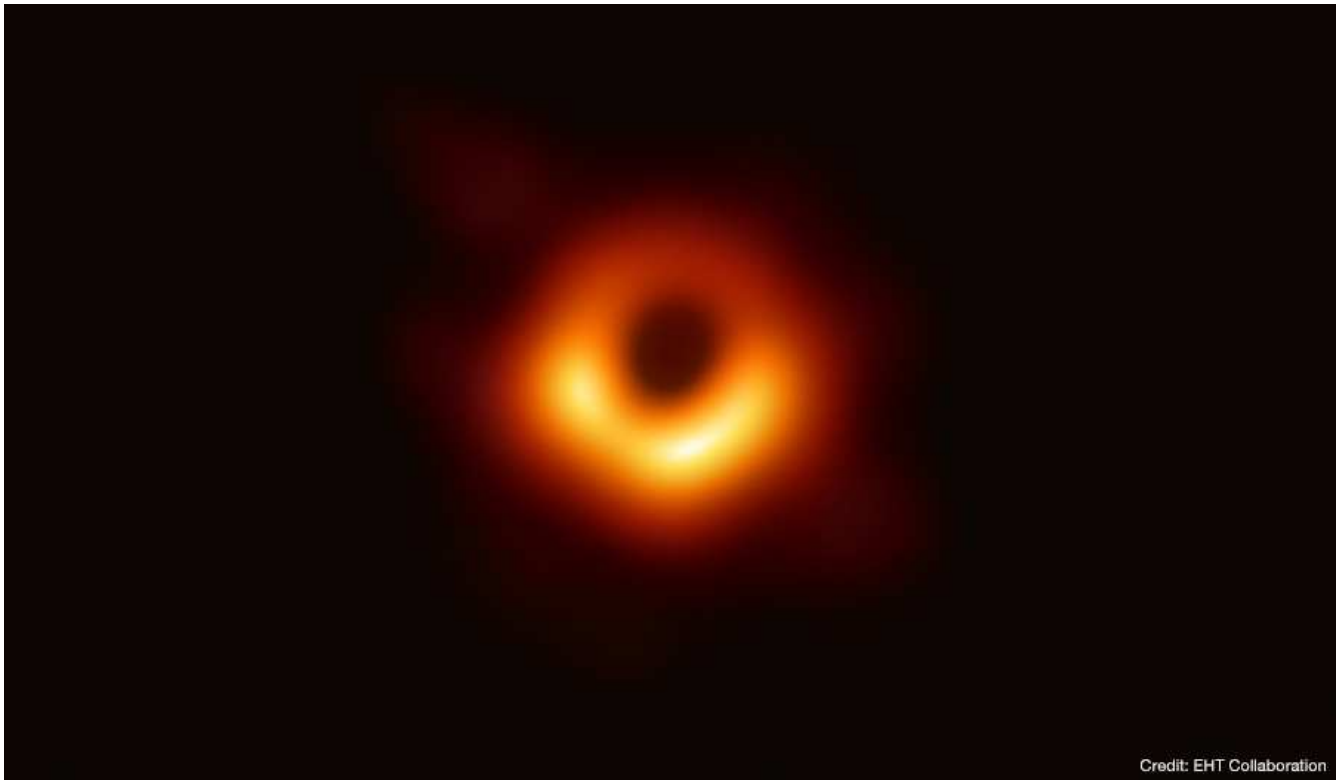


Figure: The first image of the shadow of the black hole in the center of M87 taken with EHT (Credit: EHT Collaboration)

A black hole is one of the most famous and attractive objects in the universe. Any light cannot escape out of its outer boundary 'event horizon', and therefore it is 'black'. The black hole is expected to create a dark region similar to a shadow onto a background diffuse light source.

