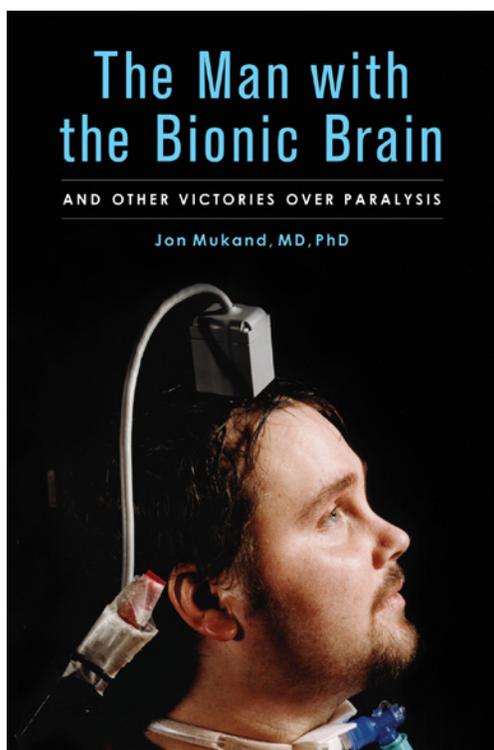


RI Physician Traces Tragedy, Triumphs in 'Man with Bionic Brain'

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PHOTOS COURTESY OF CHICAGO REVIEW PRESS

Matthew Nagle, completely paralyzed from the neck down, was the first recipient of the BrainGate neural interface system in 2004. Neurosurgeons at Rhode Island Hospital implanted microelectrodes in his brain that transmitted his thought patterns to a computer, allowing him to control a computer cursor.

*The Man with the Bionic Brain
and Other Victories over Paralysis*
Chicago Review Press, 2012

PROVIDENCE PHYSICIAN JON MUKAND, MD, PhD, has written a heart-wrenching story of tragedy tempered by hope and the promise of biotechnology in *The Man with the Bionic Brain and Other Victories over Paralysis*.

A Fourth of July weekend beach party in 2001 turned deadly for 21-year-old Matt Nagle. When a brawl erupted, the former high school football player from Weymouth, Mass., dove into the melee to rescue a buddy and was stabbed with a hunting knife. The eight-inch blade severed his spinal cord and paralyzed the 6-foot, 2-inch young man from the neck down.

Matt had just taken the police cadet entrance examination. He wanted to follow in the footsteps of his father, a police sergeant in Cambridge, Mass.

Dr. Mukand, medical director of the Southern New England Rehabilitation Center (SNERC) in Providence, would come to know Matt and his family well. In the book, he recounts Matt's memory of the attack:

I was dead for an instant or an hour. I don't know how long. Katie [a friend] held me as I turned blue and died. My lungs collapsed, but the paramedics saved me and got me to Boston Medical. Someone said, 'Come on man,



JON MUKAND, MD

About the author

A graduate of the Medical College of Wisconsin, Jon Mukand, MD, PhD, is a rehabilitation medicine specialist and medical director of the Southern New England Rehabilitation Center and serves on the clinical faculty of Brown University and Tufts University. He has edited three additional books and published research articles, poems, and reviews in *Nature*, *New England Journal of Medicine*, and the *Journal of the AMA*, among others.

He holds a PhD in English literature from Brown University.

pull through,' and I'm glad I did. I tell my parents [Patrick and Ellen Nagle] I love them every time I see them. You can't take anyone for granted, you can't take life for granted – life's too short. Too short ...'

Matt, writes Dr. Mukand, "was in a race against time, a race to get a computerized brain implant, an electrode system, stem cells, or any other technology that could cure his spinal cord injury — before he died from its many complications.

"Based on his clinical status, Matt could expect to live to forty-five. With paralysis, sensory loss, abnormal movements, bowel and bladder incontinence, pain and sexual dysfunction, Matt was one of the most disabled people I had ever met."



VIDEO Matt Nagle using BrainGate.
The investigational technology has advanced since this video was distributed in 2008.

Three years later, Matt became the first volunteer recipient of the investigational BrainGate implant, a neural interface system developed by John Donoghue, PhD, professor of neuroscience at Brown University, and a cofounder of the company Cyberkinetics, formed to advance the technology.

Dr. Mukand served as BrainGate's FDA-approved study's first clinical investigator. Matt called him his "research doctor."

On June 22, 2004, the surgery was performed at Rhode Island Hospital. Neurosurgeons situated the pill-sized BrainGate sensor on the surface of Matt's right brain in the motor cortex area.

"A hundred microelectrodes thinner than a hair and a millimeter long sent fine wires to a titanium pedestal that protruded from Matt's head," Dr. Mukand writes.

When the surgical site healed, a fiber optic cable connected Matt to a computer that analyzed and stored his brain's electrical nerve signals. The system tethered Matt to a cart operated by a clinical systems engineer.

When the system was first turned

on, nothing but gibberish registered. Weeks later, after troubleshooting and tightening the connection, the BrainGate system finally displayed activity in Matt's brain cells as he imagined different movements. The computer then interpreted the nerve signals and translated these activities into action.

Dr. Mukand describes Matt's first response when he moved the cursor with only his thoughts: "Holy shit!"

Through long sessions with the BrainGate's system engineer, Matt's successes with the technology grew. He played video games, opened and closed a prosthetic hand and controlled a robotic arm.

At the same time he struggled with depression, suicidal thoughts, raging anger and roaring fits. At times, he urged friends who came to visit him in the rehabilitation facility where he lived to pull the plug on his ventilator. Once, Matt told his mother he wanted to die. She said, "Then I'll go with you."

On October 18, 2005, Matt returned to Rhode Island Hospital for removal of the BrainGate implant. He wanted to be off the system so he could have a phrenic pacemaker implanted in his chest in order to breathe on his own; another implant was not allowed on the BrainGate study protocol. The pacemaker implant was successful and Matt was able to be off the ventilator for as long as 36 hours at a time.

On July 23, 2007, complications from an infection claimed Matt's life. He had lapsed into a coma several days prior. When no brain activity was detected, his mother held him as he was disconnected from the ventilator. His final act was to donate his organs.

Matt hoped that by volunteering for experimental therapies such as BrainGate, others would be inspired. Robbed by a violent act of who he was and who he was meant to be, within the prison of his body he glided on the currents of hope afforded by medical science and biotechnology.

Throughout the book, the author intersperses accounts of other patients such as Floyd, who suffered a spinal cord injury and uses robotic braces for legs. Dr. Mukand hopes their stories, as well as Matt's, will be useful for physicians who treat patients impaired by spinal cord injury, brainstem stroke, amyotrophic lateral sclerosis, Parkinson's disease and other movement disorders.

And he hopes others who read it will be inspired by Matt, as he was. ❖



VIDEO BrainGate2 in May, 2012
A trial funded in part by the NIH continues to evaluate the BrainGate neural interface system. This is a type of brain-computer interface (BCI) intended to put robotics and other assistive technology under the brain's control. By imagining the movement of their own arms, two paralyzed individuals were able to use the BrainGate to make complex reach-and-grasp movements with robotic arms.