Nanotech – lessons from nature

Some of our SciBar participants prepared this glossary, independently of Dr Thomas.
Your feedback on the level of information and usefulness of the SciBar glossaries is most welcome.

Nano A prefix meaning one billionth (1/1 000 000 000).

Nanocrystal A combination of a few hundred to tens of thousands of atoms into a crystalline form of matter with a diameter ≤ 100 nanometres (nm). A nanocrystal is almost all surface and no interior, giving it very different properties from the material in bulk form. The properties of semiconductor nanocrystals can be 'tuned' by precisely controlling their size.

Nanofabrication Manufacturing materials with dimensions less than 100 nm, either 'bottom up' (placing atoms or molecules one at a time) or 'top down' (removing material chemically, or mechanically using UV light, X-rays or electron beams).

Nanolithography Creates 'nanowriting' (nanoscale patterns) on a surface such as an integrated chip.

Nanometre (nm) One billionth of a metre, or a millionth of a millimetre (10^{-9} metre). One nanometre is about the length of 3–6 atoms placed side by side, or about 100 000 times smaller than the width of a human hair.

Nanoparticle Particles 1–100 nm in size, which have substantially different chemical, physical and electronic properties from those of the corresponding 'macroscale' material due to the unusually high surface to volume ratio.

Self-assembling system When the 'building blocks' of a system spontaneously form a specific arrangement, usually due to complementary shapes. Self-assembled structures are found in nature. For example, a molecule of DNA is formed by part of one DNA strand pairing up with the complementary part of a second DNA strand (forming the famous double helix). The parts fit together in only one way, a bit like tongue and groove. Also, chains of amino acids 'fold' or twist into complex but well-defined structures (proteins). Protein chains could be used as a template or scaffold for engineering materials at the nanoscale.

Self-assembled monolayer (SAM) A coating one molecule thick that forms spontaneously, as a result of a reaction between one end of the molecule and the solid surface.

Thin film A material around 1-100 nm thick. Can be formed for example by growth of nanocrystals at the interface between two solutions of precursor compounds.

Viral assembly Using a virus particle (spherical, about 30 nm diameter) as a 'scaffold' on which to attach nanostructures. The virus is genetically engineered to have surface proteins that bind to a desired material, such as a metal. The protein structures produce specific distances between the metal particles.

Useful weblinks:

http://mrsec.wisc.edu/Edetc/background/nano.html Exploring the nanoworld: series of topics written a couple of years ago giving general background. Looks incomplete initially, but if you dig under 'More' there are useful slide sets e.g. on 'what is nanoscale', societal implications, quantum dots and nanoparticles, applications and nanoscale devices.

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There will be no Bolly SciBar in August.
Our next SciBar will be Monday September 11 topic to be confirmed.
Time: 6.30pm as usual.