Recently, such a shadow of a supermassive black hole located at the center of the galaxy Messier 87 (M87) has been discovered in the picture obtained by the Event Horizon Telescope (EHT) using a technique of Very Long Baseline Interferometry (VLBI), imitating an 'earth-scale' large radio telescope in sub-mm wavelengths. The observation, performed in Apr. 2017, achieved the visual acuity of 3 million, enabling to resolve the center region of M87 to recognize the black hole.

Dr. Mahito Sasada, a specially-appointed assistant professor in Hiroshima Astrophysical Science Center, Hiroshima University, is a member of the EHT project. He developed a piece of software to reconstruct an actual image of the black-hole shadow from the data obtained by the EHT observation, together with the members of EHT Japan.

In the picture, there is a dark region in a bright circle like a doughnut.

The size of the shadow tells us the mass of the supermassive black hole in the center of M87, equal to 6.5 billion solar masses. The picture of the black-hole shadow confirms that the general relativity is established in the field of strong gravity near the black hole.

Realizing a Healthy Aging Society

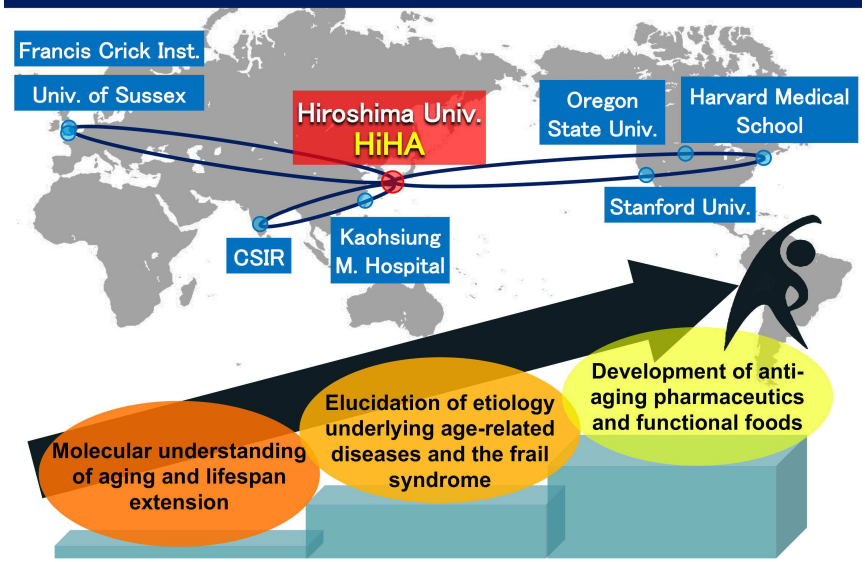
Specially-appointed Prof. Takashi Toda

How to live longer while staying healthy as we get older is a global focus in the 21st century. Thanks partly to Japanese cuisine “Washoku”, Japan’s average longevity has increased over the last decades: 81 years for men and 87 years for women. On the other hand, healthy aging, that is “a longer life in good health”, poses another issue. For instance, average healthy life expectancy of Japanese people is less than 80 years old, approximately 10 years shorter than lifespan. The main goal for HiHA lies in an understanding of the molecular basis underlying healthy aging and lifespan extension and the implementation of these knowledge into pharmacology, medical research, food science and social welfare.

