HIROSHIMA UNIVERSITY UPDATE

HIROSHIMA UNIVERSITY

VOLUME 22 • SPRING 2024

Find Hiroshima University's latest news and high-impact research here!

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.

HIROSHIMA UNIVERSITY

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HU researchers talk about their exciting fields of study and latest outcomes!

Poetry reading with Sayuri Yoshinaga:

Wishing for a world without war and nuclear weapons

Actress Sayuri Yoshinaga led a poignant poetry reading event at the Satake Memorial Hall, marking the university's 75+75th anniversary and inspiring reflection on peace.

A poetry reading event featuring renowned Japanese actor Sayuri Yoshinaga was held at the Satake Memorial Hall, Higashi-Hiroshima Campus on November 23.

The event, titled "Poetry Reading with Sayuri Yoshinaga: Wishing for a World Without War and Nuclear Weapons," attracted over 500 attendees, including students, faculty, and staff.

This occasion commemorated the 75+75th anniversary of the university's founding, set to be celebrated in 2024. It also featured guitarist Soichi Muraji, known for his performances with the NHK Symphony Orchestra and other prestigious orchestras in Japan and abroad.

Yoshinaga and Muraji were presented a certificate of appreciation from President Ochi (From left: President Ochi, student representative Inoue, Yoshinaga and Muraji)

A lifelong dedication to reciting A-bomb poems

I hope that this event will encourage people to contemplate the tragedy of war and the value of peace, especially in a time when global unrest is spreading.

President Ochi delivering a speech

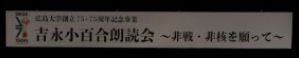
President Mitsuo Ochi opened the event by acknowledging Yoshinaga's lifelong dedication to reciting A-bomb poems.

"Ms. Yoshinaga, one of Japan's most famous actors, has devoted her life to reading A-bomb poems, emphasizing the tragedy of war and the preciousness of peace both in Japan and abroad. This reading session was made possible by the passionate wishes of many students and young doctors at the university. I hope that this event will encourage people to contemplate the tragedy of war and the value of peace, especially in a time when global unrest is spreading," he said.

Before the reading session, the Hiroshima University Shinonome Mixed Chorus Pastoral, a student group affiliated with the Hiroshima University Musical Conference on the Higashi-Hiroshima Campus, performed three choral pieces centered on the theme of peace, including "*Orizuru*" (Paper Cranes) by Shihei Umehara.

During the reading session, Yoshinaga recited A-bomb poems, such as "Prologue" by Sankichi Toge and "*Umashimenkana*" (Bringing Forth New Life) by Sadako Kurihara, accompanied by Muraji on the guitar.

The audience was captivated by Yoshinaga's evocative narration and Muraji's melodic tones. This event provided a valuable opportunity for attendees to reflect on the significance of peace, aligning with one of the university's guiding principles, "the pursuit of peace."



Members of the chorus showcasing their splendid harmony

Guitarist Soichi Muraji has formed with various orchestras in Japan and abroad, including the NHK Symphony Orchestra and the Monte-Carlo Philharmonic Orchestra's world tour.

Sayuri Yoshinaga began reading A-bomb poems in 1986, and after the Great East Japan Earthquake of 2011, she began reading poems by poets and children in Fukushima.

HU's 75+75th Anniversary Project

Explore some of the commemorative events leading up to Hiroshima University's 75+75th anniversary this year.

2023

21 OCT — International Exchange Event: European Saturday

Students and staff from Germany, France, Spain, Ukraine, Finland, and Britain shared insights on their countries with the locals. Commissioned by Higashihiroshima City, this initiative fosters communities, encourages exchange, and contributes to the city's internationalization.

28 OCT — Sustainable Brands (SB) International Conference: 4th Student Ambassador Chugoku Regional Competition

HU co-hosted the 4th SB Student Ambassador Chugoku Regional Competition, organized by Sustainable Brands Japan. A total of 176 high school students participated to learn about SDG initiatives of local companies and propose solutions to local issues with the SDGs in mind. Two teams from the 27 participating schools were eventually qualified as SB Student Ambassadors for the SB International Conference to be held in Tokyo.

11 NOV — School of Education Performs Operetta: Die Fledermaus

Students and faculty specializing in opera training at the School of Education's Music Culture Education program presented Johann Strauss II's operetta "Die Fledermaus" (The Bat) during the 17th Homecoming Day.

2024

15 JAN

HU's Original Tram and Bus Wrap Designs Take the Spotlight

Trams and buses wrapped in the university's original designs will run through Hiroshima City as part of the anniversary project

In collaboration with Hiroshima Electric Railway, HU revealed its specially wrapped tram and bus designs. The event, attended by Hiroshima Electric Railway President & Representative Director Masao Mukuda, illustrator Hirofumi Kamigaki, and HU President Mitsuo Ochi, celebrated the unique designs created by an HU student and a staff member. During his speech, President Ochi expressed the university's commitment to being "chosen by the world and loved by the community." The project, part of the 75+75th-anniversary festivities, features streetcars and buses with original designs, running throughout Hiroshima City for a year. The designs, selected through an internal competition, were made possible with crowdfunding support.

The designs were created by Haruki Yoshiasa, a student from the School of Science, and Natsuko Hikiji, a staff member at HU.

Upcoming events

Leading up to November, HU will host two key events in Kansai and Tokyo as part of its 75+75th anniversary project. These gatherings will feature enlightening lectures from special guests, providing insights into HU's offerings.

