HIROSHIMA UNIVERSITY UPDATE

HIROSHIMA UNIVERSITY

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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

CONTENTS

COVER PHOTO

New six-story building designed for legal education and research

The School of Law relocates to Hiroshima City

Starting April 2023, classes of the School of Law will be held on the Higashi-Senda Campus in Naka-ku, Hiroshima City following its relocation. A new "center for humanities and social sciences with a focus on nurturing legal professionals," will be formed in this environment where numerous law firms and businesses, the Hiroshima High Court, and the Hiroshima High Public Prosecutors Office are located.

RECENT NEWS

RESEARCH FOCUS

MEET OUR RESEARCHERS

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

Hiroshima University Assistant Professor Ji Ha Lee talks about her research on gel materials.

Hiroshima University's former Faculty of Science Building No. 1

HU signs 4-party cooperation agreement to create a new hub for peace education and research

City of Hiroshima

Hiroshima University

Hiroshima City University

Hiroshima Peace Culture Foundation

The City of Hiroshima, Hiroshima University, Hiroshima City University, and the Hiroshima Peace Culture Foundation concluded a cooperation agreement on January 25, 2023, to create a "center of knowledge" for peace.

The agreement aims to establish a world-class center for peace research and education, as well as a hub for promoting a "culture of peace" throughout Hiroshima. The center — to be located in Hiroshima University's former Faculty of Science Building No. 1 — would work to instill a desire for a peaceful society without nuclear weapons in global public opinion, while creating a trend towards peace.

"We would like to exhibit and release the academic materials collected by Hiroshima University's Research Institute for Radiation Biology and Medicine and develop the center as a place where citizens and foreign visitors can come to learn about the damage caused by the atomic bomb," commented President Mitsuo Ochi during a press conference.

"In addition, the four parties will work together to establish the center and create synergy with the Higashi-Senda Campus of Hiroshima University to enhance education and research, contribute to peace, and promote regional development."

With the conclusion of the agreement, the four parties will work together to form a "center of knowledge" for peace, using the information and expertise they each possess and establish the Hiroshima Peace Education Research Facility (tentative name) by the end of fiscal year 2023.

Commemorative photo
Representatives of the four parties during a press conference

HU to establish vaccine and drug manufacturing facility

Hiroshima University's proposal to establish a vaccine and drug manufacturing base on its campus was selected by the Ministry of Economy, Trade, and Industry (METI) for the "Developing biopharmaceutical manufacturing sites to strengthen vaccine production" project on September 30, 2022.

Under the proposal, HU will establish a facility at its Kasumi Campus to produce investigational mRNA, peptide, and nucleic acid drugs. HU's proposal was the only one selected from a university out of 41 proposals received and screened by a third-party committee of outside experts from all over Japan.

The "Developing biopharmaceutical manufacturing sites to strengthen vaccine production" project supports the establishment of bases with dual-use facilities — as preparation for infectious diseases that may become a threat in the future — that can manufacture biopharmaceuticals according to the needs of companies during normal times and switch to vaccine production in the event of an infectious disease pandemic.

The project also supports the establishment of bases with facilities capable of performing formulation and filling which are indispensable in vaccine production, as well as facilities equipped to produce materials necessary for the manufacture of pharmaceuticals.

As part of the project initiatives, HU established the *PSI GMP Education and Research Center on October 1, 2022. The center consists of an investigational drug manufacturing facility and a GMP education system, focusing on medium-molecular drugs such as messenger RNA (mRNA) vaccines, nucleic acids, and peptides.

In addition, HU has signed a collaboration agreement with the University of Southern California (USC) to implement global response and plans to jointly conduct GMP education and training in accordance with the international drug regulatory guidelines "ICH Guidelines" starting in fiscal year 2023.

*GMP
Good Manufacturing Practice
*PSI
Peace & Science Innovation Ecosystem

More here

New collaborative project with medical professional alumni starts in Indonesia

A group of medical professional alumni and members of the Hiroshima University Alumni Association Indonesia Chapter gathered in Jakarta, Indonesia, last October 2022, to discuss opportunities for collaboration in the medical and health sectors of both countries.

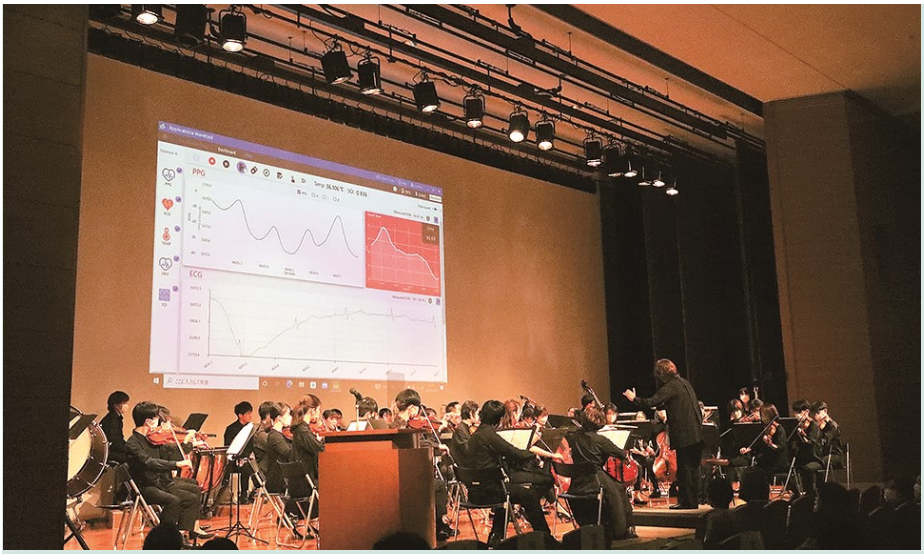
This gathering was part of the “Hiroshima University Overseas Co-creation Platform Plan,” which seeks to create new value and address social issues in pursuit of Society 5.0 and the UN SDGs. The plan involves collaborating with stakeholders — including alumni, private sectors, corporations, and institutions — both in Japan and abroad.

Group photo
Meeting in Jakarta

The meeting in Jakarta brought together alumni from across Indonesia, including notable medical professionals such as Mr. Abdul Kadir, Chairman of the Supervisory Board, Social Security Department and former General Director of the Health Services of the Ministry of Health, and Prof. Andi Husni Tanra, Emeritus Professor of Hasanuddin University.

