HIROSHIMA UNIVERSITY UPDATE

HIROSHIMA UNIVERSITY

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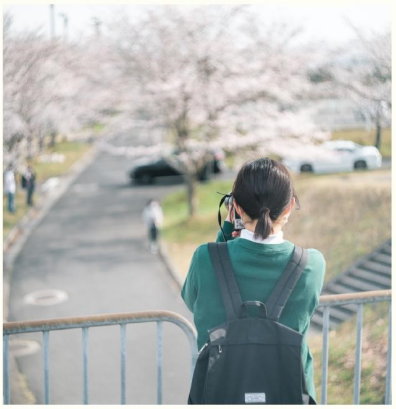
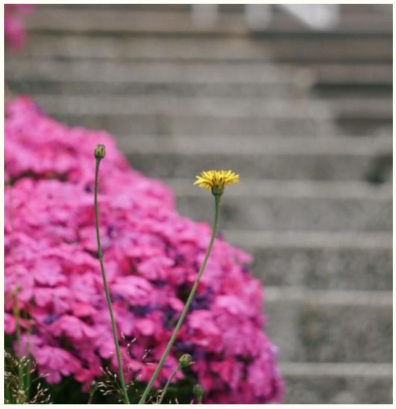
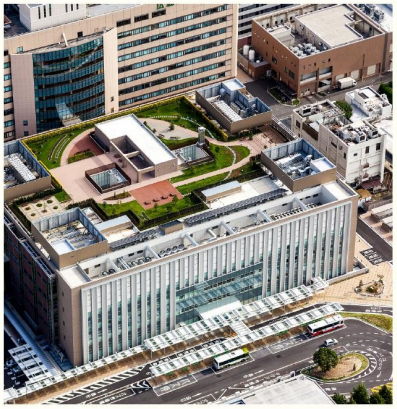
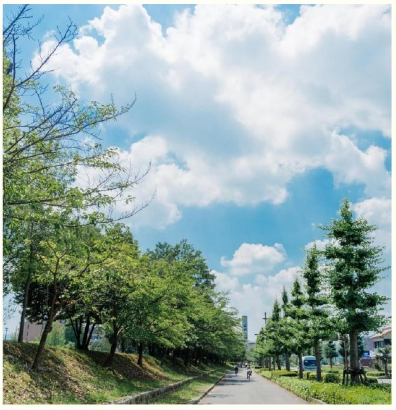
CAMPUS PHOTOS

SPRING • SUMMER


HIROSHIMA UNIVERSITY

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

HIROSHIMA UNIVERSITY

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

HU GETS TOP SPOT AMONG JAPANESE UNIVERSITIES IN THE'S GLOBAL IMPACT RANKINGS

Hiroshima University got the top spot among Japanese universities in the Times Higher Education's Impact Rankings 2021. It also ranks first in Japan for five SDG categories.

The British higher education journal Times Higher Education (THE) published its Impact Rankings 2021 — a list assessing universities against the United Nation's Sustainable Development Goals (SDGs) — last April.

HU ranked 1st in Japan for the following categories:

- SDG 4 (Quality education)
- SDG 5 (Gender equality)
- SDG 6 (Clean water and sanitation)
- SDG 8 (Decent work and economic growth)
- SDG 11 (Sustainable cities and communities)

For the overall scores, HU moved up the ranking ladder, placing 1st along with Tohoku University, the University of Tsukuba, Kyoto University, Okayama University, Hokkaido University, and the University of Tokyo. Now in its third edition, the list evaluated 1240 universities worldwide and 73 universities in Japan.

As for the world ranking, HU was among the top 100 in five of the 17 UN SDGs:

- 46th for SDG 9 (Industry, innovation, and infrastructure)
- 64th for SDG 6 (Clean water and sanitation)
- 72nd for SDG 2 (Zero hunger)
- 79th for SDG 1 (No poverty)
- 96th for SDG 12 (Responsible consumption and production)

HU ranks in top 10 of THE Japan University Rankings 2021

THE also named HU as one of the ten best universities in the country in its Japan University Rankings 2021.

The Japan University Rankings are calculated based on four broad pillars (resources, engagement, outcomes, and environment) focused on student growth and learning. It assessed 278 institutions for this year.

HU X

Q&A

With Professor Shinji Kaneko, Director of NERPS

Imagine a world without waste, poverty, or inequality. Sounds nice? It is also achievable. The SDGs play a vital role in today's society. They provide a framework to address the world's challenges and present an opportunity for community-industry-academia collaboration. The SDGs are a call for action by all countries, and now more than ever, universities, their research, and leadership play a critical role in their achievement.

We chatted with Shinji Kaneko — executive vice-president of global initiatives and director of the Network for Education and Research on Peace and Sustainability (NERPS) — to learn more about the topic and Hiroshima University's commitment towards the SDGs.

Q: Can you tell us about NERPS?

A: NERPS is an international network of educators, researchers, and practitioners collaborating towards the advancement of peaceful and sustainable societies amidst global challenges. Based at HU's Higashi-Hiroshima campus, it was established in 2018 and has 12 members, including four cross-appointed faculty members as of 2021. NERPS engages with a wide range of stakeholders to identify research priorities and emerging issues related to peace and sustainability and implement innovative interdisciplinary and transdisciplinary academic projects. It also serves as a resource hub for SDG-related activities of HU.

> **More important than ever, they [SDGs] can also provide a critical framework for green recovery in the post-COVID era**
>
> *Shinji Kaneko, Director of NERPS*

SDGs

To participate, click or scan the QR code

Q: Can you share more about the importance of SDGs in the global frame?

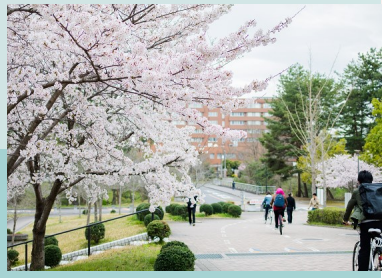
A: The global challenges we face, including poverty, inequality, climate change, environmental degradation, conflicts, and injustices, are becoming more serious and pressing. It is difficult to resolve the challenges without everyone's commitment and cooperation in the world. The SDGs are a "common base" where a variety of actors can collaborate with one another toward a better and more sustainable future for all. The goals are time bounded and measurable and can guide different stakeholders toward achieving meaningful outputs. More important than ever, they can also provide a critical framework for green recovery in the post-COVID era.

Q: What are the current efforts towards the achievements of the SDGs?

A: In June 2020, NERPS called for applications for transdisciplinary research projects on peace and sustainability. As a result, we received 23 proposals worldwide and decided to collaborate with four particularly outstanding researchers. Now, NERPS works with them as our cross-appointed professors. Six transdisciplinary research projects, including two projects of NERPS researchers, were launched in the fall of 2020 after The NERPS Science Plan 2020 was published. In order to enrich and accelerate academic discussion, we have the "NERPS Webinar Series on Peace and Sustainability in the Context of Global Change" which started in September 2020. Since then, we have organized 11 seminars attended by more than 1000 participants.

Q: What's the next step?

A: In March 2022, the NERPS Conference 2022 will be held. It will be a forum for academic exchange with researchers and practitioners from various fields on solutions to global-scale issues. In addition, this will be an opportunity for the above six transdisciplinary research projects to present their research results and co-design their next targets in collaboration with the core NERPS members and other conference participants. We will keep promoting education and research activities that contribute to the establishment of "Science for Sustainable Development" mentioned in HU's long-term vision "SPLENDOR PLAN 2017".



