Development of light-harvesting photosensitizers for deep-tissue photodynamic therapy

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Project Outline

The purpose of this research is to create "light-harvesting supramolecules" that can efficiently absorb light in the near-infrared region (700-1000 nm), which is called the "window of the body" and has high biological permeability, and concentrate energy. The aim is to create "light-harvesting supramolecules" that can efficiently absorb light and concentrate the energy, and to develop "light-harvesting assisted photodynamic therapy (LH-PDT)," an innovative method to realize photodynamic therapy (PDT) deep inside the body. Light-harvesting assisted photodynamic therapy (LH-PDT) is a non-surgical therapy that uses reactive oxygen species (ROS) generated by light irradiation of specific compounds to destroy the lesion. PDT is attracting a great deal of attention because it does not require surgery, it can selectively treat lesions by administering photosensitizers and light irradiation, and it has a low burden on patients. Although PDT has been used for the treatment of skin cancer and other diseases and has shown good efficacy, its application has been limited to diseases on the surface of the body and has been difficult to treat deep inside the body because light does not penetrate the body. The light-harvesting supramolecules developed in this study were found to exhibit good PDT properties and improved bio-residency. We are now developing light-harvesting supramolecules driven by light in the near-infrared region, which is highly permeable to living organisms, to develop effective therapies for deep-seated cancers such as LH-PDT. We have confirmed that the supramolecular assembly of rhodamine derivatives has PDT effects at the cellular level. In addition, the supramolecular aggregates were administered to tumor-bearing model mice and irradiated with light, and the results showed good effects.