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岡山大学  
OKAYAMA UNIVERSITY



“Okayama University supports the Sustainable Development Goals”

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## ■ Feature

### Towards an International Hub for ESD: International Conference on Education for Sustainable Development is held at Okayama University

Education for Sustainable Development (ESD) is program led by UNESCO to nurture leaders to bear the responsibility to build a sustainable society with the ability to view current social challenges—such as environmental issues, poverty, human rights, peace and development—and who can think globally and act locally. The ESD program is key to achieving the Sustainable Development Goals (SDGs) by the target date of 2030, that are being rapidly pursued around the world.

On November 22 and 25, 2019, the “2019 Global Conference on Teacher Education for Education for Sustainable Development” (hosted by Okayama University and the International Network of Teacher Education Institutions [Secretariat at York University, Canada]) was held at Okayama University’s 50th Anniversary Hall and the Faculty of Education to discuss the educational policy of teachers promoting ESD. Two hundred people involved in education from 40 countries around the world attended the conference, deepening the discussion on educational policies of teachers promoting ESD.



A scene of the conference

At the conference, participants announced the Asia-Pacific ESD Teacher Competency Framework, the first international framework on qualifications and abilities of teachers promoting ESD, jointly developed by UNESCO and universities in the Asia Pacific region. The framework designates “SHAPING FUTURES” as its core principle, comprising the three categories of “Facilitating Learning,” “Connecting, Collaborating, and Engaging” and “Continuing to Learn and Create.” To proliferate the framework, the participants also announced the statement (see below) consisting of nine points, summarizing the roles of educational institutes such as universities, as well as national and international organizations. It can be said that the directions for teacher education were set for the coming decade at this conference. Representatives from the participating institutions gave presentations on educational initiatives and research results, deepening the discussion to seek better education methods for ESD.

Furthermore, links between Global Citizenship Education (GCED), a UNESCO initiative, and ESD were also discussed at the conference. Although GCED and ESD overlap considerably, they have been promoted

separately. This is the first conference for GCED and ESD to be collectively discussed with the view to find ways of linking them to achieve the SDGs and reflect them in teacher education on a global level.

In addition to promoting SDGs throughout its entire organization, Okayama University has been working on teacher education for SDGs by serving as a UNESCO chair for ESD and a central institution for Okayama City as the Regional Center of Expertise (RCE), a local hub for ESD designated by United Nations University. Notably, Okayama University also leading member of the Interuniversity Network Supporting the UNESCO Associated Schools Project Network. Moreover, Okayama City was designated as Japan's first RCE in 2005, being highly evaluated because of its collaboration with the local community including community centers. This conference was held at Okayama University because of its contributions to and progressiveness in its activities for ESD and the SDGs.



The participants visited some schools in Okayama City, and learned ESD education.

Okayama University expects to continue its activities to foster and train teachers promoting ESD in collaboration with universities in the Asia Pacific region. Furthermore, Okayama University is confident that it will establish the Okayama Model, in which universities, municipalities and citizens' groups collaborate through the Whole Community Approach, advancing activities that focus on connections with local communities. At the conference, Okayama University was able to establish a very diverse framework for ESD in the Asia Pacific region. In the future, Okayama University will devise methods for forming a universal network across the entire world. Okayama University will continue to play a leading role in promoting ESD through strengthened collaboration with global and local communities.



Commemorative photo

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<Details of the statement announced at the international conference held at Okayama University>

Teacher Education for Education for Sustainable Development

2019 Statement from Okayama

Based on the multi-layering synchronization between ESD and GCED towards the achievement of SDGs target 4.7 and ESD for 2030, we will proceed as follows.

#### Institutional Level

1. Motivate all personnel in the institution to participate ESD/SDGs related activities
- 2 Integrate ESD into the existing curricula and lessons to foster ESD fully-awared teachers and personnel, based on ESD teacher competency framework
3. Provide ESD expertise for action plan/implementation of ESD programmes in local community

#### National Level

4. Develop national standards/action plan of teacher education to lead and understand ESD/SDGs
5. Design ESD teaching aids/training materials and other tools for teaching staff and students to begin with and to further develop
6. Establish clear monitoring and evaluation systems to motivate and support the implementation
7. Use media to relay information to communities, and as a platform for children/youth to share their ESD ideas, activities and movement

#### International Level

8. Formulate joint activities on ESD to share experiences with diversity
9. Hold regular conferences to present our initiatives and efforts on ESD as a platform

22 November 2019

Okayama, Japan

2019 Global Conference on Teacher Education for  
Education for Sustainable Development

#### Further information

Okayama University Education for Sustainable Development Promotion Center  
[https://edu.okayama-u.ac.jp/promotion\\_center/](https://edu.okayama-u.ac.jp/promotion_center/)



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■ News

**Honorary doctorate awarded to Professor Charles Hopkins from York University, Canada**

On November 22, Okayama University conferred an honorary doctorate on Professor Charles Hopkins from York University, Canada.

