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UNIVERSITY**

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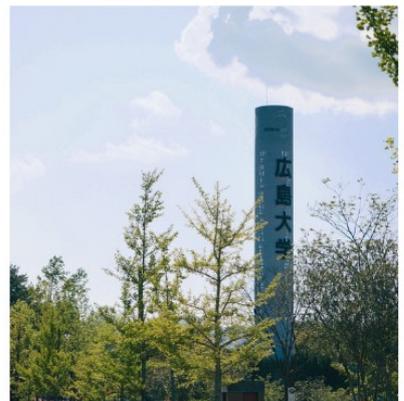
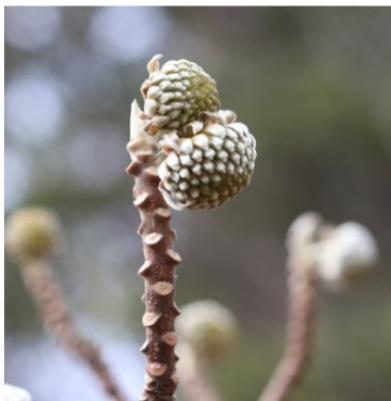
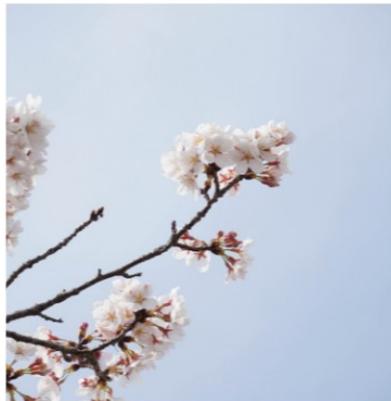
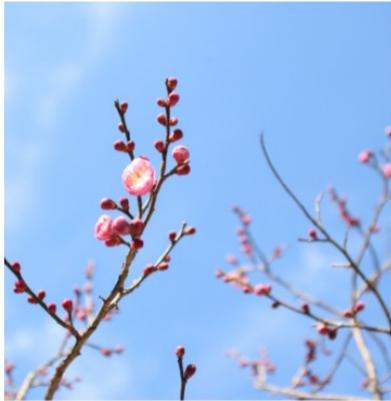
VOLUME 16 • SPRING 2022

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



CAMPUS PHOTOS

SPRING



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

HIROSHIMA UNIVERSITY UPDATE

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connections in the modern world.



Honda Motor Co. president, an HU alum, returns to campus to hold lecture

HU alumnus and Honda Motor Co. President Toshihiro Mibe returned to the university to talk about his student life and his career from being an engineer to becoming the president of one of the biggest car companies in the world.

Toshihiro Mibe — president, CEO, and representative director of Honda Motor Co. Ltd. — is an alumnus of Hiroshima University’s School of Engineering (Cluster 1, Mechanical Engineering) and the Graduate School of Engineering (Combustion Engineering Laboratory).

On November 10, Mibe came back to the Higashi-Hiroshima campus for the first time since he completed his graduate studies over 30 years ago in 1987 to give a lecture titled “To the protagonists of change, who are ready to take action with determination.” About 300 students, faculty, and staff attended the event held at the Satake Memorial Hall. The lecture was also live-streamed for alumni and other members of the university.

The lecture was organized by the Japan Automobile Manufacturers Association (JAMA) as part of its annual “University Campus Visiting Lecture Series.” In this

series, top executives from JAMA member companies speak and dialogue face to face with students about the appeal of automobiles, motorcycles, and the manufacturing sector.

In his speech, Mibe introduced his life as a university student, his career from being an engineer to becoming the president of Honda, the company’s new venture, and the creation of new businesses.

Hiroki Oppata, a fourth-year engineering student who attended the lecture, excitedly said, “I was able to learn about various challenges that are not limited to engines and bodies, such as flying cars and walking support systems for the visually impaired, and I felt that the possibilities of the automobile industry are expanding in all directions. I would like to broaden my perspective and consider my research field and society in the future.”



Don’t just assume that this is all you can do, but set your goals as high and as big as you can because each one of you is the protagonist of change in society.

TOSHIHIRO MIBE
President & CEO
Honda Motor Co. Ltd.



F1 racing car “AT02” that was used in a race

Events at MIRAI CREA

HU'S INTERNATIONAL
EXCHANGE HUB

Hiroshima University recently held three international exchange events — commissioned by Higashihiroshima City — to promote the formation of ethnic communities and cross-cultural exchange.

Through international exchange events, such as this one, HU aims to create opportunities for Higashihiroshima residents with various backgrounds to communicate with each other.

I was delighted to know that Japanese students as well as the community in Hiroshima have a real interest in knowing our countries!

JUAN DIEGO ZAMUDIO

International student (PERU)
Graduate School of Humanities
and Social Sciences

FEEL! ASEAN Night

19
NOV
2021

This event was the very first international event at MIRAI CREA. International students from ASEAN countries (Indonesia, Cambodia, Thailand, the Philippines, Vietnam, and Myanmar) discussed with members of the Higashihiroshima City Council and introduced their countries to fellow international students, Japanese students, and locals. The students shared their hometowns, traditions, and differences with the Japanese culture. Participants enjoyed the cultural exchange in a casual atmosphere.



African Cultural Fair

18
DEC
2021

International students from several African countries (Cameroon, Gabon, Ghana, Kenya, Rwanda, Lesotho, and Senegal) set up booths to demonstrate the history and culture of their home countries, using posters, goods, traditional clothing, and musical instruments. In addition, a booth was set up to introduce the activities of the “INTER-UNIVERSITY EXCHANGE PROJECT (AFRICA).” Meanwhile Egyptian students introduced their home country in another booth.

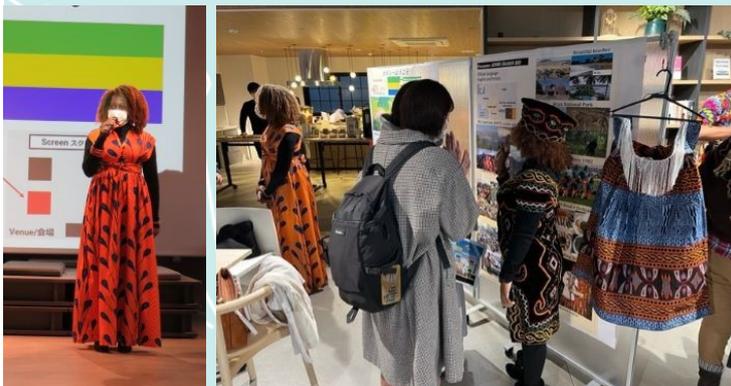
More about
the project



Latin American Saturday

26
MAR
2022

International students and alumni from five Central and South American countries (Colombia, Costa Rica, El Salvador, Honduras, and Peru) introduced the history, traditions, and richness of the Latino culture to fellow international students, Japanese students, and locals. Colorful traditional costumes, local refreshments, and snacks were also available for attendees to try.



