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Biomedical Engineering

Seminar Announcement

Biosensing with Bioluminescent Genetically Engineered Proteins and Cells: from Molecular Switches to Quorum Sensing

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Sylvia Daunert, PhD

Sylvia Daunert is the Gill Eminent Professor of Analytical and Biological Chemistry, the 2004-2005 Distinguished Professor from the College of Arts & Sciences at the University of Kentucky, and a 2005-2006 University of Kentucky Research Professor.

A diverse array of bioluminescent biosensing systems have been developed in our laboratory by employing recombinant photoproteins and genetically engineered whole cells. Specifically, the photoprotein aequorin has been genetically engineered by preparing mutant and fusion proteins, and by designing molecular switches. We have incorporated various chromophore analogues into the newly produced aequorin variants in order to shift the emission maxima and alter the bioluminescent decay kinetics (1). Moreover, we have genetically encoded aequorin with non-natural amino acids in a global as well as in a site-specific manner. These methods have allowed for the creation of newly 'colored' aequorin variants and have allowed for the simultaneous, single-well detection of two aequorin variants using time resolution. Additionally, we have prepared a bioluminescent molecular switch for glucose by dissecting the gene of the aequorin molecule into two halves and inserting in between the gene of the glucose binding protein to produce a protein molecular switch capable of glucose detection (2). In the presence of glucose, the glucose binding protein undergoes a conformational change bringing the two 'halves' of the aequorin molecule and allowing for the emission of bioluminescence in a manner proportional to the concentration of glucose present. Finally, we have taken advantage of the bioluminescence produced from bacterial luciferase by employing the *luxCDABE* cassette in order to study quorum sensing and quorum sensing molecules (QSMs) in relation to gastrointestinal (GI) disorders. To that end, we developed and employed genetically engineered bioluminescent whole-cell-based sensing systems for the detection of QSMs in biological samples, such as saliva, stool, and bowel secretions, both in subjects with various GI disorders and healthy volunteers (3).

(1) L. Rowe, A. Rothert, C. Logue, M. Ensor, S. Deo, S. Daunert, PEDS 2008, 21(2), 73.
(2) K. Teasley-Hamorsky, M. Ensor, Y. Wei, S. Daunert, Angewandte Chemie 2008, 47(20), 3718.
(3) A. Kumari, P. Pasini, S. Deo, D. Flomenhoft, S. Harohalli, S. Daunert, Anal. Chem. 2006, 78(22), 7603.