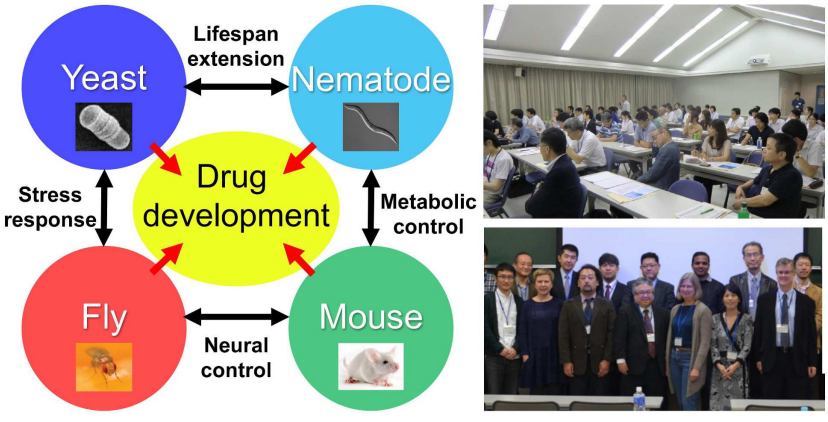
HiHA is a multifaceted, integrated research organization composed of several laboratories across Hiroshima University (http://hiha.hiroshima-u.ac.jp/en/). Individual groups have been working on a wide range of research areas, including molecular biology of cell division, genome integrity, lifespan extension, aging and development, biotechnology, immunology, medical sciences and public health and policy. One of our unique characteristics is a global research network consisting of, in addition to domestic interactions, multinational associations with oversea organizations including Francis Crick Institute (UK), University of Sussex (UK), Harvard Medical School (USA), Stanford University (USA), Oregon State University (USA), Kaohsiung Change Gung Memorial Hospital (Taiwan) and CSIR (India) (see Figure). We have been performing intercontinental collaborations with research groups within these universities/institutes (see Figure) and also, organize seminars by overseas speakers and annual international symposiums/ workshops on various topics related to healthy aging.

Our global activities during the last three years (2016-2018) include 31 research papers based upon international collaborations and 32 HiHA seminars by overseas speakers.

HiHA（Hiroshima Institute for Healthy Aging）and its research interaction network



Our strategy to accelerate innovative drug development through international collaborations



★We organize annual international symposiums and workshops and build an international research network

Optimistic Destiny of Sex Chromosome Evolution Discovered in Frogs: Recycling and Turnover

Associate Prof. Ikuo Miura

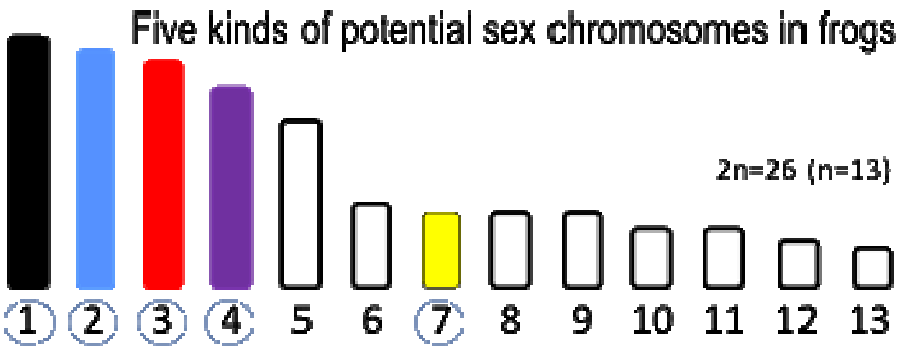
Japanese soil-frog *Glandirana rugosa*

Human Y chromosome is aging for 166 million years since the birth of therians. Its 90 % genome has already been decayed and the degeneration process is still on-going. One shocking theory says that the human Y chromosome would be gone in 5 million years. In fact, we know the extinct cases of Y chromosomes in Japanese spiny rats and European moles. In contrast to such pessimistic destiny, we have recently discovered two cases in frogs showing much more flexible evolution and optimistic destiny of sex chromosomes. One is RECYCLING[1]. In the Japanese soil-frog *Glandirana rugosa*, two geographic populations, one of which has XX-XY sex chromosomes as in mammals while the other has ZZ-ZW ones as in birds, were hybridized in the past and produced a new population. The new sex chromosome system has converged in ZZ-ZW type, where the W chromosomes of the original ZZ-ZW system were missed, and instead the X chromosomes of the other system has evolved into the new W chromosomes. This indicates that the W chromosomes, which were once gone, have revived by recycling the X chromosomes. The other case is TURNOVER of sex chromosomes[2]. We have identified five kinds of sex chromosomes in 28 true frog species distributed in the world by reading the genomes (19 species plus previous reports), and found out that the sex chromosomes did turnover 13 times before decaying among the five potential chromosomes during the phylogenetic history of 55 million years. Sex chromosomes are much tough and shrewd beyond our expectation.

