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Directional Self-Assembly of Bio-Molecular Templates for Nanotechnology Interconnects

Background: The field of information and computer technology is reaching a strategic inflection point, where a number of changes need to come together at the same time. One of these changes is the eventual end of the exponential growth of chip density, and the other is of high availability, fault-tolerance, and maintainability of information computing technology systems. We envision a scientific and technological revolution in the field of computer and information technology through a synergistic multidisciplinary research and training approach that will combine computer engineering and science with the recent advances in biotechnology. Specifically, we exploit the unique properties of engineered biomolecules and biocellular systems to create transformative technology paradigms that will have far-reaching impact on society through new computer and information technologies.

Applications:

- *Arrays of microtubule spindles have potential as assays for testing molecules that affect microtubule dynamics (e.g. anti-mitotic anticancer drugs)*
- *Microdevice manipulation by bridging scales from nanometric scales to micrometric scales*

Advantages:

- *Process provides high-level control in the nucleation and growth of directed biomolecular templates*
- *Dimension (nanometers diameter and length) of protein-based templates are not yet achievable with existing lithographic, microelectronic processing techniques*

The Technology: University of Arizona scientists are developing an integration of microtubule-based interconnections with microelectronic manufacturing technology. A microtubule is a hollow, tube-like (15nm inner diameter), dynamic biopolymer with each end exhibiting unique and specific biochemical moieties that allow controlled attachment of the biopolymer. Based on the inherent properties of a microtubule, a fabrication process mimicking the natural assembly-processes of microtubules in living cells has been developed to form, in situ, nano-sized interconnects between multiple, varied devices (both micro and nano) and interfaces through directed and controlled assembly and disassembly of microtubules. Once in place, the assembled microtubules serve as template for additional functionalization such as increased electrical conductivity through copper metallization of the microtubule inner core using the specificity and selectivity of the biochemistry of amino-acids. Metallization of the inner core results in an interconnect with a diameter of approximately 15 nm.

Lead Investigator: Pierre Deymier, PhD, University of Arizona

Status: US and PCT patent applications filed

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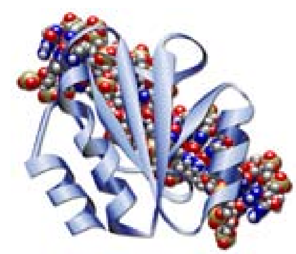

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