UCLA

DEPARTMENT OF CHEMISTRY AND BIOCHEMISTRY

presents

Procter&Gamble

UCLA Student Organization for Cultural Diversity in Chemistry Lectureship Series

with

Professor J. C. (Tito) Scaiano

Department of Chemistry
University of Ottawa

"Using Organic Photochemistry to Make Nanoparticles and Nanoparticles to Direct Organic Chemistry"

Abstract. Organic photochemistry has proven an excellent tool for the production of nanostructures of gold, silver, copper, cobalt, niobium and other elements, from the corresponding ions in aqueous systems. Among photochemical precursors, ketones are good photosensitizers for nanoparticle synthesis not because of the energy they can absorb or deliver, but rather because of the reducing free radicals they can generate. Thus efficient nanoparticle generation requires a careful selection of substrates and experimental conditions such that free radical generation occurs with high quantum efficiency, and where metal ion precursors do not cause UV screening of the organic photosensitizers. Synthesis strategies based on water-soluble benzoins have proven very versatile. Beyond organic precursors, hydrogen peroxide has proven a valuable *reducing* agent for the formation of ultraclean nanoparticles that can later be modified using laser techniques. The nanoparticle forming reactions can be interpreted in terms of multisite proton coupled electron transfer (PCeT) reactions.

Plasmon transitions provide an easy way to deliver energy to metallic nanostructures, that can then be used to control the chemistry and spectroscopy of molecules in their vicinity. A molecule irradiated in the proximity of a metal nanoparticle can be viewed as undergoing transmitter/receiver antenna interactions, a process that has also been described as analogous to a lightning rod effect. Thus irradiating the nanoparticle itself can deliver energy to a strategically located organic molecule through plasmon field interactions. While fluorescence and Raman enhancements through these interactions are well established, other forms of plasmon sensitization remain largely unexplored. For example, we have shown that this energy can trigger polymerizations with exceptional spatial resolution, a strategy that can be used for imaging applications or for the fabrication of self-assembled nanolasers.

Other examples will include metal nanoparticle catalysis of organic reactions, such as oxidations and reductions, as well as acid/base catalyzed processes. The 'laser drop' technique will be discussed in the context of a valuable tool to study the mechanisms of plasmon-mediated photocatalysis.

The antibacterial properties of silver nanoparticle composites will be briefly discussed, including the long-term goal of producing tissue replacement scaffolds.

Thursday, February 14, 2013

5:00 PM

Cram Conference Room – 3440 Mol Sci

Refreshments served at 4:30 PM

For further information, contact David Gingrich at gingrich@chem.ucla.edu