Hiroshima International Conference on Peace and Sustainability 2022



Hiroshima University's Network for Education and Research on Peace and Sustainability (NERPS) successfully held the inaugural "Hiroshima International Conference on Peace and Sustainability 2022" from March 1 to 4, 2022.

The conference was organized in collaboration with 14 institutions including AC4 at Columbia University, University of Denver, Tohoku University, Hiroshima Prefectural Government, and Elsevier, among others.

This hybrid conference included 32 sessions, with nearly 200 participants from 38 countries ranging from academic researchers, graduate students, policy makers, representatives of non-governmental organizations, and private companies. The conference provided a unique platform for presenting and exchanging knowledge on a wide range of topics related to peace and sustainability. In particular, there was a focus on the nexus between peace and sustainability that is currently underexplored in science and policy circles.

On the last day, Prof. Jeffrey D. Sachs, director of the Center for Sustainable Development at Columbia University, delivered a keynote lecture highlighting the significance of global cooperation and partnership for achieving peace and sustainability and addressing key global challenges such as geopolitical conflicts, pandemic of infectious diseases, climate change and nuclear disarmament.

NERPS will hold the second conference sometime in the first quarter of 2023.



#NERPS2022 team

HU is only Japanese university shortlisted for THE's social impact award

The British higher education journal Times Higher Education (THE) announced the shortlist for THE Awards Asia 2021, placing Hiroshima University — the only nominee in Japan — among the finalists for the category THE Data-Points Social Impact Award.

For this category, THE assessed universities in Asia based on their publicly available data to verify their commitment to the SDGs related to social issues such as poverty, health, education, equality, and employment. HU's data transparency — and the supporting evidence for its approach to achieving the elements of the SDGs — was highly valued in this category. The winner for this category, Indonesia's Institut Teknologi Sepuluh Nopember, was announced in an online event held on December 14, 2021.



HU will continue to contribute to every aspect of education, research, and society while making further efforts towards achieving SDGs.

Hiroshima University strongly protests Russia's invasion of Ukraine

On 24 February 2022, the Russian army invaded Ukraine. In a speech, Russian President Vladimir Putin said, "Russia is one of the most powerful nuclear powers in the world," and indicated that Russia was ready to use nuclear weapons.

As a university located in Hiroshima, where the first atomic bomb was dropped in the history of humankind, we strongly protest this incident and appeal for a peaceful solution to the problem as soon as possible.

In cooperation with other universities in and outside Japan, we will be committed to restoring peace, and supporting Ukrainian universities, students and researchers.

25 February 2022

Mitsuo Ochi

President, Hiroshima University

Healthy Teleworking

Science and music come together to improve the well-being of those working remotely.

While remote working has an infinite number of advantages, it also tends to put a strain on the mind and body due to the lack of in-person interactions and exercise. To address this problem, Hiroshima University and Aioi Nissay Dowa Insurance Co., Ltd. jointly developed the "AD Telework Exercise," a concept created by HU specially appointed professor Hiroyuki Wakasa to rejuvenate the mind and body. The exercise's design is based on the research results of health and sports science specialist Shiho Kurosaka, an associate professor at HU's Graduate School of Humanities and Social Sciences.

In contrast to the regular movements of conventional radio gymnastics — or radio *taiso* in Japanese — this exercise is characterized by its relaxed and fluid movements. Moving the joints keeps the skeleton in shape, while natural breathing promotes oxygen circulation and calms the body and mind.

Given the benefits of listening to music while exercising, a cheerful and rhythmic theme — enjoyable for people of all ages — was selected under the supervision of Professor Makoto Iwanaga, a specialist in psychology at the same graduate school.

At first glance, the moves may seem complicated, but in fact, they are so simple that anyone can do them. The citizens of Higashihiroshima City who participated in the promotional video also experienced the joy of physical exercise.

Check out the video from the link below!



Challenge Anything!

Making dreams come true in Hiroshima



Tsugumi Inoue

Affiliation: 3rd year student in the School of Medicine

Hobbies: Dancing and making tea at the Japanese tea ceremony club

Tsugumi Inoue is a medical student on the road to becoming a doctor committed to passing along the message of peace to future generations.

Why Hiroshima University?

When I was in high school, I worked as a high school peace messenger. As a university student, I wanted to continue supporting those activities — including signature-collecting campaigns — from Hiroshima.

What are you studying now at HU?

I am studying clinical medicine, which involves learning about the ailments of the different medical departments.

You are actively engaged in peace-related activities. Can you tell us more?

In my first year of university, I applied for the Hiroshima City A-bomb Survivor Awareness Program, hoping to make good

use of my experience as a high school peace messenger. I have been participating in monthly training sessions to become a “Memory Keeper” to pass on the testimonies of Shousou Kawamoto, an A-bomb survivor, to the next generation.

What made you interested in peace-related activities?

When I was a first-year student in high school, I was selected as the 18th High School Peace Messenger from Hiroshima. I also had the honor of giving a speech at the Conference on Disarmament held at the United Nations European Headquarters. As a member of the Japanese government delegation, I expressed the wishes of the A-bomb survivors of Hiroshima and Nagasaki for the abolition of nuclear weapons and the realization of a peaceful world in the solemn atmosphere of the United Nations Conference Hall and called on the disarmament representatives of various countries to visit Hiroshima.



MEET *Our* STUDENTS



‘Good Scientist’

Nicholas Benoit is an American student from the Graduate School of Science fascinated with neutrinos and the world behind them.

What are you studying now at HU?

I am studying Elementary Particle Physics Theory at the Graduate School of Science. In particular, I am interested in a specific elementary particle called the neutrino and the possible new things we could learn about the fundamentals of the universe from it.

How did you become fascinated with neutrinos?

When I was studying for my master's, I wanted to find a topic that was interesting, and I read about some things that the neutrino does that sounded strange. There are facts about the neutrino that we know, that are very counterintuitive to our everyday life, and I was very interested in why those facts are true.