The highlight of this celebration will be a commemorative ceremony in Hiroshima, seamlessly blending the richness of the past 75 years with the promise of an exciting future.

Discover our latest and upcoming events on our special website (in Japanese):

- **Jun** — Hiroshima University in Kansai
- **Sep** — Hiroshima University in Tokyo
- **Nov** — 75+75th Anniversary Commemorative Ceremony

2024 75 150th ANNIVERSARY

SB Student Ambassador event

Die Fledermaus performance

Row out into a sea of chaos; go beyond the horizon of creativity

Commemorative photo
Nissan Zero Emission Forum 2024

HU targets carbon neutrality in campus energy use, including commuting, by 2030, aligned with the "2030 Carbon Neutral × Smart Campus 5.0 Declaration."

HU and Nissan drive towards carbon neutrality

HU and Nissan Motor unite for a green campus initiative, using "Nissan Energy Share" to achieve carbon neutrality through electric vehicles and renewable energy.

Hiroshima University, in collaboration with Nissan Motor Co., Ltd., is embarking on a groundbreaking initiative with the goal of achieving carbon neutrality on its Higashi-Hiroshima campus. Starting in March, the project will leverage Nissan's cutting-edge energy management system, “Nissan Energy Share,” to manage the charging and discharging of electric vehicles (EVs) and their batteries.

This was unveiled during the Nissan Zero Emission Forum 2024 on February 2, where Nissan introduced its new projects targeting carbon neutrality. The collaboration positions HU as a pioneer in Japan, leading the change toward 100% electrification of campus vehicles. It involves implementing energy management with 100% renewable energy and promoting localized consumption through the Mobility x Energy framework.

Under the Hiroshima University Smart City Co-Creation Consortium, the initiative leverages the university’s EVs and the Nissan e-share mobi car-sharing service (for students, faculty, and staff), creating a network for charging and discharging energy. EV batteries will serve as storage units during parking, connecting to on-campus energy resources and solar power generation facilities.

Aligned with the university's commitment to carbon neutrality by 2030, this initiative also aims to enhance disaster resilience through EVs and instill sustainability awareness across the HU community.

The 13th Japan-China University Presidents' Forum unfolds in Hiroshima

Presidents from leading universities in Japan and China participated in the 13th Japan-China University Presidents’ Forum held in Hiroshima

Hiroshima University hosted the 13th Japan-China University Presidents' Forum on November 28 and 29. About 160 participants, including presidents and vice presidents from 37 universities in Japan and China, along with representatives from the Chinese Embassy, the Japanese Ministry of Education, Culture, Sports, Science and Technology, and other related organizations, engaged in discussions on enhancing academic and student exchange and exploring new approaches to university education and research.

Coordinated by the University of Tokyo and Peking University, this marked the first in-person meeting in four years.

"As the environment surrounding the international community is changing drastically, discussions on common issues and cooperation between universities in both countries are of great significance. I hope that this conference will provide an opportunity to further develop exchanges between Japan and China,” said HU President Ochi during the plenary session on the 29th.

The theme, "Diversity and Integration - Human Resources and Higher Education in the Coming Era," guided the keynote speeches and discussions. Topics included utilizing ICT in post-COVID education and the challenges for climate change and global issues.

President Ochi and President Gong Qihuang of Peking University

Two HU professors honored with Prime Minister's award for disaster prevention work

In the front row, Professor Kubo stands second from the left, while Director Kaibori is positioned seventh from the left in this group photo.
(Photo provided by the Ministry of Land, Infrastructure, Transport, and Tourism)

Professor Tatsuhiko Kubo from the Graduate School of Biomedical and Health Sciences and Director Masahiro Kaibori of the Resilience Research Center received the 2023 Prime Minister's Commendations to Contributors for Disaster Prevention.

The award recognizes outstanding contributions to disaster prevention efforts, including saving lives, preventing damage, and enhancing disaster prevention systems.

Tatsuhiko Kubo

As a disaster management expert, Kubo focuses on establishing standards for disaster information management from a public health perspective. During disasters, he collaborates globally with DMAT, international emergency teams, WHO, and others, contributing to international advancements in disaster medicine through data-driven activities.

Masahiro Kaibori

As a leading expert in Sabo-Engineering and community-based disaster prevention, Kaibori has significantly advanced regional disaster prevention through extensive research and field surveys. His contributions are integral to the practical development of Sabo-Engineering, shaping effective disaster prevention strategies.

Professor Takashi Yamamoto wins 80th Chugoku Culture Award

Professor Takashi Yamamoto of the Graduate School of Integrated Sciences for Life was awarded the 80th Chugoku Culture Prize sponsored by the Chugoku Shimbun.

Yamamoto was recognized for his achievements in leading the research and development of genome editing in Japan and applying that technology to the breeding of agricultural, livestock, and fishery products, as well as the treatment of diseases. He served as the first president of the Japanese Society for Genome Editing and launched the Hiroshima University venture PtBio Inc. in 2019.

The Chugoku Culture Award is presented to individuals and organizations that have made outstanding achievements in the fields of culture, art, academics, and education in the Chugoku region.

Executive VP Junko Tanaka chosen as 1 of 7 hepatitis elimination champions for 2023

The Coalition for Global Hepatitis Elimination (CGHE) selected Hiroshima University Executive Vice President Junko Tanaka as one of seven Elimination Champions for 2023 for her contributions to the eradication of hepatitis.

