Department of Mathematics and Computer Science Seminar Series

Dr. Douglas Yung, NASA/Caltech

Serra Hall, Room 210
September 18th, 2008 (Thursday)
12:30 – 1:30 p.m.

Detection of bacterial endospores: From sterilization, biodefense to astrobiology

(Target audience: Faculty and undergraduates in any major)

Bacterial spores, or endospores, are dormant structures formed primarily from *Bacillus* and *Clostridium* genera that are highly resistant to environmental extremes. Spores have long been fascinating subjects of investigation for a number of important applications, ranging from validation of sterilization and biodefense to astrobiology. Dipicolinic acid, or DPA, is a major constituent and unique chemical marker of endospores. When released *via* germination or physical rupture, DPA can bind to terbium ions (Tb^{3+}) with high affinity to form the terbium dipicolinate binary complex $[Tb(DPA)]^{+}$. This binary complex exhibits intense emission in the visible range under UV excitation, and comprises the basis of endospore detection assays and biosensors. Novel technologies are under development as a rapid method to validate and assure sterility level in medical and spacecraft assembly facilities. The Anthrax Smoke Detector has been patented and tested to serve as a cost effective front-end monitor to identify exposed victims for prompt treatment. Several spectroscopic methods have also been developed to detect trace number of endospores in Arctic ice cores, Antarctic underground lake, deep-sea sediments and desert soils to understand the longevity and survival strategies of endospores, which will consequently be applied in future extraterrestrial life detection missions.

About the Speaker

Douglas Yung earned a B.S. in Electrical Engineering and Mathematics from UCLA and a Ph.D. in Bioengineering from Caltech. He has developed a time-resolved fluorescence microscopy technique to detect bacterial endospores in order to address basic science questions from determining the longevity of life on Earth, understanding resistance, viability and ubiquity of endospores to patented applications such as the Anthrax Smoke Detector, post-anthrax decontamination protocol and air monitoring systems to be used on long-term manned spacecrafts. The research is carried out under the Planetary Science and Life Detection section at NASA's Jet Propulsion Laboratory. His work has been presented in more than 10 multidisciplinary national and international conferences, covering mathematics, bioengineering, microbiology, electrical engineering, chemistry and geophysics. His work on Anthrax Smoke Detector has been highlighted for press release during the American Society for Microbiology Annual General Meeting in 2006 and has received widespread publicity in the media. His current research interests include biophotonics, astrobiology, molecular & environmental microbiology, planetary protection, as well as life-searching expeditions in extreme places on Earth.

Please direct any questions to: Dr. Simon Koo, Math/CS (x2932; koo@sandiego.edu)