From HU, Dr. Junko Tanaka, Executive Vice President (Kasumi Campus, Faculty Personnel and Public Relations) and Prof. Shinji Kaneko, Executive Vice President (Global Initiatives), along with hospital staff, shared insights on the medical situation in Indonesia and the latest medical treatments and technology available at HU Hospital.

The meeting served as a promising step towards strengthening cooperation and collaboration between medical professionals in Indonesia and HU.



Verification performance
Real-time monitoring of performer's heartbeat

Using music to enrich the mind and explore perception

About the BMK Center

The Center for Brain, Mind and KANSEI Sciences Research at Hiroshima University is an interdisciplinary research center established to study the uniquely Japanese concept of KANSEI. Research results are implemented in society in the fields of medicine, mental health, therapeutical interventions, education, and manufacturing and allow for the creation of new academic fields through the fusion of disciplines.

Visualizing KANSEI from brain waves

The mind is an invisible world that greatly affects both ourselves and those around us. In attempts to scientifically visualize the mind, various indicators such as physical signals and questionnaires are used. Music, which is known to have positive effects on mood and mental health, has been chosen as one of the methods being explored by researchers at the Center for Brain, Mind and KANSEI Sciences Research to understand and enrich the mind and hopefully develop a method to help individuals notice and draw out their latent positive perception.

By studying the relationship between music and perception from a neuroscientific perspective, Specially Appointed Professors Shigeto Yamawaki and Tomomi Nishimoto, a world-renowned conductor, hope to uncover new insights that could be applied in a wide range of fields.

Their research has been adopted by the Moonshot Research and Development Program of the Cabinet Office — which promotes challenging R&D projects on important social issues such as the low birthrate, aging society, and global warming.

The key to their study is KANSEI, a Japanese term that refers to the complex process of perceiving, understanding, and expressing emotions. People develop expectations about future situations and oftentimes unconsciously predict future events based on their interoception, e.g. sensation of visceral and physiological signals of the body, their past experiences, or by extracting important information from the environment. When reality differs from their expectations, they become aware of their interoceptive senses, e.g. increased heart rate, which appear as excitement if an experienced outcome is unexpectedly better than their expectation or as disappointment if they are negative.

A public symposium was held at Kyoto University on October 10, 2022, to kick off the project, featuring five research presentations and a verification performance by an orchestra. Participants experienced the relationship between music and its influence on the body, and there was real-time visualization of the mental activity of a music performer and research staff.

Survey shows HU produced 2nd most number of female CEOs among Japan's national and public universities

Hiroshima University has produced the second most number of women CEOs among Japan's national and public universities, according to the 11th National Female President Survey of Tokyo Shoko Research, Ltd.

This is the fifth time in a row that the university ranked second. The survey results released last November 7 showed that there are 130 female company presidents who graduated from HU. Clinching the top spot among national and public universities is the University of Tokyo with 178 of their female graduates becoming CEOs. Osaka University placed third with 121 followed by Kyushu University with 115 and Tokyo Medical and Dental University with 102.

The survey revealed that the number of female presidents in Japan is expected to reach 584,130 in 2022, accounting for 14.70% of companies nationwide. This is up by 7.9% compared to last year. It added that the number of female presidents has doubled from the 212,153 recorded 12 years ago in 2010 when it started the survey.

HU students win architectural design competition

Toki no Ki

Grand Prize-winning tearoom work
Graduate School of Advanced Science and Engineering, M2

Three groups of Hiroshima University students were awarded prizes in the architectural design competition Ginchakai Architectural Culture Week Student Grand Prix 2022. The competition — hosted by the Architectural Institute of Japan in October 2022 — calls for designs and proposals of creative tea ceremony spaces to be displayed and used at the venue for the Ginchakai tea ceremony, an event held in Ginza-Dori, Tokyo.

After a two-stage screening process — and out of 47 entries from across Japan — the works of three teams from the Architectural Project Laboratory of the Architecture Program, Graduate School of Advanced Science and Engineering at HU, were selected for the Grand Prize, Honorable Mention Award, and Jury Prize.

The Grand Prize-winning tearoom work, "Toki no Ki (Autumn Tree)," was created by a team of four students led by Shotaro Yamashita. Made of cedar boards produced in Hiroshima Prefecture, the design is simple — consisting of a series of boards that resemble a kimono and are sewn together with twine — but the work can be transformed into various shapes, such as a folding fan, cone, or spiral shape, depending on the time, place, and occasion.

The Honorable Mention Award went to Chiyu Yamamoto's team for their work titled "Hou-Un-An (Sewing Cloud Hermitage)." The Jury Prize was awarded to Shunto Shimada's team for their work titled "Uturoi Sasou Aki-Moyou (Autumn Patterns that Invite Transition)."

More here

MEET our STUDENTS

HU student takes top spot in HIRAKU 3MT Competition with dietary approach to mental health

The HIRAKU 3MT Competition 2022, was a great success, with a total of 69 applications from 18 universities all over Japan. The competition was open to all doctorate students enrolled in Japanese universities, and 20 finalists were selected to compete in the final stage — held on November 23 — after a rigorous video presentation screening.

During the competition, each finalist was given three minutes to present their research using only a single slide. The presentations were delivered in a language appropriate to a non-specialist audience, which in turn seemed to galvanize the intellectual curiosity of the audience. The theme of the panel talks was "Facing the Future: Collaborate, Transcend, Create," and they were moderated by experienced science communicators. The moderators guided the finalists as they exchanged opinions about the kind of future they want to create.

The winner of the English Division was Jason Braga, who is a doctoral student from the Graduate School of Integrated Sciences for Life at Hiroshima University. Braga's presentation, titled "A Food to Remember," introduced the potential benefits of prebiotics and probiotics on mental health and brain function. Braga's research could lead to the development of nutritional approaches for improving mental health and overall wellbeing.

Braga also won the People's Choice Award and the Otsuka Award (sponsor award).

The HIRAKU 3MT Competition 2022 demonstrated the depth of talent and expertise present among Japan's doctoral students. The competition not only provided a platform for students to showcase their research, but also fostered collaboration and communication among researchers across different disciplines and universities.

Jason Braga

Affiliation: Ph.D. Student in the Graduate School of Integrated Sciences for Life

'Engine' of luminous merging galaxies pinpointed for the first time

Researchers used the James Webb Space Telescope to identify the precise location of a powerful energy source hidden by cosmic dust in the luminous merging galaxy IIZw096.

