



Sunnybrook Research Institute

First in Focused Ultrasound: Brain

1991

Drs. Kullervo Hynynen and Arthur Guthkelch at Brigham and Women's Hospital in Boston first to report that brain tumours can be treated with focused ultrasound (FUS) and radiation.

1992

Hynynen first to combine FUS with MRI to guide and monitor treatment.

1995

Hynynen's team first to show that FUS can be used selectively for controlled opening of the blood-brain barrier for therapeutic purposes.

1997

Hynynen and Dr. Ferenc Jolesz first to use a large, phased-array applicator for through-skull focusing and ablation.

2001

Hynynen's team first to show that FUS paired with microbubbles can locally, transiently and reversibly disrupt the blood-brain barrier under MRI guidance.

2006

SRI recruits Hynynen from Brigham and Women's Hospital.

2010

Dr. Isabelle Aubert and Hynynen first to show that antibodies delivered with MRI-guided FUS can reduce amyloid in preclinical models of Alzheimer's disease.

Hynynen and colleagues first to deliver chemotherapy into the brain in preclinical models.

Hynynen and colleagues first to perform MRI-guided FUS surgery in patients with primary brain cancer.

2011

Hynynen and Aubert demonstrate first use of MRI-guided FUS to open the blood-brain barrier and deliver stem cells into the brains of mice.

2012

Sunnybrook leads first Canadian trial using FUS to treat essential tremor.

2013

Hynynen's lab shows in preclinical models that MRI-guided FUS on its own can dissolve blood clots caused by stroke without damaging the targeted blood vessels.

Aubert and Hynynen first to show MRI-guided FUS alone reduces brain plaque in mice with Alzheimer's disease.

Aubert and Hynynen first to show that MRI-guided FUS can deliver gene therapy to targets in the brains of mice.

Hynynen and colleagues first to use MRI-guided FUS to deliver immune cells to treat cancer that has spread to the brain in preclinical models.

2014

Aubert and Hynynen first to show MRI-guided FUS alone increases neurogenesis and improves cognitive function in a mouse model of Alzheimer's disease.

2015

Aubert and Hynynen first to use MRI-guided FUS to deliver gene therapy to the spinal cord in preclinical models.

2016

Health Canada and the U.S. FDA approve FUS brain surgery to treat essential tremor.

2017

Sunnybrook is designated a Centre of Excellence in Focused Ultrasound, the first in Canada.

Sunnybrook researchers launch first North American trial of FUS surgery in people with obsessive-compulsive disorder.

2018

Sunnybrook team launches first North American trial of FUS surgery in people with treatment-resistant major depression.

2019

Sunnybrook team completes world's first clinical trial, launched in 2017, using FUS to open the blood-brain barrier of patients with Alzheimer's disease noninvasively and repeatedly, showing it is safe and feasible.

Sunnybrook team completes world's first clinical trial, launched in 2015, using FUS to open the blood-brain barrier of patients with brain cancer noninvasively, showing it is safe and feasible.

Sunnybrook team completes world's first trial, launched in 2018, using FUS to open the blood-brain barrier of patients with amyotrophic lateral sclerosis noninvasively. Show that the technique can open the barrier in the motor cortex safely and reversibly.



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Excellence in Focused Ultrasound: Brain

Focused ultrasound (FUS) is a noninvasive, breakthrough technology. It uses sound waves to exert a therapeutic effect on tissue. It could change health care forever.

THERMAL ABLATION: SCALPEL-LESS SURGERY

High-intensity ultrasound waves are targeted at precise areas of the brain under MRI guidance. More than 1,000 beams converge to produce heat that destroys the unwanted tissue, all without cutting skin.

THERAPY DELIVERY: STRAIGHT TO THE SOURCE

Microbubbles are paired with low-intensity FUS under MRI guidance. Together, they cause the blood-brain barrier—which prevents 98% of drugs from getting into the brain—to open safely and reversibly. This lets therapy be delivered to a precise target inside.



FOCUSED ULTRASOUND RESEARCH

Sunnybrook Research Institute has the largest and most complete FUS research program in the world. Our scientists' trailblazing work in biology, device development and clinical trials—from lab to patient—is having global impact.

20

Scientists and clinician-scientists in our core team

150

highly skilled research staff

50,000

square feet, including the world's only Centre for Research in Image-Guided Therapeutics

ALZHEIMER'S DISEASE

In 2018, Sunnybrook completed the world's first clinical trial using MRI-guided FUS to open the blood-brain barrier of patients with Alzheimer's disease noninvasively and repeatedly, showing it is safe and feasible.

BRAIN CANCER

In 2019, Sunnybrook completed the world's first clinical trial, launched in 2015, using FUS to open the blood-brain barrier of patients with brain cancer noninvasively, showing it is safe and feasible.

ESSENTIAL TREMOR

In 2012, Sunnybrook completed the first Canadian trial using FUS to treat severe essential tremor. It was then the only Canadian site in the pivotal, international trial, leading in 2016 to the technology being approved as a treatment in North America.

AMYOTROPHIC LATERAL SCLEROSIS

In 2019, Sunnybrook completed the world's first clinical trial using MRI-guided FUS to open the blood-brain barrier of patients with amyotrophic lateral sclerosis noninvasively. The study showed that the technique can open the barrier in the motor cortex safely and reversibly in these patients.

PARKINSON'S DISEASE

Sunnybrook led the first Canadian trial of high-intensity FUS for Parkinson's disease in 2015 and is part of the first international trial testing FUS to treat this and other movement disorders.

PSYCHIATRIC DISORDERS

Sunnybrook launched the first North American trials of FUS surgery to treat obsessive-compulsive disorder (2017) and major depression (2018).

Sunnybrook is a Centre of Excellence in Focused Ultrasound. Our researchers are internationally recognized experts in medical biophysics, biology and the clinical sciences. They are pioneering the development of FUS and its application to brain disorders, cancer, bone and joint disorders, and women's health. sunnybrook.ca/research/FUS