

Treating Atoms and Molecules as Electrical Devices:
From Nanoprocessors to Supercapacitors

James C. Ellenbogen, Ph.D.
Chief Scientist for Nanotechnology and Emerging Technologies
The MITRE Corporation
McLean, VA 22102

The speaker will describe some of the results of a long-term, 25-year R&D effort to use nanotechnology to enhance electronic and electrical systems. In this work, he was among the early investigators to view and treat atoms and molecules as though they were electrical devices, having properties such as resistance, conductance, and capacitance. That led directly to such developments as a design for a molecule that could add two numbers. It led also to the development of the world's first nanoprocessors. More recent aspects of the research include an exploration of the fundamental basis for capacitance (i.e., charge and energy storage) on the nanometer scale. One likely application of the results of that part of the R&D is the development of much more dense energy storage devices--e.g., much improved supercapacitors and batteries, or even hypercapacitors. Still another interesting aspect of these investigations that will be discussed is that they were conducted primarily with the assistance of very talented high school students and college undergraduates. Further, this work will be described within the broader context of the MITRE Corporation's broadly based effort in nanotechnology and other emerging technologies.