



Vol.23, November 2018



“Okayama University supports the Sustainable Development Goals”

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On the same day faculty members from OU met representatives from local authorities and businesses who shared their visions for the future of the local communities. The local communities proposed that OU conduct research on local problems, have exchanges with local communities, and give advice on local initiatives. In the discussions several issues were raised, including in the area of SDGs goals 3 (health and well-being), 4 (education), and 8 (economic growth).



Results of a workshop with local stakeholders.

It will be challenging for OU to work with local people to support them in the creation of sustainable communities for the future. Still it is a responsibility that OU as a local university must address.

**Further information**

About SDGs (the United Nations)  
<http://www.un.org/sustainabledevelopment/>



About an approach to SDGs of Okayama University (Japanese page)  
<http://www.okayama-u.ac.jp/tp/profile/okayama-sdgs.html>



Okayama University (Japanese page)  
[http://www.okayama-u.ac.jp/tp/news/news\\_id7750.html](http://www.okayama-u.ac.jp/tp/news/news_id7750.html)



■ News

**Okayama University Vice President Atsufumi Yokoi participated in the International Youth Exchange Conference commemorating the marriage of Their Imperial Highnesses Crown Prince Naruhito and Crown Princess Masako as facilitator of the discussion on UN Sustainable Development Goals (SDGs)**

The International Youth Conference was held in Tokyo from September 26-28, 2018. The conference is organized annually by the Cabinet Office of the Government of Japan as a part of the International Youth Development Exchange (INDEX) Program, which was established in 1994 to commemorate the royal marriage of Their Imperial Highnesses the Crown Prince and Crown Princess.

Their Imperial Highnesses the Crown Prince Naruhito and Crown Princess Masako attended this year’s conference and Okayama University Vice President Atsufumi Yokoi was invited to facilitate the discussion between nine youth delegates from seven countries. The participants exchanged views and ideas on issues including, “water and disaster” through discussions on career development, media literacy and multicultural society under the overall theme of the UN Sustainable Development Goals (SDGs) and multi-stakeholder partnerships that uphold “No one left behind.” In addition, Vice President Yokoi gave a keynote speech to an audience of approximately 100 participants from 7 countries. He introduced the SDGs through multi-stakeholder partnerships and delivered a message stating that Okayama University has taken a strong lead from the Okayama area, encouraging people throughout the world to implement the SDGs.

Through the INDEX Program this year, 41 Japanese youths were sent to one of the countries of either Austria, Laos, or Latvia, while 51 international youths were invited to Japan from the 6 countries of, Austria, Chile, the Dominican Republic, Laos, Latvia, and Vietnam. All the participants attended the International Youth Conference to contribute to the future development of youth and the global community.



Keynote speech by Okayama University Vice President Atsufumi Yokoi.



Participants listening to a lecture at the conference.



Imperial Highnesses Crown Prince Naruhito and Crown Princess Masako observing the discussion at the meeting facilitated by Vice President Yokoi. The photograph was provided by the organizers.

Okayama University will continue to make university-wide efforts to promote the SDGs a manner unique to Okayama based on the Makino Vision of “Heading Further, To a Fruitful Academic Capital,” to further strengthen cooperation with stakeholders both inside and outside the university.



Members of the youth delegation and Vice President Yokoi. The photograph was provided by the organizers.

### Further information

Okayama University (Japanese page)  
[http://www.okayama-u.ac.jp/tp/news/news\\_id7964.html](http://www.okayama-u.ac.jp/tp/news/news_id7964.html)



■ News

**Vice President Yokoi attends UNESCO’s 3rd International Conference on GCED**

The 3rd International Conference on GCED, which is intended to discuss further the relationships between the Sustainable Development Goals (SDGs), which are promoted by the United Nations together with the countries around the world, and Global Citizenship Education (GCED) were held under the co-sponsorship of UNESCO Asia Pacific Centre for International Understanding (APCEIU) and the South Korean Government on September 5 and 6 in Seoul, South Korea, with our university's Vice President for Global Engagement Strategy Atsufumi Yokoi attending the Conference.

