

# 5<sup>th</sup> International Conference on **Nanotek & Expo**

November 16-18, 2015 San Antonio, USA



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### Thinking small to define a big future

The ability to use machines to manipulate matter a single molecule at a time renders many things possible that were impossible before. Living systems do this on a regular basis. The core challenge is how to transform a labile molecule that exists in a fragile living organism and to transfer that functionality into a stable system that is economically scalable. The most significant difficulties revolve around environmental stability and the inherent structural limitations of the molecule. Presented is the generic solution methodology used to solve these limiting challenges to produce a new class of materials and devices. Elements of the discussion will include the genetic engineering of active biological molecules into engineering building blocks and their assembly to introduce “metabolism” into engineered devices and materials ultimately synthesizing new classes of materials with advanced functionality that incorporates new intrinsic properties into the matter. Two exemplars will be presented. First 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 without any living organisms with commercially competitive economics. Secondly, we will present a new technology that stabilizes biological molecules maintaining their function for months at application relevant environmental conditions transitioning additive manufacturing from 3D space to a four-dimensional, functional space. Enabling the synthesis of a new class of printable “inks” that have stabilized and active biological molecules as integrated elements of synthesized polymer constructs to create a new class of materials that now includes biologic function as an intrinsic property. The next wave of technological progress will enable the manufacturing of a unique class of devices and materials that embeds complex functional behavior as an intrinsic property enabling emergent functionality at multiple length scales. These systems will actively interact with their local environment establishing a new capability that will impact solution generation across multiple societal sectors including health care, resource recovery, food production and environmental restoration.

### Biography

Carlo Montemagno, PhD, is the former and founding Dean of the College of Engineering and Applied Science at the University of Cincinnati. Immediately prior, he was the Chair of the Department of Bioengineering and Associate Director of the California Nano Systems Institute as well as the Roy & Carol Doumani Professor of Biomedical Engineering at UCLA. Previous to Montemagno's tenure with UCLA, he served as Associate Professor in the Department of Biological and Environmental Engineering at Cornell University. He earned his BS in Agricultural and Biological Engineering from Cornell (1980) and MS 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 ten years in several senior management positions as a Civil Engineering Corps Officer. In 1995, he earned his PhD in Civil Engineering and Geological Sciences from Notre Dame University. He then 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 Nano-biotechnology.

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