

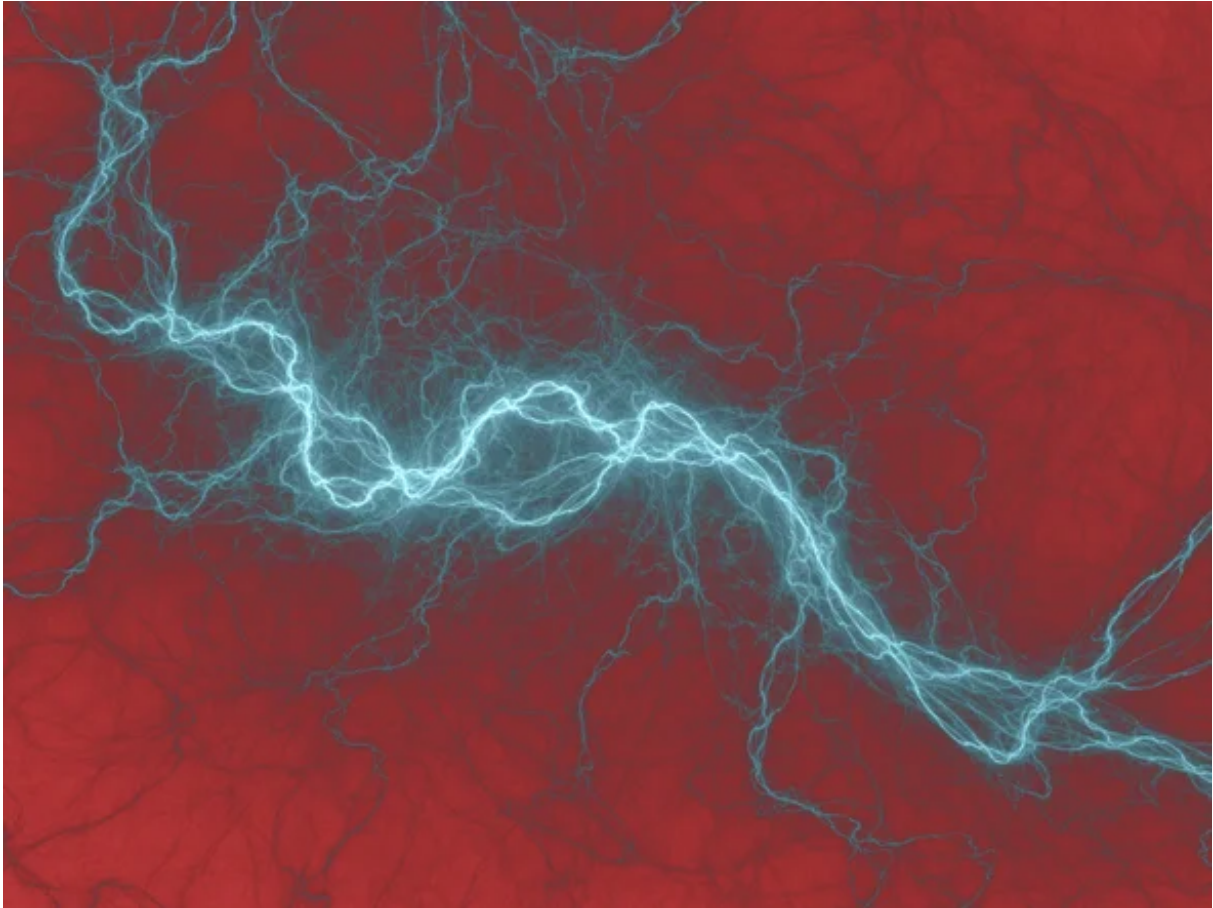
BIOTECH

## Zapping Nerves with Ultrasound Could Treat Inflammation

Stimulating nerves in the spleens of mice with ultrasound reduced their inflammatory responses and arthritis symptoms

By Bahar Gholipour on June 1, 2019

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Credit: Getty Images

Ultrasound is used widely in medical imaging, but in recent years scientists have started honing it for another use: stimulating nerves to treat disease. In two new studies in rodents, researchers focused the sonic vibrations on nerves in the spleen that communicate with the immune system, reducing inflammation. If the approach proves safe and effective in people, it could serve as a noninvasive treatment for inflammatory diseases such as rheumatoid arthritis.

About 20 years ago neuroscientist Kevin Tracey and his colleagues discovered that brain signals traveling along the vagus nerve exert control over the immune system. “These [signals] are primitive reflexes that arise in the brain stem, evolved to preserve the integrity and health of cells in the body,” says Tracey, president and CEO

of the Feinstein Institute for Medical Research in Manhasset, N.Y. Stimulating the nerve is a way to hack into those reflexes.

The vagus nerve consists of a bundle of fibers that branch into many organs. It connects with the immune system via a second nerve that innervates the spleen, where circulating immune cells make a stop before flooding the bloodstream again. The new studies, published in March in *Nature Communications*, suggest that sending ultrasound to the spleens of mice through their skin may hit the nerve endings and could be just as effective as directly stimulating the vagus nerve. The latter requires surgically implanted electrodes.

In one study, led by Tracey's colleagues at the Feinstein Institute and GE Research, rats receiving a few minutes of ultrasound treatment to the spleen nerve had a diminished inflammatory response to an injected toxin. In another study, researchers at the University of Minnesota and their colleagues reduced symptoms of inflammatory arthritis in mice by stimulating their spleen nerves for 20 minutes every day for a week. Zeroing in on the spleen may provide a more precise approach than focusing on the vagus nerve, says Hubert Lim, lead author of the latter study. "When we're targeting the spleen, we have less of an effect all over the body."

Little is known about how repeated ultrasound affects the spleen or whether it has other harmful effects, says neuroscientist Denise Bellinger of Loma Linda University, who was not involved in either study. An ongoing clinical trial aims to assess the treatment's safety in humans with rheumatoid arthritis. A bigger unknown is how ultrasound activates nerves in general. Scientists are now exploring the use of ultrasound on other parts of the nervous system, including the brain. "We know how to control nerves with electricity, and we've been doing it for more than 100 years," Tracey says. "But the idea of controlling nerve signals with ultrasound is a brand-new field."

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