SDGs & research

Millennials and Gen Z are more sustainability-orientated — even when it comes to money, researchers find

The younger generations are willing to put their money where their mouth is when it comes to sustainable living. In a study questioning both commitment to sustainable behaviors and willingness to trade better pay to work for a more sustainable-minded company, the surveyed young adults in Japan made their preferences clear.

"In this study, we provide novel evidence that the younger generation preferred a sustainable lifestyle than the older generation." said paper author Tomomi Yamane, researcher with NERPS at HU.

Read more here!

NERPS

EN ROUTE TO BECOMING A SMART CAMPUS

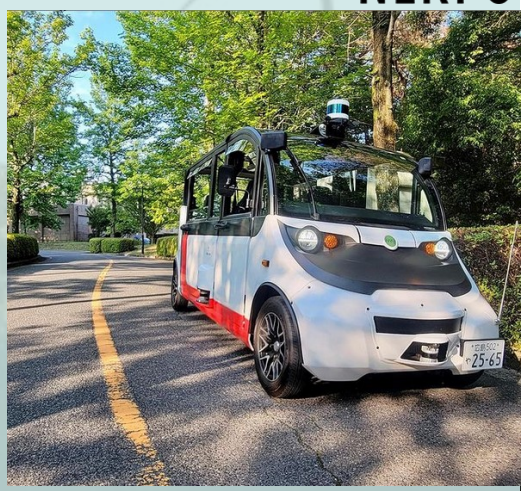
HU's self-driving shuttle operations

HU started operations of its self-driving shuttle in March 2021, en route to its goals of achieving smart campus status.

The project is part of a bigger smart city deal spearheaded by the Higashi-Hiroshima Autono-MaaS Consortium — which comprises HU, the Higashihiroshima City, US autonomous vehicle (AV) technology firm May Mobility, and Japanese companies like MONET Technologies Co., Ltd. The AV experiment is the first in Japan to demonstrate the combined mobility services of passenger rides and grocery deliveries.

The self-driving electric shuttle is equipped with multiple sensors for safety. It has seven cameras used to recognize pedestrians, animals, and other cars. It also has five lidars, a laser version of a radar, that can detect objects in every direction and recognize location. Five radars were also installed to detect objects over 100 meters away. Although equipped with technology that could help it handle different driving scenarios on its own, the shuttle still has a safety driver on board who could take over if needed.

HU President Mitsuo Ochi vowed that the university would continue working to achieve the SDGs by conducting cutting-edge research addressing regional issues.



For the latest updates, follow HIROMOBI's new Instagram account!

HU SIGNS EDUCATIONAL COOPERATION AGREEMENT WITH GALALA UNIVERSITY

Hiroshima University signed an agreement for educational cooperation with Egypt's Galala University in April this year.

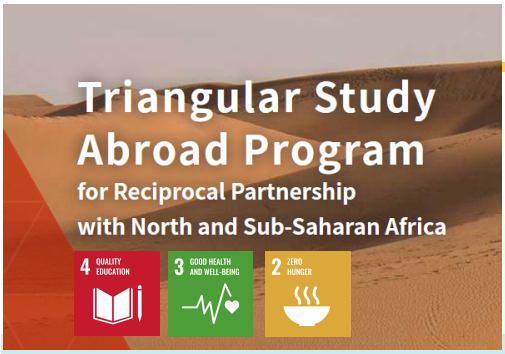
In April 2019, HU signed a Letter of Intent with the Ministry of Higher Education and Scientific Research of Egypt on cooperation with Galala University, which was scheduled to open at that time. Furthermore, HU President Mitsuo Ochi met with Egyptian President Abdel Fattah el-Sisi and Minister of Higher Education and Scientific Research Khaled Atef Abdel Ghaffar at the Seventh Tokyo International Conference on African Development (TICAD7) in August 2019. During the meeting, HU reaffirmed its commitment to collaborate with Galala University for its launch. With this agreement, HU has been able to consolidate the specific details on cooperation with the university.

The signing ceremony was held online at HU's Higashi-Hiroshima Campus, the Egyptian Embassy in Japan, and the Egyptian Ministry of Higher Education and Scientific Research.

President Ochi hopes the agreement will further strengthen the ties between Egypt and Japan, adding that both countries share a desire for peace. Going forward, HU will cooperate with Galala University in the fields of engineering, dentistry, and Japanese language education, including the creation of curriculum and offering of classes both online and locally.

What's in the photo?

The signing ceremony taking place at the venue in Japan



HU, AFRICAN UNIVERSITIES LINK UP FOR EXCHANGE PROGRAM TO ACHIEVE SDGs

An exchange program that draws on Hiroshima University's strengths and achievements in education, health sciences, and food security is launched.

Hiroshima University collaborates with four North African and two Sub-Saharan universities for an exciting program designed for students seeking to facilitate multilateral international cooperation and lead high-quality economic growth and sustainable development in Africa. The Triangular Study Abroad Program for Reciprocal Partnership with North and Sub-Saharan Africa hopes to educate prospective students who will bridge Japan and Africa and various African regions.

The program is supervised by leading experts who possess strong track records in development-related work.

How it works

The program is offered through a triangular study model, allowing students to study in Japan, North Africa, and Sub-Saharan Africa. The model starts with an online exchange program while in their home countries. Then, when the COVID-19 pandemic becomes under control, HU students would begin to visit and study in Africa for a short period of one week or two, or for a semester. Meanwhile, students in Africa would come and study for a semester in Japan. In the future, students would also organize a joint conference in Zambia.

Exchange partners

- Cairo University
- Ain Shams University
- Aswan University
- Beni-Suef University
- University of Zambia
- University of Malawi

Check out the program's website!
Japan-Africa Triangle Education Program

AMBASSADOR OF UZBEKISTAN VISITS HU

On August 6, 2021, H.E. Mukhsinkhuja Abdurakhmonov, Ambassador Extraordinary and Plenipotentiary of the Republic of Uzbekistan, paid a courtesy call to the Kasumi Campus of Hiroshima University. The meeting tackled various topics, including the potential for interchange between HU and universities in Uzbekistan. Also, a discussion with 5 Uzbek exchange students engaging in topics such as their research and daily lives took place. It is hoped that this meeting will lead to future exchanges and partnerships with universities and research institutions in Uzbekistan.

*In March 2021, H.E. Gayrat Fazilov, former ambassador of Uzbekistan in Japan, also visited HU.

HU CULTURAL ANTHROPOLOGIST GETS SHIBUSAWA AWARD

Hiroshima University lecturer Moe Nakazora's monograph, *Anthropology of Intellectual Property Rights*, published in 2019, was awarded the 47th Shibusawa Award.

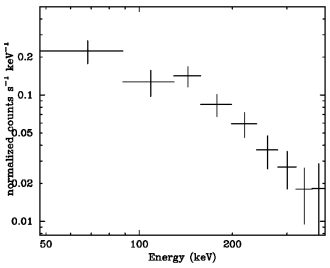
The national award commends young researchers' achievements in the fields of ethnology and cultural and social anthropology. Nakazora's research focuses on cultural anthropology and deals with various issues related to India's environment and development. Her monograph was the fruit of her 10-year fieldwork in India, exploring new perspectives on the concepts of "knowledge" and "property."

Sometimes when pharmaceutical companies get a patent for drugs, the original users no longer have access. Nakazora examined the outcomes of introducing the global framework of "intellectual property rights" into the realm of traditional medicine. "In the future, I would like to develop a new perspective on the relationship between human society and the natural environment. To that end, I would like to deepen my research through interdisciplinary collaboration with researchers in other fields," she said.

"I am happy that my research results have been recognized, but more than that, I feel like I can finally return [my research achievements] to my Indian collaborators."

