UNIVERSITY OF BIRMINGHAM

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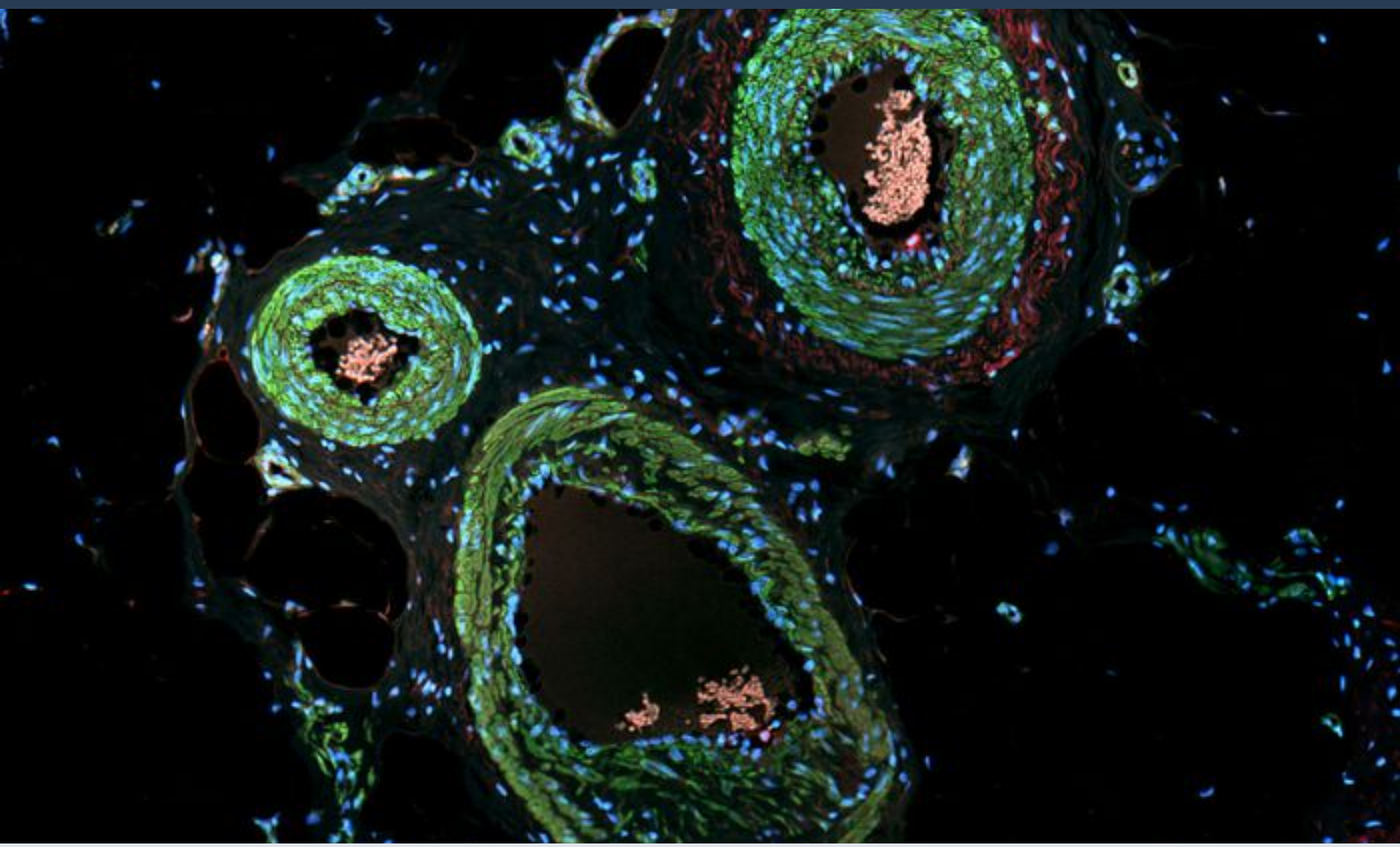
Gold 'Nanoprobes' Used to Track Blood Flow in Tiny Vessels

Gold nanoparticles which can be coated in iridium and used as luminescent probes to track blood flow in small blood vessels



Seeking

Commercial partner, Development partner

About **University of Birmingham**

At the University of Birmingham our research leads to new inventions and fuels innovation and business growth.

Background

Light microscopy is a rapidly evolving field for understanding *in vivo* systems where high resolution is required. It is particularly crucial for cardiovascular research, where clinical studies are based on ultrasound technologies which inherently have lower resolution and provide limited information.

The ability to monitor blood flow in the sophisticated vascular tree (notably in the smallest elements of the microvasculature - capillaries) can provide invaluable information to understand disease processes such as thrombosis and vascular inflammation. There are further applications for the improved delivery of therapeutics, such as targeting tumours. Currently, blood flow in the microvasculature is poorly understood. Nanoscience is uniquely placed to help understand the processes happening in the micron-dimensioned vessels.

Designing probes to monitor blood flow is challenging because of the environment; the high protein levels in plasma and the high red blood cell concentrations are detrimental to optical imaging. Conventional techniques rely on staining red blood cells, using organic dyes with short-lived usage due to photobleaching, as the tracking motif. The relatively large size of the red blood cells (7-8 micrometres), which are effectively the probes, limits the resolution in imaging and analysis of flow dynamics of the smallest vessels which are of a similar width. Therefore, to have more detailed resolution and information about the blood flow in the microvasculature, even smaller probes are required.

Tech Overview

Scientists at the University of Birmingham have designed gold nanoparticles, no bigger than 100 nanometres, which can be coated in iridium and used as luminescent probes to track blood flow in the smallest blood vessels in the body.

The team was able to stabilize water-soluble gold nanoparticles, coated with the iridium luminescent probes – at up to 100 nanometres in size using a surfactant coating. The size of 100 nanometres is ideal for not disturbing blood flow, yet still being detectable by high resolution imaging using conventional microscopes. These nanoparticles can be used as trackers for detection in sub-millimeter channels of dimensions similar to many microvessels with higher resolution than fluorescently-stained blood cells.

Further details:

‘Tailoring iridium luminescence and gold nanoparticle size for imaging of microvascular blood flow’ is published in Nanomedicine (10.2217/nnm-2017-0211).

Benefits

- Iridium gives a luminescent signal in the visible spectrum, providing an optical window which can be detected in blood.
- Other techniques can be used to quantify the gold signal, offering additional analytical options.
- Small size allows more detailed resolution down to the smallest elements of microvasculature.
- Iridium coating is long-lived compared to organic fluorophores.

Applications

By improving the understanding of blood flow *in vivo*, the nanoprobes represent an opportunity to help in the early diagnosis of disease.

Opportunity

The researchers are now looking to develop the nanoparticles to allow for targeted delivery within the body, and investigate the potential for *in vivo* imaging using near infrared probes.

The university is seeking partners for further development and commercialisation.