"The award recognizes the remarkable contributions of individuals to improved political commitment, policies, and programs that expand access to interventions and accelerate progress toward hepatitis elimination, particularly with limited resources," CGHE said.

Tanaka has been acknowledged for her contributions to epidemiology and public health in Japan and her groundbreaking work that estimated undiagnosed chronic hepatitis B and C cases.

Her recognition extends internationally, underscoring the global significance of her work.

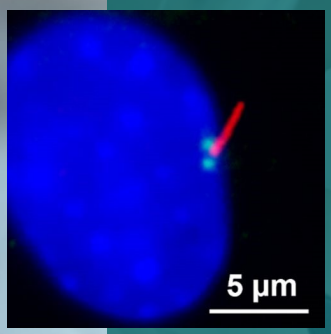
RESEARCH NEWS

Hiroshima University's high-impact research in top-tier journals

Study examines relationship of rate of wound healing, circadian rhythm, and 'hair' on cells

Most organisms on Earth follow a natural circadian rhythm coded by clock genes. Mammalian cells typically have cilia of some sort, hair-like structures with functions like movement and structural support. Primary cilia, in particular, serve as a sensory organ for cells, revealing their potential role in the healing process and how bodies heal at a different rate according to our circadian rhythm.

In a new study published in ***EMBO Reports***, researchers concluded that clock proteins have much to do with the regulation of the primary cilia. The primary cilia act in accordance with the oscillations of the clock gene's expression and can shorten or lengthen throughout the day. The length of the primary cilia can vary and is tied to the healing process of a wound. The shorter the length of the cilia, the shorter the wound-healing time appears to be. The study observed cells from mice over 72 hours and the rise and fall of the length of the cilia seems to be in line with the rhythm of a 24-hour cyclical period.



Primary cilia (red)
© Ryota Nakazato

"This suggests that the 24-hour cycle of primary cilia on fibroblasts may underlie in part the difference of wound healing speed between daytime and nighttime," said Ryota Nakazato, assistant professor in the Graduate School of Biomedical and Health Sciences. Fibroblasts are cells that contribute to forming connective tissue and are a major part of the healing process. The circadian rhythm in the primary cilia of these fibroblasts is more involved in wound healing during the day than at night.

The reason for this daytime-induced enhanced healing process appears to be from the relationship the 24-hour cycle has on the length of the primary cilium. During the day, the cilia are shorter and are more easily able to convert to a cell type that can invade the wound to begin the healing process. Primary cilia are possibly also involved in receiving and sending signals to the rest of the body which can also enhance wound repair. The cells with shorter primary cilia are more easily released from their "anchor" to start cellular migration to the wound site at an earlier time and might also more readily send out signals to increase the rate of wound repair than when the cilia length is longer.

About the study

Nakazato, R., Matsuda, Y., Ijaz, F., & Ikegami, K. (2023). Circadian oscillation in primary cilium length by clock genes regulates fibroblast cell migration. In EMBO reports (Vol. 24, Issue 12). Springer Science and Business Media LLC. https://doi.org/10.15252/embr.202356870

Researchers develop DANGER analysis tool for safer design of gene editing

Researchers created DANGER (Deleterious and ANticipatable Guides Evaluated by RNA-sequencing) analysis, a software tool facilitating safer genome editing design in all organisms with a transcriptome. With potential applications in medicine, agriculture, and biological research, their work was published in ***Bioinformatics Advances.***

Gene editing using CRISPR technology, known for its speed, accuracy, and cost effectiveness, presents some challenges: 1) unquantified monitoring of phenotypic effects from unexpected CRISPR dynamics, and 2) dependence on basic genomic data, including the reference genome. The team's DANGER analysis software overcomes these challenges. They used gene-edited samples of human cells and zebrafish brains to conduct their risk-averse on- and off-target assessment in RNA-sequencing data.

The DANGER analysis detected potential DNA on- and off-target sites in the mRNA-transcribed region on the genome using RNA-sequencing data. It evaluated phenotypic effects by deleterious off-target sites based on the evidence provided by gene expression changes. It quantified the phenotypic risk at the gene ontology term level, without a reference genome. This success showed that DANGER analysis can be performed on various organisms, personal human genomes, and atypical genomes created by diseases and viruses.

About the study

Nakamae, K., & Bono, H. (2023). DANGER analysis: risk-averse on/off-target assessment for CRISPR editing without a reference genome. In A. Ouangraoua (Ed.), **Bioinformatics Advances (Vol. 3, Issue 1)**. Oxford University Press (OUP). https://doi.org/10.1093/bioadv/vbad114

In an ancient hot spring haunt of Inca rulers, scientists discover new shrimp-like species

In an ancient hot spring haunt of Incan rulers, researchers discovered a new species of tiny, shrimp-like scavengers known as amphipods thriving at record temperatures that can cook other crustaceans to death.

Typically, amphipods dwell in cool aquatic and semi-aquatic habitats. So researchers were stunned when unidentified *Hyalella* species showed up during a hot spring biota survey of Baños del Inca (Baths of the Inca) near Cajamarca, Peru. A detailed description of the new species, *Hyalella yashmara*, was published in the journal ***Invertebrate Systematics***.

Hyalella yashmara

© Dr. Nilton Deza

Clues to adapting to climate change

Temperatures at Baños del Inca hit around 78°C closest to the thermal spring's origin. Field surveys revealed that these amphipods hang around pools simmering at 50°C not far off the hot spring's source and in channels cooled down to 35°C.