The conferral ceremony was held during the opening ceremony of the “2019 Global Conference on Teacher Education for ESD.” President MAKINO Hirofumi handed the certificate to Professor Hopkins, witnessed by approximately 160 researchers and educators both from Japan and around the world.

The honorary doctorate is conferred to recognize a person who has made an especially outstanding contribution to the advancement of science and culture and is considered appropriate by Okayama University to receive it, or a person who has made an outstanding contribution to the development of education and research at Okayama University. Professor Hopkins is a world authority on Education for Sustainable Development (ESD) and offered great cooperation for the promotion of the SDGs at Okayama University. It has been decided to award an honorary doctorate to Professor Hopkins for his especially outstanding contribution to the advancement of science and culture.

Professor Hopkins is the sixth person to whom Okayama University has awarded an honorary doctorate. Among the six awardees, Professor Hopkins is the second person selected as a recipient by his “especially outstanding contribution to the advancement of science and culture,” following Dr. Ei-ichi Negishi, Herbert C. Brown Distinguished Professor at Purdue University, who was awarded the Nobel Prize in Chemistry in March 2011.



President MAKINO (left side) handed the certificate to Professor Hopkins



The photo of President MAKINO and Professor Hopkins (Right side)

### Further information

Encouragement Letter from Prof. Hopkins  
<https://sdgs.okayama-u.ac.jp/en/sdgs/detail.php?seq=3>



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■ News

**Two students from Okayama University participated in “One Young World Summit 2019: The Global Forum for Young Leaders” representing Japan**

The international summit for youth “One Young World Summit (OYW) 2019: The Global Forum for Young Leaders” was held from October 22 to 25 in London, the United Kingdom. Mr. MATSUMOTO Sota (3rd year, Faculty of Law) and Mr. KISYABA Tomoki (1st year, Medical School) from Okayama University participated in the event as members of the Japan team.

Okayama University has served as an official partner since OYW 2015 held in Bangkok, Thailand, and has dispatched two students and, Vice President YOKOI Atsufumi for Global Engagement Strategy as an observer each year. Prior to the summit, a send-off party for the Japan team was held on September 18 at JT Art Hall Affinis located in JT’s Headquarter in Tokyo. On October 22, the opening ceremony of the summit was held in Royal Albert Hall in London. Attendees included Meghan, Duchess of Sussex, and Mayor Sadiq Khan of London (the first Muslim Mayor of London). With the proactive involvement of the British Royal Family, the welcome event was held as a national commitment.

Mr. MATSUMOTO and Mr. KISYABA participated in the plenary sessions, workshops and networking sessions, among other events. Under the framework of the SDGs, they took part in the discussions on a wide variety of topics, including climate change, war and peace, education, human rights, leadership and global business. At the plenary sessions, they listened to speeches by incumbent global leaders and national representatives, such as Dr. Muhammad Yunus (a Nobel Peace Prize laureate), Dr. Gro Harlem Brundtland (former Prime Minister of Norway



The photo of opening ceremony (from OYW)



The entrance of Meghan, Duchess of Sussex (from OYW)



The photo of KISYABA in the session



who chaired the U.N. World Commission on Environment and Development (Brundtland Commission) in 1987, which is known as the origin of “Sustainable Development”), and Sir Richard Branson (founder and president of the Virgin Group). Furthermore, the U.N. Secretary-General’s Envoy on Youth Jayathma Wickramanayake, who leads the Young Leaders Initiative that promotes the SDGs, presented the progress of Lead 2030. Lead 2030 is a platform for supporting businesses and projects of young people which contribute to the SDGs, run with the involvement of the U.N., OYW, and some of the world’s leading businesses. Through these experiences, the participating students were also able to learn directly about the latest global initiative supported by industry-academia-government collaboration. Most notably, Mr. Kisyaba was selected as one of the representatives of the world youth in the plenary session titled as “One Young World Interfaith Dialogue,” and took the platform together with incumbent leaders. He was the third Japanese person and the first Okayama University student selected and went onto the platform.



