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Architecture in NanoSpace

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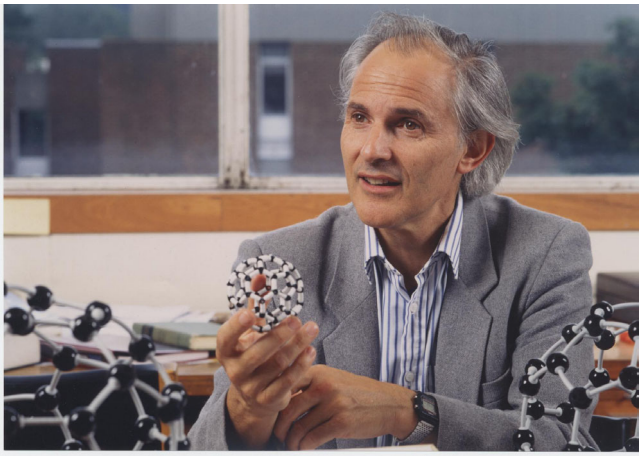

As Chemistry and Physics at one borderline and Chemistry and Biology at the other begin to become indistinguishable, multi-disciplinary research is leading to the fascinating "new" overarching field of Nanoscience and Nano-technology (N&N – not to be confused with M&M). Ingenious strategies for the creation of molecules with complex exactly-specified structures and as well as function are being developed – basically molecules that "do things" are now being made. In fact N&N is not new at all but may be considered to be the *"Frontier Chemistry of the 21st Century"*. When the molecule C_{60} Buckminsterfullerene and its elongated cousins the carbon nanotubes or Buckytubes were discovered, it suddenly became clear that our understanding of many factors governing the atomic structure of carbon and other materials was quite naïve – especially with regard to what happens at nanometer scale dimensions. New experimental approaches which focused on how atoms cluster together have led to the production of novel nanostructures and a

general refocusing of research interests on controlling self-assembly process *ie* the so-called bottom-up approach. This new approach is leading to novel advanced materials with new applications. Fascinating fundamental insights into formation mechanisms have been revealed and nanoscale devices, which parallel devices in standard engineering are now being created. On the horizon are possible applications ranging from civil engineering to advanced molecular electronics so promising to transform our economics. These fundamental advances suggest that supercomputers in our pockets (as well as our heads) and buildings which can easily withstand powerful hurricanes and earthquakes are possible. However if these breakthroughs are to be is be realised in practice a paradigm shift in synthetic chemical techniques will be necessary so we can create at will really large molecules with accurately defined structures at the atomic level. Some of the material from the Vega Science Trust website (www.vega.org.uk) which makes TV and Internet programmes to improve public awareness and understanding of science and engineering (PAUSE), will be used to illustrate some of the issues. This presents one of the greatest technical challenges for chemists. Directors of research might also ponder the fact that the C_{60} molecule, which is almost exactly one nanometer (10^{-9}m) in diameter, was discovered during an experiment aimed at understanding our earlier radioastronomy results which had uncovered puzzling facts about the molecular constituents of dusty interstellar clouds which are up to 100 light years in size – indeed some 10^{28} or a thousand million million million million times larger than C_{60}!