Researchers noticed that these creatures are virtually inert early in the morning when temperatures are between 35–40°C and bustling with activity as it grows warmer during the day. Tests revealed they can survive temperatures of up to 52.1°C, the hottest recorded for amphipods.

"Many animals cannot tolerate high-temperature environments because proteins are thermally denatured at high temperatures. We guess the new species found in the hot spring of Peru has acquired a protein that is highly active at high temperatures during the course of evolution," explained Ko Tomikawa, professor in the Graduate School of Humanities and Social Sciences.

Unraveling its unique adaptations can give clues on bolstering the heat tolerance of freshwater animals threatened by our warming climate.

About the study

Tomikawa, K., et al. (2023). Description of a new thermal species of the genus Hyalella from Peru with molecular phylogeny of the family Hyalellidae (Crustacea, Amphipoda). In J. Wolfe (Ed.), **Invertebrate Systematics (Vol. 37, Issue 4, pp. 254–270)**. CSIRO Publishing. https://doi.org/10.1071/is22060

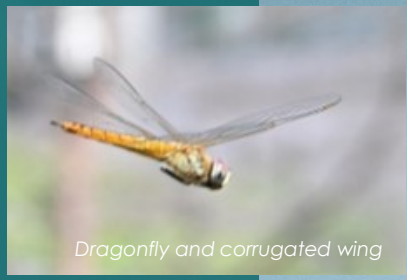
Dragonfly wings used to study relationship between corrugated wing structure and vortex motions

Corrugated wings exhibit larger lift than flat wings

The wing surfaces of insects like dragonflies are not flat like the wings on a passenger plane. Because insects possess low muscular strength, in some way their corrugated wings must give them aerodynamic advantages. Yet scientists have not fully understood the mechanism at work because of the complex wing structure and flow characteristics.

In a study published in ***Physical Review Fluids***, researchers used direct numerical calculations to analyze the flow around a 2D corrugated wing and compared its performance to that of a flat wing. They focused on the period between the initial generation of the leading-edge vortex and subsequent interactions before detachment. They discovered that the corrugated wing performance was better when the angle of attack, that angle at which the wind meets the wing, was greater than 30°.

The corrugated wing's uneven structure generates an unsteady lift because of complex flow structures and vortex motions. "We've discovered a boosting lift mechanism powered by a unique airflow dance set off by a distinct corrugated structure. It can be a game-changer from the simple plate wing scenario!" said Yusuke Fujita, a PhD student at the Graduate School of Integrated Sciences for Life.


Dragonfly and corrugated wing

© Yusuke Fujita

The researchers constructed a 2D model of a corrugated wing using a real-life dragonfly wing. The model consisted of deeper corrugated structures on the leading-edge side and less deep, or flatter, structures on the trailing-edge side. Using their 2D model, they further simplified the wing motion and focused on unsteady lift generation. Translational motion, or sliding motion, is a principal component of wing motion, in addition to pitching and rotation. The researchers' analysis expands the understanding of the nonstationary mechanisms that dragonflies use during flight.

About the study

Fujita, Y., & Iima, M. (2023). Dynamic lift enhancement mechanism of dragonfly wing model by vortex-corrugation interaction. In **Physical Review Fluids (Vol. 8, Issue 12)**. American Physical Society (APS). https://doi.org/10.1103/physrevfluids.8.123101

SKCM²'s mission to knot and knit a sustainable world

HU's World Premier International Research Center Initiative Institute

SKCM² is weaving together mathematical knot theory, chirality knowledge, and a vision of a more sustainable future.

Any knitter knows the secret to transforming a fabric's characteristic lies within the artful manipulation of the knot. Choosing to make the material stretchy, resilient to wear and tear, cozy for winter, or breathable for summer all hinges on your pick of interlocking loop patterns. Imagine doing the same with nature's building blocks. By deftly manipulating molecules into their different knotted versions, you can surpass what nature has already perfected and develop novel materials with highly desirable properties. Scientists at the **International Institute for Sustainability with Knotted Chiral Meta Matter (SKCM²)** are doing just that. In interlinking mathematical knot theory, chirality knowledge, and a vision of a more sustainable future, they aim to create synthetic versions of nature's building blocks that transcend the limitations of natural systems and unravel solutions to pressing global challenges.

The guiding philosophy of SKCM², encapsulated in the slogan "building a sustainable world, knot by knot," propels its multifaceted mission. At its core, the Institute's dedication to "mastering the knot" can endow them with the ability to create new materials, cure diseases, and understand nature's inner workings. But their ambitious endeavor extends beyond scientific exploration. They also serve as a testbed for research-based graduate education reforms that can connect young talent globally, fostering the next generation of innovators.

The Institute is led by Professor Ivan Smalyukh, a world-leading physicist in developing artificial forms of matter. His fundamental research aims to address challenging problems like the growing energy demand and climate change. Professor Smalyukh has published over 250 peer-reviewed articles, including many in Nature and Science. He has also received many awards, such as the Bessel and Glenn Brown Awards, the NASA iTech Award, and the Presidential Early Career Award from the Office of Science and Technology of the U.S. White House.

Since its establishment, SKCM² has rapidly emerged as a premier global center for developing artificial analogs of atoms and even smaller building blocks of nature. With its dedication to introducing designable materials with unique properties not found in nature, the Institute positions itself at the forefront of confronting society's knotty problems.

