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The Future of Bioelectronic Medicine

Kevin Tracey, president of the Feinstein Institute for Medical Research, on the future of implants that use electrical signals to help the body heal itself

Kevin J. Tracey, a neurosurgeon and inventor, is the president and CEO of the Feinstein Institute for Medical Research. 'Once we realized the power of the immune system to cause damage, then the question is: Can we use the nervous system to turn off the damage?' he asks *PHOTO: MATT FURMAN FOR THE WALL STREET JOURNAL*

By

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Scientist Kevin Tracey hopes that people afflicted by disease someday won't

have to take pills and worry about the side effects. Instead, they'll have tiny devices implanted below the skin that help the body to heal itself.

Dr. Tracey, 58, is president of the Feinstein Institute for Medical Research in Manhasset, N.Y., and he has been studying the idea for almost two decades. His field is bioelectronic medicine, which tries to harness the electrical signals sent out by the nervous system to control the behavior of cells.

In his latest study, published this month in Proceedings of the National Academy of Sciences, he and his colleagues implanted bioelectronic stimulators into the necks of 17 patients with rheumatoid arthritis. The disease causes the immune system to attack normal tissue in the body, leading to inflammation and painful swelling in the joints.

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The device periodically sent an electric pulse to the vagus nerve, which then sent signals to the immune system to turn off a molecule that causes inflammation. After 84 days, 12 patients had improved noticeably. The study was the first to investigate bioelectronic implants and rheumatoid arthritis in human subjects.

The hope, ultimately, is to use devices like these on other nerves and for other diseases, like inflammatory bowel disease, hypertension and Crohn's disease, all of which can be exacerbated by malfunctions in the body's immune response.

Such devices could reduce the need for medication. Rheumatoid arthritis drugs alone have world-wide sales of around $50 billion a year, says Dr. Tracey. "We live in a pharmacocentric culture today, where the world revolves around a drug for everything in a trillion-dollar pharmaceutical industry," he says. "But when I talk to patients...people don't want to take drugs."

Dr. Tracey is working on the commercial end as well. In 2007, he co-founded SetPoint Medical, a closely held company that is testing the device used in the recent study on rheumatoid arthritis. (Along with SetPoint and the Feinstein Institute, the Academic Medical Center at the University of Amsterdam was involved in the study.) He is currently a consultant to SetPoint.

Dr. Tracey first became interested in medicine as a child, when his mother died just days after doctors found that she had a brain tumor. “Is that why I became a brain surgeon?” he asks. “Who knows, but I did remember thinking as a kid that doing science would be a really wonderful career path to figure out how...to help other kids not have to go through what I went through.”

After graduating from medical school at Boston University, he went to the Cornell University Medical College in New York to train as a neurosurgeon. In 1985, he treated an infant named Janice who was badly burned when her grandmother accidentally spilled scalding spaghetti on her. She seemed to recover from the burn but then suddenly died on her first birthday when her body went into shock. Dr. Tracey decided to study the mechanisms that could cause such a tragedy.

“We discovered that the immune system was the source of the shock that caused Janice to die,” he says. “Once we realized the power of the immune system to cause damage, then the question is: Can we use the nervous system to turn off the damage?” That led him to combine his study of neurosurgery with immunology.

Dr. Tracey joined Northwell Health, New York’s largest health-care network, in 1992, and then became president of the Feinstein Institute, a research arm of Northwell Health, in 2005. The institute now has about 2,700 researchers and other staff members studying a range of diseases and treatments in laboratories and hospitals.

In the field of bioelectronic medicine, Dr. Tracey thinks that using devices as therapy could be widespread in five to 10 years. He acknowledges that there are still plenty of hurdles, however. “Everything’s dangerous until proven safe,” he says.

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Nerve stimulation could also someday be used in cases of paralysis and possibly cancer. Last year, the Feinstein Institute hired Chad Bouton, an engineer who helped to invent a bioelectronic chip for paralyzed patients. In a study published in the journal Nature this year, a quadriplegic patient who had the chip implanted in his brain was able to move his arm and fingers by thinking about it.

Dr. Tracey commutes from Greenwich, Conn., where he spends most of his downtime with his wife and four daughters. He enjoys working in his wood shop, fishing and reading, but his work is his real passion. "It's hard to have too many hobbies when you get to feel like you're doing your hobby when you get to work," he says.

Farther in the future, he predicts that we'll see devices that don't even have to be implanted into the body to stimulate nerves. Electronic signals could be delivered by a wand through the skin, controlled with a mobile phone or tablet —although he admits the technology brings up security concerns.

In the end, he hopes, many patients won't have to "take or buy or use drugs any more."

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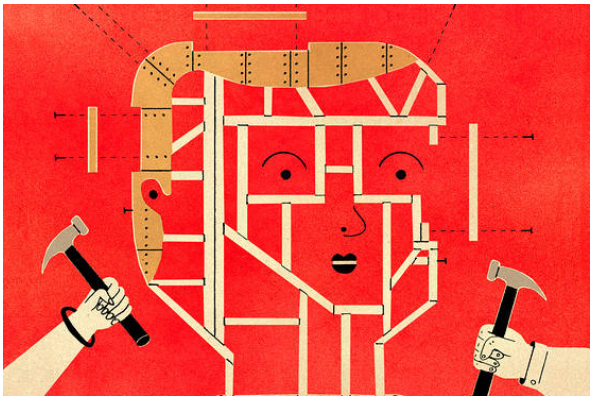

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