

**HIROSHIMA
UNIVERSITY**



HIROSHIMA UNIVERSITY

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VOLUME 20 • SUMMER 2023

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and high-impact research here!





HIROSHIMA UNIVERSITY

Embodying its founding principle of “a single unified university, free and pursuing peace,” Hiroshima University is one of the largest comprehensive research universities in Japan.

Today, HU is making steady progress as a global university, taking on worldwide challenges and strengthening its global educational network by signing international exchange agreements with universities around the world and opening overseas bases at strategic locations.



HIROSHIMA UNIVERSITY



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HU President Mitsuo Ochi shares vision for his third term in office

Stepping into his third term, President Mitsuo Ochi sets the stage for transformative initiatives at Hiroshima University.



President Ochi and the executive board members of HU

At a press conference last April 5, Hiroshima University (HU) President Mitsuo Ochi reflected on the past eight years, emphasizing his dedication to globalization and university reform to nurture "peace-pursuing, cultured individuals with an international mindset and a challenging spirit." He stressed the importance of promoting education, research, social contributions, and university reform to ensure HU's continued success.

"While continuing to ensure a smooth high school-university transition, I would like to reduce the percentage of entrance examinations based on 'one-shot' selection as much as possible. In so doing, I intend to increase the proportion of comprehensive and school-recommended selections," President Ochi said about education.

As for research, he stated, "As we have several unique research fields that HU can be proud of such as the International Institute for Sustainability with Knotted Chiral Meta Matter, genome editing, music, and brain science, I intend to give these fields my continued and greater support than ever."

As HU approaches its 75th anniversary and the 150th anniversary of the establishment of its oldest predecessor school next year, President Ochi reaffirmed his commitment, saying, "While valuing Hiroshima University's peace-pursuing spirit, the entire university will move forward, united as one."

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G7 Hiroshima Summit: HU driving the conversation on peace and global challenges

Hiroshima University set the stage for meaningful conversations on pressing global issues in the context of the G7 Hiroshima Summit.

Leading up to the G7 Summit held in Hiroshima from May 19-21, Hiroshima University (HU) took center stage by hosting a series of events dedicated to raising awareness and fostering meaningful dialogue on critical global issues such as peace, nuclear disarmament, food security, and climate change.

HU was also actively involved in the Citizens Council for the Hiroshima Summit, streamlining the G7 Summit. As a major contribution, HU provided 15 student volunteers for hospitality and 17 volunteers for interpretation, ensuring a smooth and welcoming experience for all participants.

The G7 Summit not only brought global issues to the forefront but also provided a unique opportunity to reevaluate the concepts of peace and the significance of Hiroshima itself.

Comment from a student volunteer:



Ryunosuke Nakamura

Second-year student
School of Integrated Arts and Sciences,
Department of Integrated Global Studies

Ryunosuke participated in the G7 Hiroshima Summit as a student volunteer. He offered valuable interpretation services to assist the attendees during the events.

“ Student voices ”

The G7 Summit highlighted the significance of Hiroshima's history as one of the cities exposed to the atomic bomb. My involvement as a student volunteer provided me with valuable experiences in translation and a great addition to my resume, contributing to my personal and professional growth.



April

14
APR

Japanese speech contest



HU hosted the "G7 Hiroshima Summit Japanese Speech Contest," allowing international students in Hiroshima to share in Japanese their views on peace, the planet, and our future. The contest involved 11 students from eight universities.

15
APR

Nuclear disarmament symposium

The Yomiuri Shimbun organized a symposium titled "Toward a Nuclear Weapons-Free World: The Path to Safety." HU's President and the Director of The Center for Peace gave speeches. The event had debates, discussions, and testimonies from A-bomb survivors, covering various topics including security, international law, and peace studies.



16
APR

Nuclear abolition & radiation readiness symposium

HU held the symposium "The Abolition of Nuclear Weapons – Preparation for Radiation Disaster," with the aim of sharing proposals for eliminating nuclear weapons and preparedness for radiation disasters, particularly from the perspective of Hiroshima, the birthplace of radiation disaster medicine.



Photo courtesy of ICAN

May

**28
MAY**

**Legacy
event on
dementia**

The Health and Global Policy Institute in cooperation with HU organized the 2023 G7 Hiroshima Legacy Event, titled "Charting a Course for Global Leadership from Japan in Inclusion and Innovation for Dementia." The event focused on dementia research and policies, aiming to position Japan as a leader in the international community. Discussions centered around challenges, initiatives, and prospects related to dementia, highlighting Japan's exemplary initiatives and emphasizing the importance of global promotion, awareness, and communication.



**21
APR**

**Planetary
health
symposium**

HU hosted the "University Panel Symposium on Planetary Health" to raise awareness, share insights, and discuss the role of universities in addressing planetary health. Participants from 53 organizations across 15 countries joined the event. The discussions led to the "Hiroshima Planetary Health Declaration 2023," emphasizing the need for transdisciplinary education and a research network to support the well-being of humans, social systems, and ecosystems.



**25
APR**

**G7 Youth
Summit**

The "Hiroshima G7 Youth Summit," a 3-day event organized by ICAN and hosted in collaboration with HU, united 50 young participants from 19 countries. Through discussions and site visits, they gained insights into the impact of nuclear weapons. Their "Hiroshima G7 Youth Statement" included 11 recommendations for nuclear disarmament.



**28
APR**

**Special
lecture:
What is the
G7 Summit?**

HU's School of Law held a special lecture with researchers in international relations and a commentator from Hiroshima Television. The lecture aimed to explain the significance of the G7 Hiroshima Summit and its global relevance, preparing for the scheduled event in May.



**22
APR**

**Food
security
symposium**



HU hosted the "Food Security Symposium," featuring experts who discussed Japan's food security measures and showcased research on biodiversity and global food security. HU researchers presented studies on DX dairy farming technology, oyster production, and salt damage-resistant rice. The event ended with a panel discussion with high school and university students.