Vice President Yokoi attended the Conference upon invitation by the APCEIU, and actively participated in the discussion under the framework of "By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture’s contribution to sustainable development," which is Target 4.7 of the SDGs.

Also, having meetings with Director Utak Chung and his team of the APCEIU, and South Korean Government officials, Vice President Yokoi energetically exchanged opinions about our university’s achievements in its ESD (Education for Sustainable Development), and the promotion of SDGs for which universities and the local communities work closely with each other based on the Makino Vision: “Going beyond, toward a fruitful academic capital.” He also discussed and deepened his insight into the integration between GCED and ESD, and the possibility of cooperation with our university, and introduced our university-wide efforts to promote SDGs for which we were awarded the special prize in the first Japan SDGs Awards by



Congratulatory address by Former UN Secretary-General Ban Ki-moon



Director Utak Chung (left), Vice President Yokoi and Ambassador Hahn Choong-Hee



Vice President Yokoi (left) and CEO Monika Froehler



A venue of International Conference on GCED

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the Japanese Government. He enhanced our university's global presence as a leading university related to SDGs.

#### Further information

Okayama University (English page)  
[http://www.okayama-u.ac.jp/eng/news/index\\_id8003.html](http://www.okayama-u.ac.jp/eng/news/index_id8003.html)



Okayama University (Japanese page)  
[http://www.okayama-u.ac.jp/tp/news/news\\_id7906.html](http://www.okayama-u.ac.jp/tp/news/news_id7906.html)





■ News

**Vice President Yokoi attends the 1st UNESCO’s Partners Forum, and strengthens Okayama University’s cooperation with UNESCO!**

In the framework of “Sustainable Development Goals (SDGs),” which is promoted by the UN together with countries around the world, the first UNESCO Partners Forum, which is intended to discuss how cooperation between the United Nations Educational, Scientific and Cultural Organization (UNESCO) and its various partners should be, was held on September 11 and 12 at the UNESCO Headquarters (in Paris), with Atsufumi Yokoi, Vice President for Global Engagement Strategy of our university attending the Forum.

In the opening address of this Forum, messages from UNESCO Director-General Audrey Azoulay and United Nations Secretary-General António Manuel de Oliveira Guterres were presented, and leaders of major official partners and partners from the private sector of UNESCO gave speeches. Vice President Yokoi attended the Forum upon invitation by the UNESCO Headquarters as the representative of our university, and discussed the understanding of UNESCO’s roles, as well as the strengthening of relationships with existing donors and partners toward the achievement of the SDGs with participants from around the world. He also participated in the networking event for the development of new partners.

Furthermore, Vice President Yokoi had discussions with many high officials of the UNESCO Headquarters, including Professor Charles Hopkins, who is the UNESCO Chair at York University in Canada, and one of the world’s leading authorities on Education for Sustainable Development (ESD). He also introduced our university’s promotion of SDGs in close cooperation with the local community based on our university’s past achievements in its ESD and “Makino Vision: Going



Opening address



A scene of venue



Vice President Yokoi (left), Director Soo-Hyang Choi and Professor Charles Hopkins



The UNESCO Headquarters (Paris), the venue of the UNESCO's Partners Forum

beyond, toward a fruitful academic capital,” and the fact that our university had been granted the special prize in the first Japan SDGs Awards by the Japanese Government. He also actively exchanged opinions on further strengthening the relationship with UNESCO in the future.