More about SKCM² here:

Established in 2022, SKCM² is the latest addition to the World Premier International Research Center Initiative (WPI), a program by Japan's Ministry of Education, Culture, Sports, Science and Technology to support Japanese institutions in setting up centers of research excellence. There is a total of 16 WPI centers located throughout Japan as of 2022.

About the Institute

Introducing some of the minds forming the fabric of SKCM²!

'Masters of the Knots'

IVAN SMALYUKH
Director, SKCM²

Our Institute is dedicated to building a sustainable world through highly fundamental research and through reforming graduate education. We create entirely new forms of matter, and its building blocks, in addition to revealing mysteries of the matter that nature gave us, while innovatively educating PhD students and sharing our excitement with the public. Often hiking in Colorado and in Hiroshima, I enjoy observing how mountains and islands connect into a beautiful scenery. It is much like this in science, where in a view from above I aspire to see how mountains of fundamental knowledge in different disciplines can be tied together. We feel excited, like masters of the knots ready to untie the mysteries of the world and ready to save the world by solving its knotty problems.

Fusion of fields

YUKA KOTORII
Deputy Director for Outreach and Dissemination, SKCM²

My research interests are in the field of topology in mathematics. I study the properties of the shape of a string by considering it as the same shape even if it is continuously deformed, as long as it is not cut or pasted. Any object that has a string-like shape can be abstracted and treated as a target of knot theory. Therefore, I think it can be applied to various string-like materials found in nature.

I have high expectations for the interdisciplinary research that can be done only by bringing together members from various fields of SKCM2. I am looking forward to being able to apply my research in mathematics to this interdisciplinary research. And I look forward to the creation of new fields.

Publications

Introducing some of the most recent research outcomes at SKCM²!

NATURE COMMUNICATIONS

Nature Communications Volume 14, Article number: 4581 (2023)

Topological solitonic macromolecules

Researchers experimentally create and model soliton polymers called polyskyrmionomers, composed of individual solitons, particle-like entities with atom-like characteristics. Polyskyrmionomers have the potential for data storage in magnetic nanostructured analogues.

SCIENCE

Science Volume 380,392-398 (2023)

Ultrafast reversible self-assembly of living tangled matter

Tangled active filaments, elongated structures exhibiting self-propulsion such as the tassel of cilia that cells use to move around, are common in nature. Researchers look into how their activity and elasticity contribute to collective topological transformations — reorganizing from an entangled network into an ordered structure without changing their fundamental nature.

NATURE PHYSICS

Nature Physics Volume 19, pages 451–459 (2023)

Liquid crystal defect structures with Möbius strip topology

Researchers show how twist domain walls and vortices can co-self-assemble to form a new type of stable, spatially localized objects called möbiusons with Möbius strip-like topology and can fold into various structures in a nonpolar chiral liquid crystal system. Möbiusons have potential applications in designing topology-enabled light-steering systems.

Learn more here:

Events

11 DEC — **SKCM² 2023 Winter School** (Dec. 11 - Jan. 12)

The SKCM² Winter School provided young scientists with an interdisciplinary learning experience alongside top researchers in knotted chiral meta matter. Topics included metamaterials, knot theory, solitons, chirality, soft matter, magnets, colloids, polymers, quantum materials, biomaterials, proteins, active matter, origins of life, and energy efficiency. The program featured lectures, hands-on training, and special events.

12.26 | Miyajima Outreach Symposium

12.25 | Career Forum

27 FEB — **Symposium to Promote Gender Balance and Diversity in Science**
Library Hall & Online, Hiroshima University Central Library

8 MAR — **SKCM² Spring Symposium**
Nara Kasugano International Forum - IRAKA

My advisor Jörn Dunkel is a principal investigator at SKCM². He hosted one-day conference last year at MIT where SKCM²'s director, Ivan Smalyukh, came and advertised the Winter School at Miyajima Island. So I signed up and I'm glad I did. I love Japan. I love Hiroshima. The institute brought together people from unique backgrounds. There's some people in pure math, applied math, chemistry, biology, physics, and I think that's made for a lot of interesting conversations. I'm definitely going to try to convince people to come here.

ALEX COHEN
PhD student
Massachusetts Institute of Technology

I was working on applied mathematical research at my previous university when I heard about this new project at Hiroshima University. Within pure mathematics, I study topology and geometry in three dimensions but I am happy to find that I can be useful in interdisciplinary research as well. Currently, I am also working on describing the structure of textiles. Textile research has the potential to develop materials with new structures. I would like to do applied research where I can use my skills, and also consider feedback from applied research to pure mathematics.

KEN'ICHI YOSHIDA
Postdoctoral researcher
SKCM²

Issue 3 | Since 2023

Feature

SCIENTISTS RECOGNIZED AS AMONG THE WORLD'S BEST

Meet some of our researchers named to be among the best scholars in their fields by Research.com.

We asked three scientists, recognized as among the best in the world by Research.com, questions about their fields and exciting developments in their work.

These researchers are some of the leading scholars in their disciplines, demonstrated by their impressive rankings on Research.com's best scientists list. The rankings are based on the Discipline H-index (D-index), calculated by considering only the publications and citation values belonging to a given field. Top researchers from over 3000 universities and research institutes are featured on the list.

About Research.com

Research.com is a research portal dedicated to promoting high-quality research and inspiring young scholars to contribute to the advancement of science.

