The University of Mauritius

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The Embassy of the United States of America

Invite you to 2 talks by

Professor Shuguang Zhang

(Associate Director
Center for Biomedical Engineering at the Massachusetts Institute of Technology)

Talks

(1) Technical talk/interactive session with University Faculty and students and other interested persons, on **Monday 20 Sept at 10.30 a.m at UoM (LT 2, New Academic Complex, Réduit)**.

Title: ***Designer lipid-like peptides for study of functional membrane proteins of medical, technological and economic importance*** *(Abstract attached)*

(2) General public talk on **Tuesday 21 Sept at 1.00 p.m (at Rajiv Gandhi Science Centre, Bell Village)**.

Title: ***How Innovative Scientific Research Can Drive Emerging Economies?***

Prof. Shuguang Zhang is at the Center for Biomedical Engineering and Center for Bits & Atoms, Massachusetts Institute of Technology. He received his B.S. from Sichuan University, China and Ph.D. in biochemistry & molecular biology from University of California at Santa Barbara, USA. He was an American Cancer Society Postdoctoral Fellow and later a Whitaker Foundation Investigator at MIT. He was a 2003 Fellow of Japan Society for Promotion of Science (JSPS fellow). His work of designer self-assembling peptide scaffold won 2004 R&D100 award. His and his colleagues' work for direct harvesting biosolar energy was selected to be the Top 100 Science Stories in 2004 by *Discover* Magazine and one of the 10 finalists of the 2005 Saatchi & Saatchi Award for World Changing Ideas. He was a 2006 John Simon Guggenheim Fellow. He was the winner of the 2006 Wilhelm Exner Medal of Austria. He is inducted as a foreign corresponding member of the Austrian Academy of Sciences on 19 May 2010.

Some background information on Prof Zhang's work

Designing novel materials and molecular machines

By imitating nature, scientists are designing completely new molecular patterns that can serve as a blueprint of new materials and sophisticated molecular machines. In the emerging fi eld of nanotechnology, basic natural building blocks such as amino acids are used to create structures such as peptides and proteins for applications in medicine and energy. Nanobiotechnologists have begun to exploit molecular self-assembly as a fabrication tool for building new nanobiostructures such as nanotubes for metal casting, nanovesicles for drug encapsulations, and nanofi ber scaffolds for growing new tissues. They also have constructed an extremely high-density nanoscale photosystem and ultra-lightweight solar-energy-harvesting molecular machines. With better understanding of these seemingly intractable phenomena, one day mankind may be able to use nano devices to repair body parts or to rejuvenate the skin, enhance human capabilities, harness the unlimited solar energy, and achieve other feats that seem impossible today.
Source: eJournal USA, Economic Perspectives (Oct 2005, p22-26)

Infrared chlorophyll could boost solar cells

Because over half of the light from the sun comes in at infrared wavelengths, the makers of photovoltaic panels have been working on ways to extend the section of the spectrum that solar cells can absorb to beyond red. Shuguang Zhang of the Massachusetts Institute of Technology thinks that he and his colleagues can do more than learn from the chlorophyll – they can use it directly.
Zhang's previous work includes making solar cells using proteins from spinach leaves. These proteins, known as photosystem I, contain arrays of some 200 light-gathering chlorophyll molecules that use photons to free up electrons for fixing carbon dioxide into sugars. If the electron is not immediately harvested from the photosystem for use in a solar cell, it will recombine with its hole – the region of positive charge it left behind – and re-emit a new photon. But in Zhang's set-up, the photosystem is anchored to a semiconductor nanowire capable of transferring that electron to a metal, putting photosystem I to work generating a current. He is currently working with Michael Grätzel of the Swiss Federal Institute of Technology in Lausanne, developer of low-cost dyesensitised solar cells that use inorganic molecular dyes to absorb light in the same way that chlorophyll does.
Source: Science, DOI: 10.1126/science.1191127

DESIGNER LIPID-LIKE PEPTIDES FOR STUDY OF FUNCTINAL MEMBRANE PROTEINS OF MEDICAL, TECHNOLOGICAL AND ECONOMIC IMPORTANCE

Shuguang Zhang

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G-protein coupled receptors (GPCRs) are vitally important in all aspects of signaling. In spite of enormous efforts, only 4 unique GPCR structures are known. A critical bottleneck is the notorious difficulty of finding a detergent that maintains GPCR function and stability. Here we report rapid production of GPCRs, specifically 12 unique mammalian olfactory receptors, using short, designer lipid-like peptides as surfactants. The peptides were able to solubilize each receptor. Circular dichroism and microscale thermophoresis demonstrated that the ORs had folded helical structures and bound their odorants. The peptides' performance was comparable to that of the best traditional detergent. The ability of all tested peptides to solubilize all tested ORs demonstrates their usefulness as a general class of surfactants for ORs, other GPCRs, and membrane protein studies.

Shuguang Zhang's laboratory since 2004 focuses on study of structure and function of membrane proteins and uses the membrane protein to design nanobiodevices. His lab uses photosystem I to design biosolar energy device to directly harvest photons to produce electricity. His lab currently uses synthetic biology to bioengineer ferredoxin-hydrogenase fusion to split water to produce hydrogen. His lab also studies G-protein coupled-receptors including olfactory receptor and chemokine receptors. His lab is not only interested in understanding the dynamics how GPCRs recognize their corresponding small chemical, peptide and protein ligands, but also how these GPCRs with similar structural folds play indispensible roles in a wide spectrum of diverse intercellular communications and communicate with the external world. Since membrane proteins are nature-made elegant and sophisticated molecular machines, Zhang's lab is also interested in design and fabricate membrane protein-based molecular devices, combing with other materials, from direct capture solar energy to ultra-sensitive sensing devices.

Selected Recent Reviews:

Hauser, C.A.E. & Zhang, S. (2010) Designer self-assembling peptide biological materials. *Chemical Society of Reviews*, Royal Society of Chemistry. **39,** 2780-2790.

Zhao, *et al.* (2010) Molecular self-assembly and applications of designer peptide amphiphiles**.** in *Peptide and Protein-based Materials: Present and Future*. (Ed. D. Woolfson & R. Ulijn). *Chemical Society of Reviews*, Royal Society of Chemistry. DOI:100115 B915923C.