



# HIROSHIMA UNIVERSITY UPDATE

October 2017

## News

### **The lecture meeting of Ms. Izumi Nakamitsu, Under-Secretary-General High Representative for Department Affairs United Nations was held**

On August 6, 2017, Hiroshima University invited Ms. Izumi Nakamitsu, the first Japanese woman to work as an Under-Secretary-General High Representative for Department Affairs United Nations taking her position since this May, and held a lecture meeting at the Higashi-Senda Innovative Research Center.

A total of 220 people, including faculty and administrative members, students, and local citizens, participated in Ms. Nakamitsu's lecture titled, "Challenges for Disarmament in 21 century".

Before the lecture, President Mitsuo Ochi greeted, "Hiroshima University contributes to create a peaceful and an international society. I hope today's lecture meeting will be a chance to think about what we can do together for disarmament and world peace."

In the beginning of the lecture, Ms. Nakamitsu spoke to the young generation of the 21st century to make the lecture a chance for them to think what they can do.

Afterwards, she talked about the "Treaty on the Prohibition of Nuclear Weapons", a treaty to prohibit the development or the possessing of nuclear weapons, adopted in the United Nation

this July and said, "The United Nation is trying to find challenges that go with both the nuclear power nation and the non-nuclear power nation so that the gap between these countries won't get bigger."

She talked about disarmament of Weapons of Mass Destruction (WMD) in terms of both nuclear and non-nuclear weapons, as on Arms Trade Treaty (ATT), Cyber and AI technologies, urging overall understanding towards security and disarmament while sharing her ideas about the expected, possible, and emerging roles of the United Nations.

In the questions and answers, university students and the high school students asked various questions about peace education, passing on the memories of war, and helping the conflict areas. Ms. Nakamitsu used all of the time provided and answered each of the questions.

In the end President Ochi gave Ms. Nakamitsu a thank you letter and a gift and closed the lecture with a big round of applause.

The original article:

<https://www.hiroshima-u.ac.jp/en/news/41267>



## Chinese Consul General in Osaka, Mr. Li Tianran, Visits HU

HU is committed to expanding its student and academic exchange activities with universities in China.

In this spirit, July 11 saw a delegation from the Chinese Consulate-General in Osaka, led by Consul General Mr. Li Tianran, visit HU's Higashi-Hiroshima Campus, where they had meetings with President Mitsuo Ochi and Executive and Vice President Toshiyuki Sato.

An active discussion on human resource development in the era of globalization took

place, with particular emphasis on how to train the next generation to face future challenges head on - and how universities can play their part in this.

There are currently around 800 students from China studying at HU, many of whom took part in an informal gathering held for the visiting dignitaries.

The original article:

<https://www.hiroshima-u.ac.jp/en/news/40799>



## Conclusion of Inter-university agreement with National Autonomous University of Mexico (UNAM)

Hiroshima University (HU) and National Autonomous University of Mexico (UNAM) have been collaborating on entrepreneurship education since the end of last year, which resulted in the talk about the possibility of concluding an inter-university agreement. Many consultations between the two parties followed, and eventually, on 31st August 2017, a signing ceremony for the agreement was held. From the UNAM, Prof. Ken Oyama, Vice President (International Development) attended on behalf of the President and Prof. Takashi Takata, Executive & Vice President, attended as a representative of HU.

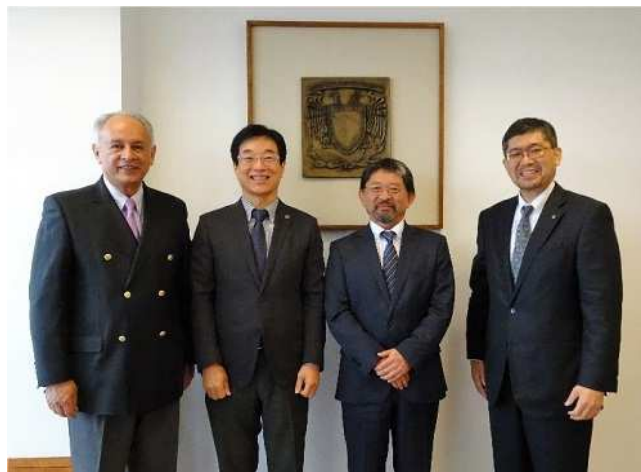
At the ceremony, both sides agreed to promote student exchanges. Another proposal includes a joint seminar on specific themes. The new partners will start a detailed discussion on these initiatives.

During their visit, Prof. T. Takada, Executive & Vice President and Prof. N. Hiram, Global Innovation Division Head of Center for Collaborative Research and Community

Cooperation (HU) met with Prof. Juan Manuel Romero, Vice President of UNAM (in charge of innovation and technology transfer), and Ms. Jessica Asai. They exchanged opinions on potential collaboration regarding industry-academia collaboration and entrepreneurship education.

The original article:

<https://www.hiroshima-u.ac.jp/en/news/41713>





### INU Student Seminar and Master's Summer School on "Global Citizenship & Peace" 2017



From Aug 4 to Aug 12, the International Network of Universities (INU) Student Seminar and the INU Master's Summer School, which provide a forum for students to discuss topics on "Global Citizenship and Peace" (GCP), were held at Hiroshima University. This year 11 INU member universities from 10 countries sent 67 students and 10 faculty members/staff for the Students Seminar and 11 students and 2 faculty members to the Master's event.

