

JOINT BIOENGINEERING SEMINAR SERIES



“Quaternary structure of proteins in living cells probed with the novel method of FRET spectrometry”

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Abstract:

When an excited fluorescent molecule, called a ‘donor,’ is located within a few nanometers of an unexcited molecule, i.e., an ‘acceptor,’ part of the donor’s energy may be transferred to the acceptor. This quantum mechanical effect, known as Förster (or Fluorescence) Resonance Energy Transfer (FRET), causes the acceptor molecule to emit light with red-shifted wavelengths compared to the excitation wavelength. Detection of such spectral shifts helps determine whether two or more fluorescent molecules interact with one another thereby allowing one to extract quantitative information regarding supra-molecular arrangements of biological macromolecules. This talk will begin with an overview of the main theoretical and technological advances that led to the recent evolution of FRET into a method for determination of the stoichiometry and quaternary structure of membrane protein complexes in living cells, dubbed ‘*FRET spectrometry*.’ Our method relies on a novel two-photon microscope with spectral resolution (called an Optical Micro-Spectroscopic system, or OptiMiS) and a competent theory of FRET in oligomeric complexes of arbitrary geometry to determine the association stoichiometry and structure of protein complexes in living cells. The second part of the talk will review recent results obtained by us and our collaborators from studies of oligomeric complexes of membrane proteins in living cells in the presence and absence of their natural ligands.

Bio:

Prof. Valerică Raicu holds a PhD degree in Biophysics from the University of Bucharest. Between 1991 and 2004, he has held research and academic positions at the Institute of Physical Chemistry of the Romanian Academy (Bucharest), Kochi Medical School (Japan), and University of Toronto (Canada). Since 2004, Prof. Raicu has been at the University of Wisconsin-Milwaukee where he currently is a Professor in the Physics Department, an adjunct faculty member in the Department of Biological Sciences, and the Director of UWM Small Businesses Collaboratory. He has served as the Physics Department Chair Between 2012 and 2015 and is a co-founder of Aurora Spectral Technologies, LLC – a start-up company commercializing technology developed by his research group. Professor Raicu has authored or co-authored over fifty peer-reviewed papers and several book chapters on various topics in biophysics, two books (*Integrated Molecular and Cellular Biophysics*, Springer, 2008; and *Dielectric relaxation in biological Systems*, Oxford University Press, 2015), as well as several patents in the area of optical micro-spectroscopy.