There must be many famous neutrino researchers in the world, so why did you choose to study in Japan?

Yes, there are many neutrino researchers in the world, and definitely there are some important experiments for neutrinos that happen in America, for example. Japan is also famous for neutrinos. For instance, there is Prof. Takaaki Kajita of the University of Tokyo, he was awarded the Nobel Prize in Physics 2015 for discovering neutrino oscillations, which show that neutrinos have mass, through his Super-Kamiokande (*) experiments.

What is your dream for the future?

My future dream may be kind of expected, it is to be a good scientist. I believe someone who is a good scientist has more focus on having good research skills that can help benefit society in the long term. So, I guess I want to be a person who is good at research and who can be helpful to society as a whole.



Nicholas Benoit

Affiliation: 3rd year Ph.D. Student in the Graduate School of Science
Hobbies: Reading, cooking/baking, traveling locally, and studying music

* Super-Kamiokande: A large neutrino detector established in Gifu Prefecture, Japan. The observation began in 1996.

Advancement in Hepatitis B cell lines a step forward in discovering new treatments

Advancement in cell lines capable of producing Hepatitis B's many genotypes can reveal much about the unique virological features and treatment responses eluding researchers of this virus.

A new study created stable cell lines capable of producing different genotypes of the hepatitis B virus (HBV), advancing understanding of each type's distinct virological features, treatment responses, and infectivity that could lead to new therapies against a virus infecting humans as far back as 4,500 years ago.

Cell lines are a vital tool in studying viruses, including vaccine production. But so far, only cell lines expressing HBV's D3 subgenotype isolated from Europe have been established and studied extensively as it is the best characterized molecular clone of the virus. While it has been an indispensable tool in studying HBV, researchers behind a study published in the August 2021 issue of the *Journal of Hepatology* argued that it may not fully represent the biology of the virus' diverse genotypes infecting the rest of the world.

HBV has nine major genotypes, one minor strain, and multiple subtypes — each potentially possessing distinct clinical characteristics and reactions to treatment. The researchers cited mounting clinical evidence showing that HBV genotypes exhibit different disease manifestations and treatment responses. They said genotypes C and F are associated with a higher risk of hepatocellular carcinoma. Patients with genotypes A and B have higher rates of HBeAg seroconversion under IFN- α treatment compared to those infected with genotypes C and F. Meanwhile, genotype D appears to be associated more with acute liver failure than other genotypes.

Although racial or ethnic background, the environment, or other confounding factors could explain the differences, the researchers argued that HBV genotypes likely play an important but yet to be defined role in the pathogenesis of liver disease.

"In this study, we succeeded in generating stable cell lines producing hepatitis B virus of various genotypes that are infectious in vitro and in vivo," said study co-author Michio Imamura, a lecturer at the Department of Gastroenterology

and Metabolism of Hiroshima University's Graduate School of Biomedical and Health Sciences.

"Establishing various genotypes of HBV-infected cell lines and mouse models permitted us to investigate the HBV genotype-associated variations in viral antigen production, infection kinetics, and responses to interferon treatment. These models are also valuable tools for antiviral development."

Their method produced stable cell lines that showed stable in vitro and in vivo models of HBV infection for genotypes A2, B2, C1, E, F1b, and H. Using it, the researchers observed that HBV genotypes exhibited different infectivity, antigen expression, replication, and responses to treatment.

The latest data from the World Health Organization showed that an estimated 296 million people were living with chronic HBV infection in 2019. It is a leading cause of liver disease worldwide with 1.5 million new infections each year. A vaccine is available to prevent HBV infection. However, there is currently no cure for it.

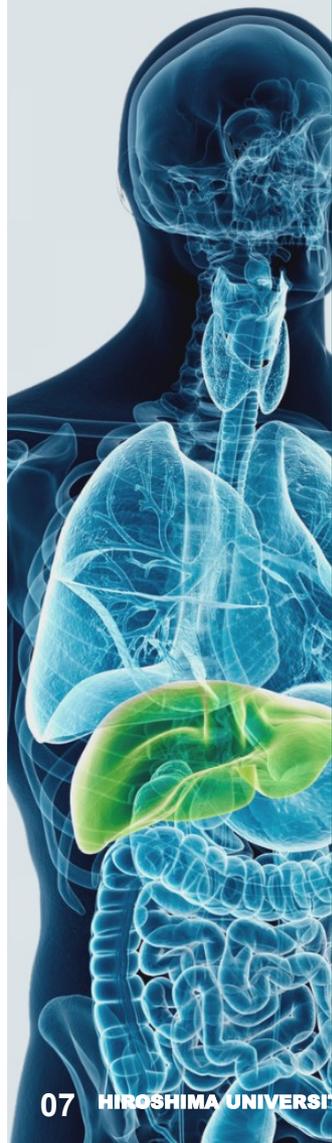
The United Nations Sustainable Development Goals aim to eliminate HBV infections as a public health threat by 2030. The researchers said the in vitro and in vivo models of infection could pave the way for the development of curative therapies that would be effective against all genotypes of the virus — a goal that is critically important for the elimination of HBV worldwide.

"Using these HBV-infected cell lines and mouse models, we expect to investigate the difference of pathogenesis according to HBV genotypes and attempt to develop new definitive therapies for HBV infection," Imamura said.

About the study

Zhang, M. et al. (2021). Infection courses, virological features and IFN- α responses of HBV genotypes in cell culture and animal models. In *Journal of Hepatology* (Vol. 75, Issue 6, pp. 1335–1345). Elsevier BV.

<https://doi.org/10.1016/j.jhep.2021.07.030>



■ Hiroshima University starts human trial of miRNA drug vs treatment-resistant cancer linked to asbestos

Hiroshima University began the doctor-led human trial of a promising new microRNA (miRNA) drug that could shrink and prevent recurrence of tumors of malignant pleural mesothelioma, an aggressive and treatment-resistant cancer caused by asbestos exposure.

The miRNA drug MIRX002 was administered to the first subject who enrolled last January 12 in the Phase 1 first-in-human study. It is HU's first drug discovery that progressed into human trials.

Malignant pleural mesothelioma is a treatment-resistant cancer that develops in the pleura, the thin membrane that lines the lungs and chest cavity, decades after asbestos exposure. Asbestos was widely used during the high-growth period of the 1960s due to its ability to fireproof steel materials. According to 2018 data of the World Health Organization, about 125 million people in the world are exposed to asbestos at the workplace. There is currently no effective treatment against it and patients usually have an average life expectancy of around one year after onset.