The participants visited the Hiroshima Peace Memorial Museum and listened to the testimony of Hibakusha, an A-bomb survivor. Other activities included workshops and a mock United Nations

General Assembly role-play where participants were divided into 10 groups of delegates representing different countries. The topic for discussion was, "Free and Equal: The United Nation's turn to Human Rights Protection Based on Sexual Orientation and Gender Identity," which provoked much serious and heated debate.

Hiroshima University and the INU have jointly held this seminar annually since 2006 with the aim of promoting educational exchange and dialogue amongst member institutions.

The original article:  
<https://www.hiroshima-u.ac.jp/en/news/41360>

### Delegation from Pusan National University College of Humanities (Korea)

On June 22, 2017, the Graduate School of Letters of Hiroshima University (HU) welcomed the Pusan National University (PNU) College of Humanities from Korea and had a research exchange.

The party included 30 researchers specializing, Japanese literature, English literature, Western Philosophy, and Oriental History, and not only did they have a whole-group (college-level) exchange, the researchers also had an exchange in groups of their research field. Furthermore, the party observed the automatic book storage in the Central Library.

In the whole-group exchange session, HU's Graduate School of Letters and PNU's College of Humanities introduced themselves using DVD. In the group exchange session, researchers of both universities were able to have a productive

exchange of views on their research, and current situation of education and research.

We all had a meaningful time with the help from Korean students studying at HU and a HU staff member with a study-abroad experience at PNU as interpreter.

Official Website of the School/Graduate School of Letters:  
<https://www.hiroshima-u.ac.jp/en/bungaku>



## Building up Research Network

Department of Economics of School of Social Science at Hiroshima University recently joined the Research Centres Networking Group (RCNG). The signing ceremony was held on 3 August 2017 at Mandarin Orchard Singapore Hotel. RCNG is a visiting research program that aims to facilitate research between faculty and research fellows across the network. The hub of RCNG is Economic Growth Centre of Nanyang

Technological University in Singapore, and the group is comprised of ten academic institutions located in Singapore, Australia, China, Korea, Vietnam, and Japan.

Official Website of the Graduate School of Social Sciences:

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

## Peacebuilding Collaboration with the Philippine Government: HU Training the Local Youth from Bangsamoro

Graduate School of Social Sciences, Hiroshima University, is helping the Muslim population in Mindanao, the Philippines, prepare for their prospective autonomous government in Bangsamoro area, which was promised in a framework agreement for peace in 2012 by the Philippine Government, following nearly a half century of Muslim struggles. Practical public administration skills based on academically examined ideas have been imparted to more than fifty Bangsamoro youths since 2014 through a unique peacebuilding collaboration between the local government (Hiroshima Prefecture) and the

university, and more collaboration is expected in future. A sizable build-up of Hiroshima trainees in Bangsamoro is certainly a foundation for a stable and efficient public service in the making. This project also gives Hiroshima a chance to know the reality of peace and conflict, and thus enabling it to pursue a research for practical peacebuilding.

Official Website of the Graduate School of Social Sciences:

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





## Agreement on Scientific and Educational Cooperation between Federal Medical Biophysical Center, Russia and RIRBM, Hiroshima University

On 7th September 2017, the Research Institute for Radiation Biology and Medicine (RIRBM), Hiroshima University, concluded an agreement on a scientific and educational cooperation with the Burnasyan Federal Medical Biophysical Center (FMBC) of Federal Medical Biological Agency, Russian Federation. The FMBC holds more than 1,000 researchers and about 7,000 students who have been studying radiation health risks, nuclear medicine, radiological emergency responses, etc. The two institutions

will collaborate to promote scientific research and also to improve education programs in those common fields, sharing their extensive experiences and lessons obtained through the radiation disasters such as the Fukushima Daiichi accident, Chernobyl accident, nuclear testing and atomic bombing.

Official Website of the Research Institute for Radiation Biology and Medicine  
<https://www.hiroshima-u.ac.jp/en/rbm>



## 18 trainees from conflict affected countries in Africa visited Tokyo and Hiroshima

HU hosted trainees from six African countries as part of the "Teacher Training and Development for Peace-Building in the Horn of Africa and Surrounding Countries" project. The Japan Study Tour, co-organized by UNESCO-IICBA and the Center for the Study of International Cooperation in Education -Hiroshima University, was held 2 - 9 August.

Participants included 18 technical staff from ministries of education, teacher trainers, and secondary school teachers from Eritrea, Ethiopia,

Kenya, Somalia, South Sudan, and Uganda.

In addition to lectures at HU, they visited Japanese MPs, former UNESCO DG Mr. Matsuura, MEXT, JICA, UNITAR, Sophia University and the University of Tokyo, and had the honor to attend the annual Hiroshima Peace Memorial Ceremony.

The original article:

<https://www.hiroshima-u.ac.jp/en/news/41690>



## Book Fair at Mexico National Polytechnic Institute (IPN)

Hiroshima University (HU) signed the inter-university agreement with National Polytechnic Institute (IPN) in Mexico City on February 28, 2017. At their request, HU donated books written by the university's faculty and researchers to the international book fair held at IPN at the end of August. At the fair, Prof. T. Sato, Executive & Vice President (International Relations) of HU gave an invited lecture on HU's approach on peace education (Spanish interpretation by Professor N. Hirami), and the participants were deeply interested in the presentation. After the lecture, HU delegation received an interview

from the local media which strengthened the presence of HU in Mexico.

