

“Doing what has never been done before is intellectually seductive, whether or not we deem it practical.”

Neil deGrasse Tyson

It's been done on monkeys, dogs, and rats; now, a plan for the first-ever human head transplant has been set in motion by Italian neurosurgeon Sergio Canavero.

The History

Generally, opinions surrounding the procedure have been less-than-supportive. [Robert J. White](#), an American neurosurgeon best known for pioneering head transplants on live monkeys, became a target of intense scrutiny by protestors and animal activists. According to his [obituary](#), “One [protestor] interrupted a banquet in [Dr. White’s] honor by offering him a bloody replica of a human head. Others called his house asking for ‘Dr. Butcher.’”

The operations White performed on monkeys did not result in any lasting success. In 1970, after numerous experiments, a newly-configured monkey could hear, smell, taste, and eat post-surgery, but ultimately succumbed to immunorejection nine days later.

The Controversy

Dr. Jerry Silver, a colleague of Dr. White’s, called the surgery [“bad science.”](#) Carla Bennett, senior writer for [People for the Ethical Treatment of Animals](#) (PETA), referred to the vivisection industry as a “powerful conglomerate of vested interests, financed by billions of dollars in government and private sector grants [that devours] millions of animals each year [and] is threatened by today’s breakthroughs in cell and tissue cultures, clinical studies, noninvasive machines, lifelike prototypes, and computer wizardry” in an [opinion letter to The New York Times](#).

White continued to perform head transplants on monkeys well into his 70s. He once wrote, “What has been accomplished in the animal model, prolonged hypothermic preservation and cephalic transplantation, is fully accomplishable in the human sphere. Whether such dramatic procedures will ever be justified in the human area must wait not only upon the continued advance of medical science but more appropriately the moral and social justification of such

procedural undertakings.”

“What has always been stuff of science fiction,” he continued, “will become a clinical reality early in the 21st century.”



Dr. Canavero, along with a select team of international surgeons, is determined to seize this radical achievement, despite a vast audience of deniers.

Popular Science writer Sarah Fecht is one of them.

“Last November, [surgeon Xiaoping Ren] and a team of Chinese researchers managed to exchange the heads of 18 mice,” [she described in her February article “No, Human Head Transplants Will Not Be Possible By 2017,”](#) “The transplanted heads had normal brain functioning. They were able to blink and wiggle their whiskers, but they were paralyzed from the neck down. They survived for about three hours after they were removed from a ventilator.”

“So yeah, human head transplants could be *possible* by 2017,” Fecht continued, “but it’s not likely to be a very pleasant or long-lasting experience for the head donor.”

The Science

The biggest challenge the procedure presents is attaching the new spinal cord to the brain, which Canavero plans to remedy with a combo of stitches and biological glue—specifically, [polyethylene glycol \(PEG\)](#).

Traditionally, PEG is used in laxatives, pre-surgical bowel preparation, and as a multipurpose lubricant. According to [a study in the Journal of Neuroscience Research by Richard B. Borgens and Debra Bohnert](#), an injection of PEG into guinea pigs’ bloodstream after spinal cord injury lead to rapid recovery through molecular repair of nerve membranes. The effectiveness of such in humans is still unknown.

The polyether compound is also prevalent in many skin creams, toothpastes, eye drops, and as a [common stationary phase in gas chromatography](#).

Dr. Hunt Batjer, chairman of neurological surgery at UT Southwestern and president-elect of the American Association for Neurological Surgeons, echoed popular doubt in Canavero’s strategy during [an April interview with CNN](#). He also questioned whether White could be considered an appropriate influence, explaining that “it’s a great leap to go from brain survival of the surgery to restoring body function,” which White apparently did not study.

"[It's] a 45-year-old reference in a primate and there is no evidence that the spinal cord was anastomosed functionally," Batjer said. "I would not wish this on anyone [and] I would not allow anyone to do it to me."

He continued, "There are a lot of things worse than death."

To the [established head donor Valery Spiridonov](#), his current health situation could fall into that category.

The Patient

Spiridonov lives with [Werdnig-Hoffmann disease](#), an extreme form of spinal muscular atrophy (SMA). [According to RareDiseases.org](#), approximately 80 percent of individuals with SMA fall into the severe category (Type I), like Spiridonov, which is evident at birth or within the first few months of life.

[The Genetics Home Reference Guide to Understanding Genetic Conditions](#) notes that most children afflicted with Type I spinal muscular atrophy are "unable to support their head or sit unassisted" and have "breathing and swallowing problems that may lead to choking or gagging." The disorder is incurable and rapidly degenerative.

"Spiridonov is willing to take a punt on this very experimental surgery and you really can't blame him," [The Independent](#) culture editor Christopher Hooton explained. "[Though the operation] could result in a hitherto never experienced level and quality of insanity."

But Spiridonov remains hopeful—an attitude many critics of the operation overlook.

"Am I afraid? Yes, of course I am. But it is not just very scary. [It's] very interesting."

The 30-year-old Russian computer programmer and graphic designer first made contact with Canavero in a simple, but optimistic email:

"Dear Doctor Sergio!

I am a 29 years old disabled man with a muscle atrophy. I was so excited to read from

newspapers about your research on head transplantation. Please tell me – what resources do you need for a successful operation? Can I be usable to you? I am ready to take part in any experiments, if you need.

sincerely, Val.”

Upon being asked what he would say to non-believers of the procedure, Spiridonov replied, [“Maybe they should imagine themselves in my place.”](#)

The Plan

The surgeon will cool both the body and the head so the cells won’t die when deprived of oxygen during the process. After the spinal cord fusion with PEG, Canavero plans to stitch up the muscles and blood supply and induce a three-to-four-week coma for healing purposes.

If successful, Spiridonov’s spinal cord will take about a year to heal fully.

The dialogue surrounding the surgery, which is expected to cost up to 13 million dollars and take as long as 36 hours, mimics that of another historical feat in science: the Space Race. There is a certain eagerness, by surgeons and patients alike, to be the first.

And the abundance of criticism toward it could ultimately be the grounding factor.

“Before going to the moon,” Canavero said, “you want to make sure people will follow you.”

[Watch Canavero’s TEDxTalk here.](#)

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