From left side: Mr. MATSUMOTO, Mr.KISYABA and Vice President YOKOI Atsufumi

OYW 2019 (the 10th OYW) attracted approximately 2,000 participants from over 190 countries around the globe. The next summit will be held in Munich, Germany from October 14 to 17, 2020.

**Further information**

One Young World: Homepage  
<https://www.oneyoungworld.com/>



OYW Okayama University website (Japanese page)  
<http://www.okayama-u.ac.jp/user/ouic/japanese/international/OYW.html>



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## ■ News

### Okayama University Women's Ice Hockey Club Takes Second Place for the Second Consecutive Year at the Japan Student Women's Ice Hockey Tournament!

The 7th Japan Student Women's Ice Hockey Tournament was held on November 7-10 at Michinoku Coca-Cola Bottling Link (Morioka City, Iwate Prefecture) and Ishidoriya Ice Arena (Hanamaki City, Iwate Prefecture). Okayama University Women's Ice Hockey Club took the second place as they did last year.

Sixteen nationwide universities that have won the regional qualifiers participated in this tournament. The qualifying leagues were held in four blocks, and Nippon Sport Science University, Tokyo Women's College of Physical Education, University of the Ryukyus, and Okayama University, who had won each league, advanced to the final tournament.

In the semi-final match against the University of the Ryukyus, the match and overtime were finished with a 1-1 tie, and as a result of the game winning shot, they won a close match of 2-1. In the final, they challenged Nippon Sport Science University, but the champions in the fourth consecutive championship were strong and our team lost 1-10.

The captain of the club YONEDA Mai (Faculty of Education, junior) said, "I think this is the result of pursuing the back of the seniors. We will continue to value the quality of Okayama University, which we have built up with our seniors, and work hard every day to achieve even greater heights."



The scene of the game



The photo of the defense (left)



The circle after the goal



The commemorative photo

### Further information

Okayama University Women's Ice Hockey Club Website (Japanese page)  
<https://soramhearty.wixsite.com/icehockeygirl-okadai>



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## ■ Research Highlights

### Rapid wheat improvement by genome editing

Genome editing is a method of altering the DNA sequence of a target gene, which can rapidly improve traits not previously observed in crops. In addition, unlike previous genetically modified crops, there is no difference in the DNA sequence between genome-edited crops and conventionally developed crops.

However, bread wheat has three different sets of genomes and respective genes which have to be modified simultaneously to change its trait.

Now, Kazuhiro Sato at IPSR Okayama University and colleagues have shown that a new highly efficient genome editing method could knockout the function of three related wheat genes.

The researchers used an *Agrobacterium*-mediated transformation system to transfer CRISPR/Cas9 to wheat genome for genome editing. Acceleration of generation advancement resulted in a triple knockout plant within 14 months.

The responsible gene was initially found in barley by Sato and his colleagues. The triple knockout on the related genes significantly delay the germination of grains which was not observed before in wheat.

The technique is used to control the gene to prevent pre-harvest sprouting of grains on the spike (Figure) and may contribute to the stable production of wheat in many countries.



Figure caption: Delays in germination in triple knockout wheat (left) by genome editing.

**Reference:**

- Authors: Fumitaka Abe, Kazuhiro Sato et al.
- Title of original paper: Genome-edited triple recessive mutation alters seed dormancy in wheat
- Journal, volume, pages and year: Cell Reports 94, 1362-1369.e4 (2019).
- Digital Object Identifier (DOI): <https://doi.org/10.1016/j.celrep.2019.06.090>
- Journal website: <http://cellreports.cell.com>
- Affiliations: Institute of Plant Science and Resources, Okayama University
- Department website: <http://www.rib.okayama-u.ac.jp/>
- Okayama University Scientific Achievement Repository:  
<http://ousar.lib.okayama-u.ac.jp/ja/57452>



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## ■ Research Highlights

### Discovery of fully-gapped topological superconductors with potential applications in quantum computing

Electric currents do not dissipate energy in superconductors because electrons in these materials move without resistive forces. Recent research shows that some superconductors can host surface states known as Majorana excitations that have potential applications in new-generation quantum computing. However, the conditions the superconductors must satisfy for such application are very stringent. Firstly, the wave function must be topological, namely, it should have twists like a Mobius band. Secondly, the energy gap must be opened everywhere in momentum space when the material becomes a superconductor. Notably, there are no reports to-date of bulk superconductors that fulfill these conditions.