The original article:

<https://www.hiroshima-u.ac.jp/en/news/41712>



## Research News

### Newly discovered brain chemical “NPGL” controls appetite and body fat composition

The latest discovery by the group of Professor Kazuyoshi Ukena, along with collaborators from Japan and UC Berkeley, adds to our understanding of how the brain regulates energy usage and feeding habits – the control mechanisms of which are not yet fully understood. They found that NPGL, a recently discovered protein involved in brain signalling, has been found to increase fat storage by the body – even when on a low-calorie diet in rats. In addition, NPGL was shown to increase appetite in response to high caloric food intake. This latest research into NPGL has greatly increased our understanding and should guide scientists in finding ways to assist the evolutionary-survivalist human body to adapt to a calorie-intense 21<sup>st</sup> century environment.

Related articles:

Iwakoshi-Ukena E, Shikano K, Kondo K, Taniuchi S, Furumitsu M, Ochi Y, Sasaki T, Okamoto S, Bentley GE, Kriegsfeld LJ, Minokoshi Y, Ukena K. Neurosecretory protein GL stimulates food intake, de novo lipogenesis, and onset of obesity. *eLife* 6:e28527 (2017)  
doi: 10.7554/eLife.28527

Matsuura D, Shikano K, Saito T, Iwakoshi-Ukena E, Furumitsu M, Ochi Y, Sato M, Bentley GE, Kriegsfeld LJ, Ukena K. Neurosecretory protein GL, a hypothalamic small secretory protein, participates in energy homeostasis in male mice.

*Endocrinology* 158:1120-1129 (2017)  
doi: 10.1210/en.2017-00064

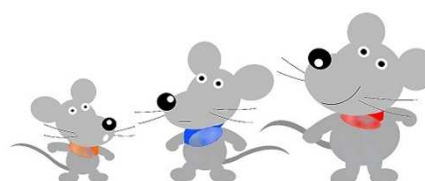
Press releases:

<https://www.hiroshima-u.ac.jp/en/news/41277>

<https://www.hiroshima-u.ac.jp/en/news/39342>

Profile of Professor Kazuyoshi Ukena:

<http://seeds.office.hiroshima-u.ac.jp/profile/en.d20d4908f81dd6d2520e17560c007669.html>



Dysregulated energy balance can result in obesity and metabolic syndrome.

## New deep sea amphipod was described

Ms. Sachi Matsukami, a former undergraduate student at the School of Education and is currently a master's student at the Graduate School of Advanced Science of Matter, has jointly described a new species of the pardaliscid amphipod "*Nicippe recticaudata*" with her supervisor Dr. Ko Tomikawa (associate professor) and Dr. Takafumi Nakano (Research Fellowship for Young Scientists) at Japan Society for the Promotion of Science. The paper in question was a product of her study for graduation at the School of Education in FY2016 (Heisei 28).

The specimens of *Nicippe recticaudata* were collected from off Cape Toi in Miyazaki Prefecture about 300 meters below the surface of the sea. By examining the morphological characteristics and the DNA data, this research has revealed that the specimen in question is a new species distinct from its congeners.

The discovery is one of the findings that typically demonstrates that there still are numerous species on this planet which have not been identified with and named yet, and that much needs to be done for unravelling global biodiversity. After this study, it is expected that more studies will be undertaken globally to further clarify the biodiversity of the members of this new species.

This study was undertaken as a graduation work which serves as a compilation of the undergraduate course curriculum at the School of

Education. In this work, students are expected to experience the following three steps of the basic science study: 1) examining earlier studies, 2) conducting their own studies, and 3) presenting the research findings in English scientific journals. We would like to contribute to cultivate future teachers who are not only "equipped with knowledge" in Biology, but also who "can explore a new field with the spirit of self-learning" through conducting the basic science research.

On 12th April 2017, the findings was published in "ZooKeys," a Bulgarian international academic journal mainly specialized in publishing articles related to the discoveries of new animal species.

### Reference:

Sachi Matsukami, Takafumi Nakano, Ko Tomikawa. A new species of the genus *Nicippe* from Japan (Crustacea, Amphipoda, Pardaliscidae). ZooKeys 668: 33-47 (12 Apr 2017) doi:10.3897/zookeys.668.12181

Profile of Associate Professor Ko Tomikawa

<http://seeds.office.hiroshima-u.ac.jp/profile/en.c500681f4dfedb5a520e17560c007669.html>





## Water in the Earth's interiors

Dr. Toru Inoue joined the Department of Earth and Planetary Systems Science, Graduate School of Science, Hiroshima University, as a professor from this April. His research interests include a topic to understand the effect of water in the Earth's interiors. He found that high pressure polymorphs of olivine, wadsleyite and ringwoodite, which are the most abundant minerals in the Earth's mantle, can contain significant amounts of water (~3 wt. %) in their crystal structures<sup>1</sup>. This suggests that the part of the mantle (the mantle transition zone) become a strong water reservoir in the Earth's mantle. His opinion was demonstrated by the funding of the natural mineral in the diamond inclusion<sup>2</sup>. Now he is investigating the water in deeper Earth's interiors. Recently, a new research center, Hiroshima Institute of Plate Convergence Region Research (HiPeR), has been established. Please

see the following website for more details.  
(<http://hiper.hiroshima-u.ac.jp/en/index.html>)

### References:

1. Inoue, T., H. Yurimoto and Y. Kudoh, Hydrous modified spinel,  $\text{Mg}_{1.75}\text{SiH}_{0.5}\text{O}_4$ : a new water reservoir in the mantle transition region. *Geophys. Res. Lett.*, **22**, 117-120, 1995.