Roughly 500 million light-years away, near the constellation Delphinus, two galaxies are colliding. Known as merging galaxy IIZw096, this luminous phenomenon is obscured by cosmic dust, but researchers first identified a bright, energetic source of light 12 years ago. Now, with NASA's James Webb Space Telescope (JSWT), the team has pinpointed the precise location of what they have dubbed the "engine" of the merging galaxy. They published their results in *The Astrophysical Journal Letters*.

"The James Webb Space Telescope has brought us completely new views of the universe thanks to it having the highest ever spatial resolution and sensitivity in the infrared," said corresponding author Hanae Inami, assistant professor at Hiroshima University's (HU) Hiroshima Astrophysical Science Center. "We wanted to find the 'engine' that powers this merging galaxy system. We knew that this source was deeply hidden by cosmic dust, so we could not use visible or ultraviolet light to find it. Only in the mid-infrared, observed with the James Webb Space Telescope, do we now see that this source outshines everything else in these merging galaxies."

As galaxies merge, their stars, planets, and other constituents can smash into one another, the debris serving as fodder for new celestial episodes. Most of these galactic collisions only emit infrared light, which has longer wavelengths than light visible to humans and is beyond the scope of human perception. In 2010, using the Spitzer Space Telescope, the same team found that the merging system was dominated by bright infrared emission. The researchers could measure the power of the engine — the source of such brightness — but could not identify its exact location due to the telescope's limited resolution.

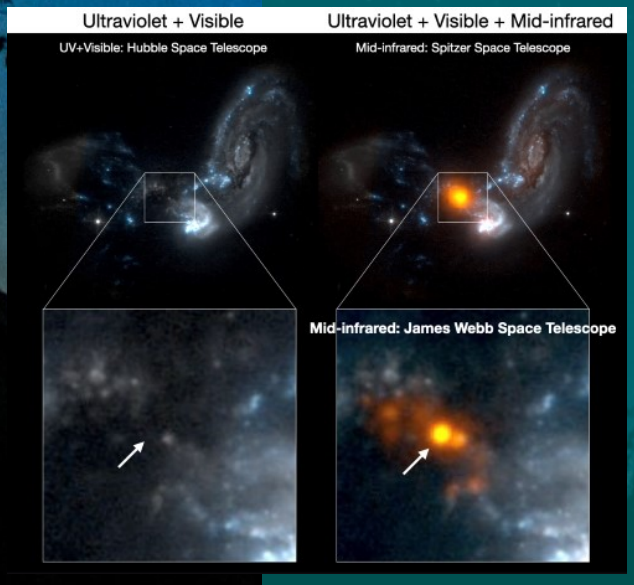
With JWST, they found that this engine is responsible for the bulk of the mid-infrared emission, which accounts for up to 70% of the total infrared emission of the system. They also found that the source has a radius no larger than 570 light years — a tiny fraction of the size of the merging system, which is about 65,000 light years across. This indicates that the energy is confined to a small space, according to co-author Thomas Bohn at HU.

"It is intriguing that this compact source, far from the galactic centers, dominates the infrared luminosity of the system," Bohn said.

According to Bohn, this source makes a significant contribution to the merging galaxies despite lying in the outskirts, like a speck of pepper on the white of a fried egg.

"We want to know what powers this source: is it a starburst or a massive black hole?" Inami asked. "We will use infrared spectra taken with JWST to investigate this. It is also unusual that the 'engine' lies outside of the main parts of the merging galaxies, so we will explore how this powerful source ended up there."

This work was conducted as a part of the JWST Early Release Science (ERS) Program of the Great Observatory All-sky LIRG Survey (GOALS) project, which targets four local merging galaxies, including IIZw096.



JWST pinpoints the 'invisible' engine that powers the galaxies in the middle of a collision.
© *Hanae Inami, Hiroshima University*

HANAE INAMI
Assistant Professor
Hiroshima Astrophysical Science Center

About the study

Inami, H. et al. (2022). GOALS-JWST: Unveiling Dusty Compact Sources in the Merging Galaxy IIZw096. In The Astrophysical Journal Letters (Vol. 940, Issue 1, p. L6). American Astronomical Society.
https://doi.org/10.3847/2041-8213/ac9389

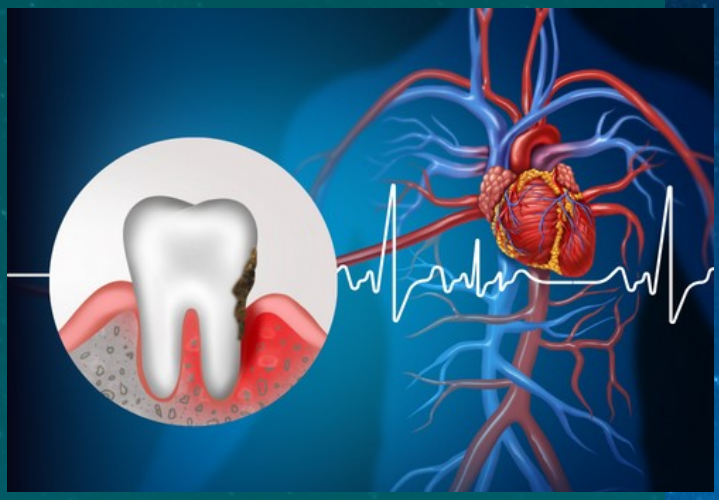
Gum infection may be a risk factor for heart arrhythmia, researchers find

New research found that periodontitis, a common gum infection known to worsen other systemic diseases, could also be linked to atrial fibrosis — potentially clarifying its previously unknown connection with atrial fibrillation.

Periodontitis, a gum disease, can lead to a litany of dental issues from bad breath to bleeding and lost teeth. Now, researchers at Hiroshima University have found that it could be connected to even more severe problems elsewhere in the body — the heart.

In a study published in JACC: *Clinical Electrophysiology*, the team found a significant correlation between periodontitis and fibrosis — scarring to an appendage of the heart's left atrium that can lead to an irregular heartbeat called atrial fibrillation — in a sample of 76 patients with cardiac disease.

"Periodontitis is associated with a long-standing inflammation, and inflammation plays a key role in atrial fibrosis progression and atrial fibrillation pathogenesis," said first author Shunsuke Miyauchi, assistant professor with Hiroshima University's Health Service Center. He is also affiliated with the university's Graduate School of Biomedical and Health Sciences.



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"We hypothesized that periodontitis exacerbates atrial fibrosis. This histological study of left atrial appendages aimed to clarify the relationship between clinical periodontitis status and degree of atrial fibrosis."

