



The Sir Martin Wood Prize Lecture

The emerging world of microbial rhodopsins in photobiology



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Biography

2002: B.S. Department of
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2004: M.S. Department of Chemistry,
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2007: Ph.D. Department of Chemistry,
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2007-2009: Project Assistant
Professor, Chemical Resources
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2009-2016: Assistant Professor,
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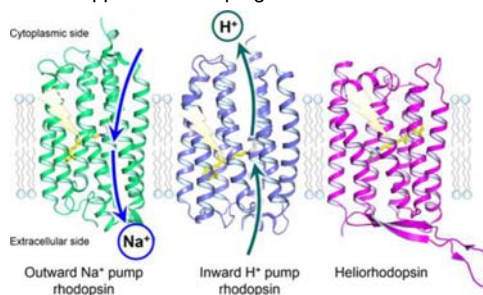
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The sun is the source of most living things on earth, and living organisms use light energy as a source of energy to drive their physiological activities and as a source of information to perceive the surrounding environment, which is useful for their own survival. The two most familiar strategies for the use of light are the vision of animals, including humans, and the photosynthesis of plants.

In photosynthesis, complexes of chlorophyll pigments and large proteins, called the photosystem exist in chloroplasts and other parts of plants, absorb the energy of sunlight and undergoes a highly efficient charge-separation reaction to produce the chemical energy necessary for the synthesis of adenosine triphosphate (ATP) and carbohydrates. On the other hand, in animal vision, the shape and color of objects seen by the eye are recognized by rhodopsin, a photoreceptor membrane protein located in the retina, which captures light entering through a lens in eye and transmits this information to the brain through the optic nerve.

In recent years, it was revealed that many microbes such as bacteria and unicellular eukaryotic microbes, has their own photoreceptive proteins called microbial rhodopsin, similar to animal rhodopsin. Both of these are membrane proteins consisting of seven α -helices, with a retinal pigment, a derivative of vitamin A, bound to the protein to absorb visible light. However, unlike animal rhodopsin, microbial rhodopsin uses the light energy to transport various ions, such as protons, sodium and chloride ions, into and out of the cells, and to control gene expression with light, to regulate enzymatic activity in a light-dependent manner, etc.

In recent years, these microbial rhodopsins have been used as a major molecular tool in "optogenetics," a new methodology to manipulate the neural activity in animals by light. In this webinar, I will present the photobiology of microbial rhodopsins, the chemical and molecular mechanisms, as well as the applications in optogenetics.



Associate Professor Inoue was awarded the Sir Martin Wood Prize at the Millennium Science Forum which took place in November 2019. The Millennium Science Forum was established in 1998 to promote scientific exchange between Britain and Japan and recognize the work of outstanding young Japanese researchers. The prize is named after Sir Martin Wood, founder of Oxford Instruments.