Lecturer Moe Nakazora

The GRBAlpha nanosatellite measures 10 cm on each side and carries a tiny scintillator, read out by a dual-channel multi-pixel photon counter setup, to detect gamma-ray bursts.



Gamma-ray spectrum of the first-detected gamma-ray burst

NANOSATELLITE CO-DEVELOPED BY HU RESEARCHERS DETECTS GAMMA-RAY BURSTS

A nanosatellite that Hiroshima University researchers helped develop detected gamma-ray bursts less than five months since it was launched into space.

The GRBAlpha nanosatellite detected the gamma-ray bursts on August 7. It was sent into space to monitor these extremely energetic explosions last March.

"This detection demonstrates that our detector onboard the CubeSat is working with our expected performance," astronomer and HU Professor Yasushi Fukazawa, who is part of the project, said.

The GRBAlpha is a 1U CubeSat developed and manufactured by an international research team comprised of HU, Hungary's Konkoly Observatory, Eötvös University, Nagoya University, Masaryk University, and space technology firms Spacemanic and Needronix.

It is the first of the eight nanosatellites to be dispatched to space for the CubeSats Applied for Measuring and Localising Transients (CAMELOT) mission to perform all-sky monitoring for gamma-ray bursts. The mission aims to demonstrate the feasibility of timing-based localization to determine where the gamma-ray bursts originated. They will launch the second nanosatellite in December 2021.

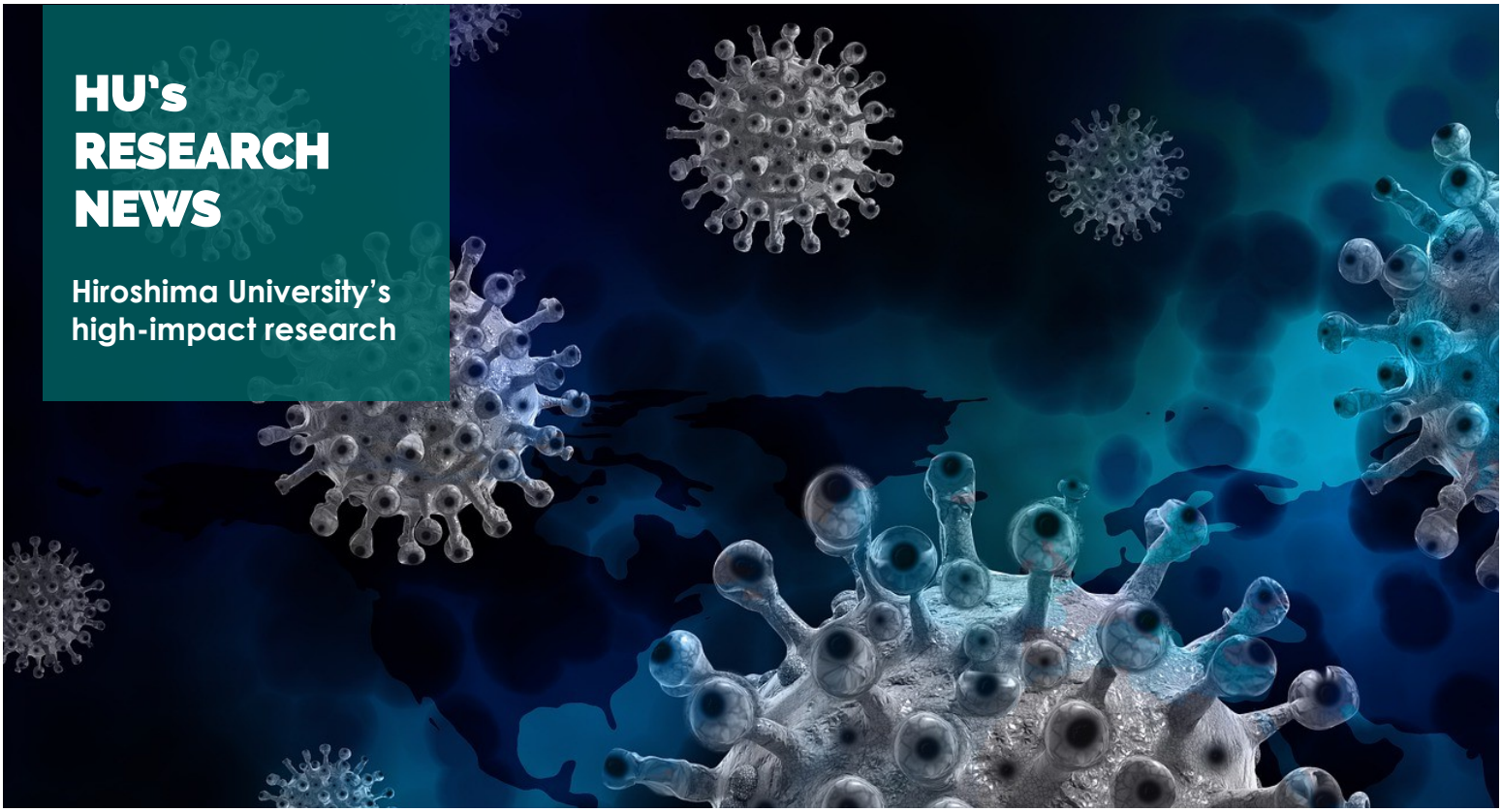
NEW JAPAN-CHINA TRANSLATION AND INTERPRETATION PROGRAM

By Morito Institute of Global Higher Education

The "Morito Institute of Global Higher Education Japan-China Translation and Interpreting Program" is an initiative for Hiroshima University master's students who are native speakers of Chinese or Japanese and aims to help them acquire more advanced translation and interpretation skills in these languages. By taking this program alongside courses at their graduate schools, students will achieve high levels of language proficiency in both Japanese and Chinese, ultimately developing individuals who can serve as bridges between Japan and China in academic exchange and social activities.

"This program will enable students to learn not only the language but also the culture, history, and geography of both Japan and China.

Toshiyuki Sato
Director of the Morito Institute of Global Higher Education and HU Executive Vice President



HU's RESEARCH NEWS

Hiroshima University's high-impact research

HIGHLY DENSE URBAN AREAS ARE NOT MORE VULNERABLE TO COVID-19, RESEARCHERS SAY

A person who owns a car or who has a college education may be less vulnerable to COVID-19, according to an analysis of cases in Tehran, Iran, one of the early epicenters of the pandemic. While such variables do not inherently lower a person's risk, they do indicate an infrastructure of protection that persists despite how densely populated a person's district might be. The international collaboration published their results in Sustainable Cities and Society.

"In the past few decades, there have been various efforts aimed at increasing urban density to enhance efficiency and contribute to climate change mitigation — but the COVID-19 pandemic has brought questions about the desirability of compact urban development to the forefront," said paper author Ayyoob Sharifi, associate professor in the Graduate School of Humanities and Social Sciences and in the Graduate School of Advanced Science and Engineering at Hiroshima University.

Through a comprehensive data analysis from the early months of the pandemic (to April 4 and June 27, 2020), the researchers found that a population's demographic structure — age, social and economic class, access to resources — is far more influential than simply how dense a population is. However, density is distinctly different than overcrowding for the resources available, the researchers said.

"We found that what drives the spread of infectious disease during a pandemic is overcrowding, which can occur in districts even with low density," said paper author Amir Reza Khavarian-Garmsir, assistant professor in the Department of Geography and Urban Planning in the Faculty of Geographical Sciences and Planning at the University of Isfahan.

