HIROSHIMA UNIVERSITY

# HIROSHIMA UNIVERSITY UPDATE

**JANUARY 2019**

## RECENT TOPICS

# *Sharing the Importance of "Peace" With new Generations*

## *Hiroshima University Peace Lecture Marathon*

In October 2018, Hiroshima University launched a new lecture series called ***"Peace Lecture Marathon."***

This lecture series invites government representatives and ambassadors in Tokyo to give a lecture on peace. With these lectures as momentum, we hope that new generations, who are currently enjoying prosperity in the City of Hiroshima, which has been reborn from the atomic destruction of World War II as a world-class city with natural scenery, learn a lot about the importance of peace and our history of hardship.

(Related articles: Page 4-5)

UNIVERSITY OF WORLD-WIDE REPUTE AND SPLENDOR

FOR YEARS INTO THE FUTURE

# HIROSHIMA UNIVERSITY UPDATE (January 2019 issue)

## CONTENTS

# PEACE LECTURE MARATHON SERIES

## *1st Peace Lecture Marathon*

## *H.E.Dr. Khaled Atef Abdel Ghaffar*

***Minister of Higher Education and Scientific Research in Egypt***

***October 10th, 2018***

On 10th October, the first lecture was held at the Higashi-Hiroshima campus, inviting H.E.Dr. Khaled Atef Abdel Ghaffar, Minister of Higher Education and Scientific Research in Egypt.

H.E.Dr. Khaled Atef Abdel Ghaffar gave a lecture entitled “Egypt science and education connect to Hiroshima and deliver peace message to the world”, and emphasized the importance of education as a mean to spread “Peace”, referring to the United Nations (UN) Sustainable Development Goals 2030 (SDGs).

The venue was filled with faculty, administrative members, and international students of Hiroshima University that avidly listened to the lecture.

## *2nd Peace Lecture Marathon*

## *H.E.Mr. Saulius Skvernelis*

***Prime Minister of Lithuania***

***October 11th, 2018***

On the following day, the second speaker, Lithuanian Prime Minister Saulius Skverneli was invited to give a lecture for the Marathon at the Higashi-Senda campus.

In his lecture entitled “Lithuania - on the Road of Peace and Modern State,” Prime Minister Skvernelis talked about how the Lithuanian people have fought for freedom and independence while going through hard times of many wars and occupation.

He also proudly presented that the country today makes great progress in laser manufacturing and the field of Life Sciences.

The venue saw an attendance of about 150 people including the faculty, administrative members and students of Hiroshima University who were engrossed with his lecture.

## 3rd Peace Lecture Marathon

# H.E. Dr. Hasan Murat Mercan

***Ambassador of the Republic of Turkey***

***December 1st, 2019***


On December 1st, “The 3rd Peace Lecture Marathon” was held at the Hiroshima University Higashi-Senda campus. H.E. Dr. Hasan Murat Mercan, the Ambassador of the Republic of Turkey, gave a lecture about the current status and issues of the globalized world.

In the Hiroshima University Honorary Doctorate Awarding Ceremony held just after the lecture, President Ochi awarded H.E. Dr. Mercan with the certificate and the medal of “Hiroshima University Honorary Doctorate.”

## 4th Peace Lecture Marathon

# Ms. Patricia Flor

***Ambassador of the European Union (EU)***

***January 28th, 2019***

On 28th January 2019, H.E. Dr. Patricia Flor, Ambassador Extraordinary and Plenipotentiary of the European Union to Japan, gave a lecture entitled “The EU as a peace project” at the Higashi-Hiroshima campus. Her lecture explored the history of the EU until 2012 when the EU won the Nobel Peace Prize, and the EU's peace projects.


The lecture was followed by a group discussion with Dr. Flor and HU students from School of Law and Graduate School of Social Sciences. The students asked many questions to Dr. Flor about the relationships between EU and NGO, the current migration situation in the EU, and many more.

## MEDIA

### President Ochi was interviewed by a Mexican TV station and talked about international academic communication strategies of HU

A program of the Mexican TV channel "TV Azteca" interviewed Hiroshima University President Mitsuo Ochi. The program was broadcast in Mexico in early December 2018.

The program entitled “Lazos entre Hiroshima y Guanajuato | adn 40” presents the academic, industrial and administrative exchanges performed between Hiroshima and Guanajuato since 2014.

Visit the following webpage to watch the program.
(YouTube) https://youtu.be/4gGo3Oeylgg


Photo source: https://youtu.be/4gGo3Oeylgg

# HU has ranked high in university rankings in Japan

## ■ UNIVERSITY RANKING BY VOKERS

### Hiroshima University has been ranked:


**2nd place for "university with high proportion of graduates who feel they are treated well in their workplaces"**


**3rd place for "university whose graduates feel that they have secured good places to work at"**

**Well treated in their Workplaces**

| | Name of University. | Total average score for comprehensive evaluation |
|---|---|---|
| 1 | Tokyo Institute of Technology | 3.2090 |
| 2 | Hiroshima University | 3.1765 |
| 3 | Kyoto University | 3.1653 |
| 4 | Gakushuin University | 3.1512 |
| 5 | Tohoku University | 3.1418 |
| 6 | Kobe University | 3.1307 |
| 7 | The University of Tokyo | 3.1129 |
| 8 | Doshisha University | 3.0848 |
| 9 | Yokohama National University | 3.0842 |
| 10 | Hokkaido University | 3.0431 |

**Secured Good Places to Work at**

| | Name of University | Total average score for comprehensive evaluation |
|---|---|---|
| 1 | Hokkaido University | 3.1866 |
| 2 | The University of Tokyo | 3.1671 |
| 3 | Hiroshima University | 3.1665 |
| 4 | Hitotsubashi University | 3.1585 |
| 5 | Sophia University | 3.1562 |
| 6 | Tohoku University | 3.1476 |
| 7 | Doshisha University | 3.1356 |
| 8 | Kyoto University | 3.1228 |
| 9 | Kobe University | 3.1141 |
| 10 | Chuo University | 3.1079 |
| 11 | Keio University | 3.1042 |
| 12 | Tokyo Metropolitan University | 3.1034 |
| 13 | Tokyo University of Science | 3.0919 |

Announced on 23rd October 2018. (The data for the survey above were collected from each employee at different companies, and the results announced on the Job hunting platform called "Vorkers" managed by Vorkers inc. )

