

Systems and Interfaces: Controlling Bio and Catalytic Processes

by Prof. Galen D. Stucky

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Abstract

The dynamic and often subtle interactions among organic and inorganic species and/or organized arrays covers a wide kinetic and thermodynamic phase space that offers almost unlimited opportunities to synthesize hierarchical multifunctional systems; and, to subsequently use the multifunctional interface chemistry to modify catalytic and bio processes. This talk will focus on two examples of some recent research on the use of inorganic species to control catalytic and bioprocesses. The first example is based on the search for a viable approach to make more efficient use of stranded natural gas by eliminating the need for flaring or reinjection into gas/oil producing geological formations. The target in this case is to selectively go directly from methane and the light hydrocarbons found in natural gas to gasoline or to petrochemical precursors needed and used for commercial carbon containing commodities. The challenge is to replace the Syngas and Fischer Tropsch processes using a smaller platform that can be utilized, for example, on ocean-based oil platforms. The second example involves the development of a protocol to accelerate or inhibit blood coagulation by using an inorganic-blood interface that selectively controls local electrolyte conditions, local dehydration, heating of blood, and presentation of a high surface area, charged polar surface that defines the interface chemistry created upon contact with the blood clotting cascade. Methods for optimizing the heat response of inorganic-based hemostatic materials, as well as incorporating antibacterial activity, will be described. By monitoring both the hemostatic and bone-forming activity of newly prepared mesostructured hemostatic bioactive glasses that have different compositions, an interesting inverse relationship for this class of wound healing materials has been determined. The relationship between *in vitro* research and *in vivo* testing, as well as the ultimate practical commercial evaluation and application will also be summarized.

Speaker Prof. Galen D. Stucky

Galen D. Stucky earned his doctorate from Iowa State University in 1962. He held positions at the University of Illinois, Sandia National Laboratory, and DuPont Central Research and Development before joining the faculty of the University of California, Santa Barbara, in 1985, where he is Professor in the Department of Chemistry & Biochemistry and the Materials Department and a member of the Interdepartmental Program in Biomolecular Science and Engineering. His current research interests include molecular assembly of nanoscale to macroscale components of composite systems; the interface of inorganics with biomolecules; chemistry associated with the efficient utilization of energy resources; and understanding Nature's routes to organic/inorganic bioassembly. He has published over 650 scientific articles and has been awarded 13 patents. Honors include the ACS Award in Chemistry of Materials (2002), the IMMA (International Mesostructured Materials Association) Award (2004), and the ATACCC Award (2008). He was elected Fellow, American Academy of Arts and Sciences, in 2005.

ALL ARE WELCOME!

Prof John Wang Host