While a person less likely to be aware of or follow public health guidelines or more likely to use public transportation may be more at risk for the disease, the researchers didn't find a statistically significant difference in urban districts with lower income and lower age compositions—indicating that age was one of the most significant risk factors for COVID-19 infection, despite density of living.

"It is perhaps too early to draw definitive conclusions, so future research should continue to investigate the relationship between urban density and transmission patterns of infectious disease," Moradpour said.

The researchers said they hope their work will help policy makers develop guidelines to benefit all during urban and pandemic-preparedness planning.

About the study

Khavarian-Garmsir, A. R., Sharifi, A., & Moradpour, N. (2021). Are high-density districts more vulnerable to the COVID-19 pandemic? Sustainable Cities and Society, 70, 102911. https://doi.org/10.1016/j.scs.2021.102911

Vaccines on campus!

HU started providing vaccinations to students, faculty, and staff — in collaboration with Higashihiroshima City — on June 21, 2021.

Vaccination is available to students, faculty, and staff enrolled at HU who wish to receive the vaccine and have made an appointment. About 10,800 students and 2,500 faculty and staff have been vaccinated as of August 16, 2021.

"As vaccination progresses, especially among students, the ratio of in-person classes will increase, and students may engage in extracurricular activities. Students will be able to participate in a wider range of activities in the future," Yuri Okamoto, Health Service Center director, said on the significance of immunization at the university.

FELLOW SCIENTISTS URGED TO EXPLORE VITAMIN B6'S POTENTIAL IN WEAKENING COVID-19 SYMPTOMS

Vitamin B6 may help calm cytokine storms and unclog blood clots linked to COVID-19's lethality. But research on it is lacking. An HU professor calls on fellow scientists to study its potential role.

Who would have thought that a small basic compound like vitamin B6 in the banana or fish you had this morning may be key to your body's robust response against COVID-19?

Studies have so far explored the benefits of vitamins D and C and minerals like zinc and magnesium in fortifying immune response against COVID-19. But research on vitamin B6 has been mostly missing. Food scientist Thanutchaporn Kumrungsee hopes their paper published in Frontiers in Nutrition can be the first step in showing vitamin B6's potential in lowering the odds of patients becoming seriously ill with the coronavirus.

"In addition to washing your hands, food and nutrition are among the first lines of defense against Covid-19 virus infection. Food is our first medicine and the kitchen is our first pharmacy," Kumrungsee, an associate professor at Hiroshima University's Graduate School of Integrated Sciences for Life, said.

In their paper, she and her fellow researchers pointed out growing evidence showing that vitamin B6 exerts a protective effect against chronic illnesses such as cardiovascular diseases and diabetes by suppressing inflammation, inflammasomes, oxidative stress, and carbonyl stress.

"Coronaviruses and influenza are among the viruses that can cause lethal lung injuries and death from acute respiratory distress syndrome worldwide. Viral infections evoke a 'cytokine storm,' leading to lung capillary endothelial cell inflammation, neutrophil infiltration, and increased oxidative stress," they said.

Kumrungsee explained that thrombosis (blood clotting) and cytokine storm (hyper inflammation) might be closely linked to the graveness of COVID-19. Cytokine storms happen when the immune system dangerously goes into overdrive and starts attacking even the healthy cells. Meanwhile, blood clots linked to COVID-19 can block capillaries, damaging vital organs like the heart, lungs, liver, and kidneys.

Vitamin B6 is an anti-thrombosis and anti-inflammation nutrient. Deficiency in this vitamin is also associated with lower immune function and higher susceptibility to viral infections.

"Thus, our attempt in this paper is to shed light on the possible involvement of vitamin B6 in decreasing the severity of COVID-19."

The associate professor said she is looking forward to clinical trials that would test their hypothesis.

About the study

Kumrungsee, T., Zhang, P., Chartkul, M., Yanaka, N., & Kato, N. (2020). Potential Role of Vitamin B6 in Ameliorating the Severity of COVID-19 and Its Complications. Frontiers in Nutrition, 7. https://doi.org/10.3389/fnut.2020.562051

ROBOT LENDS A HAND IN DECONGESTING LABORATORIES CLOGGED WITH COVID-19 TESTING BACKLOGS

A multidisciplinary team of Hiroshima University doctors and epidemic experts have developed a robot that can swiftly pretreat specimens for coronavirus testing, reducing infection risk by limiting the amount of human contact with the samples and fixing a speed bottleneck.

The research team, composed of Hiroshima University professors from the Graduate School of Biomedical and Health Sciences, includes cellular and molecular biologist Hidetoshi Tahara, epidemiologist Junko Tanaka, virologist Takemasa Sakaguchi, surgeon Hideki Ohdan, and infectious diseases expert Hiroki Ohge.

The machine is designed to automate the pretreatment process of various virus testing methods, including RT-PCR and mutant strain analysis, without worrying about cross-contamination. Sample pretreatment — the extraction and purification of genetic material from specimens using chemicals — is a manually cumbersome procedure that has caused gridlocks to the timely churning out of COVID-19 test results.

As the pandemic carries on, the risk of specimen mishandling and contamination is also a heightened concern. It can strain already exhausted laboratories dealing with the continuous influx of tests and a shortage of clinical laboratory technicians.

1,080 samples a day

The machine can automatically pick up a container, open the lid to collect the sample, put the cover back, and transfer the specimen to a test tube for pretreatment all in less than a minute. It was developed using parts from automation technology firm Festo Corporation.

If operating for 24 hours, the machine can pretreat 1,080 samples daily. The researchers hope it could soon be used to dramatically improve the speed and accuracy of all kinds of COVID-19 testing in Japan and overseas, especially those facing a shortage of clinical laboratory technicians.

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

CRACKING NATURE'S ALGORITHM

It would have been easy to dismiss the geometrically patterned bottles as room decor. Only in the laboratory of Hiroshima University Associate Professor Takuma Sugi, these weren't artsy displays. If you look closer, you would see that the bottles' crisscrossing designs were alive, formed by hundreds of thousands of *C. elegans* worms, each one as big as the period at the end of this sentence.

These worms are eyeless, but they know their place in the formation. They are leaderless, but they can form ordered patterns. They are goalless, but they seem to anticipate their neighbors' direction and meet up with them.

Systems like this — exhibiting coherent collective behavior even without a central authority orchestrating the movements — are examples of active matter. And its many forms are all over in nature.

People, both non-scientists and scientists, are fascinated with collective pattern formations as in flocks of birds and schools of fish.

He explained that animals, including humans, collectively self-organize to increase their survival and reproduction rate. Swirling flocks of starlings could confuse predators into thinking they're one colossal beast. And schools of snappers can increase their odds of successful reproduction.

"Each animal does not know its own position in collectives," Sugi said. Yet somehow, flocks of birds and schools of fishes can move around and abruptly change direction as one without colliding or straying away from the pack.

"Why can randomly moving animals form ordered patterns even without a leader?" he raised.

Such behavior is absent in low-density groups. This capability is unlocked only when there is enough of them to form a flock, school, or swarm. Sugi is decoding the algorithms that propel these smart swarms. But doing controlled experiments in a laboratory with these numbers is unthinkable.

"Understanding a mechanism underlying collective pattern formation requires both theoretical and experimental studies. But no one could hope to do controlled experiments with 10,000 real birds or fish," he said.

Unheard of behavior

Sugi discovered that a worm already used in laboratories for over half a century is a perfect candidate to study this behavior. *C. elegans*, which share many genes with us, have been extensively researched to understand aging, immunity, and diseases in humans. They are quick to grow in laboratories, and their transparency makes it easy to monitor behavioral and cell changes under a microscope.

