The Realisation of Research

Magnetic Microbubbles

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Category(s):
Diagnostic/Prognostic
Imaging
Sensors

Description:

Magnetic Microbubbles

Available For: Licensing and collaborative development

Summary

Magnetic microbubbles can be injected into the blood stream and may be directed to a specific body location by the application of an external magnetic field. They enhance ultrasound images, and can be used to deliver, and promote uptake of, cargo molecules such as drugs, antibodies or DNA. They thus have many potential applications in clinical settings, as well as in both basic and medical research.

The Technology and its Advantages

Microbubbles are tiny bubbles of gas (1-10μm in diameter) coated with a surfactant or polymer shell. When injected into the blood stream, microbubbles circulate around the body and dramatically enhance ultrasound images, as they are several thousand times more reflective than normal body tissue. They can also be used as delivery vehicles, as drugs or genes can be carried within a microbubble until the bubble is burst by ultrasound, releasing its cargo. Moreover, subjecting cells to low-intensity ultrasound in the presence of microbubbles creates temporary holes in cell membranes (a phenomenon known as sonoporation), enabling uptake of large molecules by cells.

Researchers at UCL have developed microbubbles that have non-toxic magnetic nanoparticles incorporated into their shell. Instead of circulating freely, these magnetic microbubbles have the potential to be targeted to an area of interest by the external application of a magnetic field. This bypasses the need to tailor-make microbubbles to specifically target different organs, and is more conducive to human therapy than the current method of targeting microbubbles by labelling them with monoclonal antibodies produced in animal cell cultures.

Market Opportunity

Magnetic microbubbles may prove of significant value in both basic research and clinical settings.

Potential applications in vitro include:

-Efficient, non-viral transfection - the sonoporation effect of magnetic microbubbles on cells is enhanced when used in the presence of an applied

magnetic field, improving transfection efficiency even with low doses of DNA

-Delivery of siRNA into cells for gene knockdown

-Labelling cells with fluorescent dye molecules or tagged antibodies for use in cell imaging

Potential advantages to ultrasound imaging include:

-Local concentration of microbubbles- this would increase signal strength from that region whilst reducing the administered dose

-Manipulation of the flow of microbubbles - this would be useful in, for example, perfusion imaging, where the rate of flow of microbubbles into an organ is measured as an assessment of the organ's function. Such enhanced ultrasound imaging will be of benefit when investigating the pathology of disease states, for example metastases of the liver, as well as the characterisation of disease states, for example determining the angiogenic phenotype of a tumour, in order to assess prognosis and potential response to available therapies.

Other potential therapeutic applications include:

-Drug or gene delivery to specific sites, minimising side effects and reducing the administered dose

-Improved uptake of genetic material by cells as a result of sonoporation by localised microbubbles for use in gene therapy or therapeutic RNA inhibition

-Non-invasive lysis of blood clots by localised sonoporation

-Localised delivery of MRI contrast reagents, reducing side effects and the administered dose

-Localising and intensifying cavitation activity in the target region during high intensity focused ultrasound (HIFU) surgery, thereby reducing the ultrasound intensities and treatment times required

Intellectual Property Status

Entered national phase 27th December 2010

Further Information

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