Now, a research group at Okayama University led by Guo-qing Zheng, working in collaboration with researchers at the Chinese Academy of Sciences, has discovered that copper-intercalated  $\text{Bi}_2\text{Se}_3$  ( $\text{Cu}_x\text{Bi}_2\text{Se}_3$ )—that does not usually conduct electricity before doping— is a class of topological superconductors, where the energy gap is fully opened when the copper concentration  $x$  exceeds 0.46. This finding paves the way for applications to fault-tolerant quantum computers using bulk topological superconductors.

The  $\text{Cu}_x\text{Bi}_2\text{Se}_3$  was produced by growing single crystals using an electro-chemical method and measuring the physical properties using techniques including nuclear magnetic resonance. In previous work published in 2016, Zheng and colleagues first demonstrated  $\text{Cu}_{0.3}\text{Bi}_2\text{Se}_3$  to be a topological superconductor, but its energy gap is not fully opened. In this latest research, they succeed in intercalating more copper in-between the  $\text{Bi}_2\text{Se}_3$  layers. They found that when the copper content increases to 0.46 and beyond, the energy gap is opened everywhere in momentum space. These results make  $\text{Cu}_x\text{Bi}_2\text{Se}_3$  ( $x \geq 0.46$ ) qualify as the first class of bulk topological superconductors for potential applications to quantum computing.

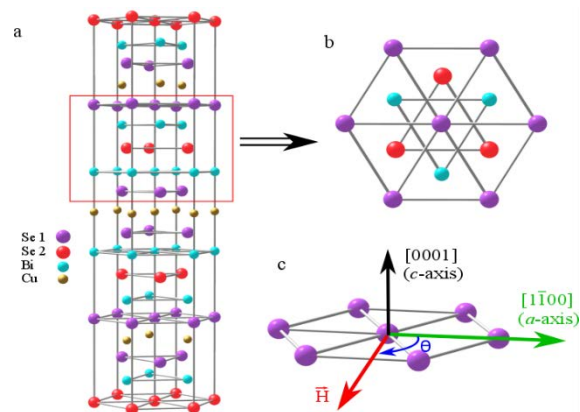


Figure Caption: (left) crystal structure of  $\text{Cu}_x\text{Bi}_2\text{Se}_3$ . (right) hexagonal plane composed of Bi and Se, and the applied magnetic field ( $H$ ) with respect to the crystal axis.

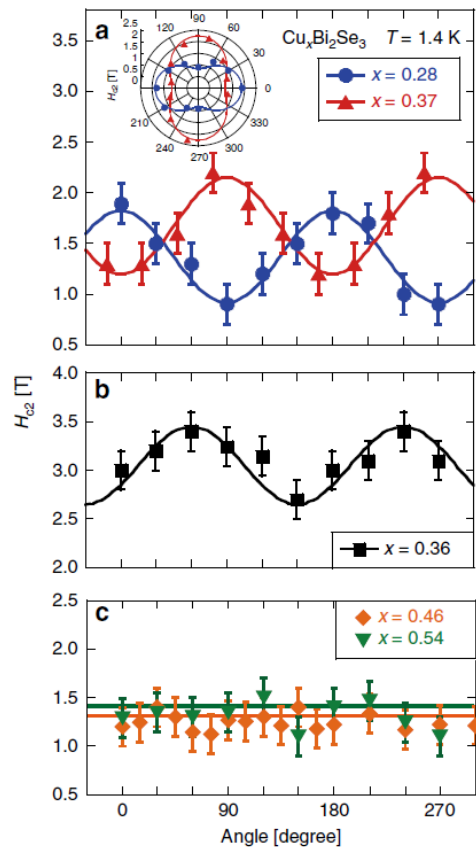


Figure Caption: upper critical field ( $H_{c2}$ ) as a function of the angle between the externally-applied magnetic field and the crystal axis. For low Cu-content  $x$ , an oscillation shows up which indicates that the energy gap has a node (zero) somewhere. Disappearance of the oscillation means that the gap is uniform everywhere.