#### Further information

Okayama University (English page)  
[http://www.okayama-u.ac.jp/eng/news/index\\_id8005.html](http://www.okayama-u.ac.jp/eng/news/index_id8005.html)



Okayama University (Japanese page)  
[http://www.okayama-u.ac.jp/tp/news/news\\_id7908.html](http://www.okayama-u.ac.jp/tp/news/news_id7908.html)



■ News

**Student of Graduate School of Medicine, Dentistry and Pharmaceutical Sciences (Dentistry) Receives Award at Meeting of International Dentistry Association**

Yasir Dilshad Siddiqui, an international student from Pakistan and in the third year of the Doctor’s Course in the Graduate School of Medicine, Dentistry and Pharmaceutical Sciences (Dentistry), received the IADR Colgate Research in Prevention Travel Award at the 96th Meeting of the International Association for Dental Research (IADR) held July 25 to 28 in London. The presentation he delivered at the meeting was highly appreciated.



Yasir(left), Next term Chairman PhD Rena D'Souza and Professor Takashiba(right)

Yasir delivered a presentation on development of a new endodontic treatment (treatment in teeth for such as dental nerves) using an anti-inflammatory lipid mediator (lipid that activates physiological functions). Apical periodontitis (inflammation caused by dental nerve disease) develops as progression of serious tooth decay and can eventually destroy the alveolar bone in jaw. The disease has very high risk, especially for elderly people with weakened immune systems, and has a severe influence to general condition. However, general treatment for apical periodontitis is problematic because it is technically difficult to treat and has high rate of recurrence, both very significant issue worldwide.



Award winning memorial board

Yasir and other members aim to develop a new intracanal medication that does not require any special medical equipment and can be handled easily by anyone. They focused on efficacy of Resolvin D2, one of the anti-inflammatory lipid mediators. In his presentation, Yasir reported that Resolvin D2 has the ability to regenerate lost jaw bone by closing the root ends of teeth, not only of suppressing inflammation. He discovered this when using Resolvin D2 with an apical periodontitis model of rats.

**Further information**

Okayama University (English page)  
[http://www.okayama-u.ac.jp/eng/news/index\\_id7922.html](http://www.okayama-u.ac.jp/eng/news/index_id7922.html)



Okayama University (Japanese page)  
[http://www.okayama-u.ac.jp/tp/news/news\\_id7780.html](http://www.okayama-u.ac.jp/tp/news/news_id7780.html)



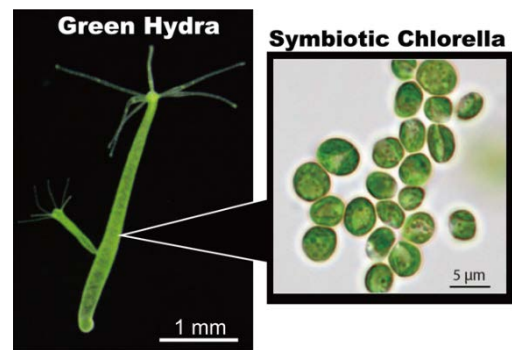
## ■ Research Highlights

### Insights into symbiosis between animals and algae: Genome analysis reveals interactions and evolution of Hydra-Chlorella symbiosis

Symbiotic existence between animals and algae are observed in many species, such as coral and jellyfish, where mutually beneficial relationships are established by exchanging nutrients and providing a safe living environment.

However, details of the interactions of these relationships and the evolutionary processes of symbiosis are still unclear.

Mayuko Hamada, an assistant professor at Ushimado Marine Institute, Okayama University, and a research group led by Noriyuki Satoh, a professor at Okinawa Institute of Science and Technology Graduate University, together with another research group led by Thomas C. G. Bosch of Kiel University, solved the mystery of animal-algal symbiosis using green hydra that harbor green algae *Chlorella* within their cells (Fig.1).

