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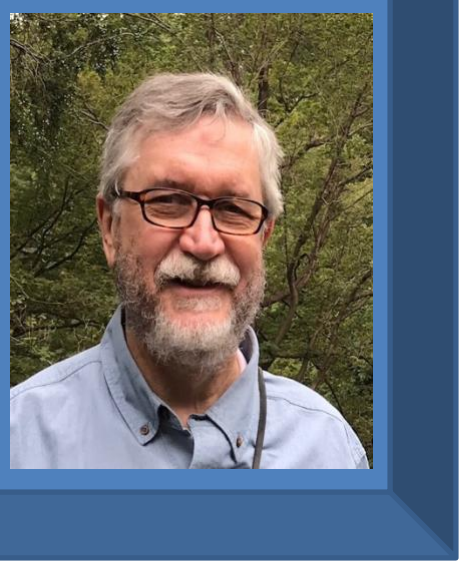

How Type I Photosynthetic Reaction Centers Evolved to Adapt to the Great Oxygenation Event

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Date: Thursday, March 1 at 3pm

Location: SEEC Building, Room C120

Abstract:

The first photosynthetic organisms evolved as far back as 3.5 billion or more years ago, but the electron donors were probably hydrogen, hydrogen sulfide, and organic molecules synthesized by extant single-celled chemotrophs, lithotrophs and phototrophs. When these highly reduced molecules were exhausted, the only readily available reductant would have been water, which is exceedingly difficult to oxidize. However, the side-product of water oxidation, dioxygen, is a highly reactive molecule, and evolutionary adaptations would have needed to take place for molecules, proteins and living organisms to survive in its presence. One of these adaptations would have taken place in the structure and function of the Type I photosynthetic reaction center that generates NADPH. In this seminar, I will draw on our recent work on the structure of the homodimeric reaction center from *Heliobacterium modesticaldum*[1] and from older work on the structure of the heterodimeric Photosystem I[2] in cyanobacteria to speculate how Type I reaction centers evolved to adapt to the onset of this highly reactive molecule.

[1]Gisriel, C., Sarrou, I., Ferlez, B., Golbeck, J. H., Redding, K. E., and Fromme, R. (2017) Structure of a symmetric photosynthetic reaction center-photosystem, *Science 357*, 1021-1025.
[2]Jordan, P., Fromme, P., Witt, H. T., Klukas, O., Saenger, W., and Krauß, N. (2001) Three dimensional structure of Photosystem I at 2.5 Å resolution, *Nature 411*, 909-917.

Bio:

John Golbeck earned his Ph.D. in biological chemistry at Indiana University with Anthony San Pietro and carried out postdoctoral studies in biophysics at Martin Marietta Laboratories with Bessel Kok. He has held faculty positions in the Department of Chemistry at Portland State University, the Departments of Biochemistry, and Chemistry at the University of Nebraska, and the Departments of Biochemistry and Molecular Biology, and Chemistry at The Pennsylvania State University. Dr. Golbeck has taken sabbatical leaves in the Department of Chemistry at Rensselaer Polytechnic University in Troy, NY, in the Biosciences Group at the Centre d'Etudes Nucléaires de Saclay in Paris, in the Fachbereich Physik at the Freie Universität, Berlin, and in the Chemistry Department at Brock University, St. Catharines, ON. His research interests involve the factors that confer thermodynamic properties to electron transfer cofactors in Photosystem I, the structural composition of homodimeric Type I reaction centers from *Heliobacterium modesticaldum*, the composition of electrically conductive bacterial nanowires in *Shewanella oneidensis*, the re-engineering of halorhodopsin to pump bicarbonate, and the use of molecular wires to connect Photosystem I with hydrogenase enzymes. John is a member of the American Society for Biochemistry and Molecular Biology, the Biophysical Society of America, and the International Society of Photosynthesis Research.

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