SHUNSUKE MIYAUCHI
Assistant Professor
Health Service Center

The left atrial appendages were surgically removed from the patients, and the researchers analyzed the tissue to establish the correlation between severity of the atrial fibrosis and severity of the gum disease. They found that the worse the periodontitis, the worse the fibrosis, suggesting that the inflammation of gums may intensify inflammation and disease in the heart.

"This study provides basic evidence that periodontitis can aggravate atrial fibrosis and can be a novel modifiable risk factor for atrial fibrillation," said corresponding author Yukiko Nakano, professor of cardiovascular medicine in HU's Graduate School of Biomedical and Health Sciences.

According to Nakano, in addition to improving other risk factors such as weight, activity levels, and tobacco and alcohol use, periodontal care could aid in comprehensive atrial fibrillation management. However, she cautioned that this study did not establish a causal relationship, meaning that while gum disease and atrial fibrosis degrees of severity appear connected, researchers have not found that one definitively leads to the other.

"Further evidence is required for establishing that periodontitis contributes to the atrial fibrosis in a causal manner and that periodontal care can alter fibrosis," Nakano said. "One of our goals is to confirm that periodontitis is a modifiable risk factor for atrial fibrillation and to promote dental specialists' participation in comprehensive atrial fibrillation management. Periodontitis is an easy modifiable target with lower cost among known atrial fibrillation risk factors. Thus, the achievement of this study series may bring benefits for many people worldwide."

Next, the researchers said they hope to conduct future clinical trials to clarify if periodontal intervention reduces atrial fibrillation occurrence and improves patient outcomes.

About the study

Miyauchi, S. et al. (2023). Relationship Between Periodontitis and Atrial Fibrosis in Atrial Fibrillation. In JACC: Clinical Electrophysiology (Vol. 9, Issue 1, pp. 43–53). Elsevier BV. https://doi.org/10.1016/j.jacep.2022.08.018

Researchers detect illegal intercountry trade of mercury using discrepancies in mirrored trade data

The Minamata Convention on Mercury is designed to protect humans and the environment from mercury pollution, but its restrictions have led to an anticipated increase in illicit mercury trade. Researchers have developed a data-driven method to identify this illegal trade by analyzing the import and export statistics of various countries. They published their work in *Environmental Science & Technology*.

Named for the Minamata Bay in Japan, where thousands of people were poisoned by mercury-tainted wastewater, the Minamata Convention on Mercury was adopted in 2013 and has since been ratified by 137 countries. The treaty prohibits the opening of new mercury mines, mandates the phasing out of existing ones, and restricts the use of mercury in products. Its advantage over other environmental conventions is that it includes a three-part design that includes legally binding regulations, an independent financial mechanism, and a compliance mechanism.

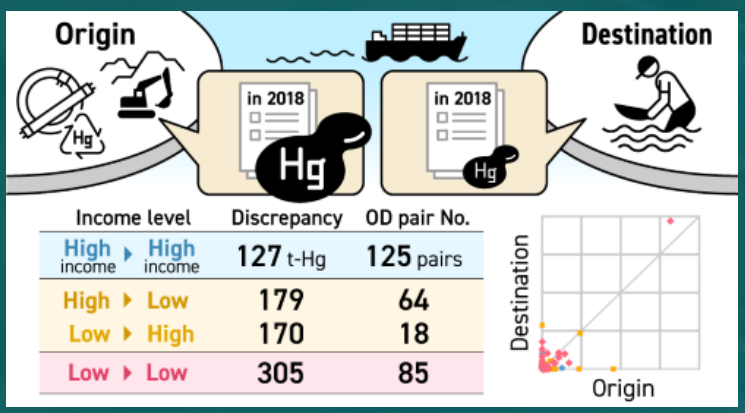
Prior to this study, no study has detected the illegal intercountry mercury trade in the context of the international movement to phase out mercury because of difficulties in monitoring illegal intercountry trade by each country's trade statistics. "Detecting the existence of illegal international trade in mercury is a key issue in assessing the effectiveness of the Minamata Convention," said Masaaki Fuse, an associate professor at Hiroshima University's Graduate School of Advanced Science and Engineering.

Countries are phasing out mercury through international environmental regulations because of its damaging effects on human health and ecosystems. With the restrictions on the legal use of mercury tightening, and the increase in the illegal trade of mercury, including smuggling, the researchers sought a way to examine the issue.

The researchers approached the question of illegal trade, looking for discrepancies. In trade statistics, a discrepancy is defined as the gap between the exports reported by the exporting country's trade statistics and the mirrored imports reported by the importing country's trade statistics. In looking at these numbers, the team applied an intraclass correlation coefficient (ICC), that is a descriptive statistic, to the mirrored exports and imports from trade statistics of each country provided by the United Nations Comtrade. The UN Comtrade is a database that provides official trade statistics as reported by countries and areas. Using the ICC, the team analyzed the trade trends by year and by country. They included both low-income and high-income countries as defined by the World Bank in their study.

Using the year-based ICC analysis, the team identified a tendency to reduce the detection of discrepancies in the reported mirrored exports and imports for mercury at the intercountry level under the recent mercury phase-out movement. Through an ICC analysis focusing on exporting and importing countries, the team verified the validity of the ICC analysis as a way to detect illegal intercountry trade of mercury.

Looking ahead to future research, the team hopes to establish a method for evaluating the effectiveness of the Minamata Convention by extending the method developed in this study.



Newly developed method
Scientists from Hiroshima University and the National Institute for Environmental Studies developed a new method to detect illegal mercury trade

"Our analyses detecting the illegal trade of related countries contribute to the effectiveness evaluation and custom capacity building required in the Minamata Convention by offering a data-driven method to enable the effective detection of illegal mercury trade

MASAAKI FUSE
Associate Professor
Graduate School of Advanced Science and Engineering

About the study

Fuse, M., Oda, H., Noguchi, H., & Nakajima, K. (2022). Detecting Illegal Intercountry Trade of Mercury Using Discrepancies in Mirrored Trade Data. In Environmental Science & Technology (Vol. 56, Issue 19, pp. 13565–13572). American Chemical Society (ACS). https://doi.org/10.1021/acs.est.2c04327

No environmental justice, no positive peace — and vice versa

©Dahlia Simangan, Hiroshima University

Pokhara, Nepal
Some low-income countries, like Nepal, score fairly well in negative peace and environmental performance, but rank low in positive peace.

Associate Professor Dahlia Simangan

Peace and environmental sustainability are known to be intrinsically related, but are often investigated separately or with broad strokes. To better inform policy and decision-making, a team of researchers explored the nuances of both categories and found that elements of environmental performance are more strongly associated with positive peace, specifically equitable resource distribution, than with negative peace, such as militarization.