Guided by its founding principle of "a single unified university, free and pursuing peace," HU remains committed to nurturing the next generation of peace leaders.

HU joins landmark Japan-U.S. semiconductor partnership

Hiroshima University has joined a landmark U.S.-Japan collaborative partnership launched by Micron and its industry partners to enhance semiconductor research and establish a talent development hub.

U.S. President Joe Biden, who visited Hiroshima for the G7 Hiroshima Summit, also joined the subsequent press conference.



© Photo by the White House

▼ HU embarks on inter-university collaboration with Purdue University

Dr. Mung Chiang, President of Purdue University, U.S., visits HU and concludes inter-university international exchange agreement

Hiroshima University and Purdue University signed an inter-university international exchange agreement on May 21, to promote academic and educational exchange. Purdue University boasts the most extensive STEM Education in the U.S., and is a leader in semiconductor human resource development.

The university presidents and other authorities convened to discuss the partnership and agreed to use academic and educational exchange programs as a university-

The University Partnership for Workforce Advancement and Research & Development in Semiconductors (UPWARDS) for the Future brings together eleven universities from across Japan and the U.S.

Coinciding with the final day of the G7 Hiroshima Summit on May 21, participating universities signed the Memorandum of Understanding in Hiroshima City. Representing Japan were HU President Mitsuo Ochi and Tohoku University President Hideo Ohno, while their U.S. counterparts were represented by Purdue University President Mung Chiang and Boise State University President Marlene Tromp.

The partnership aims to promote diverse talent development and foster research and development in the semiconductor field. Future plans include

implementing exchange programs between Japan and the United States, with a focus on promoting women's participation in the semiconductor industry. The goal is to educate a diverse pool of talent and actively engage in semiconductor development.

HU has a long history as a center for semiconductor education and research among national universities in Japan. Last March, the university established the "Setouchi Semiconductor Co-Creation Consortium" at its Higashi-Hiroshima Campus, a joint effort involving industry, government, and academia to develop semiconductors. In collaboration with Micron's world-leading plant in Hiroshima, HU aims to further contribute to the diversification and advancement of the semiconductor technology and the development of talent in Japan and the U.S.



© Photo by the White House



J-Innovation HUB: Pioneering open innovation in Japan

HU opened in April its J-Innovation HUB building, a space for industry-academia collaboration. Located adjacent to the Research Institute for Nanodevices's super clean room, the facility focuses on research in harsh environment electronics, atomic layer nano-processing, AI/IoT, and Beyond 6G. It is Japan's first facility with an integrated circuit evaluation system operating at temperatures up to 600°C and high-frequency communication and device evaluation equipment up to 100GHz, making it a pioneering hub for open innovation.

HU launches Graduate School of Innovation and Practice for Smart Society

Cultivating professionals to design and implement human-centered smart societies

Hiroshima University launched its Graduate School of Innovation and Practice for Smart Society (SmaSo) last April. The new graduate school provides an integrated education program that connects multiple research areas, aiming to cultivate professionals capable of designing, developing, and implementing human-centered smart societies at the global and local levels.

The primary objective of the graduate school is to train professionals who can contribute to economic development within the digital society framework, leveraging Japan's strengths in data science, artificial intelligence, and robotics. These individuals are expected to acquire advanced expertise in policy science to address social issues such as mobility, energy, food, health, environment, and sustainable industries.

The focus is on fostering professionals with a mindset aligned with Innovation and Practice for Smart Society, enabling them to adapt institutional design and technological development to the specific regional challenges faced by societies with diverse histories and cultures. The ultimate goal is to achieve a Smart Society, which combines economic development with solutions to social issues through the integration of cyberspace and physical space.

To mark the opening of SmaSo, a signboard unveiling ceremony took place on April 3. Dean Idaku Ishii, the head of the new graduate school, expressed his aspirations for the future.

"We aim to create a smart society where field sites and digital societal infrastructures are integrated to be practical, international, and interdisciplinary to be used for research and education," he said.

SmaSo consists of interdisciplinary education and research in six major research fields of Society 5.0:

- Cyber Physical System
- Smart Mobility
- Smart Energy
- Smart Agriculture
- Global Health and Medical Science
- Social Innovation Science



More [here](#).

HU Executive Vice President Junko Tanaka awarded Royal Order of Cambodia

Hiroshima University Executive Vice President Junko Tanaka was awarded the Royal Order of Monisaraphon on April 5 by the government of the Kingdom of Cambodia.



Commemorative photo
Minister of Health Mam Bunheng (left),
Executive Vice President Junko Tanaka (right)

This order is given by the Royal Government to individuals who have made outstanding accomplishments in the fields of literacy, arts, education, justice, administration, and science in accordance with the royal decree of the King of Cambodia.

Tanaka conducted an international survey on the hepatitis B and C viruses in Cambodia. The results showed that Cambodia had successfully achieved the World Health Organization (WHO) target of less than 1% prevalence rate of hepatitis B virus among 5-year-old children. Her achievements in nurturing young talent in Cambodia were also recognized.

Confirming the safety of genetically edited allergen-free eggs

3 GOOD HEALTH
AND WELL-BEING

Researchers have developed a chicken egg that may be safe for people with egg white allergies.

Chicken egg allergies are one of the most common allergies in children. Though most outgrow this by age 16, some will still have an egg allergy into adulthood. Egg white allergies can cause a variety of symptoms, including vomiting, stomach cramps, breathing problems, hives, and swelling. And some people with egg white allergies are unable to receive certain flu vaccines.

Using genome editing technology, researchers have produced an egg without the protein that causes egg white allergies. This protein, called ovomucoid, accounts for approximately 11% of all the protein in egg whites. The food safety profile of this modified egg, called the OVM-knockout, was detailed in *Food and Chemical Toxicology*.