**Answers in the questions were edited for clarity and brevity.*

Check out the rankings here.

Takeshi Shiono

Professor

Graduate School of Advanced Science and Engineering

Learn more about Prof. Shiono's research here.

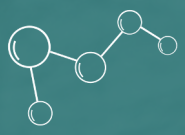
Best Scientists - **Chemistry & Material Sciences**

Small molecules are gas or liquid, but once they can be polymerized, they give a solid product whose properties can be controlled by molecular weight and molecular weight distribution. A huge number of small molecules called monomers are chemically connected to form a large molecule, macromolecule, or polymer. Materials scientist Takeshi Shiono is exploring the catalysts that polymerize very simple monomers such as ethylene and propylene in well-controlled manners.

Q: What scientific problem are you trying to answer?

A: I'm trying to find a new way to synthesize tailor-made copolymers from simple monomers that are difficult to copolymerize. If two monomers can be copolymerized, the properties of the product, copolymer, can be controlled by not only the composition of the monomers but also the sequence structure of the comonomers such as random, alternate, and block. Even from the same monomer, we can get various polymers that differ in stereoregularity by suitable catalysts.

Q: What are the discoveries that have led up to your current work?



A: We accidentally succeeded in the synthesis of a new titanium complex that can conduct living polymerization of propylene by combining a suitable activator, cocatalyst. The stereoregularity of the polymers can be controlled by the ligand of the complex, solvent, polymerization temperature, and propylene concentration. The catalytic systems can promote living copolymerization of a cyclic olefin, i.e. norbornene, and 1-alkene, which enables the synthesis of tailor-made copolymers composed of them. The International Union of Pure and Applied Chemistry defines living polymerization as a chain polymerization from which chain transfer and chain termination are absent. Living polymerization is used to produce materials with narrow molecular weight distribution, an important property for many polymer applications.

Q: What are the economic or social stakes of your study from your perspective?

A: Amorphous ethylene/norbornene copolymers, of which glass transition temperature can be controlled by norbornene content in a wide range, are commercialized as optical plastics with superior properties, but their brittleness is the weak point. We have found the gradient and block copolymers obtained by our catalysts overcome this problem. My research concerns SDGs 9 and 12. It is inevitable to consider SDGs when we do anything.

Ikuo Katayama

Professor

Graduate School of Advanced Science and Engineering

Learn more about Prof. Katayama's research here.

Best Scientists - **Earth Science**

There is three to four times more water inside the Earth in the form of hydroxyl in rocks compared to the world's seawater. Plate subduction transports rocks deeper into the Earth where the temperature rise dissolves them into a thick, syrup-like liquid. Such water is released back to the Earth's surface via volcanic eruption. Geoscientist Ikuo Katayama examines this circulation of water in the Earth's interior, which is closely tied to phenomena like earthquakes.

Q: What do you find most exciting in your field of research?

A: In the paper published in Nature in 2009, we explained the seismic signatures observed in the Ryukyu arc by the deformed serpentinite, which represents the hydration products of the mantle. This finding suggests that a significant amount of water is transported along the deeper parts of the subduction zones.

Q: What got you into this field?

A: Since childhood, I have been interested in the stars, mountains, and the wonders of nature. However, my initial motivation for studying Earth science was impure, as it allowed me to go abroad to remote areas for research. My first field was in Kazakhstan, where the diamond-bearing high-pressure metamorphic rocks were exposed.

Q: Is there anything that surprised you the most in your current research?

A: We have joined the international continental drilling project in Oman and found that carbonate mineralization is ubiquitous in the mantle. Carbon capture and storage (CCS) is one of the ways of reducing carbon dioxide from the atmosphere, which could help to solve global warming. If carbon can be trapped in the mantle rocks in the world, it has a huge potential for subsurface carbon storage.

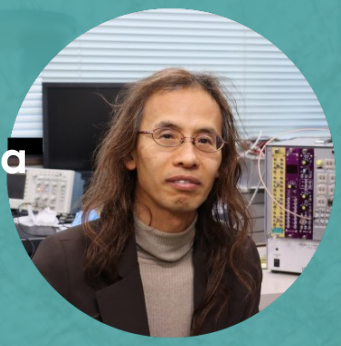
Q: What are the discoveries that have led up to your current work?

A: Mars is a dry planet, with no liquid ocean on the surface, but water can be trapped in the subsurface. A recent lander on Mars has detected the seismic discontinuity in Mars, which can be explained by the presence of an aquifer. If there is liquid water beneath the surface of Mars, it is not surprising that there is extraterrestrial life.

Yasushi Fukazawa

Professor

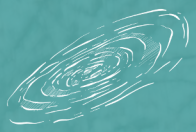
Graduate School of Advanced Science and Engineering



Learn more about Prof. Fukazawa's research here.

Best Scientists - **Physics**

As an astronomer, the telescopes Yasushi Fukazawa has been involved in are located in space, orbiting around the Earth. He investigates X-rays and gamma rays which are difficult to detect for ground telescopes as our atmosphere absorbs these electromagnetic waves. To observe them, astronomers rocket-launch telescopes into orbit where they circle the Earth as satellites. Fukazawa worked on projects to develop instruments for three telescopes and most recently helped build nanosatellites sent to space to monitor gamma-ray bursts, an astrophysical event believed to result in a black hole. He serves as the director of Hiroshima University's Core of Research for the Energetic Universe (CORE-U).