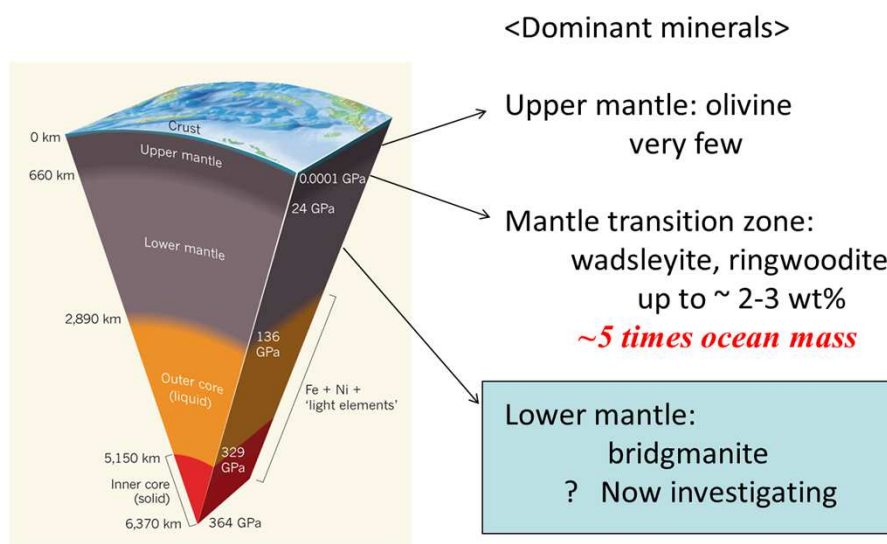
2. Pearson, D. G., et al., Hydrous mantle transition zone indicated by ringwoodite included within diamond. *Nature* **507**, 221-224, 2014.

doi:10.1038/nature13080

Profile of Professor Toru Inoue

<http://seeds.office.hiroshima-u.ac.jp/profile/en.fd6e39c23d242398520e17560c007669.html>

## Water storage capacity in the Earth's mantle



## Quantum evidence for the violation of Newton's first law

According to Newton's first law, particles in free space should always move along straight lines. But is this law still valid in quantum mechanics? Surprisingly, this question is extremely difficult to answer because the uncertainty principle prevents us from catching a particle "in the act". In the present paper, I show that unambiguous evidence for the violation of Newton's first law can be obtained from the statistics of particle positions at three different times by exploiting a quantum interference effect between states of well-defined position and states of well-defined momentum. The analysis of the particle distributions at three different times shows that at least eight percent of the particles are not moving along straight lines, providing the most striking evidence available to date that quantum interference effects can result in a violation of

Newton's first law.

### Reference:

Holger F. Hofmann. Quantum interference of position and momentum: a particle propagation paradox. *Phys. Rev. A* **96**, 020101(R)(2017)

DOI:

<https://doi.org/10.1103/PhysRevA.96.020101>

Read the full story at:

<https://www.hiroshima-u.ac.jp/en/adsm/news/41629>

Profile of Associate Professor Holger F. Hofmann:  
<http://seeds.office.hiroshima-u.ac.jp/profile/en.5a6018b52481bb7d520e17560c007669.html>



## Telomere G-tail length is promising future risk of age-associated diseases.

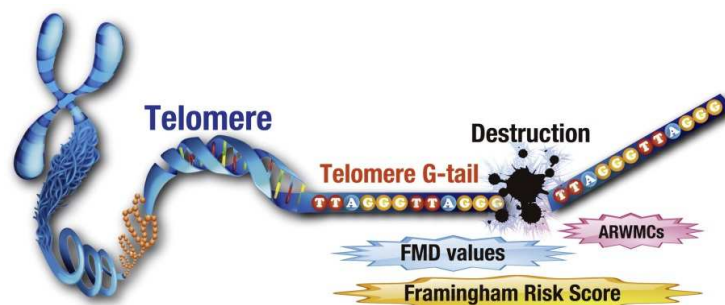
Our research is focused on Aging and Cancer, and we established novel technology such as telomere G-tail measurement method and DSE-FRET assay. Telomeres are essential DNA-protein complexes at the ends of eukaryotic chromosomes, which are essential for genomic stability and integrity. Very end of telomere is composed with a single stranded G-rich telomere DNA, the so-called "G-tail". Little is known regarding the association between G-tail length and the risk of age-associated diseases. We established the technique, G-tail telomere HPA, to measure G-tail length from biological samples such as blood cells and tissues (1). Using this technique, we found that telomere G-tail length is strongly associated with cardiovascular disease (2,3). Importantly, we found the reduction of telomeric G-tail length is associated with the risk of future cardiovascular events in hemodialysis patients (3), therefore G-tail length could be a promising biomarker for future risk of age-associated diseases.

### References:

1. Tahara, H., Kusunoki, M., Yamanaka, Y., Matsumura, S., & Ide, T. (2005). G-tail telomere HPA: simple measurement of human single-stranded telomeric overhangs. *Nat Methods*, 2(11), 829-831.  
DOI: 10.1038/nmeth797
2. Nezu, T., N. Hosomi, T. Takahashi, K. Anno, S. Aoki, A. Shimamoto, H. Maruyama, T. Hayashi, M. Matsumoto and H. Tahara. "Telomere G-tail Length is a Promising Biomarker Related to White Matter Lesions and Endothelial Dysfunction in Patients With Cardiovascular Risk: A Cross-sectional Study." *EBioMedicine* 2(8): 960-967.2015  
DOI: <http://dx.doi.org/10.1016/j.ebiom.2015.05.025>
3. Hirashio, S., A. Nakashima, S. Doi, K. Anno, E. Aoki, A. Shimamoto, N. Yorioka, N. Kohno, T. Masaki and H. Tahara. "Telomeric g-tail length and hospitalization for cardiovascular events in hemodialysis patients." *Clin J Am Soc Nephrol* 9(12): 2117-2122.2014  
DOI: 10.2215/CJN.10010913