The team, led by Dahlia Simangan, associate professor at Hiroshima University's Graduate School of Humanities and Social Sciences published their results in *Earth System Governance*.

The researchers noted that while there are indices to measure either peace or environmental wellbeing, there is not an index that comprehensively incorporates both. Further, previous analyses on the intersection of environmental sustainability and peace tended to focus on negative peace, or the absence of violence. To overcome these previous limitations, the researchers examined three different indices.

They used datasets from the Global Peace Index and Positive Peace Index for the peace component, and the Environmental Performance Index for the environmental sustainability component. The researchers conducted several correlation tests and found a consistent pattern.

They found that environmental performance, especially air quality, safe sanitation, and safe drinking water, is more closely associated with positive peace than negative peace. Some low-income countries score fairly well in both negative peace and environmental sustainability but fall short in achieving positive peace outcomes. Without positive peace, such conditions could be quickly overturned by sudden changes, such as political instability, natural hazards, and disease outbreaks.

As the results show how interconnected environmentalism and positive peace are, and how improvements in one area can aid improvements in the other, the researchers said their next step is to look to create an integrated model.

About the study

Simangan, D. et al. (2022). A global analysis of interactions between peace and environmental sustainability. In Earth System Governance (Vol. 14, p. 100152). Elsevier BV. https://doi.org/10.1016/j.esg.2022.100152

More here

Meta-analysis reveals how crowds may change gene expression in some insects

More here

Scientists investigate how genes in some insects can influence one another to change their expression depending on environmental conditions.

Grasshoppers hatched in crowded environments may have different traits than those hatched in isolation — even if they have the same genes. The mechanism of this density-dependent phenomenon, called polyphenism, is well-documented in both aphids and locusts, but how genes regulate these traits has remained shrouded until now.

To better understand this phenomenon, researchers at Hiroshima University analyzed publicly available RNA sequencing data from 66 transcriptome datasets of seven species of aphids and locusts. They published their results in *Insects*.

This meta-analysis approach allowed the researchers to uncover new information that would not be found with conventional hypothesis-driven methods, according to first author Kohei Toga, researcher in the Graduate School of Integrated Sciences for Life.

The study revealed that crowded conditions triggered an increase in DNA replication, DNA metabolic processes, and the mitotic cell cycle, highlighting their importance as regulatory mechanisms in density-dependent polyphenism research. Additionally, the researchers found evidence suggesting that neurological system modifications may also contribute to inducing density-dependent phenotypic changes in these insects.

The researchers hope that functional analysis of the genes identified in this study will lead to the development of methods to control the growth of agricultural pests like aphids and locusts and clarify how organisms respond and adapt to density.

Researcher Kohei Toga

About the study

Toga, K., Yokoi, K., & Bono, H. (2022). Meta-Analysis of Transcriptomes in Insects Showing Density-Dependent Polyphenism. In Insects (Vol. 13, Issue 10, p. 864). MDPI AG. https://doi.org/10.3390/insects13100864

Brains with compromised 'trust settings' a warning sign of lurking depression

Changes in brain patterns that shape our trust behavior can alert us to sneaking depression even if symptoms are still in stealth mode, a study found.

Brain scans revealed that shrunken gray matter volumes in regions of the "social brain" tied to a compromised trusting ability shared a connection with depression vulnerability that could help with its early detection. The study's findings are published in *Scientific Reports*.

While previous studies have showed a link between trust and depression, they were the first to uncover the neuroanatomical basis of this relationship.

"In our study, we not only replicated the association between low trust and depression but also demonstrated that brain regions associated with trust were also associated with the degree of depressive symptoms one year in advance," Alan Fermin, assistant professor at Hiroshima University's Center for Brain, Mind and KANSEI Sciences Research, said.

"Overall, we found that the brains of lower trusters showed reduced gray matter volume in brain regions involved in social cognition. Also, we found that this gray matter volume reduction among low trusters was similar to the brain of actual depressive patients. Thus, even though our participants hadn't received any diagnosis of depression, their brains were already showing signs of depression."

To better understand the neuroanatomical connection between trust and depression vulnerability, the researchers used magnetic resonance imaging to look at the gray matter volume from 470 healthy participants living in and around Machida, a suburb of Tokyo. They then used psychological questionnaires to measure trust, social anxiety, and social network size. Participants were also asked to self-report depression symptoms they might be experiencing.

The researchers hope their findings could support the development of policies to increase social trust and prevent the development of mental disorders.

Assistant Professor
Alan Fermin

More here

About the study

Fermin, A. S. R. et al. (2022). The neuroanatomy of social trust predicts depression vulnerability. In Scientific Reports (Vol. 12, Issue 1). Springer Science and Business Media LLC. https://doi.org/10.1038/s41598-022-20443-w

COVID-19 discrimination connected to psychological distress and work impairment

A research team has found that discrimination plays an important role in the development of psychological distress and work impairment, and concluded that both discrimination and mental health should be targets of intervention for COVID-19 survivors. The findings are published in *Scientific Reports*.

COVID-19 was initially considered to be a time-limited disease, but evidence now shows that some survivors experience long-term symptoms such as fatigue, shortness of breath, headaches, loss of smell or taste, and neuropsychiatric symptoms such as cognitive dysfunction, depression, anxiety, reduced sleep quality, and posttraumatic stress. Scientists are also aware that discrimination, affecting around one-third of COVID-19 survivors, is a prevalent issue that surrounds the illness.

The team conducted a cross-sectional study of 309 patients in two major COVID-19 hospitals in Hiroshima Prefecture between April 2020 and November 2021. These patients completed standardized questionnaires that included questions about COVID-19's long-term effects, psychological distress, impairments in work performance, and perceived discrimination. The majority (62.5%) had experienced one or more long-term effects of COVID-19.

Beyond determining that the long-term symptoms of COVID-19 and discrimination were associated with both mental distress and work impairment, the team's detailed analysis suggested that long-term COVID-19 symptoms may cause mental distress, which in turn affects a person's ability to perform well in the workplace.

"Interventions to prevent or reduce work impairment after the recovery from COVID-19 need to include programs to help patients cope with mental distress and public enlightenment to reduce social stigma and discrimination against the infection," said Shinya Ishii, contributing professor at Hiroshima University's Graduate School of Biomedical and Health Sciences.