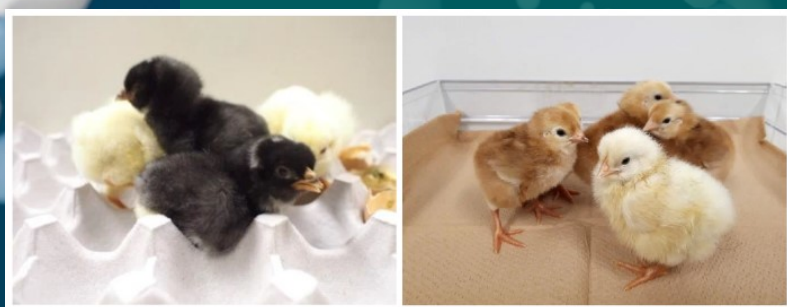
“To use OVM-knockout chicken eggs as food, it is important to evaluate its safety as food. In this study, we examined the presence or absence of mutant protein expression, vector sequence insertion, and off-target effects in chickens knocked out with OVM by platinum transcription activator-like effector nucleases (TALENs),” said Ryo Ezaki, assistant professor at the Graduate School of Integrated Sciences for Life at Hiroshima University. TALENs are restriction enzymes that recognize specific DNA sequences and break or cut them.

nucleotide bases in a gene, and none of them expressed mature ovomucoid proteins. Anti-ovomucoid and anti-mutant ovomucoid antibodies were used to detect any traces of the protein, but there was no evidence of ovomucoid in the eggs. This means that mutant ovomucoids could not create new allergens.

Other gene editing tools, such as CRISPR, tend to have off-target mutagenesis effects. This means that new mutations are prompted by the gene editing process. However, whole genome sequencing of the altered egg whites showed mutations, which were possibly off-target effects, were not localized to the protein-coding regions.

“The eggs laid by homozygous OVM-knockout hens showed no evident abnormalities. The albumen contained neither the mature OVM nor the OVM-truncated variant,” said Ezaki. “The potential TALEN-induced off-target effects in OVM-knockout chickens were localized in the intergenic and intron regions. Plasmid vectors used for genome editing were only transiently present and did not integrate into the genome of edited chickens. These results indicate the importance of safety evaluations and reveal that the eggs laid by this OVM knockout chicken solve the allergy problem in food and vaccines.”

Looking ahead, researchers will continue to verify the safety of OVM-knockout eggs. Because some people are highly allergic to this specific protein, even small amounts of ovomucoid can cause a reaction. Researchers will need to perform additional immunological and clinical studies to determine the safety of the OVM-knockout eggs. At this time, researchers have determined that OVM-knockout eggs are less allergenic than standard eggs and can be safely used in heat-processed foods that patients with egg allergies can eat.



HU scientists produced OVM knocked out chickens (colored chickens) using genome editing tools.

© Ezaki et al. 2023, *Food and Chemical Toxicology*

To develop the OVM-knockout eggs, researchers needed to detect and eliminate the ovomucoid protein in egg whites. TALENs were engineered to target a piece of RNA called exon 1, which codes for specific proteins. The eggs produced from this technique were then tested to ensure there was no ovomucoid protein, mutant ovomucoid protein, or other off-target effects. The eggs had the desired frameshift mutation, which is a mutation created by inserting or deleting

RYO EZAKI

Assistant Professor
Graduate School of
Integrated Sciences for Life



About the study

Ezaki, R. et al. (2023). Transcription activator-like effector nuclease-mediated deletion safely eliminates the major egg allergen ovomucoid in chickens. In *Food and Chemical Toxicology* (Vol. 175, p. 113703). Elsevier BV. <https://doi.org/10.1016/j.fct.2023.113703>

Can tiny brain tissues legally be a person? Researchers say not yet



Researchers discuss whether a "brain organoid" should be treated as a person by law and suggest the need for legal and social discussions uncoupled from debates on consciousness.

Grown in labs, human brain organoids are cultivated from stem cells, feed on nutrient broth and serve as a model of human brain development in miniature. Their growth and structure mimic portions of real brains, allowing scientists to better investigate the origins and potential treatments of neural diseases. How similar are they to actual human brains, though? Are they close enough to be considered people in their own right?

Researchers propose that the legal lens may prove critical when understanding the potential personhood of human brain organoids. They published their argument for a legal framework to guide the conversation in the *Journal of Law and Biosciences*.

"The moral status of human brain organoids has often been discussed, but their legal status has rarely been discussed," said Tsutomu Sawai, associate professor at Hiroshima University's Graduate School of Humanities and Social Sciences.



To clarify the legal status of human brain organoids will illuminate issues such as what information should be informed to the cell donor, to what extent the donor's consent justifies the research, and what uses are acceptable.

TSUTOMU SAWAI

Associate Professor
Graduate School of Humanities
and Social Sciences



Legal person refers to any entity that holds legal rights and obligations — it can be human or not, according to Sawai. Human legal persons are called natural persons, and they are defined by being born of a womb and whether they can be considered legal dead once their heart or brain stops working. Nonhuman legal persons are called juridical persons and can include corporations and governmental agencies.

In their paper, Sawai and his team explore how the legal definition of what it means to be a natural or a juridical person applies to human brain organoids. Currently, they do not fulfill basic requirements of what it means to be a natural person, Sawai said, but research may bridge the existing gaps.

"Although human brain organoids do not constitute natural persons at present, the likelihood of their potential to become natural persons in the near future requires more thorough consideration in advance of that reality occurring," said first author Masanori Kataoka, researcher in HU's Graduate School of Humanities and Social Sciences. "Research on linking human brain organoids with bodies is expected to advance rapidly in the coming years, whereas the conditions of natural personhood, especially viability and birth are becoming increasingly flexible and contentious."

