The Vagus Nerve's Mysterious Role in Mental Health

The healing potential of the brain's most interconnected nerve intrigues researchers

The vagus nerve is a vine of nerve fibers with roots in nearly every organ and shoots in the brain. It helps us detect a racing heart, rising blood pressure, stomachache, discomfort, an overzealous immune system and even alarm calls from microbes in our gut. When it senses trouble, the vagus helps to steady our heart, soothe our stomach, rein in our immune system and calm us down.

Wellness influencers claim we can ice, tone or zap the vagus nerve to fix almost anything—long COVID, headaches, poor memory, extra pounds, the blues. Much of that hype is unfounded. Still, some research on the vagus nerve is intriguing enough—and promising enough—to draw serious scientific attention.

Investigators have long known that activating the vagus with mild electrical pulses can treat some conditions. In 1997 the U.S. Food and Drug Administration approved a vagus nerve stimulation (VNS) device that can be surgically implanted under the collarbone and linked to a wire wrapped around the nerve. It is widely used to treat cases of epilepsy that do not respond to drugs. In 2005 the FDA certified a similar device for treatment-resistant depression, and the agency approved yet another one in 2021 to speed up recovery from stroke. Gadgets that stimulate the vagus nerve from outside the body, such as at the outer ear or neck, have been cleared in many countries, including the U.S., to treat obesity, pain and migraines.

Signaling confidence in the potential of VNS, the National Institutes of Health Common Fund launched a $250-million initiative in 2015 with a second phase in 2022. The program, called SPARC (for Stimulating Peripheral Activity to Relieve Conditions), seeks to map the nerve's individual fibers and circuits and to illuminate their functions. Scientists hope it will enable them to refine existing treatments and find new therapies for other conditions, ranging from inflammatory bowel disease to long COVID. Clinical trials are underway on so-called transcutaneous VNS (tVNS) devices, which are easier to use because they access the vagus from outside the skin, or cutaneous barrier. These tools potentially could be used to treat rheumatoid arthritis, migraine, lupus and chronic fatigue syndrome—and that's just a partial list.

"A truly revolutionary idea can take 20 to 40 years before it's thoroughly adopted," says neurosurgeon Kevin J. Tracey of the Feinstein Institutes for Medical Research in Manhasset, N.Y., "at which point everyone says how we needed that all along." The vagus vine's power may be partly mythical, and the research on it is by no means conclusive or clear. But some scientists say it offers hope for millions suffering from complex, hard-to-treat conditions.

In 1664 English neuroanatomist Thomas Willis named the longest of the brain's nerves the vagus, Latin for "wandering." "We call it the vagus nerve, singular, but there are actually two, one on each side of your body," Tracey says. Each side has up to 100,000 fibers, and each fiber contributes to a specific function: heart rate, breathing, immunity, gut contractions that help to digest food, even speech. About 80 percent of vagal nerve fibers are afferent, reporting to the brain about the state of the body; the rest are efferent, carrying instructions down from the brain. British physiologist Walter Holbrook Gaskell demonstrated in the late 19th century that afferent signals tend to excite, whereas efferent ones quiet.

Depression

Depression is a complex and variable condition. "Depressed people may look similar, but they don't all have the same disease," Tracey says. This heterogeneity could mean different types of vagus nerve signals might be effective for different people. Some might benefit from signals going down from the brain that curb inflammation and soothe the body, whereas others may benefit more from signals going up.

Neuroimaging offers some clues. Although findings vary with the type of VNS and the regimen used, stimulation of the vagus generally strengthens connections between the prefrontal cortex and the amygdala—which may lead to better control over emotions. It also boosts activity in the left anterior insula, which is associated with emotion processing. Further, a team led by Jian Kong of Massachusetts General Hospital and Harvard Medical School found that when VNS is used to treat depression, it appears to enhance connectivity between the medial hypothalamus, involved in regulating stress responses, and the rostral anterior cingulate cortex, associated with self-referential thinking. This shift may indicate increased integration of emotional and cognitive processes.

Some of these improvements could come from a VNS-induced increase in the neurotransmitters norepinephrine and serotonin, which, in studies of rodents, are associated with enhanced energy and alertness. Animal studies also indicate that VNS boosts BDNF, which helps to restore neural connections lost to stress and depression. Moreover, the treatment appears to replenish other signaling molecules that are frequently imbalanced in depression, such as gamma-aminobutyric acid and glutamate.

But to Conway, VNS's effect on dopamine pathways is one of the most compelling mechanisms. Dopamine is a crucial transmitter involved in motivation and pleasure, and its level in people with depression is low. More than a decade ago Conway and his colleagues used imaging to study how a year of VNS would change the brains of participants with major depression. They found that patients who responded to treatment showed increased activation in the ventral tegmental area, where dopamine is made.

By Jena Pincott

New Anger Management Tool for Children from the European Anger Management Association (EAMA chapter of NAMA)

Vasiliki Christofi, CAMS-IV, CCIS II, Director of EAMA, has created the Anger Management Tool for Children. Ms. Christofi, obtained her BA in Applied Communication (Communication Specialist) at London Metropolitan University, U.K. She also obtained the "Business Management Programme" of the Institute of Leadership and she is an Approved Trainer of Institute of Leadership and Certified Trainer by the Human Resource Development Authority of Cyprus.

The Anger Management Tool for Children features practical exercises to help kids release anger and channel it into positive energy. Parents are also supported with helpful tips and strategies to guide their children through this process. Additionally, the tool includes educational material to help children understand their emotions and build emotional intelligence. By using this tool, children can learn to manage their anger in a healthy and constructive manner. Visit the EAMA website to learn more and access this valuable resource to support your child's emotional development.