Source: "Vorkers"

https://www.vorkers.com/hatarakigai/vol_53

## ■ UNIVERSITY RANKING BY BP CONSULTING

### Hiroshima University has been ranked:


**Overall 1st place among 59 universities in Chugoku-Shikoku District for "Survey on University Brand Image 2018-19"**

**Power of Brand: Chugoku-Shikoku**

| 2018 | 2017 | Name of Univ. | Power of Brand (SD) |
|---|---|---|---|
| 1 | 1 | Hiroshima University | 91.1 |
| 2 | 2 | Okayama University | 79.0 |
| 3 | 10 | Matsuyama University | 62.5 |
| 4 | 4 | Tokushima University | 61.0 |
| 5 | 11 | Kochi University | 60.1 |
| 6 | 6 | Ehime University | 59.6 |
| 7 | 5 | Kagawa University | 59.1 |
| 8 | 7 | Notre Dame Seishin University | 58.4 |
| 9 | 12 | Tottori University | 57.9 |
| 9 | 8 | Okayama University of Science | 57.9 |

**Ranking per Item**

| Item | 1st | 2nd | 3rd |
|---|---|---|---|
| First class | Hiroshima University | Okayama University | Tokushima University |
| Creative mind | Hiroshima University | Okayama University of Science | Hiroshima Institute of Technology |
| Global | Hiroshima International University | Hiroshima University | International Pacific University |
| Contribution to the local communities | Hiroshima University | Ehime University | Kochi University |
| Elegant/ Faithfull | Notre Dame Seishin University | Hiroshima University | Hiroshima Jogakuin University |
| Vibrant | Matsuyama University | Hiroshima University of Economics | Hiroshima Shudo University |

This online survey was conducted to business persons residing in Chugoku and Shikoku District between July and August of 2018. The respondents were asked about their perceptions and views on the 59 key universities located in Chugoku and Shikoku District. In total, there were 2,956 valid responses.

According to "Survey on University Brand Image 2018-19," out of 49 items, HU came 1st place in 20 items including "Has a vision as educational institution"; "High degree of specialization & expertise"; "President/Faculty members being attractive."

Source: 28th Nov. 2018 Nihon-Keizai Shinbun. Local economy page, listed universities in Chugoku area

# Newly Started since April 2018

## The School of Informatics and Data Science and The Department of Integrated Global Studies

The School of Informatics and Data Science, HU's 12th School, and the Department of Integrated Global Studies at the School of Integrated Arts and Sciences, have newly started since April 2018.

As the first batch, there were 85 students enrolled at the School of Informatics and Data Science, and 44 students enrolled at the Department of Integrated Global Studies.

On May 16th 2018, the commemorative ceremony and party celebrating the establishment of the School of Informatics and Data Science and the Department of Integrated Global Studies, were held in Hiroshima city.

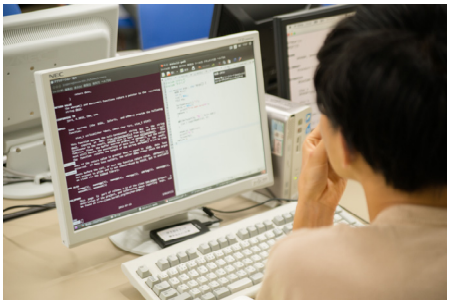
At the commemorative ceremony, President Mitsuo Ochi gave a speech about the establishment of the new School and Department; "We will continue to cultivate peace-pursuing cultured individuals with an international mindset and a challenging spirit and aim to become a university of world-wide repute and splendor for years into the future."

Prior to the ceremony, an invited lecturer, Dr. Yoshinori Ohsumi, a professor at the Institute of Innovative Research, Tokyo Institute of Technology, who was awarded the 2016 Nobel Prize in Physiology or Medicine, gave a lecture entitled

### SCHOOL OF INFORMATICS AND DATA SCIENCE

#### DEPARTMENT OF INFORMATICS AND DATA SCIENCE

**▼Curricula that significantly enhance knowledge and techniques on informatics**
**▼Lectures given by business people who play an active role at their companies and non-Japanese teachers**
**▼About 40% of the students in the inaugural class have a liberal arts background**



### SCHOOL OF INTEGRATED ARTS AND SCIENCES

#### DEPARTMENT OF INTEGRATED GLOBAL STUDIES (IGS)

**▼All lectures are basically given in English**
**▼Students study abroad for six months in their second year**
**▼A total of 15 students out of 44 in the inaugural class are foreign nationals**


Lecture given by Dr. Yoshinori Ohsumi, who was awarded the 2016 Nobel Prize in Physiology or Medicine

“Looking back my research activities spanning half a century.” About 360 people including some high school students were on the venue, who were all engrossed with his lecture from the beginning to the end.

While looking back his journey as a researcher, Professor Ohsumi gave hearty cheers to the young audience in the venue and said the following: “In the course of planning and conducting research you are in charge of, you will encounter some surprises and joys in the process. It is very important to have a mindset of trying to digest an assigned task with your own interpretations, and then to come up with a new research question.”

# “Peacebuilding In a changing world“

## A Lecture from UN Assistant Secretary-General for Strategic Coordination

On March 5th 2018, HU invited Mr. Fabrizio Hochschild, the United Nation’s Assistant Secretary-General for Strategic Coordination at the Executive Office of Secretary-General (EOSG), to give a lecture entitled “Peacebuilding in a Changing World.”

There were about 100 students and faculty/administrative members in the venue, who were all engrossed with his lecture from the beginning to the end. Lively exchanges of questions and answers between the students and Mr. Hochschild followed during the Q&A session after the lecture.

HU was established with the founding principle of “a single unified university, free and pursuing peace,” upholding "the pursuit of peace" as one of its Five Guiding Principles .

In this sense, inviting someone like Mr. Hochschild, who has been devoted to the peacebuilding activities at the United Nations, is very appropriate for HU.

To the students and the faculty/administrative members, Mr. Hochschild’s lecture was certainly thought-provoking.

# World Cup Soccer Game 2018:

## Local and International Students at HU watched the Game Together

On June 28th, about 30 students of HU's Graduate School of International Development and Cooperation (IDEC) gathered in the IDEC seminar room, and watched the World Cup soccer game of Japan VS Poland.

Among the participants, there were exchange students from Poland and from Senegal (the country Japan fought in the last game). They all gave a rousing cheer.

Mr. Urbanowicz Szymon Andrzej, exchange student from Poland, said, "Poland lost in the group league and can't go to the tournament, but in the last the team managed to show their pride. I hope Japan do their best in the final tournament."