Contributing Professor
Shinya Ishii

More here

About the study

Ishii, S., et al. (2022). The role of discrimination in the relation between COVID-19 sequelae, psychological distress, and work impairment in COVID-19 survivors. In Scientific Reports (Vol. 12, Issue 1). Springer Science and Business Media LLC. https://doi.org/10.1038/s41598-022-26332-6

Math answers puzzling behavior of bat ears inspiring real-world upgrade on Batman's go-to tech

Hiroshima University Assistant Professor Yasufumi Yamada posing with a photo of a greater horseshoe bat.

Bioengineers formulated a mathematical model that clarified the importance of bat ear motions in direction detection, making way for lean, mean sonar navigation machines.

One iconic feature of the batsuit that makes Batman easily recognizable may soon give the Dark Knight's go-to sonar technology a real-world upgrade — bat-like ears. Only, these ears would not just look like a bat's it would act like one, too.

Hiroshima University bioengineers wondering about the significance of bat ears' movements in echolocation created a mathematical model reflecting the behavior and learned the optimal pinnae motions that could amplify direction detection. Now, they plan to don sonars with moving pseudo-bat ears for a three-dimensional (3D) navigation system that is simple yet precise. Their findings are published in the journal *PLOS Computational Biology*.

Unlike many mammals that rely on visual cues to make sense of their surroundings, bats, which are mostly nocturnal, mastered spatial mapping through auditory signals. They perceive the 3D environment by emitting ultrasound pulses from their mouth or nose and receive the returning echoes with their ears. Despite this simple active acoustic sensing design of one transmitter, their nose or mouth, and two receivers, their ears, these flight marvels can accomplish complex navigation tasks in the dark like pursuing prey or flying around without colliding with other bats in the group.

To locate their prey, bats need to know the distance and direction of their target. And evolution has equipped them with key anatomical features to accomplish these. But certain species have also come up with behavioral solutions to further refine their ability to detect the direction of an echo source. One of such behaviors observed in constant frequency–frequency modulated (CF-FM) bats is the movement of both ears as they echolocate. These species use a combination of CF and FM calls, the former are signals that retain their frequency throughout their duration while the latter's frequency changes over time.

Reverse engineering bat ears into lean, mean navigation machines

The three-person Japanese research team's model mirrors the active listening behavior of greater horseshoe bats belonging to the CF-FM group. They then used supervised machine learning to run exhaustive simulations to find out the role of ear movements in direction detection and which motions work best in accomplishing the task.

"For 3D spatial perception, certain species of bats have been well observed to move both ears with an antiphase pitch motion while listening to the echoes. However, the actual motions of both ears' movements look so complex. In order to theoretically solve the appropriate ear motions for 3D sound source direction detection, we conducted a mathematical simulation," said Yasufumi Yamada, the study's corresponding author and assistant professor at HU's Graduate School of Integrated Sciences for Life.

"To explain in more detail, the ear motion conditions required for direction detection are theoretically investigated through exhaustive simulations of the pseudo-motion of the ears, rather than simulations of the actual ear motions of bats. In this simulation, we assumed that the interaural sound pressure level difference of echoes contributes to the sound source direction detection."

Their investigation showed that only certain ear motions, namely three-axis rotation, allow for accurate and robust direction detection. It also provided strong support that the behavior observed in bats where they move their ears opposite each other helps them detect sound sources more accurately.

The researchers said their mathematical approach and findings could be used in designing new active sensing systems.

About the study

Hiraga, T. et. al. (2022). Theoretical investigation of active listening behavior based on the echolocation of CF-FM bats. In D. Stowell (Ed.), PLOS Computational Biology (Vol. 18, Issue 10, p. e1009784). Public Library of Science (PLoS). https://doi.org/10.1371/journal.pcbi.1009784

Feature

GET TO KNOW OUR DPs & DRs

We asked three scientists in the prestigious Distinguished Professors and Distinguished Researchers program questions about their fields and exciting developments in their work.

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

Distinguished Professors

The DP program believes that active research pursuits by individual researchers is essential for the "formation of unique Centers of Excellence in research." To secure outstanding researchers, the university offers institutional priority status to select extraordinarily distinguished professors trying to solve pressing problems in their fields.

Distinguished Researchers

The DR program recognizes distinguished junior faculty members who are expected to become DPs in the future, enabling the university to ensure an environment where these faculty members can devote themselves to their research.

More here!

Eiso Hiyama

Distinguished Professor

Natural Science Center for Basic Research and Development

When he first became a doctor, pediatric surgeon Eiso Hiyama said the mortality rate for childhood cancer was about 80%. Now, with the help of scientific advances, around 80% of patients can expect to live. Although an impressive feat, he argued that it still means 20% succumb to the disease. Hiyama works on bridging global research and clinical applications to achieve zero child deaths from cancer.

Q: Can you please describe your field of research?

A: My research field is oncology, especially pediatric oncology, congenital malformation, reproduction, and infection. Clinically, my recent focus is childhood liver tumors and neuroblastoma. And in the basic field, I have studied the immortality of cancer cells by telomere and telomerase.

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

A: In the 20th century, all cancer cells were believed to be immortal because most cancer studies had been based on cultured cells. However, I measured telomere and telomerase in clinical cancer specimens derived from various kinds of cancers and discovered that carcinogenesis is a different phenomenon from immortalization. Some cancers do not acquire immortalization and some non-cancerous cells such as lymphocytes acquire immortalization. The process of cancer development is the most critical basis for my research. Pediatric cancers develop in a short period in comparison to adult cancers, so carcinogenesis steps are most interesting in my study field.

Q: What achievement are you most proud of?

A: We were the first to evaluate the telomere length and telomerase activity in various cancers and proposed the hypothesis that immortalization by telomerase activation will be acquired as a different step after carcinogenesis. I am proud that many subsequent studies and genomic medicine have proven this hypothesis.

Q: Is there anything exciting coming up in your research that you want to share?

A: Since there are only a few cases of pediatric cancer in Japan, we have conducted clinical trials through international collaboration with North American, European, and East Asian countries. Although I am not a good English speaker, international collaboration was able to be established through enthusiastic and frequent contacts to solve a shared problem. The world's first research for measuring telomerase activity in human cancers 40 years ago was born in close collaboration with American researchers through our proactive approach to elucidate a shared issue.

Tetsushi Sakuma

Distinguished Researcher

Graduate School of Integrated Sciences for Life

As a biotechnologist, Tetsushi Sakuma has invented tools for genome editing. One of his inventions, the Platinum TALEN is a more flexible gene editing tool that binds DNA better than the current Golden TALEN. Sakuma topped the 2022 "Best Rising Stars of Science in Japan" rankings.