Published in:

[1] Ogata M, Lambert M, Ezaz T and Miura I (2018) Reconstruction of female heterogamety from admixture of XX-XY and ZZ-ZW sex chromosome systems within a frog species. Molecular Ecology. doi.org/10.1111/mec.14831

[2] Jeffries DL, Lavanchy G, Sermier R, Sredl MJ, Miura I, Borzée A, Barrow LN, Canestrelli D, Crochet PA, Dufresnes C, Fu J, Ma WJ, Garcia CM, Ghali K, Nicieza AG, O'Donnell RP, Rodrigues N, Romano A, Martínez-Solano Í, Stepanyan I, Zumbach S, Brelsford A, Perrin N (2018) A rapid rate of sex-chromosome turnover and non-random transitions in true frogs. Nature communications 9(1):4088. doi: 10.1038/s41467-018-06517-2.



Gene Catalog for Elucidation of Mechanism of Regeneration
—Iberian Ribbed Newt, Emerging Model Animal of Organ Regeneration—

Prof. Toshinori Hayashi

Amphibian newts are known for their extremely high regenerative capacity and have a long history of research as important experimental animals in biology and regenerative medicine. Among various species of the newts, we have introduced Iberian ribbed newt (*Pleurodeles waltl*) as a candidate of new model animal.

P. waltl newts originate from Spain, and their body length reaches 30 cm in maximum. *P. waltl* newts become adults within one year and lay a large number of eggs throughout the year. We have organized a research consortium with Japanese researchers who focus on the usefulness of *P. waltl*, and have developed the resource of research. At present, the researcher population using *P. waltl* is increasing. In this study, we created a gene catalog with the aim of improving the genetic information of *P. waltl*. We have obtained RNAs from 29 samples and decoded sequence information using next-generation sequencing technology. We have constructed a gene catalog composed of 202,788 predicted proteins by analyzing the obtained sequence information with a large computer.

Figure: Iberian ribbed newt (*Pleurodeles waltl*)

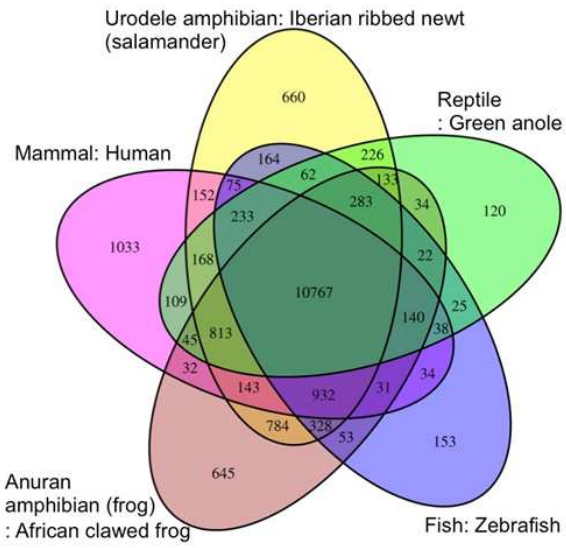


Figure: Gene repertoire comparison between the Iberian ribbed newt and other vertebrates.

This catalog has been confirmed to cover approximately 98% of the total genes possessed by *P. waltl*. Furthermore, we have opened a portal web site "iNewt" (http://www.nibb.ac.jp/imori/main/) to share this gene catalog with researchers all over the world. Our results are expected to make significant progress in research using the *P. waltl* newt in various research fields, as well as regenerative medicine and developmental biology.