HU Graduate School of Biomedical and Health Sciences Professor Hidetoshi Tahara, who leads the team of Japanese scientists behind the anticancer miRNA drug, has launched PURMX Therapeutics Co., Ltd. in January 2021 as a new venture of the university to carry out the clinical study. Dr. Morihito Okada, professor at the Department of Oncology of HU's Research Institute for Radiation Biology and Medicine, is the doctor designated as principal investigator in the trial.

■ Researchers create world's first LED light from rice husk

The first quantum dot LED manufactured from rice husks emits orange light.

Rice husk is an excellent source of high-quality silica (SiO_2) — a compound usually used to manufacture glass, ceramics, and abrasives. So far, research in the US has succeeded in creating lithium-ion batteries with high capacity and durability using rice husk silica. However, its use in LEDs had not been attempted yet.

Now, a team led by Ken-ichi Saitow, professor at Hiroshima University's Natural Science Center for Basic Research and Development, created orange-red silicon quantum dots from recycled rice husks, with a luminescence efficiency of 21%, which were assembled in LED — the world's first. They published their findings in *ACS Sustainable Chemistry & Engineering*.

The team is hopeful that their research may help recycle waste into cutting-edge devices and contribute to the achievement of the SDGs.

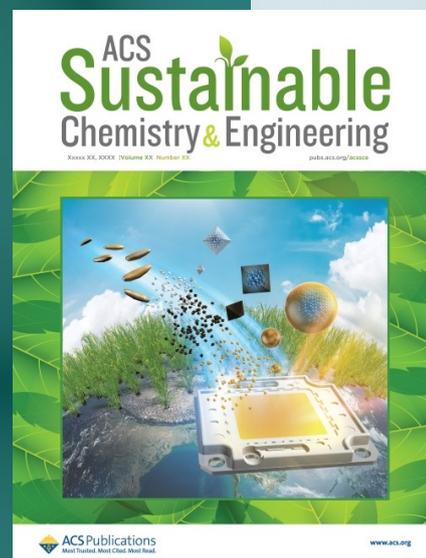
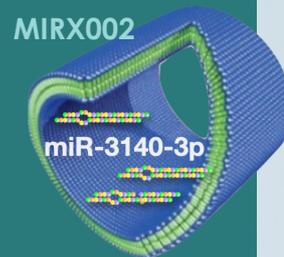
Targeting cancer stem cells

An miRNA is a smaller type of RNA, a natural nucleic acid, that can regulate gene expression. MiRNA-based drugs are attracting attention for its capability to shut down the expression of abnormal genes. There are about 2,600 known types of miRNAs.

The active ingredient of the anticancer drug MIRX002 is the natural nucleic acid *miR-3140-3p*. The drug targets cancer stem cells, which is known to drive tumor growth and its recurrence.

The researchers have completed testing the safety and efficacy of the drug in non-clinical animal studies. Using mouse models, they observed significant tumor shrinkage and prolonged survival after one to three treatments via intrathoracic administration. They also clarified that the drug has a mechanism of action that can distinguish between normal cells and cancer cells. Thus, the risk of side effects of MIRX002 is considered to be extremely low.

The Phase 1 trial will investigate the drug's safety, appropriate dose, and method of administration in humans. If the drug's safety and tolerability can be confirmed in the clinical trial, it can prove to be a breakthrough therapeutic agent that can suppress and prevent recurrence of tumors. MIRX002 also exhibits potential as an effective antitumor therapy against breast, pancreatic, esophageal, and ovarian cancer. [More here.](#)



■ Carnivores may adjust schedule to avoid each other, researchers find

researchers find



Some of the recorded carnivore species

Just as humans may leave home early to avoid a talkative neighbor, carnivorous mammals may go out of their way to avoid other species. But they're not trying to navigate awkward social interactions; rather, they're negotiating space and resources for survival.

Researchers monitored this temporal niche partitioning intermittently over six years with 73 infrared trigger sensor cameras installed at three sites in Sabah, Malaysia. The findings were published in *Scientific Reports*.

"Approximately 20% of the world's mammals face the risk of extinction, mainly due to habitat loss and overexploitation," said first author Miyabi Nakabayashi, assistant professor in the Graduate School of Advanced Science and Engineering at Hiroshima University.

"Information regarding temporal activity patterns of animals is crucial to respond to anthropogenic disturbances and implement proper conservation measures."

Researchers identified nine distinct carnivore species and categorized their activity patterns by time of day. Six were active at night, two were active during the day and one was active regardless of time. Some of the more closely related animals demonstrated a clear temporal segregation, including two wild cats, one of whom was nocturnal while the other preferred the day.

However, the researchers also found that three species of civets were all active at night, which might be due to limited competition over resources. More [here](#).

About the study

Nakabayashi, M., Kanamori, T., Matsukawa, A., Tangah, J., Tuuga, A., Malim, P. T., Bernard, H., Ahmad, A. H., Matsuda, I., & Hanya, G. (2021). Temporal activity patterns suggesting niche partitioning of sympatric carnivores in Borneo, Malaysia. In *Scientific Reports* (Vol. 11, Issue 1). <https://doi.org/10.1038/s41598-021-99341-6>

■ Rice production depends on *TAB1* gene, researchers find

Rice is old, with archeological

evidence dating back about 10,000 years. Modern crops have been engineered over the years to improve productivity and resiliency, based on experience of farmers and with the scientific understanding of researchers. The genetic guidance rice uses to grow and reproduce, however, is still not fully understood. Now, researchers are learning more, including how critical one gene is for the plant to develop grains of rice, which serve as both seeds and food. They published their finding in *Development*.

"Plants have a unique ability to produce lateral organs, such as leaves and floral organs, continuously throughout their lifecycle," said co-first author Wakana Tanaka, assistant professor at Hiroshima University's Graduate School of Integrated Sciences for Life. "This ability depends on the activity of pluripotent stem cells, which self-renew to maintain a constant number in coordination with organ differentiation in the plant. Our understanding of the mechanism underlying stem cell maintenance was progressing in the thale cress plant, another model plant, but our knowledge of these mechanisms in rice was insufficient."

Rice flowers contain floral organs, including the pistil, which houses the flower's ovary. Nestled in the ovary at base of the flower, hidden from view, are the flower's ovules, which grow into rice seeds when pollinated.

"Since all floral organs are derived from stem cells, which are present in young flower buds,

the stem cells must be maintained in a constant number until the last floral organ — the ovule — is formed," Tanaka said.