Q: Can you please describe your field of research?

A: My research field is to study high-energy astrophysical phenomena with X-ray and gamma-ray observations. Black holes, jets, and gamma-ray bursts are target objects. They are bright in X-ray and gamma-ray bands, indicating that high-energy heating and particle acceleration occur. The development of observation instruments is also performed, especially for silicon sensors and scintillation detectors.

Q: What do you find most exciting in your field of research?

A: There are many astronomical objects which are bright in the gamma-ray band. The biggest object is found as a gamma-ray cloud around one galaxy. Its size is around three million light years. It is still not understood how such a cloud is generated.

Q: What scientific problem are you trying to answer?

A: Black holes at the center of galaxies are known to eject cosmic jets as plasma flows with almost the speed of light. This ejection mechanism is not yet understood. such jets are also formed at hypernovae where massive star explodes and a black hole is born.

Q: What are some of the major projects you are working on now?

A: One is a CubeSat project CAMELOT (CubeSats Applied for Measuring and Localising Transients) which is in collaboration with Hungary and Czech Republic teams. This project aims to launch about 10 CubeSats, nanosatellites that observe gamma-ray bursts to localize their direction. Another is next generation MeV gamma-ray satellite AMEGO-X which is in collaboration with GSFC/NASA.

Issue 8 | Since 2021

WOMEN IN ACADEMIA

Meet our researchers

Spotlighting one of the many women researchers working on cutting-edge science at Hiroshima University.

Dr. Kaori Wakabayashi, Hiroshima University

Scientist taps into lobsters' inner weirdo to conquer the over 120-year quest to farm them

Their dragon-like appearance has earned lobsters the moniker "dragons of the sea." It is one reason why they are a favorite fixture during Lunar New Year banquets. And in some Asian cultures, eating them means imbibing the good fortune, rosy health, and formidable power embodied by the dragon — the most auspicious of the 12 zodiac animals.

While the former is a real-life creature and the latter an imaginary beast, fascinating similarities can be drawn between lobsters and dragons. For one, both don't stop growing, a unique ability that fueled the myth of lobster immortality. And as scientists discovered, trying to farm lobsters is a feat as elusive as taming fire-breathing dragons of lore. But marine biologist Kaori Wakabayashi is inching science closer to conquering its over 120-year pursuit by letting these "dragons of the sea" get real weird.

Surf 'n slurp

It all began with a chance inquiry over a decade ago. Wakabayashi said the Tokyo University of Marine Science and Technology laboratory she would later be a part of was shown bizarre "jellyfish riders" a diver couldn't identify.

"The diver actually collected these animals together with the jellyfish, brought them to our laboratory, and then asked my ex-supervisor what they were," said Wakabayashi, now an associate professor at Hiroshima University's Graduate School of Integrated Sciences for Life.

The thin, flat, and transparent creatures with spindly legs clinging to the jellyfish turned out to be phyllosomata, the larval form of slipper and spiny lobsters. In particular, the ones brought to them by the diver were slipper lobster larvae, which have been documented to hitch rides and munch on jellyfish. Intrigued by this behavior, the laboratory embarked on a project to further explore its ecological role and tapped her expertise on marine invertebrates' younger stages.

Slipper lobster *(Ibacus novemdentatus)*

Swiss army knife-like appendages

Zooming in on appendages, they noticed the larvae's walking legs, called pereiopods, are barbed with hard spikes perfect for latching on jellyfish. They also found comb-like protrusions styling the tip of the third maxilliped, an elongated appendage for grooming. As a defense, jellies slime their predators so having specialized limbs to scrape off mucus that may harbor bacteria can be handy.

Wakabayashi wondered if a diet exclusively on jellyfish could sustain the free-floating slipper lobster (*Ibacus novemdentatus*) larvae until they molt into bottom-dwelling juveniles — the stage they start resembling their adult form.

They found that a diet solely of jellyfish not only supplied enough sustenance but also fast-tracked the usually 1.5-2 months-long planktonic larval phase by letting the slipper lobster skip one development stage.

An appetite for venom

Wakabayashi was also curious if slipper lobster larvae could afford to be picky with jellyfish or if they acquired an appetite for venom. The phyllosomata suffered no harm even as they gobbled the deadlier species, venomous tentacles and all.

The secret is in their digestive system. The larvae are shielded from the venomous stingers by an armor of chitin — the same biological polymer making up their tough exoskeleton — lining nearly their entire intestines. They also secrete an impenetrable membrane that seals in the stingers but lets nutrients pass through so exposed parts of their gut are protected.

"Exhibiting that lobsters cling to and eat jellyfish in the tank condition is our original finding. Then finding out that this species can eat not only one but a variety of species of jellyfish is also our original finding. Demonstrating that they can complete larval development by only feeding on jellyfish is also our original finding," Wakabayashi said. "So I am now trying to combine these to develop a technique for commercial farming."

Her initial trials have already shown progress. Only the jellyfish diet produced adults with pale pink exoskeletons compared to the auspicious reddish hue of wild slipper lobsters coveted in Asian markets. Wakabayashi is working to raise slipper lobsters that exhibit the same flushed tones as the wild-caught ones. And as her strides in the secrets of lobster lives taught her, she may soon find the answer to this in its oddest behaviors.

