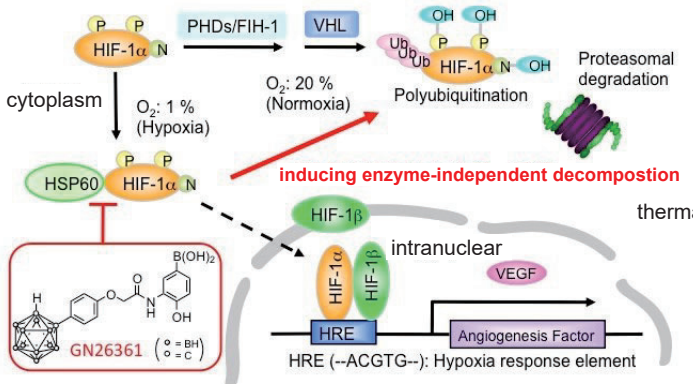
Nakamura-Okada Lab

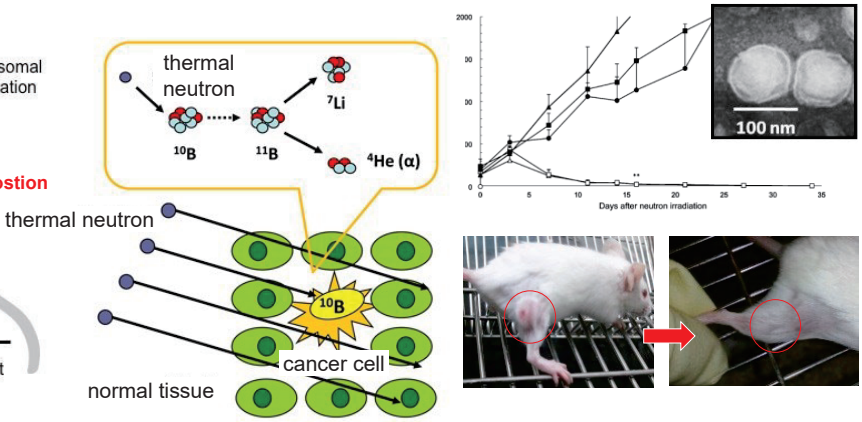
Elucidation and Cotrol of Biological Functions Based on Synthetic Organic Chemistry

Laboratory for Chemistry and Life Science

http://syn.res.titech.ac.jp/

Our group aims to realize innovations in drug discovery toward development of new cancer therapy and in chemical biology based on synthetic organic chemistry. We proceed synthetic methodology development based on organometallic chemistry, interdisciplinary researches in medicinal science and chemical biology as well as applied research for boron neutron capture therapy. All these researches come from "creation of molecules" based on synthetic organic chemistry.



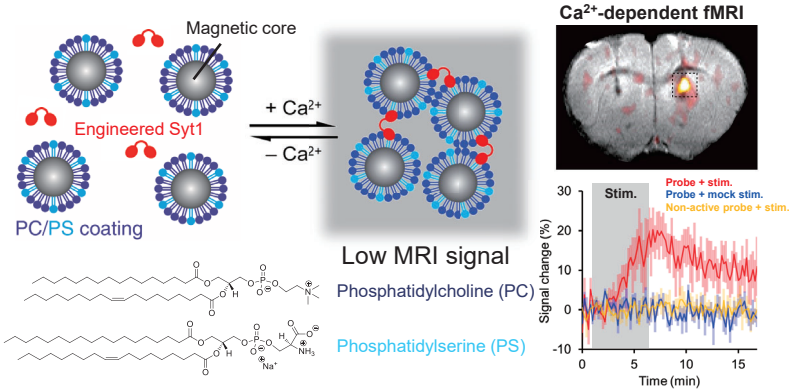


Development of next generation anti cancer drugs targeting Hypoxia Inducible Factor-1 (HIF-1)

In contrast to normal tissues, supply of oxygen and nutrition is insufficient in solid tumor tissues. Angiogenesis is strongly activated by the HIF-1α in these tumor tissues and this accelerated proliferation, invasion, and metastasis of cancer cells. Therefore, HI1-α has been regarded as a promising drug target. Our group have developed inhibitors for the HIF-1α and we already reported one of the most active synthetic inhibitor. In addition, we developed a rare inhibitor for molecular chaperone, HSP60 and successfully elucidated its role in controlling the function of HIF-1α.

Development of boron delivery system for boron neutron capture therapy for realizing a cancer therapy with minimal side effects

Boron netron capture therapy (BNCT) is a less invasive, new cancer therapy that kills cancer cells by high energy α-ray that is locally generated in cancer cells from less harmful thermal neutrons and ^{10}B-containing drugs. Ideal cancer therapy only kills cancer cells without damaging normal tissues, therefore selective delivery of the ^{10}B-containing drugs to cancer tissues is important. We develop a next generation boron nano carrier that selectively accumulate in tumor tissues based on synthetic organic chemistry.



Development of Magnetic Probes for Imaging and Controlling Biological Functions

Optical techniques using ultraviolet-visible light are useful for molecularly specific analysis but they have limitations derived from low tissue penetration of the light. Imaging modalities using magnetic field are powerful tools to observe a wide region of the body, although their molecular specificity is inferior to optical modalities. In order to bridge the gap, we develop magnetic probes that respond a biomolecule and cause perturbation of magnetic field. The goal of the research is to establish a versatile magnetic technique capable of imaging wide and deep regions of the body with molecular specificity.

Development of photo-induced protein modifications toward controle of protein functions

Chemical modifications of target proteins in living cells have garnered much attention because they lead to not only elucidation of biological phenomena but functionalization of the proteins. We have utilized short-lived radical species in the protein modifications. We successfully modified target proteins through covalent bond formation using single electron transfer (SET) reaction at the surface of the target protein by photoredox catalyst that is connected to a ligand of the protein.