nanoparticle-targeted circulating tumour cells is distinct from that of blood or tissue.

Mice at a later stage of tumour development showed greater numbers of circulating tumour cells. Free-flowing untargeted nanoparticles were cleared away from the magnetic trapping region when blood-flow velocities exceeded a few millimetres per second. By choosing superficial vessels with flow-rates larger than this threshold, Zharov and co-workers succeeded in trapping the circulating tumour cells and not the free nanoparticles. When the magnet was removed, cells that were previously trapped under the magnet were released and the photoacoustic signals decreased.

Photoacoustic detection has been applied with great success to imaging microvascular structures and for functional and molecular imaging[7]. One of the advantages over optical detection methods is that depth-resolved measurements are possible with photoacoustic methods. Signals from the magnetically trapped cells can be localized to vessels of a given depth with suitable flow conditions, and the dual wavelength illumination approach taken by the authors meant that the detection method is very specific. Furthermore, photoacoustic methods can detect very low concentrations of nanoparticles; even single circulating tumour cells can be detected when targeted with only a few nanoparticles.

Although the free nanoparticles were cleared quite rapidly, calculations show that the collisional probability of nanoparticles with the circulating tumour cells enables the cells to be targeted on a timescale of minutes. At this timescale, one concern is that macrophages (cells of the immune system that remove foreign material) may bind to these particles and become a source of false positives. Although the nanoparticles in the present study had a polymer coating to prevent macrophages from binding to them, sometimes such a coating also means that the nanoparticles will have a longer circulation life (up to hours) in the bloodstream. Short circulation lifetimes and fast *in vivo* targeting of the nanoparticles might be preferred in this case, because when free nanoparticles are cleared faster than the time it takes for macrophages and other cells to bind to (and uptake) them, a cleaner background can be established.

One exciting possibility, yet to be implemented, is the use of high-power laser pulses to ablate the circulating tumour cells as they are detected. At sufficient laser power levels, the local heating within a nanoregime around the nanoparticles can reach thousands of degrees. This generates nano- or microbubbles, and cells can be destroyed from the heat or cavitation damage[8]. The *in vivo* safety and efficacy of this approach, however, has yet to be validated. Alternatively, magnetically enriched cells could be extracted for analysis and destruction.

It may be some time before nanoparticles are cleared by the relevant regulatory authorities for human patients, and we need an improved understanding of the long-term *in vivo* consequences of these nanoparticles. Although the technique will not be able to capture all of the circulating tumour cells *in vivo* and is unlikely to prevent all metastases from forming (it only takes one circulating tumour cell to create a metastatic tumour), this work brings us a new tool in the fight against cancer. ❐

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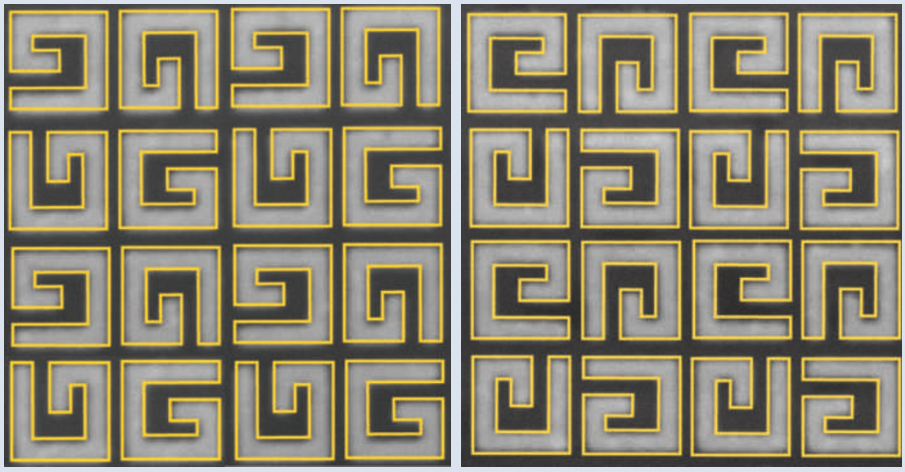
PLASMONICS

Gee whiz

An object possesses handedness (or chirality) if its mirror image cannot be superimposed on it. Circularly polarized light can also be left-handed or right-handed, and these two chiralities have been shown to give rise to different plasmon modes in nanostructures. Now, Ventsislav Valev and colleagues at the Katholieke Universiteit Leuven, Univerisity Hasselt and transnational University Limburg, all in Belgium, have demonstrated that the handedness of incoming light can change the handedness of the luminescent pattern produced by an array of plasmonic nanostructures (*Nano Lett.* **9,** 3945–3948; 2009).



The array is made from G-shaped (right) or mirror-G-shaped (far right) gold nanostructures in various orientations. Yellow lines have been drawn around the shapes in these scanning electron micrographs to improve their visibility. The actual arrays used in the experiments consist of 3,333 x 3,333 nanostructures. When illuminated with red light, the array generates a ratchet-shaped second harmonic signal with a handedness that can be controlled by the handedness of the red light. The team can also measure the handedness of the material by illuminating it with a single chirality of polarized light, rather than the two chiralities needed in other approaches.

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