Q: Can you please describe your field of research?

A: My field of research is the development of basic technology for genome editing and its application to various cells and organisms. Genome editing is a new technology of genetic engineering, contributing to a wide range of life science studies such as medicine, pharmaceutics, agriculture, livestock, and fisheries.

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

A: I think the most important achievement in my scientific carrier to date is the establishment of Platinum TALEN, which is a highly active and highly specific genome editing tool. Platinum TALEN led us to a variety of academic and industrial collaborations, which opened up a new world of multidisciplinary research.

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

A: Genome editing technology can be applied to any cell and organism for any purpose. We can do anything depending on how it is used. For example, we can create disease-resistant crops, nutrient-enriched foods, cancer-targeted biomedicine, and so on. Therefore, genome editing technology has countless influences in both economic and social contexts.

Q: What achievement are you most proud of?

A: It was not actually a matter of science, but the proudest thing was that a 2022 ranking named me as Japan's top rising star of science. Since this honor clearly depends on my research activity of numerous collaborations, I felt I was recognized by the research community as one of the leading scientists.

Q: Is there anything exciting coming up in your research that you want to share?

A: Yes, we have recently developed a new method of precision gene modification named "Frame Editor" in collaboration with researchers at the Massachusetts Institute of Technology. In addition, we just created a unique system of genome editing in cooperation with the industry. The system is under the process of patent filing and is still unpublished, but it will shortly appear in academic conferences and scientific journals.

Yoriko Tominaga

Distinguished Researcher

Graduate School of Advanced Science and Engineering

Electronics engineer Yoriko Tominaga is an associate professor at the Graduate School of Advanced Science and Engineering. She develops novel optical and terahertz devices based on the crystal growth of semiconductors.

Q: Can you please describe your field of research?

A: Electronic materials and semiconductor engineering, especially crystal growth of compound semiconductors.

Q: What got you into this field?

A: I just followed my academic interests and destiny.

Q: What scientific problem are you trying to answer?

A: I would like to understand how atoms are combined to synthesize materials.

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

A: Semiconductor industry, especially optical communication technology, terahertz fields, and reuse of rare metals included in semiconductor devices.

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

A: Bismuth atoms have a variety of possibilities to control the crystalline quality of compound semiconductors.

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

A: I am working on 3 kinds of projects; 1. bismide III-V compound semiconductors for novel THz devices, 2. quantum structures of bismide III-V compound semiconductors for novel semiconductor lasers for optical communications, and 3. development of novel crystal growth methods using marine photosynthetic bacteria.

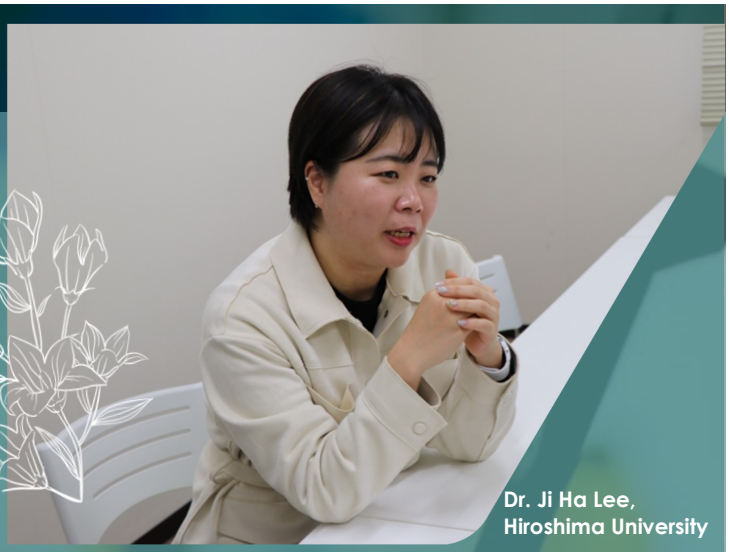
Q: Is there anything exciting coming up in your research that you want to share?

A: Two pieces of my research for bismide III-V compound semiconductors grown under ultra-high vacuum and compound semiconductors formed by marine photosynthetic bacteria are actually connected in a deep and essential way.

WOMEN IN ACADEMIA
Meet our researchers

Meet Dr. Ji Ha Lee

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



Dr. Ji Ha Lee, Hiroshima University

As a chemist, Assistant Professor Ji Ha Lee from the Graduate School of Advanced Science and Engineering works on developing recyclable and degradable gels sturdy enough to replace plastics as well as nanogels that can help with targeted drug delivery. We chatted with her to get to know more about her and her work.

Q: Can you please tell us about your field of research?

My research focuses on gel materials. Gels are not fully liquid nor solid but they behave sometimes like a liquid and sometimes like a solid. Think of konjac, contact lenses, and jelly.

They are a substance with a physical structure that can range from soft and weak to hard and rough. Gels are defined as a dilute cross-linked system that doesn't flow when in a steady state, appearing mostly like a liquid but behaving like a solid due to its three-dimensional cross-linked network structure. They are commonly found in different forms and have properties such as solvents, crosslinking points, and 3D network structures. Furthermore, the hardness and roughness of soft gels can be controlled through external stimulation, such as pH, temperature, and light. With these properties, gels have potential applications in various fields like medicine, food, and cosmetics!

Q: I wonder what got you into this field?

A: As a 4th-year undergraduate student, I joined a laboratory for my graduation experiment and knew about gel research for the first time. The laboratory mainly focused on creating sensors using fluorescent compounds in the presence of heavy metal ions such as mercury, lead, and cesium. However, the process involved many synthesis steps, which I found tedious. Instead, I chose to focus on gel research, which had a shorter and simpler synthesis process. My experiment was successful, and I was fascinated by the fluorescence and color changes that occurred during the gelation process from solution to gel in the presence of a metal ion. I also appreciated the versatility of gels, which could change from liquid to solid depending on the environment.

Q: Can you walk us through the scientific problem that this intrigue of gels has now led you to answer?

Yes! You see, the efficient utilization of resources requires materials that are easily recyclable and degradable. While polymers like plastics have various applications, they are hard to decompose due to the formation of numerous covalent bonds through polymerization reactions. However, since bonding strength and degradability are in a trade-off relationship, it is difficult to design a material in which these two characteristics are compatible. As a solution to these challenges, the creation of materials using interactions between molecules in supramolecular science is attracting attention.

