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NEW TECHNOLOGY

Nanotechnology targets cancer cells

All the biological processes in our body, including events that lead to cancer, occur at the nanoscale. Two recent studies published in *Nature Nanotechnology* have highlighted the potential of nanomaterials in providing new and more-effective tools to target cancer cells, with the aim of improving diagnosis and treatment.

In the first study, David Scheinberg and colleagues reported a two-step approach: cancer cells are first bound by an antibody conjugated with an oligonucleotide sequence and then this 'antibody/cancer cell complex' is targeted by single walled carbon nanotubes (SWNTs) labelled with a complementary oligonucleotide sequence. The SWNTs can deliver a cytotoxic alpha particle-emitting isotope that kills the tumour cell. Scheinberg highlights the potential of this approach: "SWNTs offer the possibility of carrying many ligands (hundreds per molecule) and are rapidly cleared through the kidney," with little toxic effect. This approach resulted in tumour shrinkage in mice, and "provided a proof of concept for *in vivo* self-assembly of other ligands on SWNT". In the future, SWNT could be used to deliver RNA inhibitors to tumours to 'silence' genes involved in tumorigenesis.

In the second study, Sunitha Nagrath and colleagues developed a highly sensitive technology to isolate circulating tumour cells (CTCs). By incorporating a nanomaterial, graphene oxide (GO), on a gold patterned microfluidic substrate, the authors generated an "island of nanoarms for sensitive CTC capture", explains Nagrath. This GO-based chip facilitates high capture rates for targeting cells present in low numbers and also enables *in situ* on-chip culture of the captured cells.

As Nagrath highlights, in oncology "early detection can mean the difference between life and death". This approach provides a powerful tool that can be used for early cancer diagnosis, and allows the culture of the captured cells for further research activities.

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Nanotechnology-based therapies, such as those featured in these studies, can directly and selectively target cancer cells, unlike conventional cancer therapies that target both healthy and cancerous cells.

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Original articles Mulvey, J. J. *et al.* Self-assembly of carbon nanotubes and antibodies on tumours for targeted amplified delivery. *Nat. Nanotechnol.* doi:10.1038/nnano.2013.190 | Yoon, H. J. *et al.* Sensitive capture of circulating tumour cells by functionalized graphene oxide nanosheets. *Nat. Nanotechnol.* doi:10.1038/nnano.2013.194