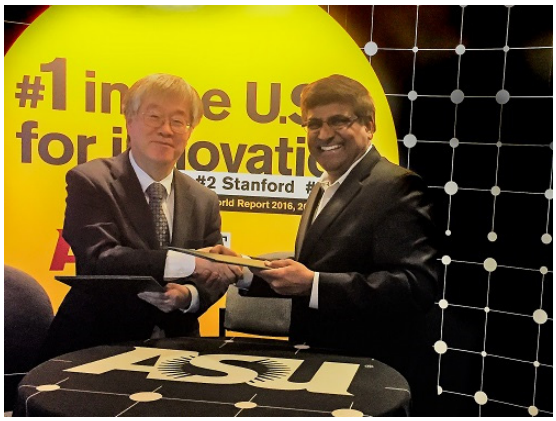
Mr. Kenzo Uemura who planned this event said, "Friends beyond the border joined the event so it was very exciting cheering. Poland and Senegal were both doing well. In the final tournament, I want to cheer for Japan with everybody."

# Memorandum of Understanding concluded with Arizona State University

On April 17th, 2018, Hiroshima University concluded the Memorandum of Understanding (MoU) with Arizona State University, USA with a view to promote academic and educational exchanges between the two institutions.

The MOU envisages expanding university partnerships and promote student and researcher exchanges between the two universities, which have been pursuing research collaborations in the issues including smart cities, aging and governance of new technologies.

Dr. Yohsuke Yamamoto, Executive Vice President for Research and Dr. Satoshi Watanabe, Vice President for University Strategy attended the signing ceremony with Dr. Sethuraman Panchanathan, Executive Vice President of Knowledge Enterprise Development of ASU and other parties concerned.




Executive Vice President Sethuraman Panchanathan (right) and Executive Vice President Yohsuke Yamamoto (left)

# New Partnership Agreement with Hiroshima City

On November 29th 2018, Hiroshima University concluded a new partnership agreement with Hiroshima City. Hiroshima University is now listed on Hiroshima City's website as one of the "Peace Research Institutes". http://www.city.hiroshima.lg.jp/english/

広島市 The City of Hiroshima

広島大学 HIROSHIMA UNIVERSITY

Image source: The City of Hiroshima

Mr. Kazumi Matsui, Mayor of Hiroshima (right) and President Ochi (left)

# Cultural Exchange Event

## By enjoying Hiroshima's Food Together

On June 25, 2018, Hiroshima University held a cultural exchange event. We scheduled the event to take place after the Ramadan fast ended in order that all of our international students, faculties, and staff members with various cultural and religious backgrounds could join the event to eat together. We had more than 300 participants who consisted of not only Muslim students and foreign researchers, but also Japanese students, non-Muslim international students, and staff of Hiroshima University.

In holding the event, Hiroshima University received support from Otafuku Sauce Co., Ltd. (a global company founded in Hiroshima and famous for its production of Okonomi Sauce), with which Hiroshima University has concluded a comprehensive collaboration agreement. The company kindly provided us with its original "Halal Okonomi Sauce," which received Halal certification (a certification given to food items which are lawful, permitted, or allowed for Muslims) from an official certifying agency.

Also, Yamadaya Co., Ltd., famed for its "Momiji-Manju" (small, maple-leaf-shaped sweets), kindly offered us its Halal certificated "Momiji-Manju" and "Shakushi-Senbei" (rice-spatula-shaped crackers), and Chugoku Sangyo Co., Ltd., the company managing Higashi Hiroshima Driving School, kindly offered us drinking water.

With the cooperation of the General Incorporated Foundation Okonomiyaki Academy, we prepared dedicated iron plates, on which Okonomiyaki was cooked, at the University Hall where the event took place. Participants fully enjoyed Okonomiyaki served by professional chefs, which was freshly baked and catering to vegetarians and Muslims.

Some participants left positive comments: "It's not easy to get halal food in Japan so I really appreciate this kind of event," "It's my first Okonomiyaki and it's very good! I knew that Okonomiyaki is one of Hiroshima's famous foods and I always wanted to try one," "I enjoyed interacting with the international students."

Students and staff members with a wide variety of dietary backgrounds were able to promote cross-cultural exchange and mutual understanding beyond cultural differences, while enjoying Hiroshima's food together.


# HIROSHIMA UNIVERSITY GOODS

## *Collaboration Goods with Hiroshima Toyo Carp*


*We designed a line of merchandise with Hiroshima Toyo Carp, our local professional baseball team. The team has won this year's League championship game(3 years in a row!)*

*The basic tone of the lineup is Green, the school color of HU. "Carp Boya(Carp Kid, the iconic figure of the team)" wearing an old fashioned HU school cap is placed on it.*

These items are available on Hiroshima University Higashi Hiroshima campus, Kasumi campus, and the Tokyo Office.

## PRODUCT OUTLINE

Tote Bags


Face Towels

Foodies

T-shirts(Green)
<Japanese phrase>


T-shirts(Green)
<English phrase>


T-shirts(Red)
<English phrase>

★Find latest information on our website!

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

| | | |
|---|---|---|
| Hoodies(Gray) | Size: M, L | 4,000 yen |
| T-shirts(Green) <Japanese phrase> | Size: M, L | 2,000 yen |
| T-shirts(Green) <English phrase> | Size: S, M, L | 2,000 yen |
| T-shirts(Red) <English phrase> | Size: S, M, L | 2,000 yen |
| Tote Bags | — | 1,500 yen |
| Face Towels | — | 1,500 yen |

Graduate School of Integrated Sciences

# Researchers Identify New Type of Depression

## Protein linked with depression shows promise as new drug target

Depression is a mental disorder that affects over 300 million people around the world. While treatments exist, many of them are based on one hypothesis of how depression arises. Patients that do not fit this mold may not be getting benefits. A study led by Hiroshima University (HU), which was published online this May in Neuroscience, shed light on how one protein called RGS8 plays a role in depression behaviors.

Scientists think depression occurs because of the monoamine hypothesis, so named for the type of two chemicals that depressed people lack: serotonin and norepinephrine (NE). Ninety percent of antidepressant drugs are made based on this idea. They aim to recalibrate these two monoamines. For some of these patients, however, it may not be enough.

Thirty percent of patients on typical antidepressants do not experience an effect, and researchers are getting closer to understanding why.

“Thirty percent of people on these drugs do not experience an effect,” Yumiko Saito and Yuki Kobayashi said. Both are neuroscientists in HU’s Graduate School of Integrated Arts and Sciences. “Obviously, we need a new drug! We need another explanation for what could cause depression.”