He himself had been exploring neuroscience with the help of this worm. In 2011, he published his research demonstrating how its non-neuronal cells can trigger behavioral changes the same way thermosensory neurons do.

In 2019, he and his colleagues were able to show that once you get a swarm of them together, these worms form dynamical networks never seen before.

Their findings suggested that the critical factors behind the collective pattern formations were the worms' alignment after collision and smooth turning. That study was the first to use the worm in exploring active matter.

Their research on the feats accomplished by bundles of this microscopic animal was one of the 34 studies highlighted in 2019 by Nature Reviews Physics, a scientific journal belonging to the prestigious Nature portfolio.

"We investigated the mechanism underlying this animal's collective behavior from the perspective of physics," he said.

The next step, he added, is to examine collective behavior in *C. elegans* from the viewpoint of neuroscience and genetics using genome editing techniques, a matter he had accomplished in this worm before. Nearly eight years ago, he and fellow scientists used TALEN gene editing technology to create a mutation in the worm's AMPA-type receptor linked to defective sensory behavior.

In their active matter study, Sugi observed that mutant worms move at a curvier trajectory and form tighter networks compared to non-mutants.

"We would like to know the neural computation driving collective behavior."

Sugi is now working on a new microscopy technique that will allow them to investigate the neural circuit basis of the worm's collective behavior and its decline in real-time. With a life cycle of two weeks, this worm can offer insights into how its neural circuit function dwindles as it ages.

"We are often fascinated with the emergence of more intelligent behaviors when living things collectively self-organize at the population level. Our ultimate research purpose is to understand the origin of this intelligence."

ON AN ISLAND LABORATORY, A SCIENTIST IS DRAWN TO THE SIMPLE LIFE FORMS

On Hiroshima's Mukaishima Island, there's a marine worm that's so tiny, simple, and common, it appears rather unremarkable compared to the other marvels living in the ocean. Inside its squishy body, however, are wonders that could hold clues about rapid healing, regeneration, and our prehistoric ancestors.

It is perhaps fortunate that on the same island stands a marine biology laboratory, one of Japan's oldest, headed by a scientist best equipped to unravel the worm's mysteries.

Associate Professor Kunifumi Tagawa, a developmental biologist and director of Hiroshima University's 88-year-old Marine Biological Laboratory, often stumbles upon a gathering of these worms on the island's sandy shores.

By all accounts, simplicity encompasses every aspect of the acoel flatworm's life. Its needs are undemanding. It drifts in the water, lounges on the shore, and for food, all it needs is to sunbathe its translucent body to nourish the symbiotic microalgae inside that feed it. It's extremely low maintenance that it can, and does, exist in all of the world's oceans. Even its anatomy is uncomplicated. It has no body cavity, circulatory system, or gut. This simplicity is exactly what had drawn in Tagawa.

As a developmental biologist, he explores the origins of *chordates*, which include humans, by studying animals with the most primitive traits among the worm-like *hemichordates* and planula-like *acoelomorphs*.

Hemichordates are of particular interest from the evolutionary perspective because their ancestral features can help reconstruct a common ancestor from a branch of the tree of life that leads to humans. Over 500 million years ago, humans and *hemichordates* shared a common *deuterostome* ancestor — the first to form its anus before its mouth as an embryo.

Acorn worm, *Ptychodera flava* (4-5 cm)

Pioneering research

Tagawa's quest to decode the development, regeneration, and evolution of *hemichordates* started over two decades ago when his graduate school mentor asked him to go to Hawaii to collect and spawn acorn worms.

"Nobody knows how to make them spawn," Tagawa said of these invertebrates with acorn-shaped heads. A few years later, in 1998, he published his findings on the spawning and early development of the acorn worm *Ptychodera flava* abundant on the sandy coast of Oahu.

That same year, he started the world's first molecular developmental biology research on acorn worms and went on to explore their place in evolution.

"At first, I was not interested in evolution because it is hard to prove. I majored in chemistry, so I like getting accurate or clear results," Tagawa said.

"But somehow, I got fascinated and am still working on this animal."

What a prehistoric human ancestor looks like

Tagawa received his first Fujii Award from the Zoological Society of Japan in 2011 for his research on acorn worm regeneration, which could offer insights on regenerative medicine in humans.

"Usually, if we got the tip of our finger cut off, it won't grow back. But this one can regrow its head. It can regrow lost body parts. So that's why we are trying to compare what's the difference between this worm and humans," he said.

In 2015, he and other researchers sequenced the genome of two acorn worm species and found that we humans share 70% of our DNA with them. His work elucidated that the prehistoric ancestor of *deuterostomes* is an acorn worm-like creature.

A simpler life form

And by studying the *acoelomorpha*, Tagawa can venture to ancient members of all bilaterally symmetric animals, called *bilateria*, many evolving guts that open at each end, allowing creatures to harvest more energy and grow larger. Acoel flatworms, a type of *acoelomorpha*, are thought to be the most ancient *bilaterian*.

Tagawa and a team of scientists published two years ago the entire genome sequence of the *Praesagittifera naikaiensis*, the acoel flatworm species on Mukaishima Island.

He said it is an excellent model organism in understanding why regrowing body parts is easy for it but not for us.

"I'm trying to understand the molecular mechanisms of its regeneration and compare it with other animals to understand why vertebrates have limited regeneration capability," he said.

Tagawa won his second Fujii Award last year for a study on acoel flatworms that supported the grouping of *xenoturbellids* and *acoelomorphs* within the *xenacoelomorpha* phylum. By comparing Hox genes responsible for instructions on an animal's body plan, he bolstered the position that *xenoturbellids* and *acoelomorphs* share a single common ancestor.

For more than 20 years, Tagawa has been researching chordate evolution. But his excitement on the topic has not waned.

"What excites me in my research is very simple — knowing new things. Knowing a new thing is always exciting.

ODDS OF RESTORING FERTILITY VIA SPERM STEM CELL TRANSPLANT ARE AS RANDOM AS A COIN TOSS. SCIENTISTS FOUND A WAY TO RIG IT

The chances of restoring fertility through sperm stem cell transplant are as random as a coin toss. But a team of scientists developed a new strategy that serves as a "weighted coin" that can favorably rig the odds to achieve outcomes where fertility is successfully restored.

The ability of stem cells to fix impaired functions of host tissues after transplantation has been a lifesaving breakthrough in treating previously incurable conditions. Much like a coin toss, however, the fate of the transplanted stem cells is unpredictable. They may choose self-renewal, grow into a different kind of tissue, or die.

Spermatogonial stem cells follow the same stochastic fate of unpredictability in outcomes. But a group of fertility scientists led by Hiroshima University's Yoshiaki Nakamura discovered a new method that has favorably flipped the odds and successfully reversed male infertility in mice — showing great promise for future applications in regenerating human sperm after cancer treatment and repopulating threatened and endangered species. Results of their study are published in the journal Cell Stem Cell.

"Transplantation of spermatogonial stem cells promises a wealth of applications such as the treatment of infertility in men and the preservation of genetic diversity. Yet, currently, its inefficiency rules out the practical application of this technology," Nakamura, assistant professor at the HU Graduate School of Integrated Sciences for Life, said.

"Our knowledge about the fate behavior of individual spermatogonial stem cells and their progenies following transplantation remains poorly developed, limiting the potential to develop new strategies to increase the currently low transplantation efficiencies," he added.

Taking an up-close look at single-cell resolution, the international team of Japanese and British scientists tracked the fate of transplanted spermatogonial stem cells in mice. They implanted normal mouse sperm stem cells in infertile mice and found that only a tiny fraction repopulates in the long-term as working spermatogonia and the rest change into a different type of cell — a process called differentiation — or cease to carry out its function and die.