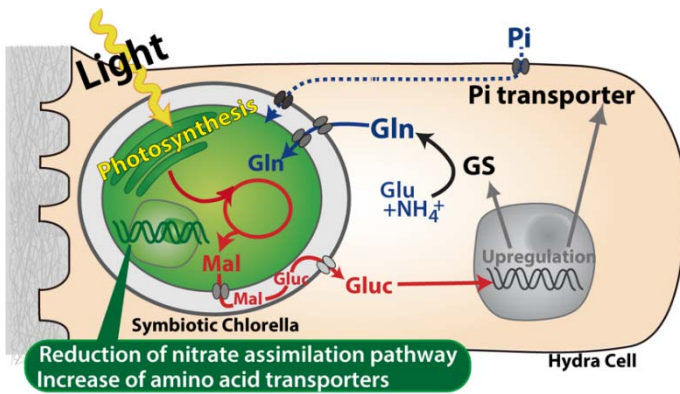


(Figure1) Green hydra *Hydra viridissima* and its symbiotic algae *Chlorella* sp. A99

The researchers identified the important genes involved in symbiosis, genome and transcriptome analysis of green hydra and the symbiotic *Chlorella*.

The results of the analysis identified a cooperative relationship involving nutrients, in which *Chlorella* receives some nutrients such as amino acids from Hydra while providing photosynthetic products to Hydra (Fig. 2). In addition, as the number of transporter genes for taking in amino acid supplied by Hydra increased in the symbiotic *Chlorella*, its nitrate assimilation system degenerated. This clearly shows that the symbiotic *Chlorella* specialized within the body of Hydra to live efficiently.

This research not only improves the understanding of the evolution of such unique symbiotic relationships, but also it is expected to act as a foundation for solving environmental issues such as coral bleaching and industrial applications of algae.



(Figure2) Summary of symbiotic interactions between Hydra and Chlorella. Chlorella produces and secretes maltose (Mal) as the photosynthetic product. The sugar induces expression of Hydra genes encoding glutamine synthetase (GS) and Phosphate (Pi) transporter. GS catalyzes the condensation of glutamate (Glu) and ammonium (NH<sub>4</sub><sup>+</sup>) to form glutamine (Gln), which is used by Chlorella as a nitrogen source. Since the sugar also up-regulates the Pi transporter gene, which controls intracellular phosphate levels, it might be involved in the supply of phosphorus to Chlorella as well (blue broken line). In the symbiotic Chlorella genome, degeneration of the nitrate assimilation system and an increase of amino acid transporters was observed (green balloon).

## References

- Authors: Mayuko Hamada, Katja Schröder, Jay Bathia, Ulrich Kürn, Sebastian Fraune, Mariia Khalturina, Konstantin Khalturin, Chuya Shinzato, Nori Satoh, Thomas C.G. Bosch
- Title of original paper: Metabolic co-dependence drives the evolutionarily ancient *Hydra-Chlorella* symbiosis.
- Journal, volume, pages and year: *eLife* **7**, e35122 (2018).
- Digital Object Identifier (DOI): 10.7554/eLife.35122
- Journal website: <https://elifesciences.org/articles/35122>
- Affiliations: Ushimado Marine Institute, Okayama University
- Institute website: <http://www.science.okayama-u.ac.jp/~rinkai/index.html>



## ■ Research Highlights

### Uncovering the regulatory system of seed germination.

Abscisic acid (ABA) is a plant hormone that regulates seed germination and stress responses. Protein phosphatases functioning in the ABA response interact with ABA-receptor complexes.

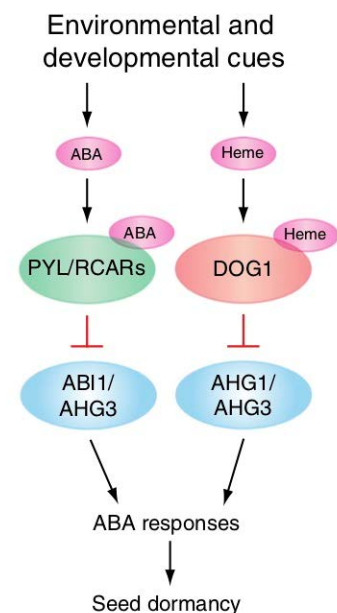
However, it is not known whether AHG1, a protein phosphatase of Arabidopsis, interacts with ABA-receptor and how AHG1 regulates the seed germination.

