

SEMINAR

**Department of Materials Science and Engineering
Center for Advanced Materials and Nanotechnology
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GETTING TO “MIND”

THE FOUNDATION DEVELOPMENT OF A ROOM TEMPERATURE BIOLOGICAL SUPERCOMPUTER

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Reception following 4:00-5:30

Abstract

Recent advances in our ability to manipulate matter at the scale of individual molecules have created an incredible level of excitement in both the scientific community and the general population. The excitement over this new capability, commonly labeled nanotechnology, is vested in the expectation of the development of new materials and systems that offer unparalleled functionality. Materials that autonomously adapt their shape and physical properties in response to their surroundings, computers that instead of operating by switching the flow of electrons, manipulate information through the management of the ethereal world of quantum states and, molecular sized machines that actively repair damage to our bodies and function as molecular scale prosthetics are all expectations of nanotechnology. While the question of whether or not this vision is truly achievable is still open, the truth is that much of the expectations for nanotechnology are already realized in living systems.

Living systems however, are more than a product of matter manipulation at the molecular scale; the richness of functionality associated with living systems is a direct product of the information generated from both the interactions between molecules and the overall supra-molecular structure of the system. In essence living systems are “living” because of the fusion of nanotechnology and informatics. Living systems result from the precision assembly of matter

with prescribed modalities for the transport and transduction of information among supra-molecular clusters.

The concept of Integrative Technology, the intersection of the precision assembly of matter, nanotechnology, coupled with the functional building blocks of nature, biotechnology, and fused by the network flow of spatiotemporal information, informatics, is presented. The power of Integrative Technology is manifested through the engineering of synthetic biological systems. The ultimate example of which would be the fabrication of a synthetic biological processor. The design, modeling and experimental results associated with the fabrication and engineering of Excitable Vesicles, a nano-sized building block with the ability to intrinsically process information will be discussed.

Excitable vesicles have the potential of controlling and manipulation of information that would ultimately lead to the manifestations of emergent higher-order behavior. These systems are designed, engineered and produced from nanoscale components to create complex systems and materials that self-organize on multiple length scales to manifest complex emergent functional behaviors.

Biography

Dr. Carlo Montemagno is currently the Carol and Roy Doumani Professor of Biomedical Engineering, the Chairman of Academic Affairs for UCLA's Biomedical Engineering IDP and a Professor of Mechanical and Aerospace Engineering. After receiving his B.S. degree from Cornell in biological engineering, Dr. Montemagno spent eight years in the U.S. Navy as a Civil Engineering Corp. officer. During this time, he earned a M.S. in Petroleum and Natural Gas Engineering at Pennsylvania State University, and became involved with the management of Naval Petroleum Reserved in California, ultimately rising to the post of Technical Assistant Director. In 1988, Dr. Montemagno joined Argonne National Laboratory, where he served as group leader for both the Advanced Environmental Studies and the Environmental Physics research groups. While at Argonne National Laboratory, Dr. Montemagno earned his doctorate at the University of Notre Dame in Civil Engineering in 1995. He joined the Biological and Environmental Engineering Faculty of Cornell University in 1995 where he stayed until joining UCLA in 2001. Dr. Montemagno's research is focused on the application of nanotechnology to biological systems. His current projects are directed at the development of biomolecular motor powered nanoelectromechanical devices, muscle powered MEMS devices, microrobotic and the engineering of on-chip detectors for pathogens. This and related work has garnered him international recognition including major stories in the New York Times, Discover Magazine, and elsewhere.

http://www.cnsi.ucla.edu/faculty/montemagno_c.html

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