This study builds upon previous work in which her team found that RGS8 controls a hormone receptor called MCHR1. Parts of the brain involved with movement and mood regulation show signs of RGS8 expression. MCHR1, when active, helps regulate sleep, feeding, and mood responses. The researchers found that RGS8 inactivates MCHR1 in cultured cells.

Thus, the idea is that less RGS8 means increased depressed behavior. However, this effect had never been examined in a living being. Here Saito’s group studied depression in mice in two scopes: at the behavioral level, and at the immunohistological level.

First, the mice did a swim test, which is a common behavioral analysis method to assess depressive behaviors in animals. Researchers measure the time each mouse was active, then subtract it from the total test time, leaving researchers with an immobility time period.

Mice with more RGS8 in their nervous system recorded shorter immobility times than those with a normal amount of RGS8. When given an antidepressant drug that acts on monoamines, though, the RGS8 mice had even shorter immobility times. However, when the mice were given a drug that stops MCHR1 from working, immobility time did not change.

“These mice showed a new type of depression,” Saito remarked. “Monoamines appeared to not be involved in this depressive behavior. Instead, MCHR1 was.”

With that conclusion, the team looked at the mice’s brains under the microscope to determine the relationship between MCHR1 and RGS8. More specifically, they examined the size of cilia sprouting from cells in a region of the hippocampus called the CA1, where RGS8 concentration was highest. Cilia are TV antennae-like organelles involved in cellular communication.

The team found that RGS8 mice not only had less depressed behavior than those without extra RGS8, but they also had longer cilia. That is, mice that took the drug that stopped MCHR1 from working had longer cilia.

In the past ten years, scientists have been seeing that dysfunctional cilia are associated with disorders like obesity, kidney disease and retina disease. Not much is known about their relationship with mood disorders. These findings led Saito’s group to think that RGS8 is a promising candidate toward the development of new antidepressant drugs, which is a focus for future experiments.

*Original Paper*

Title: Depression-resistant Phenotype in Mice Overexpressing Regulator of G Protein Signaling 8 (RGS8)

Authors: Yuki Kobayashi, Risa Takemoto, Shogo Yamato, Tomoya Okada, Michihiko Iijima, Yoshikatsu Uematsu, Shigeyuki Chaki, Yumiko Saito.

Journal: Neuroscience 282, 160-169, 18 May 2018

https://doi.org/10.1016/j.neuroscience.2018.05.005

# Black Phosphorus

## A promising material for ultra-speed optical communications -

*Abstract*

Dr. Munisa Nurmamat and Prof. Akio Kimura of the Core Research Center for Emergent Condensed Matter Physics (Department of Physical Sciences, Graduate School of Science), Hiroshima University, in collaboration with the research groups of the Institute for Solid State Physics, the University of Tokyo and Graduate School of Material Science, University of Hyogo, made a great progress in understanding the electronic structure and the carrier dynamics of Black Phosphorus. They conducted the experiment utilizing the state-of-the-art time- and angle- resolved photoelectron spectroscopy combined with the near infrared laser pulses, which achieves the world best energy resolution. They discovered that the duration of the excited electrons in the conduction band of Black Phosphorus was substantially prolonged above 400 pico seconds. Their finding paves the way to the ultra-speed optical communications. It also tells us that Black Phosphorus is one of the best platforms to realize Bose-Einstein condensation of excitons (electron-hole pairs) in solids.

Two-dimensional materials have attracted a great deal of attention in terms of electrical and optical device applications. One of them, graphene, a carbon mono-atomic sheet is well known to possess 'massless electrons'. Due to its fascinating property, graphene has been extensively studied. 'Massless electrons' would be responsible for ballistic electrical transport, which is a key ingredient for developing quite low-consuming power devices in the future. However, a lack of band gap in Graphene is one of the most serious problems because on-and-off switching ratio becomes quite low that prevents it from practical applications.

Black phosphorus (BP, hereafter), one of the several allotropes of phosphorus discovered a century ago exhibits a band-gap as well as anisotropic thermal, electrical and optical properties with excellent mobility, thus overcoming several problems in Graphene. Therefore, BP has now a renewed interest due its marvelous prospects in device applications. Especially, it is highly expected to be applied not only for infrared laser source but for optical communications, where the wavelength fits quite nicely with the band-gap of BP.

In order to examine if the BP is truly suitable for optical device applications or not, the efficiency of the photo absorption needs to be scrutinized. If every photon can give its energy fully to an electron to excite from the valence band to the conduction band, the photo absorption efficiency could be 100%. However, the efficiency is usually materials -dependent. It is determined intrinsically by the quantum mechanical rules and sometimes by the extrinsic factors such as crystal quality and defects etc.. Researchers have tried to directly observe how efficiently the valence band electrons can be excited into the conduction band by optical pumping with the near infrared pulses.

Angle-resolved photoemission spectroscopy (ARPES) has emerged as the most powerful tool for mapping out the occupied part of band structures, by measuring the kinetic energy

of photoemitted electrons as a function of their momenta. However, the conduction band cannot be accessed by ARPES. Our ultimate goal to observe the excited electrons in the conduction band of BP can only be achieved by utilizing near infrared laser pulses. Time- and angle-resolved photoemission spectroscopy (TARPES), the conventional ARPES implemented by a pump-and-probe method, is a powerful tool to study the electron/hole bands and electron/hole dynamics with energy and momentum resolutions.

BP forms a folded honeycomb sheet running along the a-axis as shown in Fig. 1(a). One of the unique features distinguishing BP from other two-dimensional materials is its anisotropic transport properties. Figures 1(b) and 1(c) show TARPES images taken along the c- and a- axes recorded before (t = -1.33 pico second) and after (t = 1.06 pico second) pump.

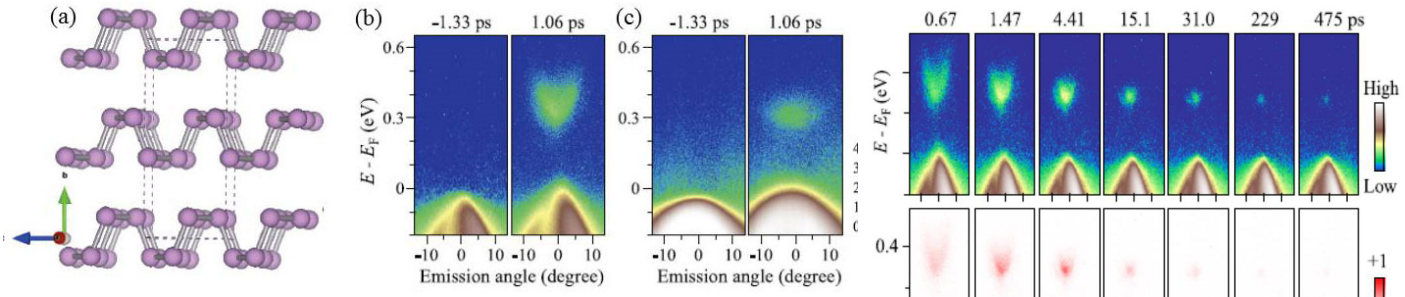



**Figure 1**: (a) Crystal structure of Black Phosphorus. TARPES images of BP with valence and conduction bands along c-axis (b) and a-axis (c) recorded with before and after pumping. The pump-probe delay times and axis are noted on the spectra.