In thale cress, a gene known as *WUS* is essential for stem cell maintenance during the early stages of flower development, when the pistil and stamens form. The researchers previously isolated a rice plant without the homologous gene, called *TAB1*, from a population of mutated rice plants. In this study, they further examined the mutant without *TAB1* (*tab1* mutant) and found it lacked ovules.

"Without ovules, the *tab1* mutant did not produce any fertile rice grains, suggesting the *TAB1* gene is essential for rice grain formation," Tanaka said.

In further analysis, the researchers found that in the *tab1* mutant, stem cells were present during the formation of early floral organs but had disappeared by the time ovules formed.

"This result indicates that the *TAB1* gene is required for the robust maintenance of stem cells until the last stage of flower development," Tanaka said. "Collectively, the *TAB1* gene plays an important role in maintaining stem cells during ovule formation, eventually leading to the formation of seeds. This direct necessity of stem cell activity in ovule formation is not seen in thale cress, so it seems to be unique to rice."

About the study

Tanaka, W., Ohmori, S., Kawakami, N., & Hirano, H.-Y. (2021). Flower meristem maintenance by *TILLERS ABSENT 1* is essential for ovule development in rice. In *Development* (Vol. 148, Issue 24). <https://doi.org/10.1242/dev.199932>

Ghanaian youth positive mental health linked to social connections and caring

Social scientists have quantitatively explored the links between psychosocial development among youth and their mental health in Ghana and found that emotional, social, and psychological well-being are linked to having healthy relationships with friends, family and community.

The findings were published in *Frontiers in Psychology*.

Ghana has a youthful population, with over 55 percent under the age of 25 as of 2018. This makes evidence-based youth policy an essential part of the country's strategy for economic development, including the relationship between young people's personal growth and their mental health.

There have been a number of evidence-based programs developed across the continent of Africa that promote positive mental health, but most of these target adults rather than youth. So, the researchers set out to better understand the relationship between what sociological researchers call "Positive Youth Development" (PYD)—a formalized set of developmental indicators—and what psychologists call the mental health continuum (MHC) from languishing to flourishing.

This latter concept, the MHC, describes three axes of measurement: emotional well-being, social well-being, and psychological well-being. Meanwhile PYD is a framework for measuring indicators of thriving for such youthful populations that emphasizes the full horizon of an individual's talents, capabilities, interests, and future potential rather than, as historically has been the case, only on typically negative aspects such as learning disabilities or substance abuse.

Previous studies had explored the relationship between PYD indicators and mental illness, but not between PYD indicators and the full MHC.

Within the PYD framework, there are a group of developmental constructs known as the 5Cs. (Within the social sciences, 'constructs' refer simply to any mental abstractions that humans use to express concepts, so for example, 'age', 'gender', 'fatigue', 'muscle soreness', 'height' might be constructs used to describe a person). The 5Cs are a widely operationalized conceptualization of the PYD framework, describing developmental outcomes related to Character (having integrity, moral commitment, and respect for societal and cultural rules), Confidence (having a sense of mastery and future, positive identity, and self-efficacy), Connection (having healthy relation to friends, family, school, and community), Caring (showing empathy and sympathy), and Competence (in academic, social, and vocational skills).

The researchers wanted to test whether the 5Cs developmental constructs within the PYD framework could predict positive mental health outcomes.

They found that all three types of well-being (emotional, social, and psychological well-being) descriptive of positive mental health were linked to Connection (having healthy relationships to friends, family, school, and community), and one type of well-being (psychological) was linked to Caring (showing empathy and sympathy).



These results suggest that positive mental health promotion programs such as the Inspired Life Program used in parts of Africa might consider integrating PYD principles for Connection and Caring into their practice involving youthful populations

said Assistant Professor Russell Sarwar Kabir of the Graduate School of Humanities and Social Sciences at Hiroshima University, one of the researchers involved in the study.

As Ghana has what he describes as a more collectivist culture compared to some Western societies, he hopes to see whether the findings from this African nation can be corroborated with data on youth in Japan, another society he argues has culturally collectivistic tendencies.

About the study

Kabir, R. S., Doku, D. T., & Wium, N. (2021). Connection in Youth Development Key to the Mental Health Continuum in Ghana: A Structural Equation Model of Thriving and Flourishing Indicators. In *Frontiers in Psychology* (Vol. 12). Frontiers Media SA.
<https://doi.org/10.3389/fpsyg.2021.676376>



Broccoli compound induces cell death in yeast, offers research path for cancer treatment



Broccoli may contain advantages beyond nutrition.

A molecule found in broccoli, cabbage and more digests down into DIM, a compound with brighter benefits than the name implies, such as inducing cell death in breast, prostate and colon cancer. Now, researchers are beginning to understand the mechanism underpinning this molecular behavior — information that could help elucidate future anti-cancer treatments.

In a report in *PLOS One*, Hiroshima University researchers found that DIM, or 3,3'-Diindolylmethane, also triggers controlled whole-cell death and recycling of cellular components in fission yeast. Whether the DIM-induced damage mechanism is conserved in humans remains to be seen, but paper author Masaru Ueno explained that unicellular fission yeast allow for easier examination of the molecular machinery that mimics behavior in more complex organisms.

“We discovered that the chemical compound, DIM, induces novel biological activity that damages the nuclear membranes in fission yeast,” said Ueno, associate professor at Hiroshima Research Center for Healthy Aging, Graduate School of Integrated Sciences for Life, Hiroshima University.

The nuclear membranes enclose the cell's genetic information. Once the genetic material is replicated, the nuclear envelope, which comprises the inner and outer membranes, pinches into two and part, resulting in two cells where there once was one.

“Integrity of the nuclear membranes is important for human health,” Ueno said. “Mutations that cause defects in the nuclear membrane accelerate aging. Nuclear membranes also rupture and repair themselves during cancer cell migration.”

Part of the cell's process of repair is called autophagy, or “self-eating”. It is the degradation pathway of cellular components, where the cell will consume its internal parts to conserve energy and streamline life-sustaining processes. Ueno also noted that autophagy is implicated in

both aging and age-related diseases. If repair is no longer an option, cells will rupture in a programmed death process called apoptosis. According to Ueno, many cytotoxic anticancer drugs work by inducing apoptosis, so being able to control the process can help preserve and improve human health.

“Our results suggest that the nuclear envelope could be one of the early targets of DIM,” said paper author Parvaneh Emami, graduate student in the Graduate School of Integrated Sciences for Life, Hiroshima University.