Now, Takashi Hirayama and colleagues at Okayama University, National Agriculture and Food Research Organization, The Scripps Research Institute, Nagoya University, University of California, San Diego report that AHG1 is involved in a novel regulatory system for seed dormancy and germination.

Search for AHG1 interacting proteins revealed that the protein DOG1—that is proposed to be a seed dormancy regulating protein—binds AHG1. The interaction between AHG1 and DOG1 was characterized further using various types of recombinant proteins both *in vivo* and *in vitro*.

These studies showed that interaction between AHG1 and DOG1 is necessary for their physiological functions. Further analysis showed that DOG1 inhibits AHG1 phosphatase activity *in vitro*. In addition, the *in vivo* and *in vitro* data suggest that coordination with heme regulates DOG1 function.

The regulatory mechanisms for seed dormancy and germination will enable improvements in seed quality, for example, through breeding wheat without pre-harvesting sprouting using this knowledge.



A hypothesized regulatory system of seed dormancy.

**Reference:**

- Authors: Noriyuki Nishimura, et al.
- Title of original paper: Control of seed dormancy and germination by DOG1-AHG1 PP2C phosphatase complex via binding to heme.
- Journal, volume, pages and year: *Nature Communications* **9**, 2132 (2018).
- Digital Object Identifier (DOI): 10.1038/s41467-018-04437-9.
- Journal website: <https://www.nature.com/ncomms/>
- Affiliations: Institute of Plant Science and Resources, Okayama University.
- Department website: <http://www.rib.okayama-u.ac.jp/index-j.html>



## ■ Research Highlights

### Atomic basis for understanding bacterial photosynthesis

The light-harvesting 1 (LH1)-reaction center (RC) is a pigment-membrane protein super-complex existing in purple photosynthetic bacteria and functions in light energy absorption and conversion. It is viewed as the “the purple heart of photosynthesis” due to its importance in photosynthesis.

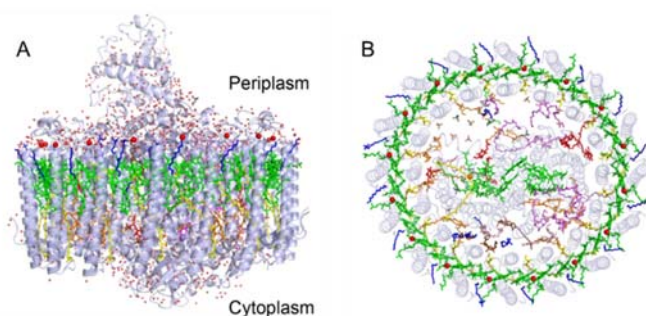
The structure of LH1-RC has been determined at a low resolution, but no high-resolution structure has been reported, which hampers our understanding of the mechanism of highly efficient light energy absorption and conversion within this super-complex.

Recently, Long-Jiang Yu and colleagues at Okayama University and Ibaraki University determined the high resolution crystal structure of LH1-RC from a thermophilic photosynthetic bacterium *Thermochromatium tepidum*.

The resolution was significantly improved by optimizing methods for purification and crystallization, and the crystals obtained were used to collect X-ray diffraction data at the synchrotron radiation facility SPring-8.

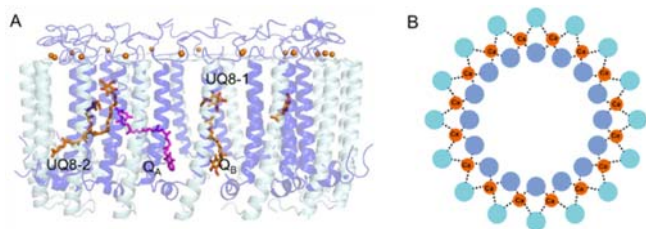
The high resolution structure of LH1-RC revealed the detailed arrangement of the protein subunits and pigments within the super-complex, based on which, a number of novel and unique features were found. These include a completely closed ring structure of 16 pairs of LH1- $\alpha$ ,  $\beta$ -subunits, possible quinone and proton channels, unique binding pattern of 16  $\text{Ca}^{2+}$  ions related with the unusual red shift of the absorption peaks and thermostability.