Reference:

- Authors: T. Kawai, C.G. Wang, Y. Kandori, Y. Honoki, K. Matano, T. Kambe & Guo-qing Zheng.
- Title of original paper: Direction and symmetry transition of the vector order parameter in topological superconductors  $\text{Cu}_x\text{Bi}_2\text{Se}_3$ .
- Journal, volume, pages and year: NATURE COMMUNICATIONS 11, 235 (2020).
- Digital Object Identifier (DOI): 10.1038/s41467-019-14126-w
- Journal website: <https://www.nature.com/articles/s41467-019-14126-w>
- Affiliations: Department of Physics, Graduate School of Natural Science, Okayama University.
- Department website: [http://www.physics.okayama-u.ac.jp/zheng\\_homepage/](http://www.physics.okayama-u.ac.jp/zheng_homepage/)
- Okayama University Scientific Achievement Repository: <http://ousar.lib.okayama-u.ac.jp/ja/57939>



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## ■ Research Highlights

### Mechanism of photosynthetic water oxidation revealed by intermediate state structures analyzed by an X-ray free electron laser

Photosynthetic water oxidation produces electrons, protons and molecular oxygen from water using light energy from the sun, thereby providing molecular oxygen in the atmosphere and reducing power for the reduction of CO<sub>2</sub> into sugars. This reaction is catalyzed by a Mn<sub>4</sub>CaO<sub>5</sub>-cluster bound to photosystem II (PSII), and proceeds through five intermediate states called S<sub>i</sub>-states (i=0-5). The structure of PSII have been resolved at atomic resolution, and the structure of an intermediate S<sub>3</sub>-state has also been reported. However, ambiguities still exist regarding the mechanism of water oxidation due to insufficient resolution of the S<sub>3</sub>-state as well as a lack of other intermediate state structures.

Michihiro Suga, Fusamichi Akita, Jian-Ren Shen at Okayama University, and colleagues from RIKEN have obtained the structure of the S<sub>3</sub>-state at a higher resolution and also analyzed the structure of the S<sub>2</sub>-state by a combination of pump-probe and fixed-target serial crystallography methods using femtosecond X-ray free electron lasers (XFEL) at SACLA, Japan. In this approach, the S<sub>2</sub> and S<sub>3</sub>-intermediate states were generated by one or two laser pulses at room temperature, and the excited PSII microcrystals were frozen in liquid nitrogen and used for X-ray data collection.

The results confirmed insertion of a new oxygen atom O6 close to an already existing oxo-oxygen O5 in the Mn<sub>4</sub>CaO<sub>5</sub>-cluster in the S<sub>3</sub>-state, and showed that dioxygen formation may occur through an oxyl/oxo coupling mechanism between O5 and O6. Moreover, a number of structural changes were found during S<sub>1</sub>-S<sub>2</sub>-S<sub>3</sub> transitions in the PSII protein environment, which reveal the mechanism of water oxidation by a cooperative action of substrate water access, proton release, and O=O bond formation. The results obtained will be important for design and synthesis of efficient artificial catalysts for water-splitting that may be utilized in artificial photosynthesis and therefore may contribute greatly to a sustainable society.