The aim of my study is to develop a "sol-gel-gel plastic" with controlled mechanical strength and degradability through the introduction of covalent bonds for improved strength and supramolecular interactions for dissolvability in solution. The goal is to create a recyclable and degradable gel system.

Q: That could be good for the environment. Can you expound on that?

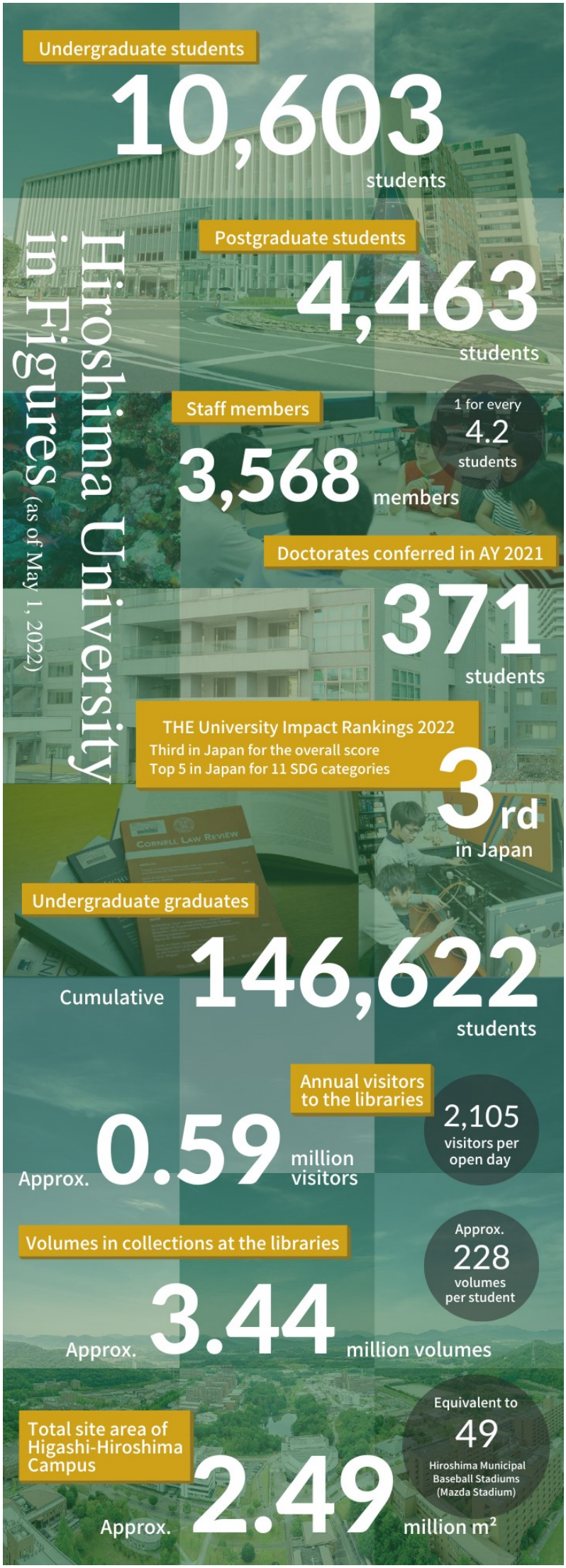
What I'm doing is utilizing technology that can accurately control the transformation from a soft material to a hard material — a new material developed as a replacement for plastic.

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

Well, in addition to developing alternative plastic materials, our research also focuses on utilizing gel systems for a drug delivery system or DDS. The goal of a DDS is to effectively deliver drugs to the desired target while minimizing side effects and maximizing efficacy. To achieve this, various drug carriers are used, including gel materials. Gel materials have the advantage of allowing precise control over the amount of drug encapsulation. Furthermore, the rate and amount of drug release can be adjusted by controlling the mechanical properties of the gel.

Recently, we successfully controlled the elasticity of a gel system made from chitosan, a natural polysaccharide, by precisely adjusting the concentration of a weak acid. The resulting stretchable gel was used to include a drug, and the release rate was found to be 90%, compared to just 10% in a non-stretchable gel. This demonstrates the potential for creating a new material that can release drugs at desired target sites in controlled amounts.

Dr. Lee with her students (Hiroshima University)



SCHOOLS AND GRADUATE SCHOOLS

SCHOOLS (UNDERGRADUATE)

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

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

GRADUATE SCHOOLS

Graduate level studies at Hiroshima University consist of 4 graduate schools below.

Graduate School of Integrated Sciences for Life
Graduate School of Biomedical and Health Sciences
Graduate School of Humanities and Social Sciences
Graduate School of Advanced Science and Engineering

ADVANCED COURSE

Special Course of Special Support Education

INTERDISCIPLINARY GRADUATE EDUCATIONAL PROGRAM

In addition, three unique program offerings combine graduate level academic coursework with integrative research components.

Phoenix Leader Education Program (Hiroshima Initiative) for Renaissance from Radiation Disaster

TAOYAKA PROGRAM for creating a flexible, enduring, peaceful society

The Frontier Development Program for Genome Editing

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

NEW SPACES ON CAMPUS

14 JUL 2022

Radiation Disaster Medical Training Building

A new training facility on radiation disaster medicine.

21 JUL 2022

Materials MBR Building and Data-driven Research Building

An open innovation center where co-creation activities are carried out to address issues that are difficult for individual companies to solve.

16 OCT 2022

Hiroshima University Kiteminsai Lab

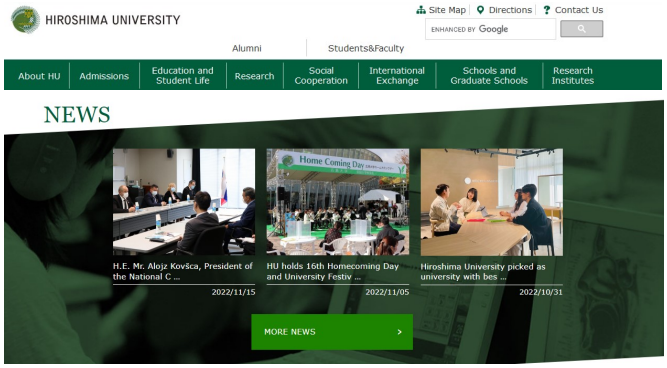
A co-working space on the second floor of the Hiroshima JP Building located adjacent to the south exit of Hiroshima Station.

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

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30 NOV 2022

Ryoun Lecture Building

A new lecture building in the Kasumi campus for medical and law students, with spaces to host conferences, training sessions and other events.

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