The researchers noted that previous discussions on this topic have focused almost exclusively on natural personhood, overshadowing questions about the potential juridical personhood of human brain organoids. Corporations, for example, are considered juridical persons so that they can participate in legal matters, such as entering contracts. According to Kataoka, whether this applies to human brain organoids would depend on what legal purposes such consideration may have, and the matter should be considered separately from whether they are natural persons.

"Current brain organoid technology is in many ways quite limited, and it has not yet reached a stage where human brain organoids could become natural or juridical persons," Sawai said. "However, as we have emphasized, this issue will soon become urgent once brain organoid technology has been further developed. In preparation for that time, it is essential to examine the accompanying questions thoroughly and in advance; we have taken the first step in that direction."



© Urupong/Getty Images via Canva.com

About the study

Kataoka, M., Lee, T.-L., & Sawai, T. (2023). The legal personhood of human brain organoids. In *Journal of Law and the Biosciences* (Vol. 10, Issue 1). Oxford University Press (OUP). <https://doi.org/10.1093/jlb/lsad007>

Air pollution worsens movement disorder after stroke

3 GOOD HEALTH AND WELL-BEING



11 SUSTAINABLE CITIES AND COMMUNITIES



Polycyclic aromatic hydrocarbons, in particular, lower the prognosis of ischemic strokes by causing inflammation in the brain.

Air pollution has been shown to have a negative effect on the prognosis of ischemic stroke, or stroke caused by reduced blood flow to the brain, but the exact mechanism is unknown. A team of researchers recently conducted a study to determine whether or not increased inflammation of the brain, also known as neuroinflammation, is the main culprit. The team published their findings in *Particle and Fibre Toxicology*.

Mice exposed intranasally to urban aerosols from Beijing, China, for one week demonstrated increased neuroinflammation and worsening movement disorder after ischemic stroke, compared to control mice that were not exposed to air pollution. Additionally, this effect was not observed in urban-aerosol treated mice lacking a receptor for chemicals released by the burning of fossil fuels, wood, garbage and tobacco, called polycyclic aromatic hydrocarbons (PAH). This suggests that PAHs are involved in both neuroinflammation and increased movement disorder associated with air pollution exposure in ischemic stroke.

“We designed this study to determine the effects of air pollution on disorders in the central nervous system,” said Yasuhiro Ishihara, senior author of the study and professor at Hiroshima University’s Graduate School of Integrated Sciences for Life. “Our narrower focus was to determine whether or not the prognosis of ischemic stroke was affected by air pollution,” said Ishihara.

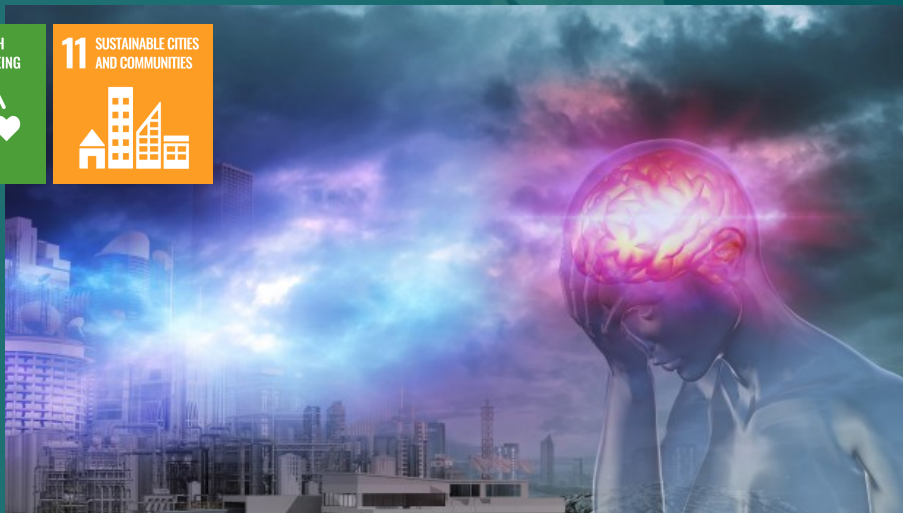
The group went one step further by identifying specific components of air pollution that may directly contribute to lower prognoses in ischemic stroke.

They found evidence that intranasal exposure to air pollution from Beijing, China, increased neuroinflammation after ischemic stroke in mice through activation of microglial cells, which are immune cells found in the brain. Movement disorder was also negatively impacted in ischemic stroke mice exposed to the same air pollution. A second set of experiments replacing Beijing air pollution with PM2.5 (tiny, aerosolized particles of air pollution that are 2.5 micrometers in width or less) from Yokohama, Japan demonstrated similar results, suggesting the PM2.5 fraction of urban air pollution contains the chemical responsible for increased neuroinflammation and decreased ischemic stroke prognosis.

In order to identify chemicals in air pollution responsible for decreased ischemic stroke prognosis, the research team used a mouse that lacked the aryl hydrocarbon receptor, a receptor that is activated by the presence of PAHs, to determine whether or not exposure to the Beijing air pollution would have the similar effect on mice without working aryl hydrocarbon receptors. Mice lacking the aryl hydrocarbon receptor demonstrated lower microglial cell activation and movement disorder compared to normal mice, suggesting that the PAHs present in Beijing air pollution are responsible for at least some of the neuroinflammation and lower prognosis seen in ischemic stroke mice exposed to air pollution.

Ultimately, the goal of the research team is to better understand the mechanism by which PM2.5 causes neuroinflammation, since air pollution is inhaled first into the respiratory tract.

