

Collaborative Research from the Center for Membrane Biosciences

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Abstract

The Center for Membrane Biosciences has been facilitating new research activities between the IUPUI School of Science and IU School of Medicine in the structure, biochemistry, and physiology of biological membranes. Results from two projects resulting from these collaborations are presented.

Project 1: Ceramides are sphingolipids involved in the development of lung alveolar cell apoptosis (programmed death) and possibly in the clearance of apoptotic cells by alveolar macrophages. We use a combination of molecular and cellular methods to determine the effect of ceramides on the ability of alveolar macrophages to engulf apoptotic cells. Engulfment experiments of labeled apoptotic Jurkat cells were performed with rat alveolar macrophages (AM) obtained via bronchoalveolar lavage. AM were treated with various ceramide species and efferocytosis was quantified by flow cytometry. Using small-angle X-ray scattering and solid state ²H NMR we determined how ceramides (C6:0, C18:1) affect the molecular organization and the physical properties of model membranes. These studies can lead to a better understanding of the molecular mechanisms responsible for apoptotic cell clearance. If the clearance process is impaired, apoptotic cells may progress to secondary necrosis, resulting in release of harmful cellular contents and tissue inflammation.

Project 2: Highly-photostable quantum dots (QD) conjugated to lipids or antibodies can be utilized to explore changes in compartmentalization of the plasma membrane due to hyperinsulinemia using wide field single molecule fluorescence microscopy. Protocols describing the bio-inertness and monovalent binding of QDs to antibodies are outlined, as well as use of confocal fluorescence correlation spectroscopy to determine colloidal stability of CdSe/ZnS QDs in aqueous solution. Tracking experiments on QD-conjugated to transferrin receptors in healthy and insulin-resistant adipocytes detect changes in membrane compartmentalization. The impact of chromium picolinate on receptor mobility was also investigated.