**Figure 2**: TARPES spectra of BP along c-axis (Upper panels) recorded at a various pump probe delay times and its difference to the image before pumped (Lower panels).

Before pumping, there is no photoelectron intensity from the conduction band [see left panels of Figs. 1(b) and 1(c)] and only the valence band dispersion obtained here along c- and a- axes, again signifies its anisotropic nature as discussed above. The unoccupied states are filled after the pumping and form the upward parabolic band dispersion along c-axis with the energy minima at ~ 0.3 eV as shown in -panel of Fig. 1(b). In a sharp contrast, the energy-band dispersion along a-axis observed at the same delay time is much more flattened [see right-panel of Fig. 1(c)]. These obvious shape-different band dispersions along c- and a- axes signifies a giant anisotropy in the conduction band of BP. The effective masses along c- and a-axes are estimated as 0.047 and 1, respectively.

To unveil the dynamics of pump-generated carriers in the unoccupied state, researchers have investigated the transient ARPES spectra with the typical pump-and-probe delay times. The panels of Fig. 2 show TARPES images taken along the c-axis recorded after ($0 \le t \le 475$ pico second) pump. In the decaying process, the electrons in the unoccupied states lose its energy quickly in the range of t = 0 ~ 3 ps. In contrast, the electrons in the bottom of conduction band exhibit a long relaxation time more than 400 pico second. Note that it is much longer than that was observed for graphene up to ~ 1 pico second.

Researchers have clarified that the valence band electrons can be excited efficiently into the conduction band by the light pulses. Most importantly, they find a substantially prolonged duration for the excited electrons piled up at the bottom of the conduction band. This result certainly shows that the material can be transparent when the incident laser pulse is strong enough. This is so called “saturable absorption”, which is a key property for high-speed optical communication. Having considered that the size of the band gap can be enlarged up to an energy corresponding to visible light as the number of layers decreases down to monolayer, BP is highly expected to work in a wide wavelength range. This result also contains another important message from the fundamental point of view. An exciton, an electron-hole pair created by optical absorption single particle, has been predicted to show the Bose-Einstein condensation in case that the conduction bands are highly anisotropic like BP.

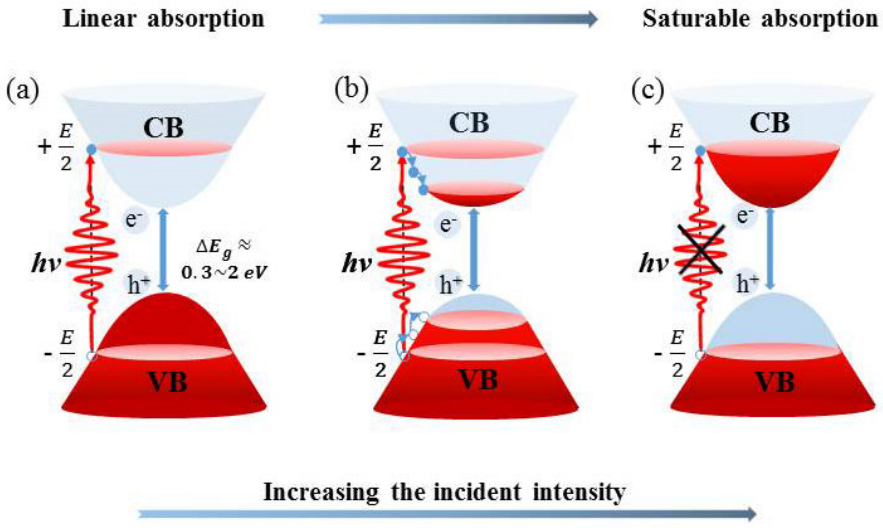



**Figure 3**: Photo absorption in BP. (a) Electrons in the valence band are excited into the conduction band by the photo-absorption when the light intensity is small. (b) After the absorption, the excited electrons decays into the lower states of the conduction band. (c) Saturable absorption, where the photo absorption cannot occur anymore and the material becomes transparent when the light intensity is strong enough.

# Advanced Functionalization of Hydrogen Storage Materials

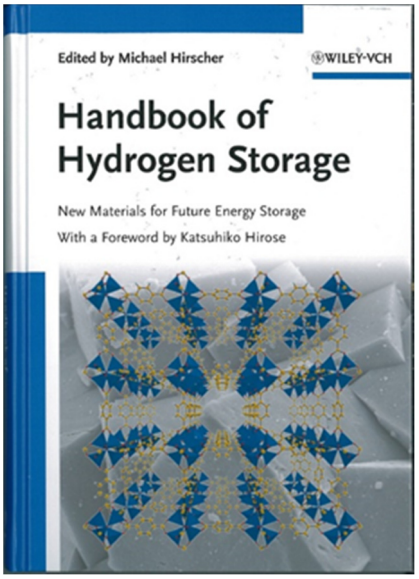
When compared with compressed hydrogen, hydrogen storage materials potentially contains significant amount of hydrogen in terms of the gravimetric and volumetric capacity. Developing new hydrogen storage materials with suitable properties is required for the future hydrogen energy society. As the candidate for hydrogen storage materials, there are many different kinds of systems. Here they report their attempts to come up with new hydrogen storage materials so far.

The amide-imide systems are well-known as the hydrogen storage systems, which show more than 6 wt% hydrogen capacity, and typically written as LiNH2 + LiH « Li2NH + H2. We in fact decided to focus on the reaction mechanism because this amide-imide system shows quite complicated “solid-solid reaction” with hydrogen desorption. Following such observation, we elucidated that the ammonia molecule has a quite important role for the progress of this reaction[1]. The detail of mechanism is explained in the handbook of hydrogen storage as shown in Fig. (a)[2]. Alternatively, the ammonia molecule itself is considered as hydrogen storage materials because it shows quite high hydrogen capacity of more than 17wt%. Although ammonia is quite stable in moderate conditions, our team succeeded in obtaining hydrogen gas from ammonia by means of the following two methods. One method is so called “ammonolysis” reaction[3] and the other “electrolysis” reaction[4]. These indicated that by starting from one simple reaction, we have been successful in expanding the reaction systems to more interesting reactions. Recently, we have been able to elucidate the mechanism of a complicated reaction of NaH and LiNH2 system [5], which has been known as “the mystery reaction” for a decade.

