SACRAMENTO STATE

Department of Physics and Astronomy

FALL 2021 Colloquium Series - Virtual

"How do Environmentally-important Bacteria Breathe Without Oxygen? Structures, Functions, and Electron Transfer Mechanisms of Protein Nanowires"

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Deep in the ocean or underground, where there is no oxygen, *Geobacter* bacteria "breathe" by projecting tiny protein filaments called "nanowires" into the soil, to dispose of excess electrons resulting from the conversion of nutrients to energy. These nanowires enable the bacteria to perform environmentally important functions such as cleaning up radioactive sites, generating electricity, or sharing electrons with other bacteria. Scientists have long known that *Geobacter* make conductive nanowires – 1/100,000 the width of a human hair – but no one had discovered what they are made of and why they are conductive.

I will present our recent studies that have revealed a surprise: the protein nanowires have a core of metal-containing molecules called hemes. Previously nobody suspected such a structure. Using high-resolution cryo-electron microscopy, we were able to see the nanowire's atomic structure and discover that hemes line up to create a continuous path along which electrons travel. I will present our recent experimental and computational studies to identify the nanowire composition, structure and mechanism of conductivity by measuring their DC and THz conductivity as a function of nanowire length, temperature, frequency, pH and heme stacking. I will also present bioinspired synthetic protein nanowires and methodology to set standards for reporting protein conductivity mechanisms. These studies solve a longstanding mystery of how nanowires move electrons to minerals in the soil or help generate electricity.

Thursday, Oct. 7, 2021
4:00 – 5:20PM

Talk will be via Zoom – contact physics@csus.edu for links or visit our Colloquium Spotlight at www.csus.edu/physics

Open & Free to all students, faculty and public