Hiroshima University at a Glance

(as of May 1, 2023)

12 SCHOOLS (UNDEGRADUATE)

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

4 GRADUATE SCHOOLS

- Integrated Sciences for Life
- Biomedical and Health Sciences
- Humanities and Social Sciences
- Advanced Science and Engineering

1 RESEARCH INSTITUTE

- Graduate School of Innovation and Practice for Smart Society

STUDENTS

15,000+

UNDERGRADUATE AND GRADUATE

INTERNATIONAL STUDENTS

1,800+

FROM 80+ COUNTRIES & REGIONS

Hiroshima University hosts students worldwide, with the highest number coming from CHINA, INDONESIA and VIETNAM.

INTERNATIONAL EXCHANGE AGREEMENTS

400 AGREEMENTS WITH 354 INSTITUTIONS IN

56 COUNTRIES & REGIONS

OVERSEAS BASES

23

IN 15 COUNTRIES & REGIONS

THE UNIVERSITY IMPACT RANKINGS 2023

3rd IN JAPAN FOR THE OVERALL SCORE

TOP **100** IN THE WORLD FOR 6 SDG CATEGORIES

ADMISSIONS

For admissions inquiries or to learn more about the graduate degrees offered at HU, please click or scan the QR codes below.

Admissions

Graduate Degrees at HU

CAMPUS LOCATION & ACCESS

❶ 〈Hiroshima City (Midori District)〉
Elementary School
Junior High School
Senior High School

❷ 〈Higashi Hiroshima City〉
Kindergarten

❸ 〈Hiroshima City (Shinonome District)〉
Elementary School
Junior High School

❹ 〈Mihara City〉
Kindergarten
Elementary School
Junior High School

❺ 〈Fukuyama City〉
Junior High School
Senior High School

WHAT'S NEW ON CAMPUS

1 NOV 2023

New cafe in the Ryoun Lecture Building (Kasumi Campus)

Experience the convenience of our recently launched self-service cafe, now available on the 1st floor of the Ryoun Lecture Building at the Kasumi Campus.

4 NOV 2023

HU launches local 5G network

Hiroshima University held a ceremony to commemorate the opening of its local 5G network as part of the Town & Gown Initiative.

HU Original Goods

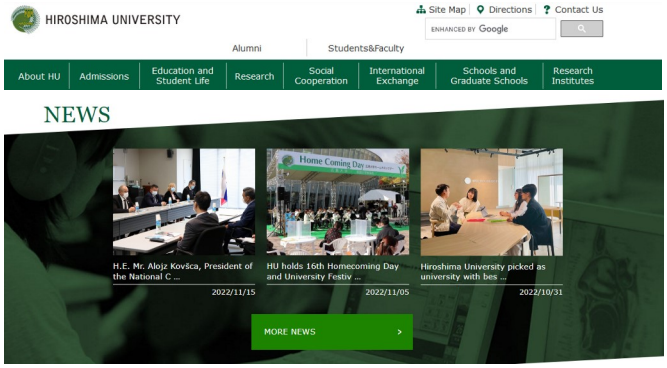
HU has launched a new line of original merchandise, including a green hoodie and dry t-shirt. Both items incorporate the university's emblem and its signature green color, blending tradition with a timeless design aesthetic.

FIND MORE ABOUT HU

HU OFFICIAL WEBSITE – ENG

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

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



UPDATES FROM OUR LABORATORY

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

https://www.hiroshima-u.ac.jp/en/laboratory-updates

HU STUDENT VLOGS

What is it like being an international student at HU? Our student vlogger takes you through her journey as an international student at HU as she shares the charms of the university and its surroundings.

https://youtu.be/TRxoBTcmTWo

Finding researchers at HU is now easier than ever!

Introducing the Researcher Directory — HU's researcher search system. Users may now search the research fields and achievements of approximately 1,900 researchers affiliated with HU by topic, Sustainable Development Goals (SDGs), discipline, alphabetical order, or simply entering a keyword in the built-in search box.

Check out the site here ↓

https://www.guidebook.hiroshima-u.ac.jp/en

SOCIAL MEDIA ACCOUNTS

HU Facebook
@HiroshimaUniv.en

HU Research Facebook
@HiroshimaUniversityResearch

HU X (formerly Twitter)
@HiroshimaUnivEn

HU Research Twitter
@Hiroshima_Univ

HU YouTube
HiroshimaUniv

HU Instagram
@hiroshima_univ

HU LinkedIn
HiroshimaUniv.en

Connect with us!

75+75th Anniversary Project Commemorative Goods

Available now are a 315-piece jigsaw puzzle and a scarf, both featuring the most iconic sites of HU. These items, created by Hiroshima-based illustrator Hirofumi Kamigaki, were specially designed to commemorate HU's 75+75th anniversary.

Hiroshima University 75+75th Anniversary Project

Introducing new catchphrase and logo

Born under a new system in 1949, Hiroshima University's history dates back to 1874, when the Hakushima School — its oldest predecessor school — was founded. In over 140 years, the university has produced numerous talented individuals.

In this sense, 2024 marks 75 years since the foundation of HU and 150 years since the founding of its oldest predecessor school.

As part of HU's 75+75th anniversary project, the university has created a new catchphrase and logo.

Catchphrase

Row out into a sea of chaos; go beyond the horizon of creativity.

HIROSHIMA UNIVERSITY

University of World-wide Repute and Splendor for Years into the Future

Hiroshima University
Public Relations Office
E-mail: koho@office.hiroshima-u.ac.jp