Profile of Professor Hidetoshi Tahara  
<http://seeds.office.hiroshima-u.ac.jp/profile/en.98a277349a3000df520e17560c007669.html>

Official Website of the Department of Cellular and Molecular Biology, Hiroshima University  
Institute of Biomedical & Health Sciences:  
<http://www.telomere.jp>



(Nezu et al., *EBioMedicine* 2(8): 960-967. 2015)

## Nano/subnano-tuning of silica-based microporous membrane: Beyond the border

“Membrane” can be defined as a selective barrier to separate mixtures into two streams. For example, purified water can be produced from seawater, and hydrogen can be highly purified from the mixtures. Separation Engineering Laboratory, cooperated by three faculty members, T. Tsuru, M. Kanezashi and H. Nagasawa, at Department of Chemical Engineering, has been working on inorganic microporous membranes, especially focusing on silica-based membranes, from the viewpoints of membrane development and applications to gas and liquid-phase separation [1].

Figure 1 shows the typical structure of porous ceramic membranes. The separation top layer, which has separation ability and must have controlled pore sizes suitable for specific separation, is formed as thin as possible on the intermediate layer and supports. Membrane performance can be compared using two important parameters: selectivity and permeability, and the two parameters generally show trade-off lines, that is, higher permeability with lower selectivity. Our team has been working hard to develop silica-based membranes, the separation performances of which are beyond the border [1].

We proposed the use of organosilica top layer, which shows very high flux and selectivity for  $H_2$  and  $CO_2$  by tuning the network pore sizes (Figure 2). In addition, organosilica membranes were found to show stable desalination performance, that is, ROBUST properties, even in harsh

conditions.

Another recent progress is doping fluorine into silica networks, which enables the tuning of silica networks in large and uniform pore sizes (Figure 2) [2]. We also developed a novel processing technology by atmospheric-pressure plasma-enhanced chemical vapor deposition (PECVD) for the fabrication of silica membranes for gas separation (Figure 3) [3].

### References:

1. Tsuru, T., Silica-Based Membranes with Molecular-Net-Sieving Properties: Development and Applications, Journal of Chemical Engineering of Japan, in press.
2. Kanezashi, M., T. Matsutani, T. Wakihara, H. Tawarayama, H. Nagasawa, T. Yoshioka, T. Okubo and T. Tsuru, Tailoring the Subnano Silica Structure via Fluorine Doping for Development of Highly Permeable  $CO_2$  Separation Membranes, ChemNanoMat **2**, 264-267 (2016)
3. Nagasawa, H., Y. Yamamoto, N. Tsuda, M. Kanezashi, T. Yoshioka, T. Tsuru, Atmospheric-Pressure Plasma-Enhanced Chemical Vapor Deposition of Microporous Silica Membranes for Gas Separation, J. Membr. Sci., 524, 644-651 (2017) doi.org/10.1016/j.memsci.2016.11.067

Profile of Professor Toshinori Tsuru

<http://seeds.office.hiroshima-u.ac.jp/profile/en.c24ddc6f9a2c256a520e17560c007669.html>

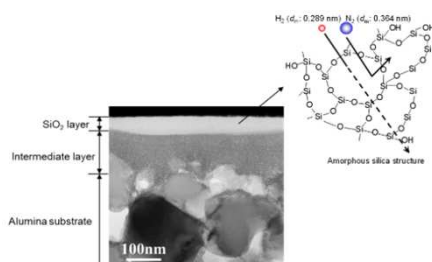


Fig. 1. Cross section of  $SiO_2$ -based membranes

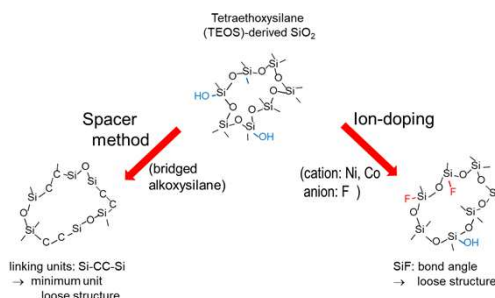


Fig.2 Subnano-tuning of silica networks

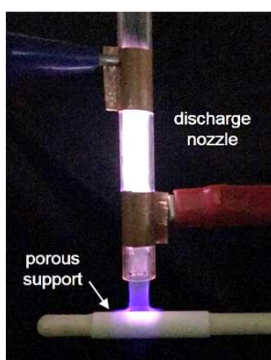


Fig.3 AP-PECVD for silica membranes

## Unravelling the Mechanism of the Decline in Fertility with Age & Developing a Technique for Ovarian Rejuvenation

Fertility decreases slightly in women around the age of 30, but is clearly evident at a median age of 40. As a consequence, many women in developed countries including Japan, USA, UK and EU countries rely on assisted reproductive technology (ART) to become pregnant. However, the success rate of ART in women more than 40 years old women is low.

In our study (Umehara et al., Aging Cell 2017), using the unique ovarian aging model mice, we revealed that the growth of fibrosis tissue in ovarian stroma is induced by the high serum levels of LH present with increasing age. The fibrosis is associated with the arrest of follicular development. Thus, GnRH antagonist treatments might provide a new, non-invasive strategy for improving fertility in a subset of non-responder aging women before menopause.