HU scientists uncovered the relationship between stroke and air pollution
© Yasuhiro Ishihara, Hiroshima University



YASUHIRO ISHIHARA

Professor
Graduate School of
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About the study

Tanaka, M., Okuda, T., Itoh, K., Ishihara, N., Ogu-ro, A., Fujii-Kuriyama, Y., Nabetani, Y., Yamamoto, M., Vogel, C. F. A., & Ishihara, Y. (2023). Polycyclic aromatic hydrocarbons in urban particle matter exacerbate movement disorder after ischemic stroke via potentiation of neuroinflammation. In *Particle and Fibre Toxicology* (Vol. 20, Issue 1). Springer Science and Business Media LLC. <https://doi.org/10.1186/s12989-023-00517-x>



Preventing truck crashes needs to take 'dashcam' approach to driver 'microsleeps'

Truck drivers unintentionally taking 'microsleeps' of a few seconds can cause terrible traffic accidents, but efforts and technologies aiming to prevent the problem have focused mainly on monitoring driver eye activity while missing a host of other key indicators of the problem.

Researchers using dashcam footage of real-world collisions involving large trucks to analyze driver and vehicle behavior has found that anti-drowsiness alarms or similar technologies to prevent falling asleep at the wheel need to go beyond a focus on monitoring the drivers' eyes and consider other microsleep behaviors including a relaxation of back and neck muscles and abnormal activity of the vehicle itself. Their findings were published in *Accident Analysis and Prevention*.

A microsleep is a brief episode of sleep that lasts for just a few seconds and can occur involuntarily even during desperate efforts to wake up. It can lead to impaired cognitive and motor performance, including slower reaction times, decreased attention, and even complete loss of consciousness. Microsleep episodes can have a significant impact on driving performance and increase the likelihood of dozing off while driving.

A great deal of research into typical microsleep behaviors has investigated one or more aspects of the problem such as eye closure or changes in pupil diameter. No study has yet performed an analysis that takes a more holistic approach, combining the driver's eye and mouth movements as well as their entire body and vehicle driving behavior. Most such studies have also only considered driver performance during computer simulations. No research has yet looked at actual collisions of large trucks.

"But in recent years, there has been an explosion in the use of dashcam video recorders," said Hajime Kumagai, lead author of the paper and a specialist in sleep medicine with the Graduate School of Biomedical and Health Sciences at Hiroshima University.

"This means that a great many traffic accidents, and their possible relationship to episodes of microsleeping have been recorded. This inspired us to employ dashcam footage to investigate microsleep-related behaviors immediately prior to real-world truck collisions."

In total, the researchers reviewed 3,120 seconds of video footage from interior and exterior dashcams across 52 cases from truck collisions in Japan. They analyzed the footage from one minute before the crash right up until the crash. In each incident, the person at the wheel had been a professional driver, and all crashes occurred on either urban roads or highways.

The footage was visually analyzed in a second-by-second manner to simultaneously evaluate any eye changes and microsleep-related activity including the driver's actions to try to prevent falling asleep (anti-sleepiness behaviors), behavioral signs of microsleep, and abnormal vehicle behavior.

The researchers concluded that the key signs of microsleep include behaviors suggesting a creeping sleepiness, such as the absence of body movement, relaxation of antigravity muscles (the muscles such as back and neck muscles, as well as calves and quadriceps used to support ourselves against the force of gravity), eyes being half-closed, and closure of the eyes for one second or more.

"Up to now, technologies used to attempt to detect and counter falling asleep at the wheel have focused mainly on monitoring the driver's eyes," said Toshiaki Shiomi, a co-author of the study. "What we found means that it is crucial to monitor not just the eyes but also the driver's whole body, as well as vehicle behavior in order to reliably detect microsleep-related activity."

This should also help in avoiding false alarms by ensuring a clear distinction between microsleep-related and non-microsleep-related behaviors.



HAJIME KUMAGAI
Contributing Associate Professor
Graduate School of
Biomedical and Health Sciences



© Markus Spiske via [Pexels](https://www.pexels.com/)

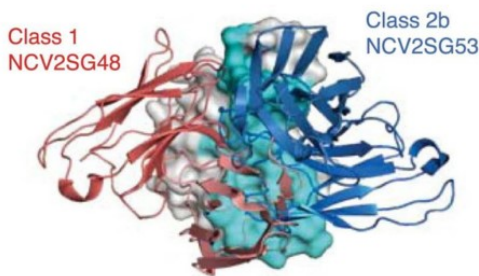
About the study

Kumagai, H., Kawaguchi, K., Sawatari, H., Kiyohara, Y., Hayashi, M., & Shiomi, T. (2023). Dashcam video footage-based analysis of microsleep-related behaviors in truck collisions attributed to falling asleep at the wheel. In *Accident Analysis & Prevention* (Vol. 187, p. 107070). Elsevier BV. <https://doi.org/10.1016/j.aap.2023.107070>

Study on rare antibodies hints at strategy tweaks that may future-proof COVID-19 vaccines

What scientists learned about the rare antibodies targeting SARS-CoV-2's Achilles' heel could help fine-tune our COVID-19 vaccine strategy for longer-lasting immunity.

New research examining how frequently our bodies produce broadly neutralizing antibodies (bnAbs) capable of thwarting a range of SARS-CoV-2 variants offers clues on the strategy tweaks that could potentially future-proof COVID-19 vaccines. The study was published in *Communications Biology*.



© Tomoharu Yasuda et al.

To counter invading viruses, our body deploys specific antibodies, among them the neutralizing kind targeting the receptor-binding domain (RBD) — the “Velcro hooks” used by pathogens to fasten onto our cells. As SARS-CoV-2 accumulates genetic mutations, new variants emerge donning sneaky disguises to outsmart our defenses. So-called bnAbs are elite neutralizing antibodies that can keep up with the virus’ evolving tricks. Unfortunately, conventional COVID-19 vaccines have struggled to elicit them.

“Conventional COVID-19 vaccines are known to be less effective against emerging SARS-CoV-2 variants due to the difficulty in producing bnAbs,” said study corresponding author Tomoharu Yasuda, professor at Hiroshima University’s (HU) Graduate School of Biomedical and Health Sciences.

“In order to develop a vaccine with sustained efficacy, it is important to clarify the mechanisms of how bnAbs are generated after virus infection.”

