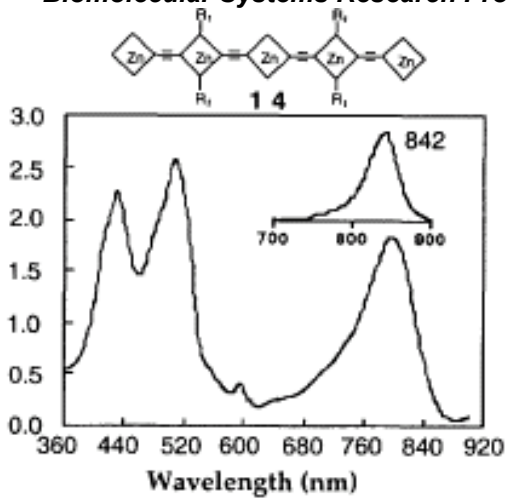
Ultra bright Near Infrared Fluorophores for New Biomedical Sensor Technology

Michael Therien, University of Pennsylvania

Biomolecular Systems Research Program



Multi-porphyrin structure with extended IR emission.

Description

Fluorescent probes conjugated to molecular recognition molecules can target and locate tumors through fluorescent imaging.

The technique is limited by the sensitivity required for deep tissue imaging (~few cm). Ultra-bright probes can increase sensitivity and target depth.

New probes, highly conjugated porphyrin-based chromophore arrays, exhibit superradiance, yielding much higher signal upon excitation.

Innovative Claims/NASA Significance

This work will develop superradiant NIR probes and molecular beacons for the detection of human cancers (particularly breast and possibly prostate); moreover, work completed to date indicates that these ultrabright NIR emitters will offer sensitivity enhancements that exceed by more than one order of magnitude than that established to date for the current state-of-the-art NIR beacons and probes. NIR can probe through significant amounts of tissue, Thus, the end product of this technology is expected to be the non-invasive (non-intrusive) detection of small human cancers. Other applications include new contrast agents, novel technology to tag biological substrates that enables real-time tracking and monitoring of such species via non-invasive optical technology, and biomedical sensors.

Plans

Year 1

1. Chemical synthesis of supperadiant pigments
2. Photophysical studies
3. Conjugate to RNA

Year 2

1. Use pump-probe experiments to explore fundamentals of supperradiant probes
2. Develop even brighter probes
3. Begin in-vitro and cell culture experiments

Year 3

1. Move to animal models