As another example, we also focused on magnesium hydride showing more than 6 wt% hydrogen capacity. Our team has a champion result of its hydrogen absorbing reaction by adding suitable catalysts[6, 7] as shown in Fig. (b). Magnesium hydride is quite interesting material as hydrogen storage, but we have instead focused on this material as anode for Li-ion battery. Quite recently, we have been able to reveal the excellent properties of magnesium hydride, which showed the capacity that is four times higher than that of the conventional graphite anode as shown in Fig. (c)[8].

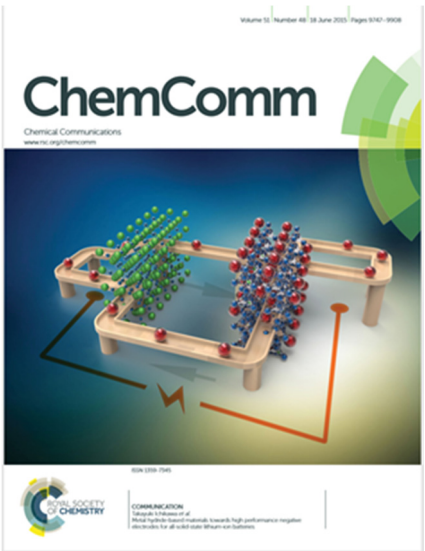
As mentioned above, we focused on the materials that have interesting hydrogen storage capacity, and then elucidated their basic reaction mechanisms. We have substantially expanded the functions of these materials, which are derived from the original systems, to totally different systems in some cases.

(a)




(b)


(c)




**Figures**: the front covers of (a) Handbook of Hydrogen Storage[2], (b) Journal of Materials Chemistry A[7], and (c) Chemical Communications[8], which researchers from our group has taken share of writing.

## References

[1] T. Ichikawa, et al, J. Phys. Chem. B, 108, 7887-7892, (2004) [2] T. Ichikawa, “Amides, imides, and mixtures”, Handbook of Hydrogen Storage (2010) WILEY-VCH, [3] H. Yamamoto, et al., Int. J. Hydrogen Energy, 34, 9760-9764, (2009), [4] N. Hanada, et al., Chem. Commn., 46, 7775-7777, (2010), [5] A. Jain, et al., J. Phys. Chemistry C, 120, 27903-27909, (2016), [6]N. Hanada, et al., J. Alloys Compd., 420, 46-49, (2006), [7] A. Jain, et al., J. Mat. Chem. A, 5,15543-15551, (2017), [8] L. Zeng, et al., Chem. Commun., 51, 9773-9776, (2015)



Graduate School of Biomedical&Health Sciences


# The Anatomical Pathway from the Mesodiencephalic Junction to the Inferior Olive Relays Perioral Sensory Signals to the Cerebellum in the Mouse

Perioral tactile signals are initially transmitted from mechanoreceptors on the skin to trigeminal nuclei, and then mainly sent to the somatosensory cortex. Sensory signals are also known to be transmitted to other subcortical areas, but details of these targets and pathways are largely unknown.

A research group in Department of Neurophysiology Graduate School of Biomedical & Health Sciences, Hiroshima University, recently found existence of an unidentified sensory pathway from perioral organs to the cerebellum using mice. Cerebellar Purkinje cells are known to be activated by perioral sensory stimulations. Neuronal activity of Purkinje cells evoked by perioral stimulations were effectively blocked by local suppression of neurons in the mesodiencephalic junction, which is referred to as the area parafascicularis prerubralis. This study would contribute to disclose roles of subcortical sensory signal processing in brain functions.