Reference:

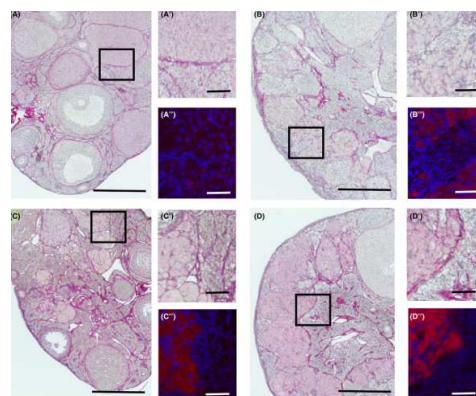
Takashi Umehara, Tomoko Kawai, Ikko

Kawashima, Katsuhiro Tanaka, Satoshi Okuda, Hiroya Kitasaka, JoAnne S. Richards, Masayuki Shimada. The acceleration of reproductive aging in *Nrg1<sup>flox/flox</sup>;Cyp19-Cre* female mice. Aging Cell (2017)

DOI: 10.1111/ace.12662

Profile of Professor Masayuki Shimada

<http://seeds.office.hiroshima-u.ac.jp/profile/en.421632da20fa61ea520e17560c007669.html>



(Umehara et al., Aging Cell 2017)

## A New Landscape of Multiple Dispersion Kinks in a High-Tc Cuprate Superconductor

Conventional superconductivity is caused by electron-phonon coupling. The discovery of high-temperature superconductors raised the question of whether such strong electron-phonon coupling is realized in cuprates. Strong coupling with some collective excitation mode has been indicated by a dispersion “kink.” However, there is intensive debate regarding whether the relevant coupling mode is a magnetic resonance mode or an oxygen buckling phonon mode. This ambiguity is a consequence of the energy of the main prominent kink. The research group of Associate Professor Akihiro Ino shows a new landscape of dispersion kinks. They report that heavily overdoping a  $\text{Bi}_2\text{Sr}_2\text{CaCu}_2\text{O}_8$  superconductor results in a decline of the conventional main kink and a rise of another sharp kink, along with substantial energy shifts of both. Notably, the latter kink can be ascribed only to an oxygen-breathing phonon. Hence, the multiple phonon branches provide a consistent account of their data set on the multiple kinks. Their results suggest that strong electron-phonon coupling and its dramatic change should be incorporated into or reconciled with scenarios for the evolution of high-Tc superconductivity.

Reference:

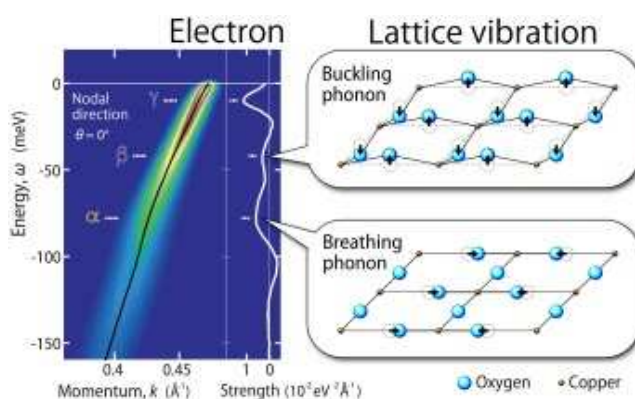
H. Anzai, M. Arita, H. Namatame, M. Taniguchi,

M. Ishikado, K. Fujita, S. Ishida, S. Uchida, and A. Ino. A New Landscape of Multiple Dispersion Kinks in a High-Tc Cuprate Superconductor. Scientific Reports 7, Article number: 4830 (2017) doi:10.1038/s41598-017-04983-0

Profile of Associate Professor (Special Appointment) Akihiro Ino

<http://seeds.office.hiroshima-u.ac.jp/profile/en.344df66cc4e3e6da520e17560c007669.html>

The Hiroshima Synchrotron Radiation Center (HiSOR) calls for collaborative research proposals using synchrotron radiation in the vacuum ultraviolet and soft x-ray regions. Please visit the webpage (<http://www.hsrc.hiroshima-u.ac.jp/english/index.html>) for details.





## Wearable electronic devices made practical due to HU innovation

The development of flexible electronic devices, worn over our skin as clothing, could catapult us into a sci-fi wonderland of wearable and interactive technology.

However, materials required to realize such devices for everyday use would need to be, not only lightweight and flexible to ensure user comfort and safety - but also produced using methods that are practical, safe and cost effective.

Researchers, led by Professor Ken-ichi Saitow, from HU's Natural Science Center for Research and Development, believe they have found a way to realize such materials for a mass market.

Their production method, carried out at room temperature, is not only extraordinarily simple but the material that results performs far better than those previously produced using methods requiring temperatures in excess of 120°C.

By simply brushing a glass surface using a velvet cloth, the researchers were able to manipulate the surface structure so that its molecules aligned in a single direction.

When a conductive polymer, a cellulose material, was then applied to the glass surface, using a method known as spin coating, an extremely lightweight and transparent film was produced whose own molecules aligned to the same regular

pattern due to binding of the cellulose to glass.

The resultant uni-directionality of molecules within the clear film meant that electricity could flow through its regular structure without obstruction – allowing for electronic efficiency with minimal heat gain – very important for devices intended to cover your skin!

It's simple low-temperature production, and extreme thinness, makes it even more outstanding and could see a whole swath of smart clothing in your wardrobe very soon.