Using these insights, they developed a new method that can artificially tune the fate of the sperm stem cells to increase the likelihood of repopulation to a level where fertility is restored. They briefly introduced a retinoic acid synthesis inhibitor after transplantation, which temporarily prevented the donor sperm stem cells from undergoing differentiation. The chemical inhibitor helped orchestrate an outcome where the stem cells choose a fate of self-renewal.

After looking at the fate of transplanted spermatogonial stem cells up-close at single-cell resolution, the researchers discovered that only a small fraction repopulates as working spermatogonia. They developed a new strategy that introduces a chemical inhibitor to increase the odds of sperm stem cells choosing a fate of self-renewal. (Pexels)

"We demonstrated that repopulation efficiency of transplanted spermatogonial stem cells increased by tuning their stochastic fate," Nakamura said, adding that the next step for their research is to confirm if their new strategy will also work for livestock and eventually humans.

> **"My final objective is to apply spermatogonial stem cell transplantation for the fertility of male individuals with cancer after chemotherapy or the preservation of genetic diversity in farm animals and rare or endangered wild animals**

About the study

Nakamura, Y., Jörg, D. J., Kon, Y., Simons, B. D., & Yoshida, S. (2021). Transient suppression of transplanted spermatogonial stem cell differentiation restores fertility in mice. Cell Stem Cell.
https://doi.org/10.1016/j.stem.2021.03.016

JAPAN'S HANDS-OFF FORMULA IN DISCIPLINING SCHOOL-CHILDREN WORKS. IS IT WORTH A TRY ELSEWHERE?

A look at Japan's *mimamoru* approach suggests that adults' non-intervention in kids' fights allows children to nurture social and interpersonal skills on their own. Is it worth a try in other countries?

A study examining Japanese schools' hands-off approach when children fight showed it could create opportunities for autonomy and encourage ownership of solutions, suggesting a new strategy in handling kids squabbles in other countries.

Called *mimamoru*, the pedagogical strategy is a portmanteau of the Japanese words *mi*, meaning watch, and *mamoru*, meaning guard or protect. It is generally understood as "teaching by watching" — where adults, including early childhood educators, intentionally let kids handle disagreements on their own to promote their learning through voluntary exploration and actions. While not an official part of Japan's early childhood education and care (ECEC) curriculum, it is treated as an implicit guideline. The approach reflects Japanese socialization practices at home and school, where it is a norm for grownups to wait for children to respond to problems and guide them to take ownership of their learning.

"This study aims to understand the reason why Japanese early childhood educators tend not to intervene, and how and in what contexts they do," said study author Fuminori Nakatsubo, ECEC specialist and associate professor at Hiroshima University's Graduate School of Humanities and Social Sciences.

Maximizing learning through minimal intervention

A total of 34 Japanese and 12 US early childhood educators participated in focus groups that used modified video-cued multi-vocal ethnography methods to scrutinize the non-intervention strategy. After watching a three-minute clip showing it in action at a private preschool in western Japan, the international mix of educators discussed non-verbal cues exhibited by the students and teachers and the timing of intervention. Their findings are published in the Early Childhood Education Journal.

It may seem counterintuitive to just stand by when youngsters are in a tussle. But the approach sees conflicts as a valuable opportunity for learning which adults can rob kids from gaining if they immediately intercede. Stepping in and judging kids' behaviors may also inadvertently set them up as good and bad, impacting relationships negatively.

The study noted that allowing children to experience a feeling of "It hurts!" (physical pain) or "Oh no, I shouldn't have done it!" (guilt) can be a teachable moment that physical fights do not solve any problem.

Mimamoru's three major characteristics

The researchers, however, clarified that "watching" doesn't mean that adults ignore the safety of children. Japanese educators intervene when the risk of physical harm caused by fighting is greater than the benefit for children to learn.

Japanese and US educators highlighted mimamoru's three major characteristics: temporary, minimal intervention to reduce the immediate risk of physical harm; non-intervention or staying out of the fight to encourage kids to solve their problem; and non-presence or leaving the children by themselves once determined that they can sort out their dilemma without adult support.

Selecting which to apply among these three relies heavily on an educator's patience in balancing benefits vis-a-vis threats, careful observation of behaviors, and trust in the children's capacity to learn from their own experiences.

"Although the mimamoru approach looks passive, it rather challenges educators to remain patient, watching and waiting for children to think and act on their own. An underlying assumption of this Japanese practice is adults' trust in children's inherent goodness, more specifically, their ability to learn through everyday social interactions," the researchers explained.

> "In other words, children learn through their exploration of autonomy under the protection of adults

Nakatsubo said he hopes their research revealed the "hidden strengths" inherent in the approach of Japanese educators.

About the study

Nakatsubo, F., Ueda, H. & Kayama, M. Why Don't Japanese Early Childhood Educators Intervene in Children's Physical Fights? Some Characteristics of the *Mimamoru* Approach. Early Childhood Educ J (2021). https://doi.org/10.1007/s10643-021-01184-3

SCANNING 'CHEMICAL FINGERPRINTS' TO SEE IF ORDINARY CELL'S REPROGRAMMING INTO STEM CELL IS GLITCH-FREE

A new non-invasive technique scans "chemical fingerprints" to see if ordinary cells' reprogramming into stem cells is on track and verify transformation success by matching "print" patterns.

The 2012 Nobel prize-winning discovery that ordinary cells could be coaxed to revert to their earliest pluripotent stage ushered in the era of ethical stem cell research. Suddenly, scientists can have an inexhaustible supply of pluripotent stem cells — the most versatile of stem cells — that can become any type of cell much like how embryonic stem cells function but without the ethical troubles that hampered research in the past.

These reprogrammed cells called induced pluripotent stem cells, or iPS cells, hold great promise for regenerative medicine, where they can be used to develop tissue or organ replacement-based treatments for life-threatening diseases.

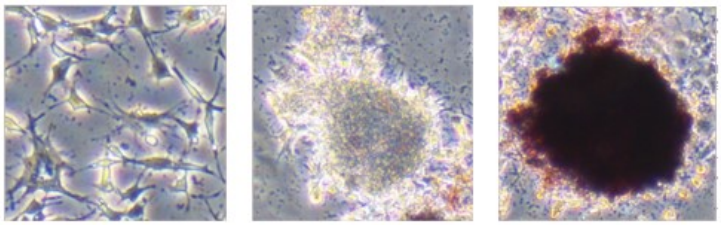
Artificially inducing ordinary cells to reset back to pluripotency, however, is a lengthy and delicate process. Obtaining iPS cells depends on chance. And knowing all they can about the chemical changes cells undergo during reprogramming can help scientists improve the odds of attaining viable iPS cells for clinical applications. Current methods that track reprogramming status, however, use destructive and costly techniques.

A study led by Dr. Tomonobu Watanabe, professor at Hiroshima University's Research Institute for Radiation Biology and Medicine, showed how Raman spectroscopy could be a low-cost, simpler, and non-intrusive technique in monitoring what goes on inside the cell as it transitions.

"The quality evaluation and sorting of existing cells have been carried out by investigating the presence or absence of expression of surface marker genes. However, since this method requires a fluorescent antibody, it is expensive and causes a problem of bringing the antibody into the cells," Watanabe said.

"Solution of these problems can accelerate the spread of safe and low-cost regenerative medicine using artificial tissues. Through our method, we provide a technique for evaluating and sorting the quality of iPS cells inexpensively and safely, based on scattering spectroscopy," he added.