## Original Article

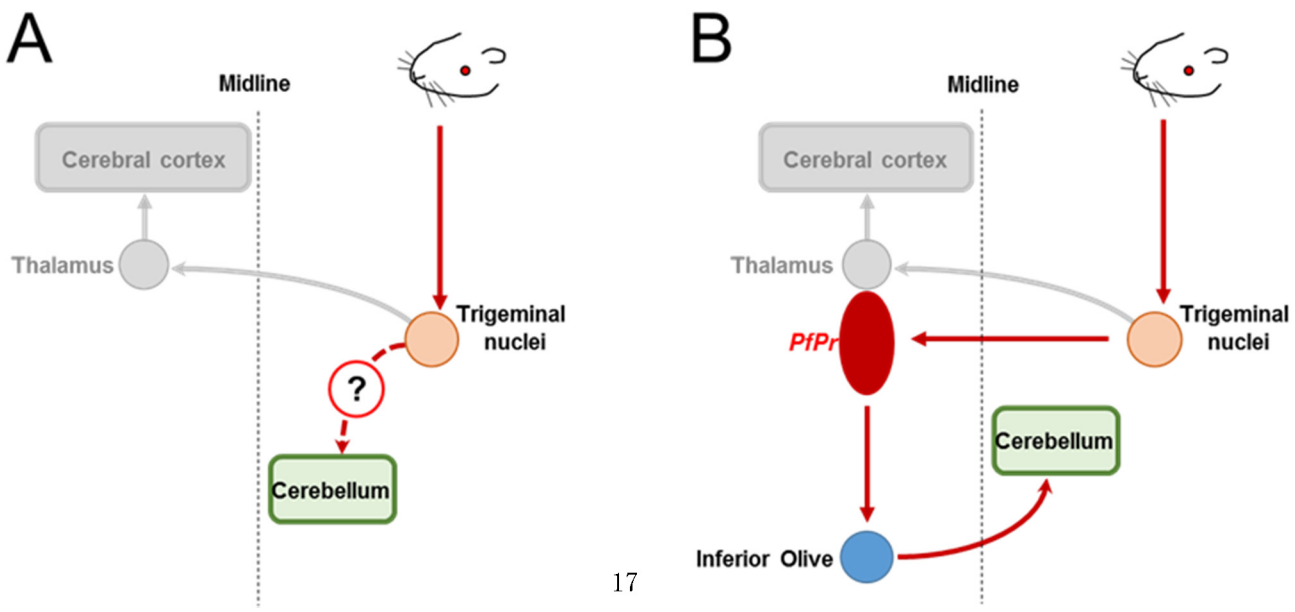
The Journal of Physiology

https://physoc.onlinelibrary.wiley.com/doi/10.1113/JP275836


## Original Website

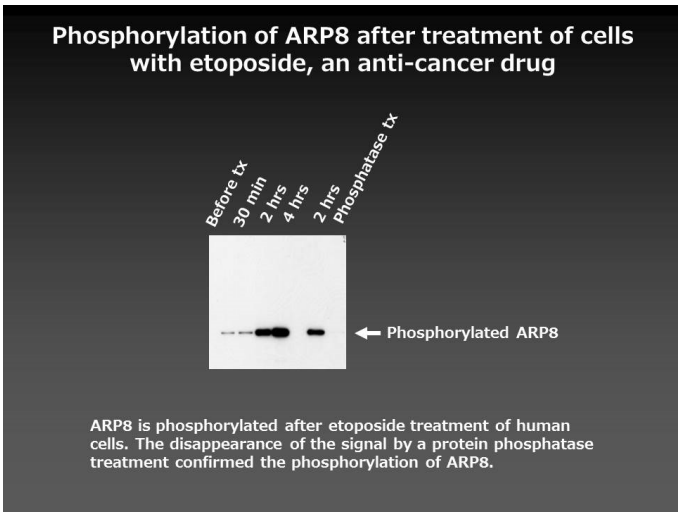
Department of Neurophysiology, Graduate School of Biomedical & Health Sciences

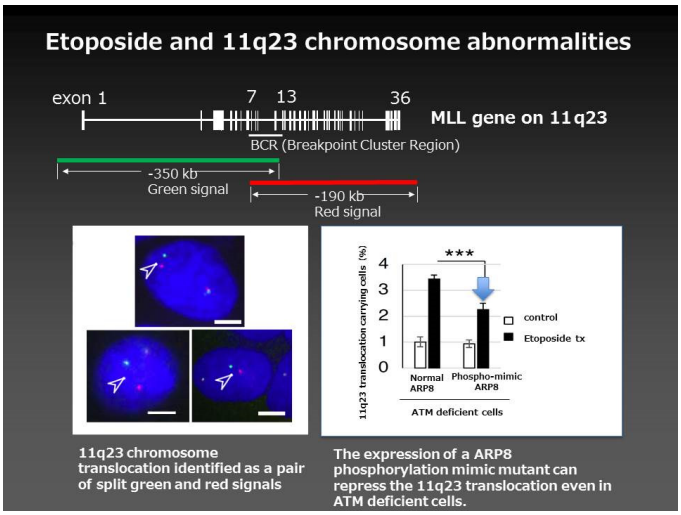
http://home.hiroshima-u.ac.jp/physiol2/

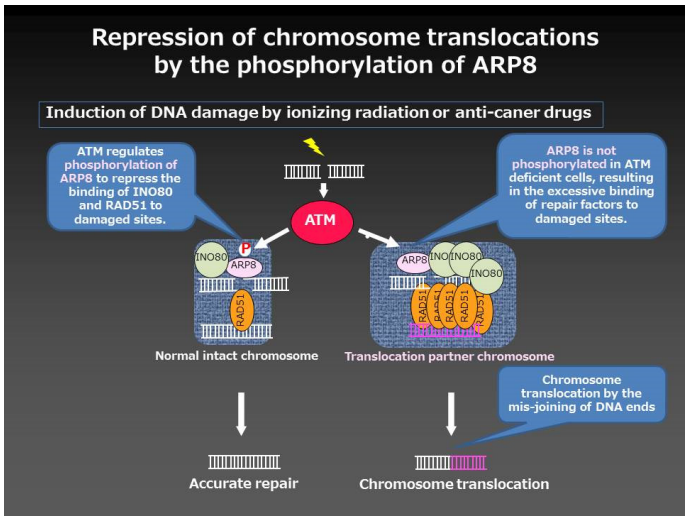


# Protection of human genome from ionizing radiation and anti-cancer drugs

Chromosome translocations are one of the most common types of genetic rearrangements induced by DNA damaging agents, such as ionizing radiation and certain chemotherapeutic agents. A research group of the Department of Cellular Biology at Research Institute for Radiation Biology and Medicine, Hiroshima University, has reported its discovery that ARP8, a component of INO80 chromatin remodeling complex, plays important roles to repress the chromosome abnormalities after the induction of DNA damage. ARP8 is phosphorylated by ATM and ATR kinases to prevent too much accumulation of DNA repair proteins on the damaged chromatin for the repression of chromosome translocations. “Too much is as bad as too little.” is true for DNA repair proteins and ARP8 regulates their loading on the damaged chromatin.




## References

■Sun J, Shi L, Kinomura A, Fukuto A, Horikoshi Y, Oma Y, Harata M, Ikura M, Ikura T, Kanaar R, Tashiro S.

Distinct roles of ATM and ATR in the regulation of ARP8 phosphorylation to prevent chromosome translocations.

Elife. 2018 May 8;7. pii: e32222.

doi: 10.7554/eLife.32222

■Sun J, Oma Y, Harata M, Kono K, Shima H, Kinomura A, Ikura T, Suzuki H, Mizutani S, Kanaar R, Tashiro S.

ATM modulates the loading of recombination proteins onto a chromosomal translocation breakpoint hotspot.

PLoS One. 2010 Oct 27;5(10):e13554.

## Original Website

Department of Cellular Biology, Research Institute for Radiation Biology and Medicine

https://www.hiroshima-u.ac.jp/en/rbm/research/lab/Cellular_Biology

# Schools and Graduate Schools

## Schools

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

## Advanced Course

Special Education Major Program

## Graduate Schools

Graduate level studies at Hiroshima University consist of 11 graduate schools including Education, Biomedical & Health Sciences, Engineering, and many other majors. In addition, two unique program offerings: “The Phoenix Leader Education Program for Renaissance from Radiation Disaster” and “The Taoyaka Program for Creating a Flexible, Enduring, and Peaceful Society”, combine graduate level academic coursework with integrative research components.

