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Small things offer big promise

The ability to use machines to manipulate matter in a single molecule at a time renders many things become possible which were impossible before. Living systems do this on a regular basis. The core challenge to accessing life function is transforming the labile molecules that exist in a fragile living organism into a stable engineered system that is economically scalable. The most significant difficulties revolve around environmental stability and the inherent structural limitations of these molecules. The solution to these difficulties is in hand. Presented is the generic solution methodology used to solve these limiting challenges to produce a new class of materials and devices. By introducing "metabolism" into engineered devices and materials, solutions to grand societal challenges in Medicine, Environment and Agriculture now appear to be attainable. Furthermore this new technology does not rely on $100's of millions of infrastructures making it globally assessable to developing nations. It offers a global promise of economic opportunity and prosperity. Exemplars of the application of this new technology will be shown. We will elucidate the design, engineering and assembly of a complex closed system that uses a highly modified photosynthetic process to transform carbon waste into valuable drop-in specialty chemicals. Enabled by the synthesis of a new class of printable "inks" that have stabilized active biological molecules as integrated elements of synthesized polymer constructs, we will present a technology that transitions additive manufacturing from 3D space to a four-dimensional, functional space creating a whole new class of materials and devices. The application of this technology to medicine, particularly the treatment of type 1 diabetes, glaucoma and other medical conditions will also be illustrated.

Biography

C D Montemagno is the former and founding Dean of the College of Engineering and Applied Science at the University of Cincinnati. Immediately, he was the Chair of the Department of Bioengineering and Associate Director of the California NanoSystems Institute as well as the Roy & Carol Doumani Professor of Biomedical Engineering at UCLA. Previous to his tenure with UCLA, he served as Associate Professor in the Department of Biological and Environmental Engineering at Cornell University. He earned his BSc in Agricultural and Biological Engineering from Cornell (1980) and MSc in Petroleum and Natural Gas Engineering from Penn State University (1990). After completing his undergraduate studies in 1980, he joined the United States Navy and served for 10 years in several senior management positions as a Civil Engineering Corps Officer. He then joined Argonne National Laboratory where he led laboratory and field investigations developing Bioremediation technology for the treatment of hazardous waste. In 1995, he earned his PhD in Civil Engineering and Geological Sciences from Notre Dame University. Upon obtaining his PhD in Civil Engineering, he began his academic career as an Assistant Professor at Cornell University in the Department of Agricultural and Biological Engineering where he was one of the pioneers in the field of Nanobiotechnology. He has amassed a distinguished scholarly record resulting in a number of patents as well as appointments to numerous editorial boards and governmental committees. He is a Fellow of the American Academy of Nanomedicine, a Fellow of the American Institute for Medical and Biological Engineering, and a Fellow of the NASA Institute of Advance Concepts. He is a recipient of the Feynman Prize for Experimental Work in Nanotechnology. His current research and near term investigations focus on the development of experimental techniques to integrate metabolic functionality into materials through the engineering of biomolecular systems. Recent efforts addressed the creation of advanced systems for water purification and treatment, and the development of materials for the synthesis of high-value chemicals through the harvesting of solar energy.

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