The high resolution structure of LH1-RC provides a basis to elucidate the highly efficient light energy absorption and conversion reactions in bacterial photosynthesis, which may provide important clues for the development of artificial photosynthetic systems.



(Figure1) Side view (A) and top view (B) of the LH1-RC super-complex from *Tch. tepidum*. Colour codes: protein subunits, grey; BChls, green; spirilloxanthin, yellow;  $\text{Ca}^{2+}$  ions, red; water, raspberry.





(Figure2) (A) Distribution of the menaquinone and ubiquinone molecules over the LH1-RC super-complex. (B) Schematic model for the coordinating pattern of the 16  $\text{Ca}^{2+}$  ions in the LH1 complex.

**Reference:**

- Author: Long-Jiang Yu, Michihiro Suga, Zheng-Yu Wang-Otomo and Jian-Ren Shen.
- Title of original paper: Structure of photosynthetic LH1-RC supercomplex at 1.9 Å resolution.
- Journal, volume, pages and year: *Nature* **556**, 209–213 (2018).
- Digital Object Identifier (DOI): 10.1038/s41586-018-0002-9
- Journal website: <https://www.nature.com/articles/s41586-018-0002-9>
- Affiliations: Research Institute for Interdisciplinary Science, Okayama University.
- Department website: <http://www.riis.okayama-u.ac.jp/>

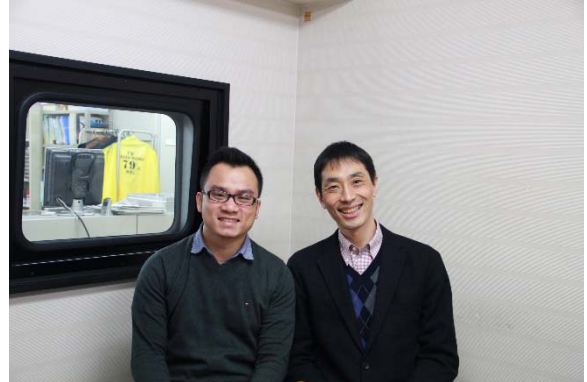


## ■ Topics

### Radio Message from International Students (World Heartful Message)

Okayama University was broadcasted an internet radio program in which international students who have come to study at Okayama University from countries all over the world talked on topics such as their life as international students, what it is like to live in Okayama City, and their research themes. The broadcasts were produced in English or the native languages of the students.

Mr. Nguyen Quang of the Graduate School of Environmental and Life Sciences from Republic of Vietnam talked about his research and plans for the future.



Mr. Nguyen Quang (left)

#### Further information

<https://www.youtube.com/watch?v=EMIIVPQJ1I8>



Radio Message from International Students

[https://www.youtube.com/playlist?list=PLJikPQTwoCj4ggrOUY2cs\\_AJZleWdG4t8](https://www.youtube.com/playlist?list=PLJikPQTwoCj4ggrOUY2cs_AJZleWdG4t8)



◆ Further information

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E-mail: [www-adm@adm.okayama-u.ac.jp](mailto:www-adm@adm.okayama-u.ac.jp)  
Website: [http://www.okayama-u.ac.jp/index\\_e.html](http://www.okayama-u.ac.jp/index_e.html)



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



Okayama University Medical Research Updates (OU-MRU)  
<http://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



SUSTAINABLE DEVELOPMENT GOALS



“Okayama University supports the Sustainable Development Goals”