Reference:

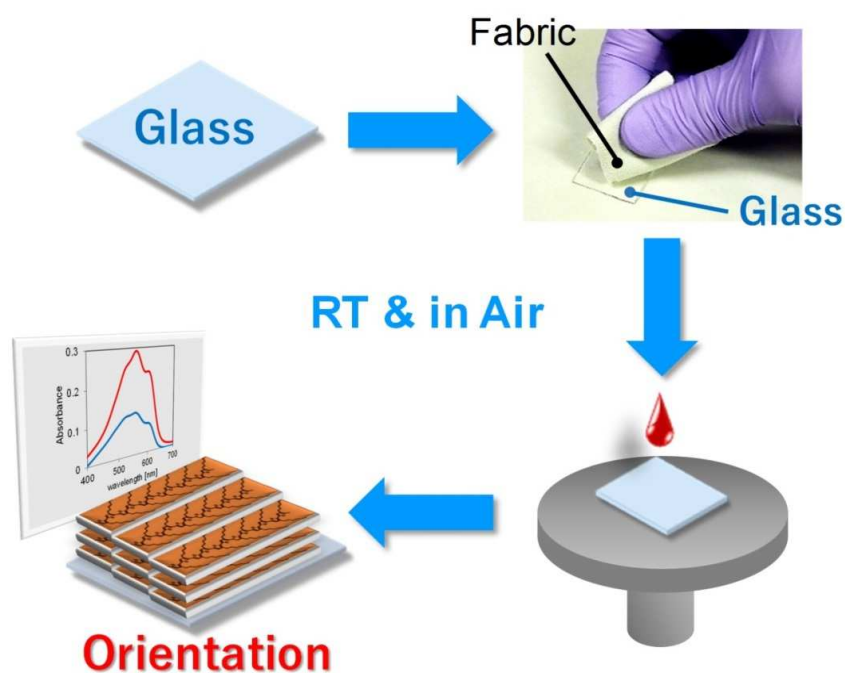
Masayoshi Imanishi, Daisuke Kajiya, Tomoyuki Koganezawa & Ken-ichi Saitow. Uniaxial orientation of P3HT film prepared by soft friction transfer method. Scientific Reports 7, Article number: 5141 (2017)  
doi: 10.1038/s41598-017-05396-9

Profile of Professor Ken-ichi Saitow

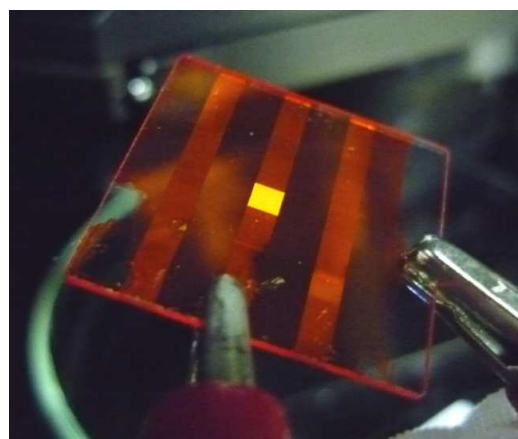
<http://seeds.office.hiroshima-u.ac.jp/profile/en.fc8cbe3928a119ac520e17560c007669.html>

Official Website of Saitow group:

<http://home.hiroshima-u.ac.jp/saitow>



Schematic diagram of a new method, soft friction transfer method, conducted at room temperature and in air to prepare a oriented polymer film.



Electroluminescence (EL) from a light-emitting device composed of oriented polymer film. EL light is polarized along brushing direction.

## Coherent spin phase order on macroscopic length scales in structurally *chiral* magnets

A team at the Center for Chiral Science (CCS) in Hiroshima University has explored chiral magnetism and obtained a globally renowned reputation as one of the pioneers. In particular, our research group found out a coherent spin phase order which appears on macroscopic length scales in structurally chiral magnets. Based on the concept of phase coherence, one may couple distinct macroscopic responses among the spin phase coherent states in *chiral* magnets, the charge coherent states in superconductors, and/or optical coherent states of laser (Fig. 1). Indeed, taking advantages of the spin phase coherence unique to the chiral magnetic system, we have succeeded in observing the discretization effects of electric responses in chiral helimagnet  $\text{CrNb}_3\text{S}_6$  crystals (Fig. 2), which can contribute to the device applications of the next-generation **ultrahigh-density memory**\*. The coherence of spin phase order also enables an information transfer with almost zero energy, providing a tantalizing glimpse into the future devices. We believe that a hyper energy-saving society can be realized using the chiral magnetic system. Chirality is indeed an essential concept in

our research and we are now making enormous efforts to establish the “**Chiral Material World**,” an interdisciplinary research field for world-changing innovations.

\*This study was reported at the press conference of the Japanese Ministry of Education, Culture, Sports, Science, and Technology (MEXT) in 2015.

Official Website of the CResCent (Chirality Research Center):

[http://home.hiroshima-u.ac.jp/kotai/KibanS/t005/t005/index\\_e.html](http://home.hiroshima-u.ac.jp/kotai/KibanS/t005/t005/index_e.html)

Profile of Professor Katsuya Inoue (Research Group Leader):

<http://seeds.office.hiroshima-u.ac.jp/profile/en.419c8c1beb2a2224520e17560c007669.html>

