Neurotherapeutic Drug Delivery via Focused Ultrasound

Technology #m09-025

This technology uses ultrasound to create a transient opening in the blood-brain barrier in vivo. The technology allows physicians and other health care professionals efficient and targeted access to specific locations in the brain. They can control the size of the blood-brain barrier opening and the area of the region affected by the blood-brain barrier. This control is mediated by changing the size of the microbubble. The microbubble size determines the amount of drug that can pass through the opening allowing physicians to control the efficacy and/or toxicity of the drug being administered. The use of this technology has also shown that biomimetic agents are capable of going through the opened blood-brain barrier and reaching the neurons in the hippocampus.

Ultrasound technology gives greater access to the brain and obviates the need for invasive transcranial procedures

The blood-brain barrier (BBB) is a major impediment to therapeutic drug delivery and limits available treatments for patients with neurological disorders. Most neuropathic agents require invasive transcranial delivery procedures which limits the possibility of large-scale screening for new drug candidates. This technology facilitates the targeted delivery of BBB impermeable drugs and makes large-scale screening possible. The invention makes cooperative use of focused ultrasound (FUS) and microbubble technologies to achieve localized, transient, and non-invasive molecular delivery into the brain. Focused ultrasound waves at low intensity (similar to levels in medical imaging) are used to locally create an opening in the BBB, accurately positioned by a computer-controlled device. In conjunction with the ultrasound, small diameter microbubbles are administered as ultrasound contrast agents for diagnostic purposes. The entire procedure is further monitored with high-resolution magnetic resonance imaging (MRI), allowing detailed spatial analysis of both the opening and surrounding tissue. The ultrasound-induced disruption of the BBB allows molecular tracers and pharmacological agents to access previously protected brain regions. Targeted trans-BBB delivery of bioactive molecules has great potential for treatment of disorders with focal pathologies like Alzheimer’s and Parkinson’s disease. This technology has been tested and verified in multiple in vivo mouse studies.

Lead Inventor:

Elisa E. Konofagou Ph.D.
**Applications:**

- Non-invasive administration of compounds that are currently only delivered via trans-cranial surgery
- Reviving drug candidates that were formerly dropped from development
- Neurological disorders with focal pathologies could be specifically targeted for drug delivery (e.g., Alzheimer’s and Parkinson’s)
- Treatment of psychiatric disorders
- Anesthetizing specific portions of the brain while leaving other portions unaffected

**Advantages:**

- Minimally invasive due to transient creation of small BB opening
- Safe and quick relative to techniques such as cranial surgery
- Non-toxic compared to drug-based methods for BBB disruption
- Highly localized for access to specific regions of the brain
- Based on FDA approved technologies: MRI, ultrasound and microbubbles

**Patent information:**

- Patent Issued ([US20090005711](https://www.google.com/search?q=US20090005711))

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**Related Publications:**


**Inventors**

Elisa Konofagou