Department of Chemistry and Molecular Biology
Seminar
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Imaging Signaling Biochemistry in Living Cells by Fluorescence Resonance Energy Transfer

Dr. Adam Hoppe
Assistant Professor, Department of Chemistry and Biochemistry
South Dakota State University, Brookings

Abstract

The biochemistries of the living cell are exquisitely organized in both space and time. While classical biochemical approaches explain how individual proteins function in isolation, new methods are needed to understand how collections of interacting proteins function within the complex environment of the living cell. To this end, we have developed quantitative fluorescence imaging technologies based on Fluorescence Resonance Energy Transfer (FRET) to measure the localization and interactions of proteins within living cells. These technologies provide new insights into the spatial and temporal organization of the signaling mechanisms controlling the processes by which macrophages internalize particles by phagocytosis. In particular, small G-proteins of the Rho family (Cdc42, Rac1 and Rac2) and a lipid modifying enzyme phosphatidylinositol-3-kinase (PI3K) create localized and dynamic gradients to regulate the cytoskeletal machinery mediating formation of phagosomes. These observations and the models derived from them lay the foundation for development of quantitative models for understanding how receptor signaling biochemistries control cell function.