

Focused Ultrasound (FUS)

What is focused ultrasound?

FUS is an innovative medical technology that uses sound waves to treat very precise areas inside the body without surgery. FUS works in a similar way like a magnifying glass focusing sunlight – it concentrates harmless sound waves to create a therapeutic effect in a targeted spot. Depending on the treatment goal, this focused energy can heat, disrupt, or stimulate neurons or other active cells in the body.

What stage is the research at for using focused ultrasound in medicine?

FUS is already approved for certain conditions such as uterine fibroids (non-cancerous growths in the uterus) and some types of tremors (involuntary shaking of the hands or legs).

For neurodegenerative diseases, FUS is still in the early stages of research, but first results are promising – it appears to safely affect the brain's protective barrier, which may help medications reach the brain more effectively and improve symptoms in some cases.

More research is needed to confirm its long-term safety and effectiveness before it can be used more widely for brain-related conditions.

How is focused ultrasound used in health care?

FUS has a wide range of applications in medicine, including:

Destroying certain types of cancerous tumors without the need for invasive surgery.

Reducing tremors for people with Parkinson's or essential tremor.

Relieving chronic pain by targeting specific nerves.

Helping medicines reach the brain by temporarily modulating the blood-brain barrier (the brain's protective layer).

How does focused ultrasound affect blood-brain barrier?

The blood-brain barrier is a natural shield that protects the brain from harmful substances but also blocks many medicines that could be used for treatment. Because of its role, any method that opens it must be done very carefully.

FUS uses sound waves and tiny “microbubbles” to gently open the barrier for a short time — usually a few hours to a couple of days. This allows medicine to reach the brain. The barrier then closes on its own.

Microbubbles, already common in medical imaging, make the procedure precise and safe by targeting only the chosen area. The entire process is closely monitored to minimize risk.



What potential effects of focused ultrasound researchers are exploring in neurodegenerative diseases?

FUS shows promise in treating neurodegenerative diseases like Alzheimer's, Parkinson's, or amyotrophic lateral sclerosis (ALS). Researchers are exploring several possibilities, including:

Delivering treatments directly to the brain to improve their effectiveness.

Breaking apart harmful protein clumps such as amyloid plaques linked to Alzheimer's disease.

Stimulating specific brain regions to reduce tremors and improve other symptoms.

How safe is focused ultrasound?

Safety is a top priority. While no medical procedure is without risk, studies so far show that FUS can be performed safely when carefully targeted.

Researchers closely monitor patients for side effects and continue to refine the technology to make it even safer.

How FUS might be useful in the future?

FUS offers a non-invasive and targeted way to treat diseases, potentially reducing the need for surgery and improving how therapies are delivered. For people with neurodegenerative conditions, it may lead to better symptom management and offer new treatment possibilities, making it a promising and innovative area of research.

REBALANCE



Latvian Council of Science

This research is funded by the Latvian Council of Science, project 'Mechanisms of focused ultrasonic mediated Brain cleaning Coupled with enhanced mechanosensation (REBALANCE)', project No. ES RTD/2023/22