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Why 'soot' could be the key to delivering drugs to cancer cells

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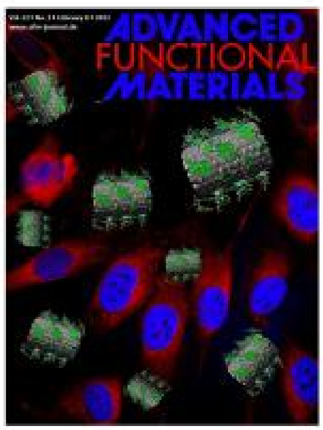

Carbon Nanotubes: Interactions Between Amino Acid-Tagged Naphthalenediimide and Single Walled Carbon Nanotubes for the Design and Construction of New Bioimaging Probes (Adv. Funct. Mater. 3/2012 Journal Cover). Credit: Drs Sofia Pascu and Stan Botchway

Nano-scale tubes made of carbon could be used to safely penetrate human cells and deliver anti-cancer medicines or modified DNA molecules for gene therapy. Although there is a long way to go before the concept can undergo medical trials, a team led by Dr. Sofia Pascu at the University of Bath has shown how these tubes could be used as a 'cargo carrier', to break through the outer membranes of cells that some useful therapeutic molecules would otherwise be unable to enter. The tubes, which are just a billionth of a metre long, can occur naturally, in candle soot for example. They could also be used to carry imaging agents such as fluorescent tags and radionuclides (radioactive isotopes widely used in therapy and diagnosis) that would make it possible to obtain better images of cells and tissues and so aid earlier detection of cancers.

The technique developed by the team has involved shortening, modifying and purifying the carbon nanotubes so that they are completely harmless. A payload of molecules is then wrapped very tightly around them using an innovative, rapid and low-cost process based on the techniques of “supramolecular chemistry”, a branch of chemistry coined as chemistry beyond the molecule. Early indications show that prostate cancer cells might absorb the nanotube/molecule assemblies particularly well.

Next steps include looking at how the nanotubes could be developed not only to carry a medically useful cargo both inside and outside the tube but also to target specific cells (particularly damaged or cancerous ones). Further work will also include devising a simpler way of ensuring a strong attachment between molecules and nanotubes so that the molecules can penetrate the cell membrane successfully without becoming dislodged first.

This pioneering work has been carried out by the Bath team in collaboration with the Lasers for Science Facility at the Research Complex at Harwell and also involves the Universities of Oxford, Cambridge and Nottingham. It is also being funded by the Medical Research Council, the Royal Society and the University of Bath.

Details on the team’s work to date have been published in the February issue of the journal Advanced Functional Materials.

More information: The full paper can be found here.

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