This finding builds on a previous report from a research team in Germany, who found that a high concentration of DIM increases the lifespan of fission yeast. It may seem counter-intuitive that an apoptosis-inducing compound can increase the lifespan of an organism, but Emami explained DIM appears to prompt such behavior only in exponentially dividing cells — like cancer. If cancer cells die off, the organism can live longer.

“Recent studies in humans show that DIM is a potential anti-cancer drug that acts by the induction of apoptosis in a wide range of cancer types, including breast, prostate, gastric and pancreatic,” Ueno said. “Research also demonstrates that DIM induces autophagy in cancer cells. However, the impact of autophagy on tumor formation and progression are not fully understood. The understanding of apoptosis and autophagy mechanism by DIM in fission yeast may be helpful for human cancer and longevity research. We think that study of the nuclear envelope structure could be a good starting point for these cases.”

The researchers will continue investigating the role of DIM in fission yeast.

About the study

Emami, P., & Ueno, M. (2021). 3,3'-Diindolylmethane induces apoptosis and autophagy in fission yeast. In R. Sugiura (Ed.), *PLOS ONE* (Vol. 16, Issue 12, p. e0255758). Public Library of Science (PLoS).
<https://doi.org/10.1371/journal.pone.0255758>



An aging Japanese island's lessons on the future of sustainable travel

The small-scale, community-led Shiosai art fair embodies a revitalizing tourism approach that has breathed new life into the aging island village of Mitarai.

One of the artworks displayed during Shiosai festival



A rural art fair's grassroots-led, mindful, and immersive travel experience embodies a revitalizing tourism approach that a study found has built community resilience, strengthened local identity, and re-energized daily life in a Japanese island village grappling with decline.

Mitarai, on the east coast of Osakishimajima Island in the Seto Inland Sea, is a sample of a peripheral community in Japan facing depopulation, aging, and socioeconomic decline, a phenomenon that the study said is symptomatic of late capitalism in many developed nations where the decline of outlying areas is predominant.

Wedged between Honshu, Kyushu, and Shikoku, three of Japan's four main islands, the Seto Inland Sea is home to around 3,000 smaller isles, a dozen of which serve as festival venues of one of the country's biggest art fetes, the Setouchi Triennale.

"My early seven published peer-review research in English already highlighted the role of how big-scale art festivals like Setouchi Triennale can help to facilitate regional revitalization through art tourism and in-migrant micro-entrepreneurship," said the study's lead author Hiroshima University Assistant Professor Meng Qu from the Graduate School of Humanities and Social Sciences' Department of Integrated Global Studies.

However, under this type of optimistic background, Qu said that his research on big-scale art fairs showed that community-level outcomes are highly divergent between villages and islands.

"Some islands are revitalized by newcomers and art businesses. But on some islands, nothing has happened. This brought me another thought — large-scale art festivals revitalization is not the only option or panacea for diversified rural communities," he said.

Together with Wakayama University Professor Joseph Cheer, Qu researched small-scale community-engaged bottom-up type of art fairs exemplified by Mitarai's Shiosai art fest. This week-long community art fete has been held since 2017 to rejuvenate the village.

The researchers explored the extent to which bottom-up art events in small rural communi-

ties can serve as a vehicle for sustainable development. And examined the specific challenges of employing bottom-up art events in small, rural community contexts.



The links between art events and sustainable development in rural contexts where revitalization is pressing is becoming increasingly obvious.

"Findings suggest that the Shiosai drives visitation to the area and has reinvigorated latent cultural heritage. The festival stimulates inward migration and enhances community resilience and vital social capital."

The researchers found that the festival puts a premium on upholding and considering local opinions as well as valuing the area's history, culture, and architecture. Activities are not limited to art but also in pursuits that help safeguard local collective memory through co-learning, reinvigorate dwindling agriculture through "half-agriculture and half-art crafts" experiences, and enliven the atmosphere by revitalizing and re-using abandoned old buildings.

The festival also attracted creative in-migrants and succeeded in nurturing social connections with artists from neighboring regions and partnerships with both local businesses and nearby universities.

"In Mitarai, the focus is on the local community playing a central role, emphasizing meaningful social engagement, co-creation, and co-development," they said.

But as the festival is driven from the bottom-up without external support, the researchers noted that the extent of future local-level involvement remains a critical success factor. [More here.](#)

About the study

Qu, M., & Cheer, J. M. (2020). Community art festivals and sustainable rural revitalisation. In *Journal of Sustainable Tourism* (Vol. 29, Issues 11–12, pp. 1756–1775). Informa UK Limited. <https://doi.org/10.1080/09669582.2020.1856858>

Feature

GET TO KNOW OUR DPs & DRs

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

Itaru Osaka

Distinguished Professor

Materials scientist Itaru Osaka works on “ π -conjugated polymers,” known as electrically conductive polymers. These materials can also be used as a solution-processable semiconductor and can be used for electronic devices such as solar or photovoltaic cells that are lightweight, flexible, and semitransparent in contrast to conventional silicon devices.

Q: What scientific problem are you trying to answer?

An issue in organic photovoltaics is the lower power conversion efficiency compared to conventional silicon photovoltaics. One of the goals in my current research is how to improve the performance of π -conjugated polymers and organic photovoltaics.

Q: What got you into this field?

I was assigned to the group of Prof. Hideki Shirakawa, who received the 2000 Nobel Prize in Chemistry for the discovery of conductive polymers, when I was a graduate student at Tsukuba University which got me into this field.

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

The materials that I have been working on can be used for electronic devices including photovoltaic cells, and these devices are lightweight and flexible and can be produced by cheap solution-processing. These devices are thus believed to be next-generation devices for IoT (Internet of Things) as well as low-carbon society.

Q: Your research is trying to help achieve UN SDG goals 4, 7, 9, and 13. How important for you is pursuing science that aligns with SDGs?

Very important. On the one hand, one of the aspects of my research is to pursue my own interests, but on the other hand, it is the researcher's mission to return our research to society. In my case, as I mentioned, π -conjugated polymers are indeed promising materials to contribute to SDGs, more specifically carbon neutrality.

Itaru Osaka

Professor

Graduate School of
Advanced Sciences
and Engineering



Yoshihiko Kadoya

Distinguished Professor

Economist Yoshihiko Kadoya is director of Hiroshima University's Hiroshima Institute of Health Economics Research (HiHER). He explores health economics, a field that approaches various health issues from an economics perspective.