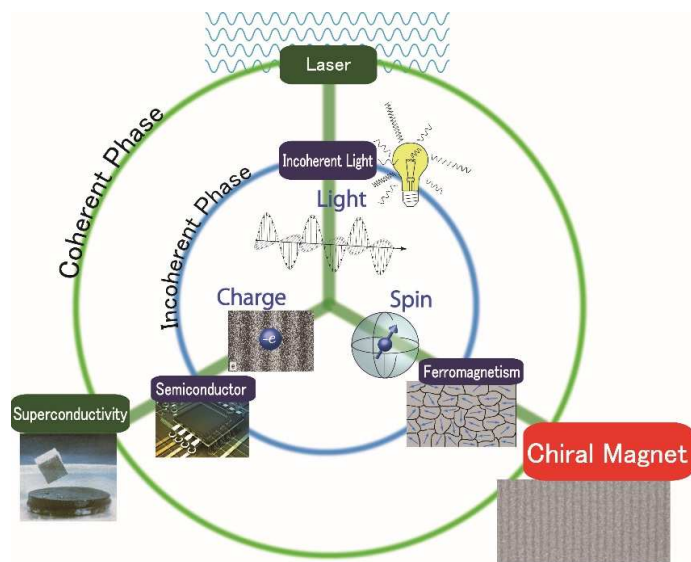


Fig. 1: The phase coherence of spin, charge, and optical systems



Fig. 2: Micrograph of a chiral magnetic crystal of  $\text{CrNb}_3\text{S}_6$ .

# Schools and Graduate Schools

## Schools

For undergraduate level, Hiroshima University consists of 11 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  
(To Be Opened in 2018)

## 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

## Advanced Course

Special Education Major Program

## Interdisciplinary Graduate Educational Program

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.



Please visit our website for more details!

About Schools and Graduate Schools

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

About Resercher Interviews etc.

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



# Education

## Student and Faculty Numbers

Undergraduate Students 10,887 (As of May 1, 2017)

Graduate Students 4,520 (As of May 1, 2017)

Academic Faculty Members 1,726 (As of May 1, 2017)

## Networks and Overseas Bases

### Overseas Bases

HU has established overseas bases in 14 countries/regions (As of May, 2017)

Number of Overseas Bases 16 (As of May, 2017)

### International Exchange Agreements (As of October 26, 2017)

University-level: 274 Agreements with 251 Organizations in 47 Countries/Regions

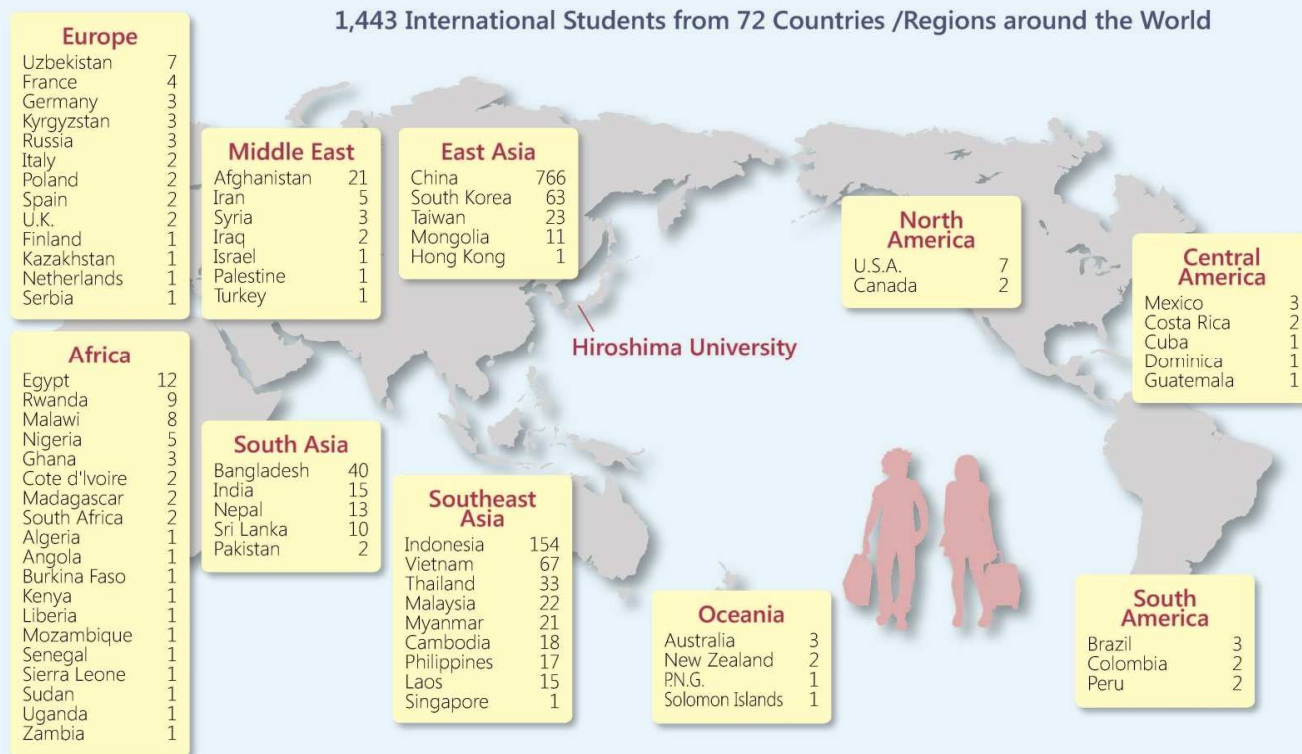
Faculty / Department-level: 342 Agreements with 312 Organizations in 50 Countries/Regions

## International Exchange

Number of International Students 1,443 from 72 Countries/Regions (As of May 1, 2017)

### 留学生数 (2017年5月1日現在) Number of International Students (As of May 1, 2017)

1,443 International Students from 72 Countries /Regions around the World



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



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