Raman spectroscopy avoids invasive approaches that require dyes or labels to extract biochemical information. Instead, it relies on vibration signatures produced when light beams interact with chemical bonds in the cell. As each chemical has a distinct vibration frequency, scientists can use it to identify the cell's molecular composition.



This photo shows cells screened using Alkaline Phosphatase (AP) staining.

A group of scientists used "chemical fingerprint" data collected via non-invasive Raman spectroscopy to train an AI so it can monitor if the reprogramming of ordinary cells into stem cells is on track and check for markers that will verify a successful return to their earliest pluripotent stage.

The team used this spectroscopic technique and followed mouse embryonic stem cells as they differentiated into neuronal cells then artificially reprogrammed back to pluripotency. They used the "chemical fingerprint" data they collected to teach an AI model so it can track if the reprogramming is progressing without a hitch and verify iPS cell quality by checking for a "fingerprint" match with the embryonic stem cell.

To measure the progress, they assigned the "chemical fingerprint" of neuronal cells as the transformation starting point and the embryonic stem cell's patterns as the desired end goal. Along the axis, they used "fingerprint" samples collected on days 5, 10, and 20 of the neuronal cells' reprogramming as reference points on how the process is advancing.

They published their findings in the October 2020 issue of the journal Analytical Chemistry.

"The Raman scattering spectrum contains comprehensive information on molecular vibrations, and the amount of information may be sufficient to define cells. If so, unlike gene profiling, it allows for a more expressive definition of cell function," Watanabe said.

"We aim to study stem cells from a different perspective than traditional life sciences."

> "We aim to study stem cells from a different perspective than traditional life sciences.

About the study

Germond, A., Panina, Y., Shiga, M., Niioka, H., & Watanabe, T. M. (2020). Following Embryonic Stem Cells, Their Differentiated Progeny, and Cell-State Changes During iPS Reprogramming by Raman Spectroscopy. Analytical Chemistry, 92(22), 14915–14923. https://doi.org/10.1021/acs.analchem.0c01800

TO PREDICT UNDERWATER VOLCANO ERUPTIONS, SCIENTIST LOOKS AT IMAGES FROM SPACE

A new study monitored satellite images to obtain sea discoloration data as a novel indicator in detecting if an underwater volcano's eruption is imminent.

A new study suggests sea discoloration data obtained from satellite images as a novel criterion in predicting if eruption looms for an underwater volcano.

There have been frequent eruptions of submarine volcanoes in recent years. The past two years alone recorded the explosions of Anak Krakatau in Indonesia, White Island in New Zealand, and Nishinoshima Island in Japan. Observing signs of volcanic unrest is crucial in providing life-saving information and ensuring that air and maritime travel are safe in the area.

Although predicting when a volcano will erupt can be difficult as each behaves differently, scientists are on the lookout for these telltale signs: heightened seismic activity, expansion of magma pools, increases in volcanic gas release, and temperature rises.

For submarine volcanoes, Yuji Sakuno, remote sensing specialist and associate professor at Hiroshima University's Graduate School of Advanced Science and Engineering, proposed a new indicator — seawater color.

The relationship between the chemical composition of discolored seawater and volcanic activity has been known for a long time. Still, there have been very few quantitative studies that used remote sensing to explore it. And among these few studies, only the reflectance pattern of discolored seawater has been analyzed.

> **This is an extremely challenging research result for predicting volcanic disasters that have frequently occurred in various parts of the world in recent years using a new index called seawater color.**

"I was the first in the world to propose the relationship between the seawater color information obtained from satellites and the chemical composition around submarine volcanoes."

The findings of the study are published in the April 2021 issue of the journal Water.

Sakuno explained that volcanoes release chemicals depending on their activity, and these can change the color of the surrounding water. A higher proportion of iron can cause a yellow or brown discoloration, while increased aluminum or silicon can stain the water with white splotches.

One problem, however, is that sunlight can also play tricks on seawater color. The study looked at how past research that chromatically analyzed hot spring water overcame this hurdle and fixed brightness issues. A relational model between seawater color and chemical composition was developed using the XYZ colorimetric system.

Sakuno examined images of Nishinoshima Island captured last year by Japan's GCOM-C SGLI and Himawari-8 satellites. Himawari-8 was used to observe volcanic activity and GCOM-C SGLI to get seawater color data. GCOM-C SGLI's short observation cycle — it takes pictures of the ocean every 2-3 days — and high spatial resolution of 250 m makes it an ideal choice for monitoring.

Using the new indicator, Sakuno checked satellite data from January to December 2020 and was able to pick up signs of looming volcanic unrest in Nishinoshima Island approximately a month before it even started.

"In the future, I would like to establish a system that can predict volcanic eruptions with higher accuracy in cooperation with the Japan Aerospace Exploration Agency (JAXA), the Maritime Security Agency, which is monitoring submarine volcanoes, and related research," he said.

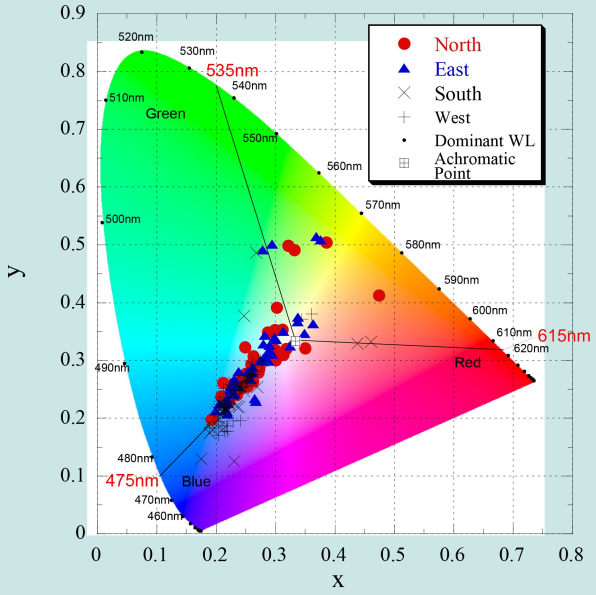


Photo courtesy of Yuji Sakuno

This image illustrates the colorimetric data of discolored seawater in four directions (north, east, south, and west) around Nishinoshima Island in 2020. The study investigated the color characteristics of the water to validate if the data obtained by SGLI accurately captures the actual conditions of the discolored seawater. It detected significant fluctuations in the distribution of chemicals in Nishinoshima Island, estimated from SGLI data, about one month even before the volcano became active.

About the study

Sakuno, Y. (2021). Trial of Chemical Composition Estimation Related to Submarine Volcano Activity Using Discolored Seawater Color Data Obtained from GCOM-C SGLI. A Case Study of Nishinoshima Island, Japan, in 2020. Water, 13(8), 1100. https://doi.org/10.3390/w13081100

STUDY FINDS BRACES DISRUPT ORAL MICROBIOME TO PRE-GUM DISEASE STATE

A study showed braces that give our smiles a makeover could also transform oral microflora to a pre-gum disease state. Now scientists plan to use their findings to prevent this from happening.

A scientific study on the mouth's microbial community found that patients who got braces had their good bacteria outnumbered by gum disease-causing ones. (Pexels)

A study that sequenced oral microbiome before, during, and after braces of Japanese patients revealed a transformed bacterial community akin to mouths at a pre-gum disease state.

"People who had undergone orthodontic treatments could get a healthy oral environment and beautiful mouth," said study co-author Isamu Kado from the Department of Orthodontics and Craniofacial Developmental Biology of Hiroshima University's Graduate School of Biochemical and Health Sciences.

But he added that these treatments could also be associated with bacteria-related problems.

Our mouth is the second most diverse microbiome in the human body, harboring over 700 bacterial species. And having braces on could make cleaning difficult and induce plaque accumulation.