Q: What got you into this field?

I became interested in health economics because Japan has among the world's highest aging rates, and the world is keeping a close eye on how the situation is unfolding here. I was intrigued by the notion of approaching the issues of healthcare and long-term care using the economics skills I had learned.

Q: You've said before that you hope to establish an interdisciplinary research hub, how important is an interdisciplinary approach in research for you?

I believe that every science involves some aspect of data analysis. And what data analysis in the field of economics excels in is the analysis of "dirty data" — i.e. data with many uncertain elements. For example, economic activities and policies are greatly influenced by the surrounding environment, such as the culture, history, and system of a particular time or region, and the actions and choices of individuals can be influenced by their emotions. It is our job to clean and analyze such irrational and uncertain data using complex statistical methods and draw inferences about causes and effects.

I want to utilize this advantage of taking into account various influences in analysis to solve a variety of complex and intertwined social problems that are difficult to comprehend from a single field approach.

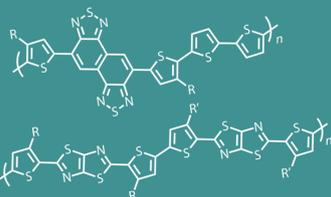
Q: What are some of the major projects you are working on now?

I have actively worked on COVID-19 related research that includes a) people's vaccination behavior, b) the impact of the pandemic on people's loneliness, c) economic measures against the pandemic, and d) the promotion of sustainable health & household finance.

Yoshihiko Kadoya

Professor

Graduate School of
Humanities and
Social Sciences



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!](#)

Ryo Tanaka

Distinguished Researcher

Rehabilitation scientist Ryo Tanaka explores the relationship between physical function and activities of daily living like walking to help detect, prevent, and treat functional impairment and extend life expectancy.

Q: What got you into this field?

My introduction to this field came from my experience working as a physical therapist in a hospital. Physical therapy is one of the tools used for rehabilitation. Exercise is a component of physical therapy, and I had been involved in teaching exercise to patients with back and knee pain to relieve their pain. However, some patients do not benefit from it. Such experiences got me interested in rehabilitation science.

Q: What scientific problem are you trying to answer?

The main scientific problem is what factors influence the effectiveness of exercise. Although biological factors like inflammation are the primary cause of pain, today it is known that psychological and social factors are also related to it. In the case of knee pain, I am interested in the psychological factors that are involved in its development and progression. We are investigating whether these factors affect the effectiveness of the exercise.

Q: Your research is trying to help achieve UN SDG goals 3 and 4. How important for you is pursuing science that aligns with SDGs?

That is very important to me. In addition to my academic activities, I am also involved in activities that give back to society the results of my research. We offer seminars for the general public which leads to dialogue and sometimes to the discovery of new research topics.

Q: Tell us about your current projects.

We're working on a project on the early detection and prevention of locomotive syndrome — a condition in which mobility ability is impaired due to problems with organs related to movement. Knee pain is one of the factors contributing to it. We believe that management of knee pain can help in its early detection and prevention.



Ryo Tanaka

Associate Professor
Graduate School of
Humanities and
Social Sciences



Hiroshi Ochiai

Distinguished Researcher

Molecular biologist Hiroshi Ochiai's research focuses on quantitative cell biology using mouse embryonic stem cells as a model. He is currently examining the regulatory mechanism of transcription, which regulates gene expression, especially the phenomenon called transcriptional bursting, using mouse embryonic stem cells.

Q: What scientific problem are you trying to answer?

We are interested in elucidating the intercellular heterogeneity in gene expression levels observed among the same cell types and studying the mechanisms of cell fate determination that are induced by this heterogeneity.

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

If we can establish a technology to control intercellular heterogeneity in gene expression in pluripotent stem cells, it will lead to the establishment of an efficient cell differentiation induction method, which will enable the safe and secure utilization of regenerative medicine.

Q: Your research is trying to help achieve UN SDG goals 3 and 9. How important for you is pursuing science that aligns with SDGs?

It is important to overcome research objectives and challenges, but if we can make even a small contribution to the SDGs through this process, we will be happy to do so.

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

My group has recently developed a technology that allows us to visualize the nuclear positions of specific genes and their transcriptional activities with high accuracy. Using this technology, we have been able to identify several new phenomena, such as the formation of clusters of specific transcription-related factors in the vicinity of the Nanog gene in the ON state, or the formation of clusters of other factors near Nanog, regardless of the transcriptional state of the gene.



Hiroshi Ochiai

Associate Professor
Graduate School of
Integrated Sciences
for Life



WOMEN IN *Meet our researchers* ACADEMIA



What we can learn from Japan's anthropomorphism subculture on creating a less lonely world

A pioneering psychologist's research may soon revolutionize how dating video games are played in the future and redefine social connections in the modern world.

Anthropomorphism — the attribution of human traits to non-human beings — can be seen everywhere in Japan from man-gas and animes to games, including ones that simulate dating.

Although feelings of infatuation with fictitious characters isn't an alien concept in human psychology, the obsession displayed by fans within Japan's romance video game subculture has often been viewed as bizarre if not perverse. Many fear that people may end up substituting real-world connections for what is deemed as unnatural digital intimacy.

One of the many permeating myths surrounding video gaming is the fear that it breeds isolation. And this myth has resurfaced with renewed alarm as dating video games gained popularity outside Japan. A Japanese psychologist's research is showing initial evidence that our fear may be far from true and fraught with misunderstanding.

Psychologist Mayu Koike's pioneering research on romantic anthropomorphism explores why some people woo virtual lovers and how it may be redefining social connections in the modern world.

"Japan is one of the leading countries of anthropomorphism in the world. These sub-cultures are extremely popular, with global fans. Some people even imagine fictional characters as if they are present in real life," Koike, an assistant professor at Hiroshima University's Graduate School of Humanities and Social Sciences, said.

Koike, whose research focuses on the relations between people and virtual agents, examines how relationships research can be used to understand new technologies.



As a person who was born and raised in Japan, I am interested in exploring the benefits of forming a romantic relationship with virtual agents and whether it has the potential to improve psychological well-being.



Loneliness epidemic and COVID-19 pandemic

In 2020, her research found that the use of touch and a human-like voice were perceived as important factors in anthropomorphized relationships. Current dating video games usually rely on interactive bots with pre-scripted answers. She and her colleagues also discovered that the desire to develop social skills and alleviate negative feelings is among the reasons why many are attracted to playing dating video games.

