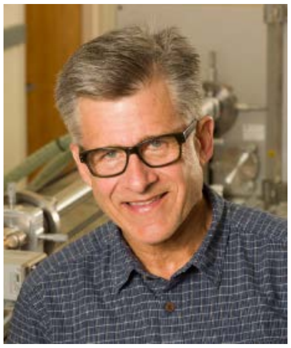

Jeff Brinker,

Distinguished and Regent's Professor of Chemical and Biological Engineering and Molecular Genetics and Microbiology Emeritus, Member UNM Comprehensive Cancer Center, the University of New Mexico, Albuquerque, NM.

Tuesday, 30th April 2019

Noon in 1003 Kemper Hall

Synthetic, Biomimetic, and Nanoparticle Modified Cellular Constructs

Natural materials systems evolved over billions of years to solve some of the greatest engineering challenges facing the modern world, e.g. achieving simultaneously hard, tough, and strong protection systems, perfect molecular separation, ultra-thermal insulation, and self-cleaning. The optimized property combinations found in nature often emerge as a result of hierarchical composite designs comprising disparate materials organized on multiple scales, where the feature sizes are prioritized according the relevant functional length scale (exciton, stress field, phonon, van der Waals contact, wavelength, etc.). Mimicking these evolved hierarchical designs employing the complete palette of elements and compounds available to the chemist promises the discovery of new classes of materials that derive synergistic and often emergent properties stemming from nanoscale confinement, interfacial phenomena, compartmentalization, hierarchical organization, asymmetry, catalytic activity, switchability, and collective behavior. *Developing complex structure and function within robust, scaleable, and sustainable engineering material systems is a synthesis grand challenge that served as the overarching goal of Brinker Group research over the last several decades.* To address the challenges of biomimetic materials synthesis, our group pioneered a spectrum of self- and directed-assembly methods that serve as a tool kit to fabricate synthetic structures with architectures rivaling the complexity of natural materials. This lecture will discuss the process *silica cell replication* wherein all cellular features are transformed into exact silica replicas in a self-limiting process. The bio-composite replicas preserve indefinitely selective surface antigen binding and multiple protein functions in their native contexts. Red blood cell (RBC) replicas serve as a starting point for rebuilding completely synthetic RBCs via layer-by-layer polymer deposition, silica etching and fusion of native RBC membranes. Rebuilt RBCs can be loaded with multiple cargos and circulate much like native RBCs, providing an unusual example of a long circulating synthetic *macroparticle*. Finally, we have developed a simple, universal approach to modify living cells and RBCs with a spectrum of different nanoparticles conferring to the cells new non-native and often extremophile functionalities. Nanoparticle modified RBCs show extended circulation time *in vivo* and unusual biodistributions – they can be configured as imaging agents, delivery vehicles, or sequestration agents.

Bio: C. Jeffrey Brinker was born in Easton, Pennsylvania and attended Rutgers University where he received his B.S., M.S., and Ph.D. degrees in ceramic science and engineering. Jeff joined Sandia National Laboratories as a Member of the Technical Staff in 1979. He was promoted to Distinguished Member of the Technical Staff at SNL and appointed

Distinguished National Laboratory Professor of Chemistry and Chemical Engineering at the University of New Mexico in 1991. Since 1999, he has served as one of several Sandia Laboratory Fellows and as Distinguished and Regent's Professor of Chemical and Biological Engineering with co-appointments in the Departments of Molecular Genetics and Microbiology and the UNM Cancer Center. Brinker has been recognized nationally and internationally for his work in sol-gel processing (the fabrication of nanoscale materials from soluble molecular precursors) and its extension to self-assembly of porous and composite nanostructures via evaporation-induced self-assembly, and recently novel types of biotic/abiotic materials and interfaces, including porous nanoparticle supported lipid bilayers used as nanocarriers. His awards include five R&D100 Awards, the American Chemical Society's Ralph K. Iler Award in the Chemistry of Colloidal Materials, five Department of Energy Basic Energy Sciences Awards, the DOE Ernest O. Lawrence Memorial Award in Materials Science, and the Materials Research Society MRS Medal. He is a member of the National Academy of Engineering, the National Academy of Inventors, and the American Academy of Arts and Sciences. He is a Fellow of MRS, the American Ceramic Society, and the International Sol-Gel Society.