Previous studies have linked braces to imbalances in the oral microbiome. These studies, however, focused on specific harmful species like the tooth decay-causing Streptococcus mutans and not the bacterial community as a whole.

Kado and his colleagues cataloged the whole bacterial population present in the mouths of 71 patients by running supragingival plaque and saliva samples through Next Generation Sequencing (NGS) technology. They monitored microbiome changes before the braces were put on, six months after the placement, and post-removal.

They found a spike in the number of harmful anaerobic bacteria and a drop in the friendly ones comparable to oral environments at risk of gum disease.

"In our study, the oral microbiome definitely changed during orthodontic treatment. The shift represented an increase of anaerobes, a bacterium that does not require oxygen for growth, and a decrease in commensal bacteria," Kado explained.

"This oral condition was similar to the microbiome of the transitional stage from healthy gingiva to periodontitis."

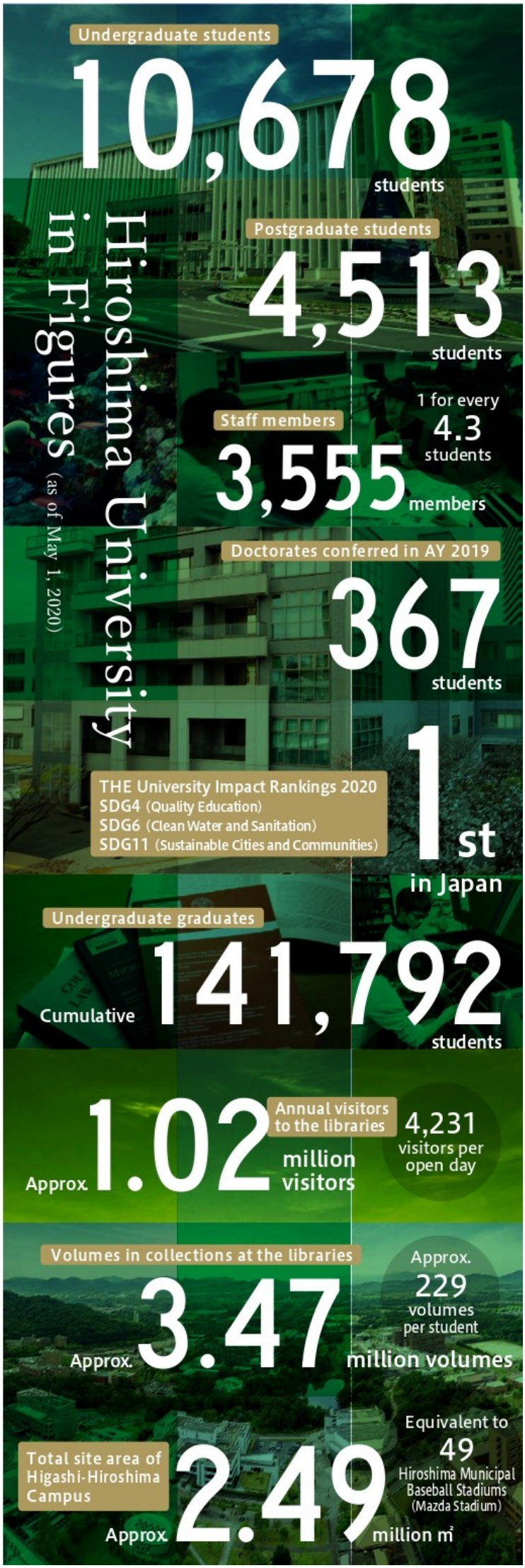
The researchers said their findings, published in Scientific Reports last December 2020, could support their goal of establishing a prevention system that would avert tooth decay and gingivitis from happening during orthodontic treatments.

> **To achieve this goal, it is necessary to clarify the difference in dental caries risk between patients. If this can be achieved, the quality of orthodontic treatment will be further improved**

Other co-authors in the study include Junzo Hisatsune, Keiko Tsuruda, and Motoyuki Sugai from HU's Department of Antimicrobial Resistance and HU Professor Kotaro Tanimoto also from the Graduate School of Biomedical and Health Sciences.

About the study

Kado, I., Hisatsune, J., Tsuruda, K. et al. The impact of fixed orthodontic appliances on oral microbiome dynamics in Japanese patients. Sci Rep 10, 21989 (2020). https://doi.org/10.1038/s41598-020-78971-2



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 Needs 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

Building area: 820.06 m²
Total floor area: 3,984.22 m²

Opening of the Experiment Building for Frontier Radiation Science — located in the university's Research Institute for Radiation Biology and Medicine (RIRBM).

May 13, 2021

HU launches new experiment building for frontier radiation science

The Experiment Building for Frontier Radiation Science is equipped with radiation, animal and molecular biological experimental facilities for joint use of researchers in Japan and overseas. It also houses the Nuclear Disaster Training Center dedicated to radiation disaster medicine. The Division of Radiation Information Registry — responsible for the storage, investigation, and analysis of medical materials related to the atomic bombing of Hiroshima and other cities — was also relocated to this building.

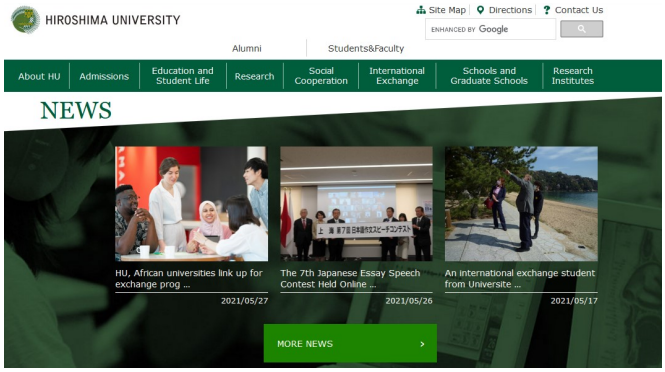
The building aims to become a center for studies that contribute to the global development of radiation disaster medical science.

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

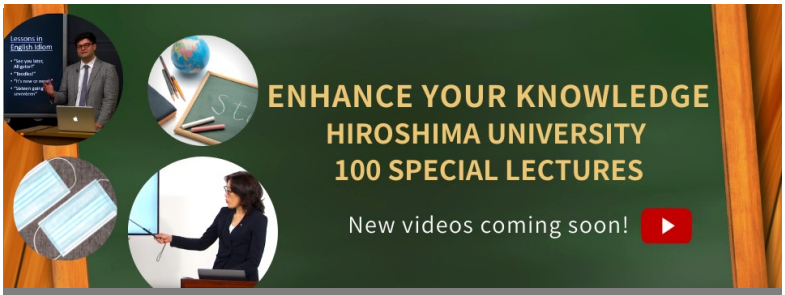
Wondering what it's like at Hiroshima University? Here's our new video introducing our campuses and the mesmerizing sights of Hiroshima Prefecture.

https://youtu.be/r1Wg7oQZHYs

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 SPECIAL LECTURES

Enhance your knowledge through the Hiroshima University 100 special lectures. Learn more about our faculty, classes, and research topics in this lecture series presented by HU! Due to COVID-19, part of the videos used in the footage were from the previous years. Regardless, the final videos wonderfully conveyed our campus atmosphere. We hope this project gives the general public a sneak peek into HU's campus life.

Check out the talks in Japanese and English ↓

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

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HiroshimaUniv.en
https://www.linkedin.com/school/hiroshima-univ/

Summer at Hiroshima University
Spanish Plaza, Higashi-Hiroshima Campus

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

HIROSHIMA UNIVERSITY