Graduate School of Integrated Arts and Sciences

Graduate School of Letters

Graduate School of Education

Graduate School of Social Sciences

Graduate School of Science

Graduate School of Advanced Sciences of Matter

Graduate School of Biomedical & Health Sciences

Graduate School of Engineering

Graduate School of Biosphere Science

Graduate School for International Development and Cooperation

Hiroshima University Law School

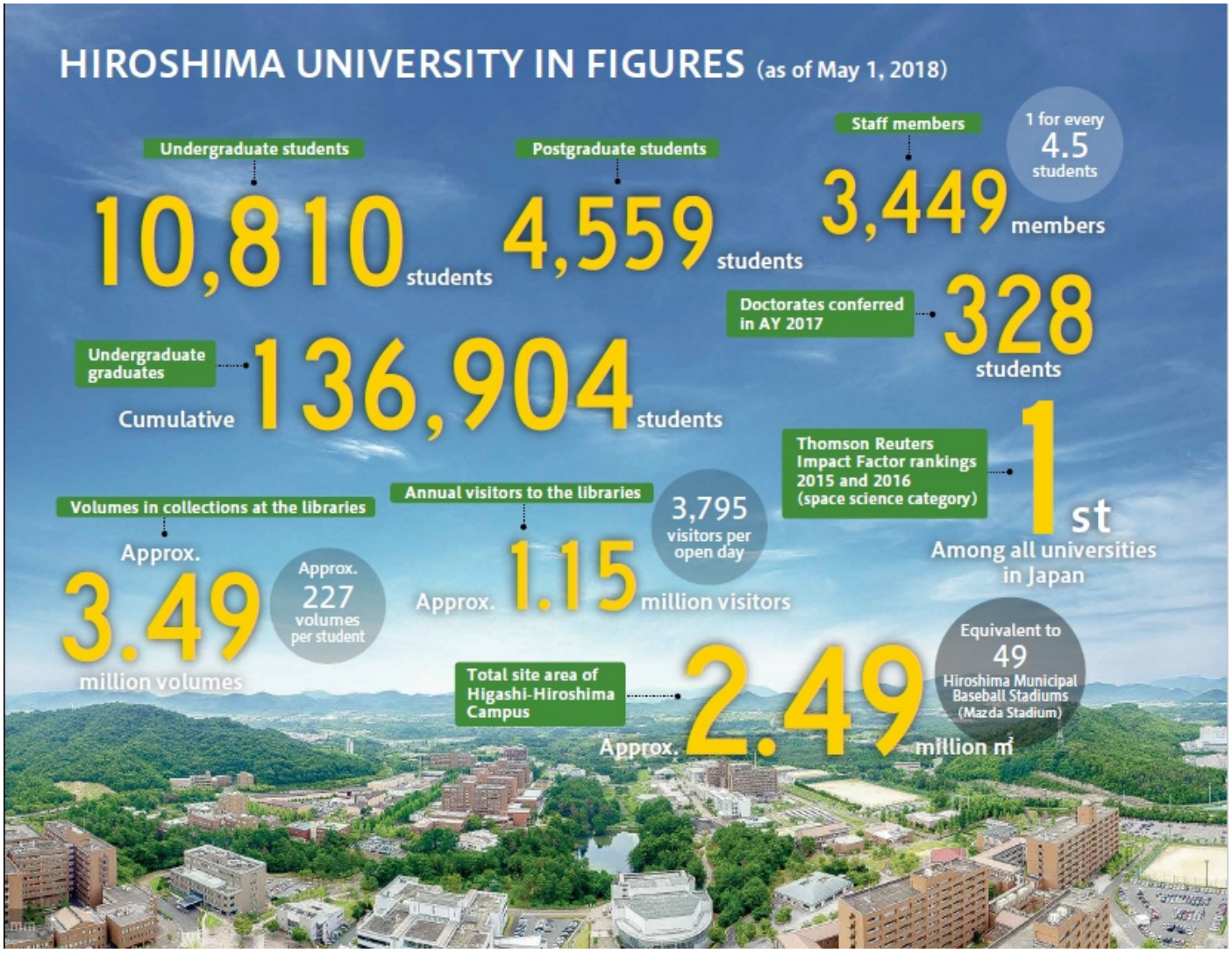
Graduate School of Integrated Sciences for Life (to be opened in April 2019)

Graduate School of Biomedical and Health Sciences (to be opened in April 2019)

## Interdisciplinary Graduate Educational

Phoenix Leader Education Program (Hiroshima Initiative) for Renaissance from Radiation Disaster (adopted by MEXT), TAOYAKA PROGRAM for creating a flexible, enduring, peaceful society (adopted by MEXT) and Education Program for Global Environmental Leaders.

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.




# Networks and Overseas Bases

## Overseas Bases

HU has established overseas bases in 15 countries/regions (As of September, 2018)
Number of Overseas Bases 18 (As of September, 2018)

## International Exchange Agreements

(As of December 30, 2018)
University-level: 327 Agreements with 299 Organizations in 51 Countries/Regions
School / Institute-level: 377 Agreements with 341 Organizations in 52 Countries/Regions

# International Students

(As of May 1, 2018)
A total of 1,660 students from 73 countries and regions are studying at HU

# Campus Location

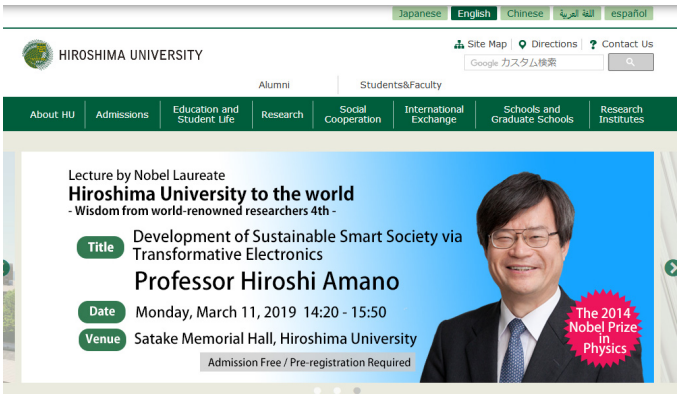
Hiroshima University comprises three campuses: vast and green Higashi-Hiroshima Campus, and Kasumi Campus and Higashi-Senda Campus, both located in Hiroshima City, a locale whose name resonates with humanity's quest for international peace and cultural prosperity.

# Find more about HU

Please visit our website for more details!

■HU Official Website

(English) https://www.hiroshima-u.ac.jp/en




■Updates from our Laboratory

https://huscf.hiroshima-u.ac.jp/


# HU Promotional Video


Hiroshima University Promotional Video is available on our YouTube channel!

This video features the university's leading research including "Genome Editing," "Research on High-Energy Astrophysics," "Regional Promotion," "Brain Science and KANSEI," and "Live-Donor Liver Transplant" as well as everyday campus scenes. Please also enjoy the beautiful drone footage of our campuses!

Visit the following webpage to watch this video.

(YouTube)

https://youtu.be/OzZ4YBex8Ps

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