

Personalized brain stimulation significantly decreases depression symptoms in pilot study

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In a small pilot study, UNC School of Medicine researchers led by Flavio Frohlich, Ph.D., used a new closed-loop system to measure the electrical brain patterns of individual patients and then stimulate those patterns with a weak electrical current, resulting in significantly

improved symptoms of major depressive disorder.

Our brains are full of electricity, billions of signals being sent each day whether we're exercising, eating, singing, reading, working, sleeping, or just relaxing. And when we're sitting with our thoughts—awake with our eyes closed—particular electrical patterns at 8–12 Hz dominate our brains. They are called alpha oscillations.

In people who battle major depressive disorder, these alpha waves in the left and right sides of the prefrontal cortex are often out of balance; the left side is often overactive.

What if that overactivity could be brought back into balance? Would it help alleviate depressive symptoms? Flavio Frohlich, Ph.D., professor of psychiatry at the UNC School of Medicine, has pioneered methods for investigating this question, finding fascinating answers while helping patients relieve their depression symptoms.

Now, for the first time, Frohlich and colleagues—including longtime collaborator David Rubinow, MD, former chair of the UNC Department of Psychiatry—have developed and successfully tested a closed-loop system that can measure a person's individual alpha frequencies and stimulate the brain with a low-level alternating [electrical current](#) to bring balance to alpha oscillations.

In each hour-long session—for five consecutive days—this closed-loop system allowed the researchers to continually measure alpha waves and mete out low levels of electricity to help the brain bring its [alpha oscillations](#) back into synchronicity.

In a [paper published](#) in the *American Journal of Psychiatry*, data show that 80% of 15 patients experienced marked improvement in their depression symptoms immediately and throughout the following two

weeks, according to standard clinical tests and self-reporting.

There was no [placebo group](#) in this [pilot study](#). But the Frohlich lab has secured funding to do a randomized double-blinded control study of Frohlich's new closed-loop system.

"Today's stimulation paradigms mostly focus on specific neuronal networks across brain regions and are not designed to target the structure of large-scale electrical brain activity, which can be measured as rhythmic patterns we refer to as network oscillations," said Frohlich, who directs the Carolina Center for Neurostimulation.

"We already knew, through our research and others, that brain stimulation can improve depression symptoms, but current paradigms use six weeks of treatments. We showed dramatic improvement after five days. Our work shows that low-energy electric brain stimulation has potential for safe, rapid relief without medication."

More information: Tobias Schwippel et al, Closed-Loop Transcranial Alternating Current Stimulation for the Treatment of Major Depressive Disorder: An Open-Label Pilot Study, *American Journal of Psychiatry* (2024). [DOI: 10.1176/appi.ajp.20230838](https://doi.org/10.1176/appi.ajp.20230838)

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