Reference:

Matsunami M., Suzuki M., Haramoto Y., Fukui A., Inoue T., Yamaguchi K., Uchiyama I., Mori K., Tashiro K., Ito Y., Takeuchi T., Suzuki K.T., Agata K., Shigenobu S*., Hayashi T*. (2019)

A comprehensive reference transcriptome resource for the Iberian ribbed newt *Pleurodeles waltl*, an emerging model for developmental and regeneration biology.

DNA Research 26: 217-229

DOI: https://doi.org/10.1101/423699.

Schools and Graduate Schools

Schools

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 including Education, Biomedical and Health Sciences, Engineering, and many other majors. In addition, three unique program offerings: “The Phoenix Leader Education Program for Renaissance from Radiation Disaster” and “The Taoyaka Program for Creating a Flexible, Enduring, and Peaceful Society” and “The Frontier Development Program for Genome Editing”.

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 (opened in April 2019)

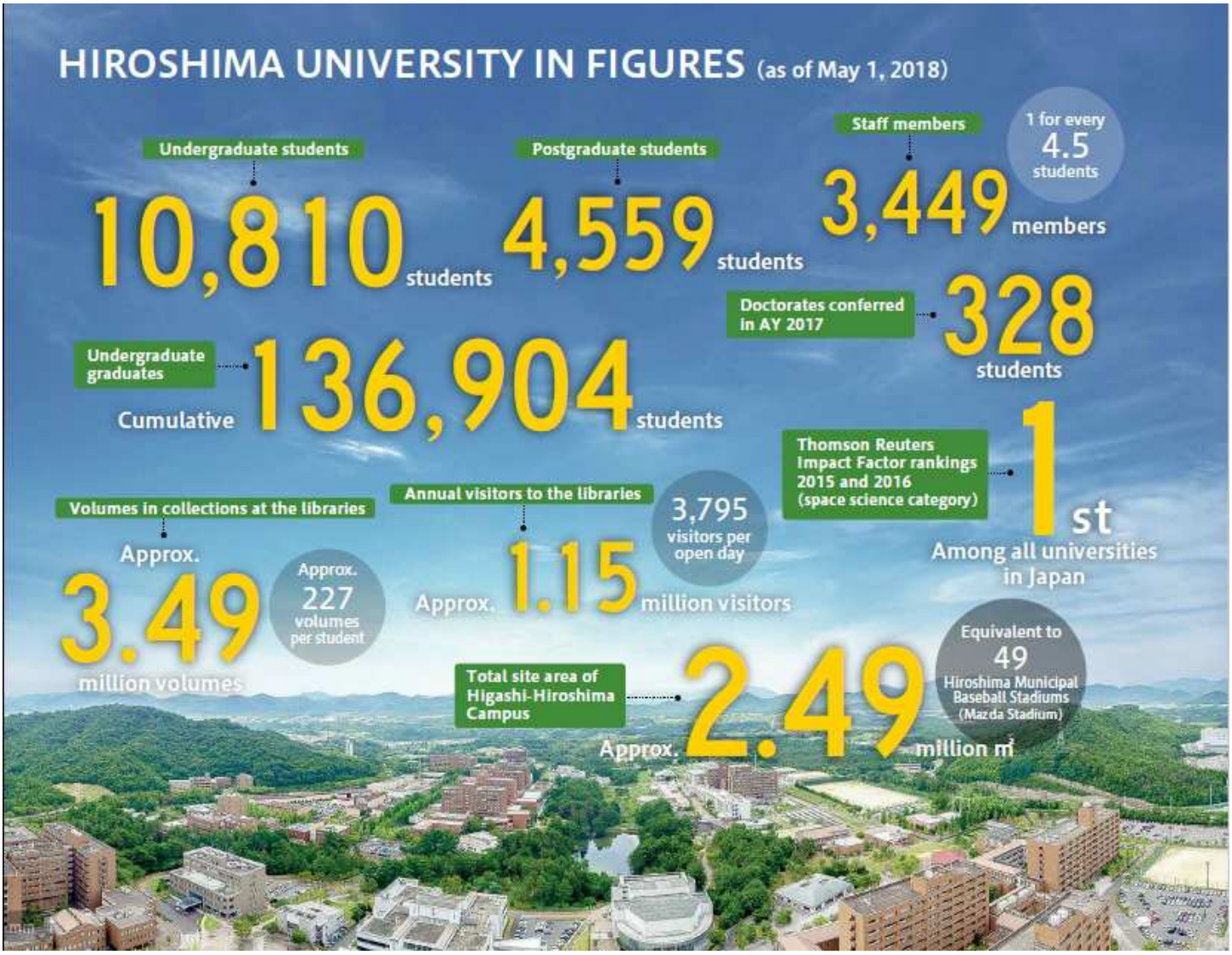
Graduate School of Biomedical and Health Sciences (opened in April 2019)