Observing blood sera at 8-55 days from 18 unvaccinated patients on their first bouts of COVID-19, the researchers found that samples collected on the 55th day exhibited the highest frequency of bnAbs compared to those taken at other time points.

Analyzing the samples, the researchers identified four therapeutic monoclonal antibody (mAb) candidates — NCV1SG17, NCV1SG23, NCV2SG48, and NCV2SG53 — which neutralized the authentic SARS-CoV-2 strain caught by the patients. The four mAbs also took out the original SARS-CoV-2 virus strain (Wuhan-Hu-1), Alpha, Delta, and variants with point mutations only at K417, L452, or E484 known to decrease sensitivity to antibody neutralization. All, however, failed to neutralize Omicron BA.1 except for NCV2SG48 which showed equivalent potency against the variant as Sotrovimab, among the few mAbs treatments that work against this Omicron sublineage.

Upon closer look at what makes it so potent, they found that prolonged exposure for nearly two months to SARS-CoV-2 triggered the patients’ germinal centers (GC) to introduce a high rate of changes called somatic hypermutations (SHMs), equipping NCV2SG48 with an extensive binding interface.

“We found that bnAbs are created by amino acid substitutions, called somatic hypermutation, in the antigen recognition site of antibodies. It produced additional binding sites and markedly extended the binding interface between the antibody and the viral receptor, which contributed to the neutralization of broad variants,” Yasuda explained.

He believes their findings could help refine our vaccination strategy to mimic sustained exposure of about two months.

“We do not need to develop a completely new vaccine to induce bnAbs,” he said. “A single vaccine shot generally maintains 2-3 weeks of germinal center reaction. So by getting a general vaccine three times, the duration of GC reaction could be around two months in total.”

By switching antigens from different SARS-CoV-2 variants one after the other during GC reaction, Yasuda said vaccines could induce a response similar to what occurs during chronic infection, where viruses continuously mutate as they replicate, but sans the obvious symptoms.



The researchers have now started discussions on developing an mRNA vaccine that is capable of inducing bnAbs based on their findings.



TOMO HARU YASUDA
Professor
Graduate School of
Biomedical and Health Sciences

About the study

Shitaoka, K., Higashiura, A., Kawano, Y., Yamamoto, A., Mizoguchi, Y., Hashiguchi, T., Nishimichi, N., Huang, S., Ito, A., Ohki, S., Kanda, M., Taniguchi, T., Yoshizato, R., Azuma, H., Kitajima, Y., Yokosaki, Y., Okada, S., Sakaguchi, T., & Yasuda, T. (2023). Structural basis of spike RBM-specific human antibodies counteracting broad SARS-CoV-2 variants. In *Communications Biology* (Vol. 6, Issue 1). Springer Science and Business Media LLC. <https://doi.org/10.1038/s42003-023-04782-6>



Team develops smartphone app to enhance midwifery care in Tanzania

App leads to better birth preparation for pregnant women

Scientists developed a smartphone app for midwifery education to provide quality care for mothers and babies in Tanzania

© Dorkasi Mwakawanga, Muhimbili University of Health and Allied Sciences



This study highlights the potential of leveraging technology to enhance midwife education, ultimately contributing to maternal health and addressing high maternal and child mortality rates.

YOKO SHIMPUKU

Professor
Graduate School of Biomedical
and Health Sciences



About the study

Shimpuku, Y., Mwilike, B., Mwakawanga, D., Ito, K., Hirose, N., & Kubota, K. (2023). Development and pilot test of a smartphone app for midwifery care in Tanzania: A comparative cross-sectional study. In M. L. Munro-Kramer (Ed.), PLOS ONE (Vol. 18, Issue 3, p. e0283808). Public Library of Science (PLOS). <https://doi.org/10.1371/journal.pone.0283808>

An international research team from Tanzania and Japan created a smartphone app and conducted a pilot study of how the app might be used to improve midwives' knowledge and skills in Tanzania. Their study, published in PLOS ONE, focused on the app's potential effects on the learning outcomes of midwives and birth preparedness of pregnant women in Tanzania.

"The smartphone app for midwives showed significant improvements in their learning outcomes, leading to better birth preparations for pregnant women in Tanzania. This study highlights the potential of leveraging technology to enhance midwife education, ultimately contributing to maternal health and addressing high maternal and child mortality rates," said Yoko Shimpuku, a professor in the Graduate School of Biomedical and Health Sciences, Hiroshima University.

Pregnant women in sub-Saharan Africa have low access to healthcare. In Tanzania, only 51% of pregnant women have four or more antenatal care visits, while the World Health Organization (WHO) recommends at least eight visits during pregnancy. Because of Tanzania's high maternal mortality ratio, it is crucial to increase women's access to healthcare and improve the quality of antenatal care.

The team used a mixed-methods study to provide an educational app for midwives in the intervention group. They obtained data about the continuous use of the app and measured midwives' learning outcomes. Their next step was to conduct focus group discussions on the usability of the app and surveys among pregnant women about birth preparedness in the intervention and control groups to evaluate if the midwives had provided them with proper information. The control group of pregnant women received regular antenatal care and answered the same survey.

The study included 23 midwives who took part in the testing and provided learning outcome data. Their results showed that 87.5% of the midwives continued to study with the app two months post-intervention. There were 207 pregnant women included in the study. The intervention group of pregnant women had significantly higher knowledge scores and home-based value scores than did the women in the control group, where the app was not used. This home-based value score indicates that the higher the score, the more women tended to prefer giving birth at a health facility instead of at home.

From conducting earlier studies, the research team knew that there is extensive smartphone use in Tanzania, especially among the younger population. The app provided updated information on WHO guidelines and practical suggestions for midwives to use for health education at antenatal care visits. They conducted the study in two health facilities in Dar es Salaam from October 2019 to March 2021.