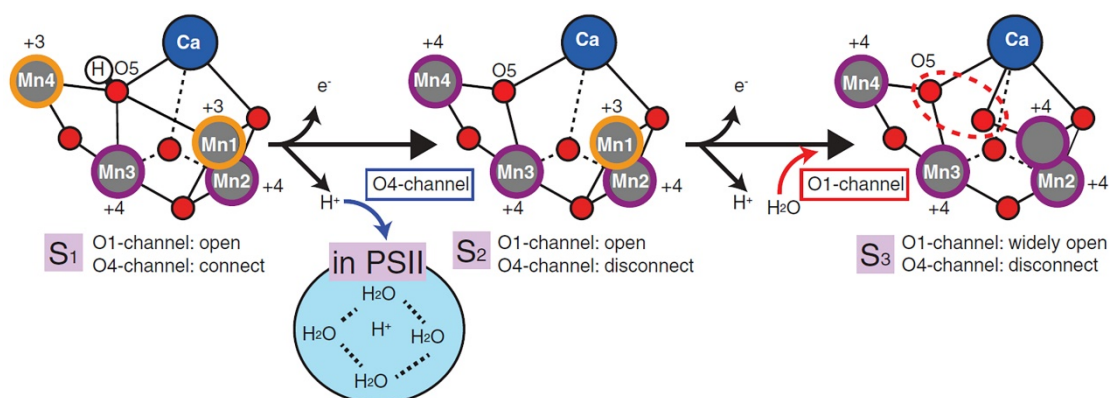


Figure Caption: Structural changes of the Mn<sub>4</sub>CaO<sub>5</sub>-cluster during the S<sub>1</sub>-S<sub>2</sub>-S<sub>3</sub> transitions.

**Reference:**

- Authors: Michihiro Suga, Fusamichi Akita, Keitaro Yamashita, Yoshiki Nakajima, Go Ueno, Hongjie Li, Takahiro Yamane, Kunio Hirata, Yasufumi Umena, Shinichiro Yonekura, Long-Jiang Yu, Hironori Murakami, Takashi Nomura, Tetsunari Kimura, Minoru Kubo, Seiki Baba, Takashi Kumasaka, Kensuke Tono, Makina Yabashi, Hiroshi Isobe, Kizashi Yamaguchi, Masaki Yamamoto, Hideo Ago, Jian-Ren Shen  
long durations of death feigning
- Title of original paper: An oxyl/oxo mechanism for oxygen-oxygen coupling in PSII revealed by an x-ray free-electron laser
- Journal, volume, pages and year: Science 366, 334-338 (2019)
- Digital Object Identifier (DOI): 10.1126/science.aax6998
- Journal website: <https://science.sciencemag.org/content/366/6463/334.long>
- Affiliations: Research Institute for Interdisciplinary Science, Okayama University
- Department website: <http://www.riis.okayama-u.ac.jp/en/>
- Okayama University Scientific Achievement Repository:  
<http://ousar.lib.okayama-u.ac.jp/ja/57820>



## ■ Topics

### Okayama University Weight Training Club

Powerlifting is a competitive sport, in which athletes compete the total weight on three athletic events: squat, bench press, and deadlift. Okayama University's Weight Training Club, which works on the powerlifting, has a great track record including winning the overall championship 13 times in national competitions in 30 years of club's history.

The secret of strength is a system that alumni, who were successful graduate players in the club, foster the players of next generation as a manager or coach.

Therefore, players can efficiently improve their skills and perform in competitions as well as prevent significant injury through appropriate assistances and instructions.

Ms. KUMAHARA Momoka, a senior student in the Faculty of Law, originally joined an art club, but joined the weight training club when she was a sophomore because she admired her friend who performed in the club. Since then, she improved her skills and finally became the champion in the women's 52-kilogram weight class at the 46th All-Japan Powerlifting Championships held in June 2019. Ms. Kumahara said, "After I started powerlifting, I was able to improve my mental strength as well as muscle strength, having mental space and confidence. The expectations for the excellent performances of Okayama University's Weight Training Club will be continuously raised from now on.



A scene of Weight Training Club's activity



Ms. KUMAHARA Momoka

#### Further information

Okayama University Weight Training Club (Japanese page)  
<http://www.ouwtc.com/>



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◆Further information

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Website: [https://www.okayama-u.ac.jp/index\\_e.html](https://www.okayama-u.ac.jp/index_e.html)



Okayama University e-Bulletin  
<https://www.okayama-u.ac.jp/user/kouhou/ebulletin/>



Okayama University Medical Research Updates (OU-MRU)  
<https://www.okayama-u.ac.jp/eng/research/ou-mru.html>



About Okayama University (YouTube 1)  
<https://www.youtube.com/watch?v=iDL1coqPRYI>



Okayama University Image Movie (YouTube 2)  
<https://www.youtube.com/watch?v=KU3hOIXS5kk>

◆About Okayama University

Okayama University is one of the largest comprehensive universities in Japan with roots going back to the Medical Training Place sponsored by the Lord of Okayama and established in 1870. Now with 1,300 faculty and 13,000 students, the University offers courses in specialties ranging from medicine and pharmacy to humanities and physical sciences. Okayama University is located in the heart of Japan approximately 3 hours west of Tokyo by Shinkansen.



Hirofumi Makino, M.D., Ph.D.  
President, Okayama University



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