

# ***Nano-materials***

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The two most important events in Materials Science and Engineering in the past 50 years have been the introduction of surface free energy as a tool for creating new materials and the cracking of the genetic code of the entire biosphere which is underway and is creating a tidal wave of information that is going to transform our technology to the core. These two events are intertwined at the most fundamental level in that the key to the assembly of complex nanomachines lies within each of our cells. The ribosome has done its evolutionary job of getting us to 2006 and its now time to turn this marvelous machine loose to manufacture materials and machines that have nothing to do with evolution.

In this talk I will start with a fundamental examination of the structure of nanomaterials and the various tools we have for elucidating this structure. The disordered shell around a periodic Bragg type core structure presents the biggest challenge to our understanding and ability to model properties. Next we need to examine the impact of nanostructure on microstructure and again the tools we have to determine these effects. Lastly I would like to explore applications of using the machinery of the living cell to manufacture nanostructures via biomimetics to use structures that already exist in nature – collecting the low hanging fruit. Nature provides elegant examples of organisms that generate three-dimensional structures with complex patterns from the macroscale to the nanoscale. Lastly we will look at methods to take genes from species producing desirable structures, perhaps modify them, and then retrofit them onto a compliant single celled bug who will then become a manufacturing unit. By mid 21<sup>st</sup> century I believe that we will know enough genetics, biochemistry and materials science to computer design genes to produce devices from nanomachines to complete computer systems using the cellular machinery produced by evolution.