The midwives using the app received training on how to use it and were also reimbursed for the cost of the mobile data. The app used an online education platform called Gocus and included WHO recommendations on antenatal and intrapartum care for pregnant women. The team also created content with locally adapted illustrations explaining why preventive behaviors or early treatment were important and showing midwives how to demonstrate these concepts in their antenatal care. The videos on the app were narrated in Kiswahili, a language most local women understood better than English.

Looking ahead, the team's next step is to refine and expand the app for larger-scale implementation, focused on reducing maternal and child mortality rates in developing countries, starting with Tanzania.

Feature GET TO KNOW OUR RESEARCHERS

**Meet some of our researchers
working on cutting-edge
science in their fields.**

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

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

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

About Research.com

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

Check out the
rankings [here](#).



Hitoshi Okamura

Professor

*Graduate School of Biomedical
and Health Sciences*

Psychiatrist Hitoshi Okamura's research focuses on establishing a rehabilitation approach that emphasizes psychological and social well-being. He aims to improve the quality of life of people with cancer, older adults, and those with mental disorders.

**Q: Can you please describe your
field of research?**

A: On the psychosocial well-being of cancer patients, currently, I am working on the identification of psychosocial aspects related to risk-reducing salpingo-oophorectomy for hereditary breast and ovarian cancer. I am also working on the development of new rehabilitation methods aimed at reducing the progression of dementia or preventing dementia.

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



A: The psychosocial well-being rehabilitation approach for cancer and dementia, which are predicted to continue to increase in number, can contribute to improving the quality of life of patients.

**Q: How important for you is pursuing
science that aligns with SDGs?**

A: I believe that Goal 3 of the SDGs, "Ensure healthy lives and promote the well-being of all people of all ages," is exactly in line with what our research aims to achieve.

I expect that addressing cancer and dementia, which can affect anyone, will lead to the formation of a society that



Prof. Hitoshi Okamura

Best Scientists - **Psychology**

To learn more about Professor Okamura's research, visit his profile [here](#).



can live in harmony with both diseases, thereby increasing the number of people who can play an active role in society and creating an economic ripple effect.

Q: What achievement are you most proud of?

A: We have shown that the system for improving cognitive dysfunction we developed — which combines exercise and cognitive training — can be used effectively as a simple means to improve attention and cognitive dysfunctions, and reduce the burden of caregiving on caregivers, not only in older adults with dementia but also with mild cognitive impairment.

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

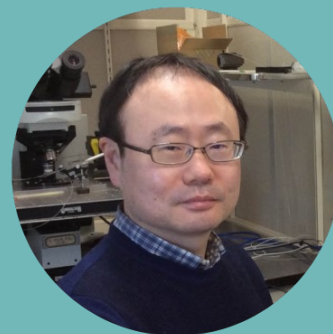
A: In a joint research project with Mazda Motor Corporation, a new system for improving cognitive dysfunction has been created. It can help maintain and improve the convertible attention function, which plays a role in the performance of multiple operations simultaneously, and the frontal lobe function, responsible for coordinating these multiple operations. These are part of the functions required for driving a car, and research is underway to examine the effectiveness of this system.

Kouichi Hashimoto

Professor

Graduate School of Biomedical and Health Sciences

Neuroscientist Kouichi Hashimoto explores how the mammalian brain converts electrical signals into a cellular response, the way information is encoded, transmitted, and interpreted within neural circuits, and the developmental processes that shape the neuronal architecture underlying various cognitive functions in adulthood.



Prof. Kouichi Hashimoto

Best Scientists - **Neuroscience**

To learn more about Professor Hashimoto's research, visit his profile [here](#).



natal synapse refinement. Our analysis may contribute to drug development and the establishment of treatments.

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

A: We previously analyzed the spontaneous mutant mice named “stargazer,” which have a mutation in a gene presumed to be a gamma subunit of voltage-dependent Ca^{2+} channels. We unexpectedly found that stargazer mice showed impaired trafficking of AMPA-type glutamate receptors to synapses (Hashimoto, 1999). This analysis contributed to the discovery of a new gene family, transmembrane AMPAR regulatory proteins (TARPs).

Q: What achievement are you most proud of?

A: Previous analyses had mainly focused on the developmental decrease in the number of CF synapses (CF elimination). We focused on the functional aspects, and carefully analyzed developmental changes in synaptic functions using various electrophysiological techniques. As a result, we found that CF refinement is achieved through several developmental processes in addition to CF elimination, such as the selective strengthening of a single CF and CF translocation to the dendritic regions.

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

A: The immature brain has redundant network connections compared to the adult brain. Among these connections, functionally important ones are strengthened and less important ones are eliminated during postnatal development. We have found developmental processes and molecular mechanisms for such refinement processes using the postnatal development of the climbing fiber (CF) to Purkinje cell (PC) synapses as a model system.

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

A: When I was a graduate student at Jichi Medical School, we disclosed some important molecules involved in CF synapse refinement. In these studies, we collaborated with excellent researchers with different research backgrounds, such as morphology and molecular biology. Knowledge, experiences, and personal connections obtained from these collaborations are the basis of my research.

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



A: Some mental disorders are believed to be caused by impairment of the post-

WOMEN IN

Meet our researchers

ACADEMIA

Blurring the line between planetary and human health spans

What does healthy aging look like? For answers, Hiroshima University environmental health expert Dr. Saori Kashima taps into a new science dedicated to Earth's longevity.

Days before the G7 Hiroshima Summit in May, scholars delivered a call to act on the planet's health to the Hiroshima Peace Memorial Park, a monument to atomic weapons' apocalyptic threat that shook Albert Einstein to utter in 1946 his oft-quoted plea for humanity's survival:

"... a new type of thinking is essential if mankind is to survive and move toward higher levels."

Seventy-seven years since, as human activity ushered a breach in seven of the eight boundaries ensuring Earth's safety, scholars are making a similar appeal.