Hiroshima University Law School

Interdisciplinary Graduate Educational Program

Phoenix Leader Education Program (Hiroshima Initiative) for Renaissance from Radiation Disaster (adopted by MEXT), TAOYAKA PROGRAM for creating a flexible, enduring, peaceful society (adopted by MEXT) and Education Program for Global Environmental Leaders.

President Mitsuo Ochi and HU students



Networks and Overseas Bases

Overseas Bases

HU has established overseas bases in 15 countries/regions (As of September, 2018)
Number of Overseas Bases 19 (As of May, 2019)

International Exchange Agreements

(As of May 1, 2019)
University-level: 347 Agreements with 314 Organizations in 52 Countries/Regions
School / Institute-level: 391 Agreements with 354 Organizations in 52 Countries/Regions

International Students

(As of May 1, 2019)
A total of 1,899 students from 72 countries and regions are studying at HU

Campus Location

Hiroshima University comprises three campuses: vast and green Higashi-Hiroshima Campus, and Kasumi Campus and Higashi-Senda Campus, both located in Hiroshima City, a locale whose name resonates with humanity's quest for international peace and cultural prosperity.

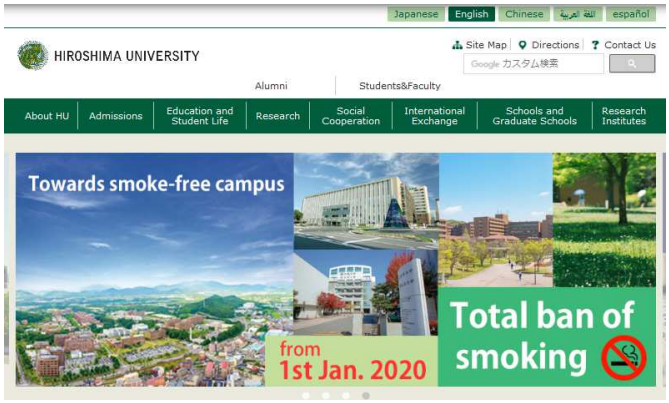
Find more about HU

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

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

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

Meet Ms. Emma Buchet,

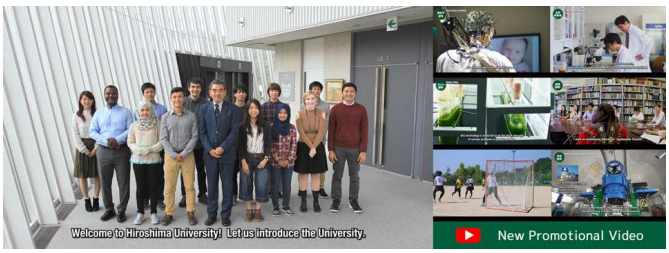
Our new Sci-Com Fellow! (Feb 2019-)

The Research Planning Office(研究企画室) 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.

(YouTube)

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 You Tube

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

HU Research Facebook

https://www.facebook.com/HiroshimaUniversityResearch

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