"Some people struggle to make friends or feel isolated. Loneliness negatively affects both our physical and mental health. Especially due to the COVID-19 pandemic, many people experienced isolation and depression," Koike explained.

Koike's research may revolutionize how dating games are played in the future by helping developers understand what players pursue in it.

"Virtual agents have grown increasingly common in the world around us so if we can lead the way in understanding these new relationships — human and virtual agents — it might help to reduce loneliness and improve well-being," she said.



Romantic anthropomorphism is a new field pioneered by Assistant Professor Mayu Koike. It combines both anthropomorphism and romantic relationship research.



Mayu Koike, Hiroshima University

'Unique way' of finding connections

Koike's latest research in 2021 showed that building an authentic relationship with virtual agents is important to have a greater positive affect, which in psychology is associated with a more optimistic outlook in life. As gamers find that romance with game characters boosts their mood and helps build real-life social skills, she believes it would be beneficial if society could change their misconceptions about relationships with virtual entities.

She also started a side project to define the emotion of "moe," a concept originally established in Japan's anime and manga subcultures. It captures the idea that humans might fall in love with virtual characters. Her findings showed that both Japanese and British citizens can understand "moe" and have experienced this as a positive emotion.

"If a person should feel 'moe' strongly, they will follow to feel a pleasant feeling more strongly too," she said.

"This research identifies a unique way that people find a connection in the modern world and provides novel insight into the fields of anthropomorphism and relationship science."

Undergraduate students

10,605 students

Postgraduate students

4,435 students

Staff members

3,651 members

1 for every 4.1 students

Doctorates conferred in AY 2020

364 students

THE University Impact Rankings 2021

Top spot among Japanese universities and first in Japan for five SDG categories

SDG4 (Quality Education)
SDG5 (Gender Equality)
SDG6 (Clean Water and Sanitation)
SDG8 (Decent Work and Economic Growth)
SDG11 (Sustainable Cities and Communities)

1st in Japan

Undergraduate graduates

Cumulative 144,231 students

Annual visitors to the libraries

Approx. 0.41 million visitors

1,711 visitors per open day

Volumes in collections at the libraries

Approx. 3.46 million volumes

Approx. 230 volumes per student

Total site area of Higashi-Hiroshima Campus

Approx. 2.49 million m²

Equivalent to

49

Hiroshima Municipal Baseball Stadiums (Mazda Stadium)

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



Hiroshima University
in Figures
(as of May 1, 2021)

CAMPUS LOCATION & ACCESS



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



Congrats
CLASS OF 2021

HU holds AY 2021 Commencement Ceremony

Hiroshima University held its AY 2021 Commencement Ceremony at the Higashi-Hiroshima Sports Park on Wednesday, March 23, 2022.

Congrats, graduates!
Our best wishes on this new journey!

*HU's original academic gown for postgraduates is available starting this year. Graduate students can now have the option of wearing it.

Relive the highlights from the 2021 Commencement Ceremony [here](#).

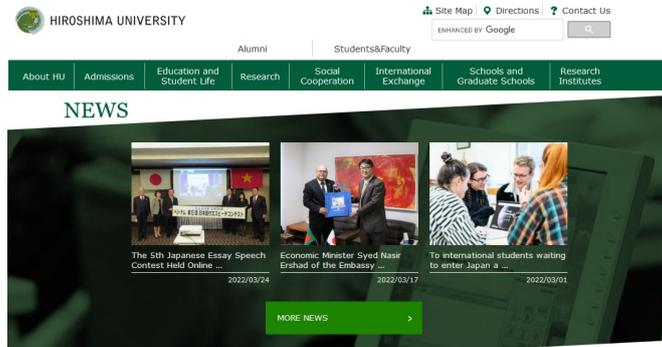


FIND MORE ABOUT HU

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>



HU PROMOTIONAL VIDEO

Wondering what it's like at Hiroshima University? Here's our new video introducing our campuses and the mesmerizing sights of Hiroshima Prefecture.



 <https://youtu.be/r1Wg7oQZHYs>



SOCIAL MEDIA ACCOUNTS

 HU Facebook
[@HiroshimaUniv.en](https://www.facebook.com/HiroshimaUniv.en)
<https://www.facebook.com/HiroshimaUniv.en>

HU Research Facebook
[@HiroshimaUniversityResearch](https://www.facebook.com/HiroshimaUniversityResearch)
<https://www.facebook.com/HiroshimaUniversityResearch>

 HU Twitter
[@HiroshimaUnivEn](https://twitter.com/HiroshimaUnivEn)
<https://twitter.com/HiroshimaUnivEn>

HU Research Twitter
[@Hiroshima_Univ](https://twitter.com/HU_Research)
https://twitter.com/HU_Research

 HU YouTube
[HiroshimaUniv](https://www.youtube.com/user/HiroshimaUniv)
<https://www.youtube.com/user/HiroshimaUniv>

 HU Instagram
[@hiroshima_univ](https://www.instagram.com/hiroshima_univ)
https://www.instagram.com/hiroshima_univ

 HU LinkedIn
[HiroshimaUniv.en](https://www.linkedin.com/school/hiroshima-univ/)
<https://www.linkedin.com/school/hiroshima-univ/>

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>

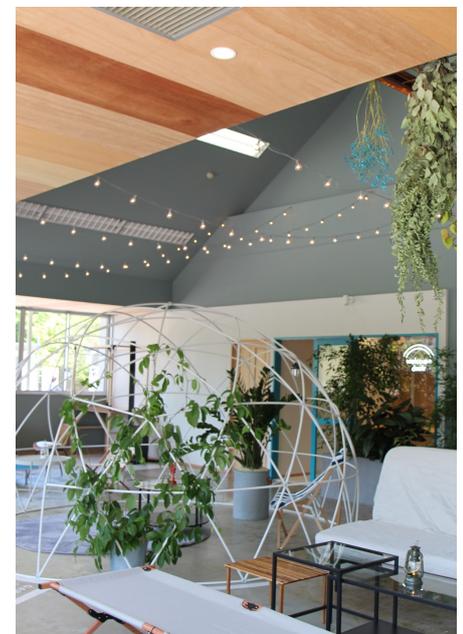


NEW RESEARCHER DIRECTORY

Finding researchers at Hiroshima University is now easier than ever! Introducing the Researcher Directory – HU's brand new researcher search system – launched last July 1, 2021. 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>



Spring at Hiroshima University
Higashi-Hiroshima Campus



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



HIROSHIMA UNIVERSITY