"We are now facing a 'Great Transition' in tackling various global issues, such as climate change, biodiversity loss, environmental pollution, and conflicts. Educational and academic institutes are required to take on the challenge of new scientific approaches that go beyond existing ordinary thinking," they said in the Hiroshima Planetary Health Declaration 2023.

Nine years ago, the new science of planetary health was birthed to do just that — take on the old "othering" view of nature and start seeing our interconnectedness from a new lens of trans-disciplinarity. This field unites researchers and practitioners across disciplines into becoming front-liners working to nurse the planet back to health, and in turn, improve ours.

And on the front lines of this growing field in Japan is Dr. Saori Kashima, an environmental health expert and director of the Center for the Planetary Health and Innovation Science (PHIS) at Hiroshima University's IDEC Institute.



Dr. Saori Kashima,
Hiroshima University

Life span and health span gap

Data shows that the number of countries where a fifth of the population is over 70 years old continues to grow. And Japan's "super-aging" society ranks as the oldest in the world with one in three people being elderly.

Although our average life span has extended by nearly three decades, rising to 73 years of age in 2020 compared to 47 in 1950, our health span, which refers to the number of years we can expect to live in reasonably good health, has lagged.

Environmental pollution and climate change-fueled extreme weather are known to unequally disadvantage the vulnerable population, which includes those in old age. And this is a problem Kashima understands well.

Last year, she co-authored a study on the impacts of the 2018 Japan flood, the country's second-largest water-related disaster. Their findings showed how calamities are a potential risk factor for dementia in the elderly. In another study, she and her co-researchers found that natural disasters increase the likelihood of nursing home admissions and urged policymakers to prepare for this emerging risk factor.

Looking forward to healthy aging

Now, Kashima is taking on the task of discovering what healthy aging looks like and driving the national and local actions needed to achieve it. Her new undertaking aligns with the United Nations Decade of Healthy Ageing, a global collaboration lasting until 2030 that aims to better the lives of older people, their families, and their communities. And she is turning to planetary health science for guidance.

She and her PHIS colleagues from the fields of science, engineering, and agriculture, among others, are working with community and government partners in developing the Planetary Healthy Aging Index (PHAI). It will serve as a community-oriented index to measure, monitor, and evaluate progress in attaining healthy aging for us and the planet.

Kashima hopes for countries to adopt an index like PHAI that incorporates the planet's health into its agenda.

"Even if we develop local policies and actions considering human health, without the health of the planet, it is hopeless to achieve 'healthy aging' in the future," she said. "People need a fundamental shift, a 'Great Transition,' in how we live on Earth."



Dr. Kashima with her students

Undergraduate students

10,603

students

Postgraduate students

4,463

students

Staff members

3,568

members

1 for every

4.2

students

Doctorates conferred in AY 2021

371

students

THE University Impact Rankings 2022

Third in Japan for the overall score

Top 5 in Japan for 11 SDG categories

3rd
in Japan

Undergraduate graduates

Cumulative

146,622

students

Annual visitors
to the libraries

Approx. 0.59 million visitors

2,105
visitors per
open day

Volumes in collections at the libraries

Approx. 3.44 million volumes

Approx.
228
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 the 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

Graduate School of Innovation and Practice for Smart Society

ADVANCED COURSE

Special Course of Special Support Education

INTERDISCIPLINARY GRADUATE EDUCATIONAL PROGRAM

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

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

TAOYAKA PROGRAM for creating a flexible, enduring, peaceful society

The Frontier Development Program for Genome Editing



CAMPUS LOCATION & ACCESS



- 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



NEW SPACES ON CAMPUS



**18
MAR
2023**

HU Monument

A new monument installed with the aim to foster a sense of community and pride among HU students, faculty, staff and the wider public.



**18
MAR
2023**

New bus terminal in the Higashi-Hiroshima Campus

The Shitami-Kagamiyama District Bus Terminal located at the central entrance of the Higashi-Hiroshima Campus aims to improve transportation and strengthen community ties.



Stone monument inscribed with Hiroshima University

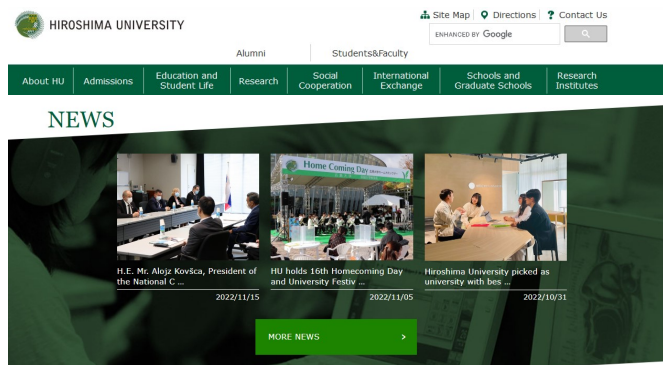
HU Professor Takahiro Tanaka from the Grad. School of Advanced Science and Engineering and a graduate student in the Architecture Program (at the time) provided the design and assistance in the construction.

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 STUDENT VLOGS

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



<https://youtu.be/TRxoBTcmTWo>



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>



Finding researchers at HU is now easier than ever!

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

Check out the site here ↓

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



Topic

SDGs

Discipline

Alphabetical order

SOCIAL MEDIA ACCOUNTS



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



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HU LinkedIn
[HiroshimaUniv.en](https://www.linkedin.com/company/HiroshimaUniv.en)

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APR
2023

SENDA LAB

A new space in the Higashi-Senda Campus that serves as a hub for regional cooperation, disaster prevention and mitigation, and a center for recurrent education and lifelong learning.

HIROSHIMA UNIVERSITY UPDATE



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Hiroshima University 75+75th Anniversary Project



Introducing new
catchphrase and logo

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

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

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

Catchphrase

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



HIROSHIMA UNIVERSITY

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

Hiroshima University
Public Relations Office
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