

【Grant-in-Aid for Specially Promoted Research】 Science and Engineering (Chemistry)



Title of Project : Development of synthetic photo-functional molecules for medical applications

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Research Area : Chemistry related to living body

Keyword : Biofunctional chemistry, Biological recognition/Biofunctional chemistry

【Purpose and Background of the Research】

Despite the advance of medical sciences, it is still difficult to diagnose and cure diseases such as cancer and cardiovascular disorder, which are major causes of death in Japan. Molecular imaging technologies are attracting attention because they may provide not only mechanistic insight, but also noninvasive and accurate diagnosis of such diseases. With respect to chemistry, extensive research is being performed for the development of functional molecules, such as fluorescent probes and MRI contrast agents that can selectively visualize lesions.

Over the last decade, our group has focused on the development of photo-functional molecules. More than fifty compounds have been developed based on design strategies established by ourselves (Fig. 1), and 14 of them are now commercially available. In this research project, taking advantage of our world-leading experience in this field, we aim to develop novel photo-functional molecules for medical applications, including diagnosis and treatment.

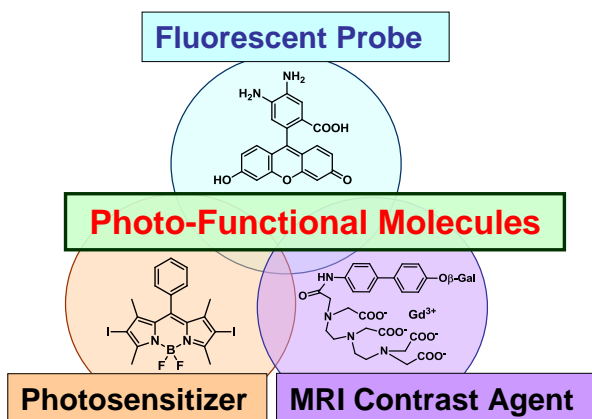


Fig. 1 Examples of photo-functional molecules developed by our group

【Research Methods】

To detect fluorescence emitted within the body, fluorescent probes that are excited at wavelengths in the near-infrared region (650-900 nm) are necessary. Therefore, we plan to develop novel long-wavelength fluorophores

that are compatible with a range of chemical modifications, and functionalize them by incorporating reactive moieties with specific targets. In addition, we will develop fluorescent probes and contrast agents that react with chemical species related to cancer and ischemia, and apply them for in vivo imaging. Probes for use in the screening of drug candidates and for blood tests will also be developed.

As to photosensitizers, we plan to develop molecules that produce reactive oxygen species only in the target lesions, thereby reducing the adverse effects of the current systems.

【Expected Research Achievements and Scientific Significance】

Using the novel probes, dynamic analysis of target molecules in vivo will be feasible, and this will be helpful to understand the mechanisms of diseases. Development of novel therapeutic agents is also expected.

【Publications Relevant to the Project】

- "Development and Application of a Near-Infrared Fluorescence Probe for Oxidative Stress Based on Differential Reactivity of Linked Cyanine Dyes" D. Oushiki, H. Kojima, T. Terai, M. Arita, K. Hanaoka, Y. Urano and T. Nagano, *J. Am. Chem. Soc.*, **132**, 2795-2801 (2010).
- "Design and Development of Enzymatically Activatable Photosensitizer Based on Unique Characteristics of Thiazole Orange" Y. Koide, Y. Urano, A. Yatsushige, K. Hanaoka, T. Terai and T. Nagano, *J. Am. Chem. Soc.*, **131**, 6058-6059 (2009).

【Term of Project】 FY2010-2014

【Budget Allocation】 419,200 Thousand Yen

【Homepage Address and Other Contact Information】

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