Special Project

Authorized by Ministry of Education, Culture, Sports, Science and Technology (MEXT) Joint Usage / Research Center COE Formation for Artificial Photosynthesis

profile
Professor, OCARINA
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Obtained a Doctorate in Engineering at the Graduate School of Bioscience and Biotechnology, Tokyo Institute of Technology in March 1997. Was a researcher at the Kanagawa Academy of Science and Technology Foundation and the National Aerospace Laboratory of Japan (present-day JAXA). In addition, he was a lecturer, an assistant professor, and then an associate professor at the Faculty of Engineering, Oita University. He became a professor of OCARINA in April 2013. He has also been acting as the Director of the Research Center for Artificial Photosynthesis since April 2015.

One of Osaka City University (OCU)' s priorities is researching solutions for urban and international environmental problems and new energy production. We have obtained high-level research results in the area of artificial photosynthesis for the production of fuel from solar energy. The Research Center for Artificial Photosynthesis (ReCAP) was established in June 2013 with the support of Osaka City as a base of industry-university-government cooperation. Joint research chairs and departments were organized by OCU instructors who have been engaged in advanced photosynthesis and artificial photosynthesis research, as well as companies involved with that research, to realize artificial photosynthesis, which was until now considered an impossible technology. This is the only facility in Japan for industry-university joint research that has facilities and equipment for artificial photosynthesis.

Artificial photosynthesis is a groundbreaking technology that produces hydrogen and methanol from water and carbon dioxide, using inexhaustible solar energy; it will solve the energy problem that the world will be faced with in the near future. Artificial photosynthesis technology not only contributes to solving environmental problems by decreasing carbon dioxide concentrations that have been increasing due to the use of fossil fuels such as gasoline, but also enables the creation of an ideal sustainable society in which carbon circulates, since low-carbon fuel produced by this technology will reconvert to carbon dioxide after consumption.

Our center is equipped with chemistry laboratories, biochemical laboratories and analysis instrument facilities for joint research chairs and departments. The analysis instrument facilities house state-of-the-art high-accuracy analyzing equipment such as a nuclear magnetic resonance spectrometer, a Fourier transform ion cyclotron resonance mass spectrometer, and an ultra-high luminance X-ray crystal diffractometer, which can also be used by outside researchers. In addition, the center endeavors to provide a better environment for researchers by providing, for example, a female researcher support facility.

In April 2016, ReCAP was authorized by MEXT as a Joint Usage/Research Center focusing on the research of artificial photosynthesis, making the best use of research results that have been achieved so far all over the world. The period of authorization is six years.The Kickoff Seminar on CEO formation for artificial photosynthesis was held on August 17, 2016. Tomoyuki Sakaba, Assistant Manager of Scientific Research Institutes Division, Research Promotion Bureau, MEXT explained MEXT activities for the "Joint Usage/Research Center" and "Project to Promote Characteristic COE — Start-up support," as well as the promotion of research centers for the planning of large-scale academic research projects. He also talked about expectations with regard to the center. Haruo Inoue, Specially-appointed Professor of Tokyo Metropolitan University, delivered a commemorative lecture entitled "The Current Situation and Vision with Regard to Artificial Photosynthesis". He talked about a clear target and the present conditions for the practical use of artificial photosynthesis in society, and explained the drastic measures that will be necessary in the future to bring about change.

Fig.1 COE Formation for Artificial Photosynthesis

Based on OCU' s photosynthesis and artificial photosynthesis research results, ReCAP started as a center of research activities to develop the technology of photosynthesis and artificial photosynthesis for the creation

of next-generation energy and as a solution for environmental problems.

I would like to explain the features of COE formation for artificial photosynthesis, as well as future activities.
This center is expected to expand the domestic and overseas communities of researchers and joint research networks related to photosynthesis and artificial photosynthesis, disseminate research results, and promote the industry and university collaboration system for practical application of research results. ReCAP is a core of excellence organized by many researchers in various fields to promote the research of artificial photosynthesis and the application of related technology.The situation is such that there is nowhere for researchers studying natural photosynthesis and artificial photosynthesis systems to discuss their research results in Japan or abroad. Now, an artificial photosynthesis system based on natural photosynthesis has been studied vigorously. We have been promoting the study of an innovative photosynthesis system, a hybrid system integrating biological organization and functional materials. The center is disseminating highly original study output focusing on "Photosynthesis and Artificial Photosynthesis," which other laboratories cannot follow. The center's state-of-the-art analytical instruments enable us to respond to joint research in various fields.

In order to advance the joint research at the Joint Usage/Research Center, we set the study period per research topic to three years, and select topics for the departments by advertising outside the university. We conduct joint research to explore new research topics, including the use of analyzing instruments and facilities, and contribute to the training of next-generation human resources. In order to carry out joint research, we reorganized ReCAP and established four departments related to the creation of next-generation energy, so that we can accept a wide range of topics from fundamental studies to application of research results in cooperation with companies. Many joint research projects focusing on artificial photosynthesis are expected to be carried out at this center to foster researcher communities and networks both inside and outside of Japan for practical use of the technology.

We advertised for joint research topics for FY2016 including the following: Analysis of photosynthetic protein mechanism and its application to artificial photosynthesis; Invention of polymer catalyst/biocatalyst for molecular conversion of carbon dioxide; Production of photo-hydrogen using semiconductor photocatalyst / carbon dioxide restoration system; Creation of artificial light collection system and its application to artificial photosynthesis; Solar cell / Energy carrier / Study of artificial photosynthesis to compose chemicals, and selected about 20 projects.
We have great expectations for research results related to new photosynthesis and artificial photosynthesis.

In addition to joint research, we provide information related to the "Joint Usage/Research Center" via the website, the new ReCAP facebook page, and semiannual newsletters. In addition, we plan to hold lectures related to artificial photosynthesis on a regular basis, so please have high expectations for the COE Formation for Artificial Photosynthesis.
Please access the following:

Organization of COE Formation for Artificial Photosynthesis

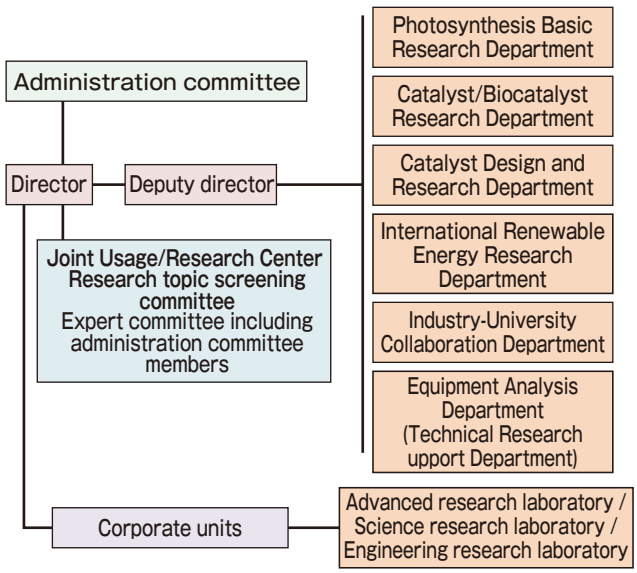

Fig.2: Organization of COE Formation for Artificial Photosynthesis

Website of COE Formation for Artificial Photosynthesis, OCU
http://recap.osaka-cu.ac.jp/ap-coe/index.html

Facebook page of COE Formation for Artificial Photosynthesis, OCU
https://www.facebook.com/RECAPOSAKACUACJP/