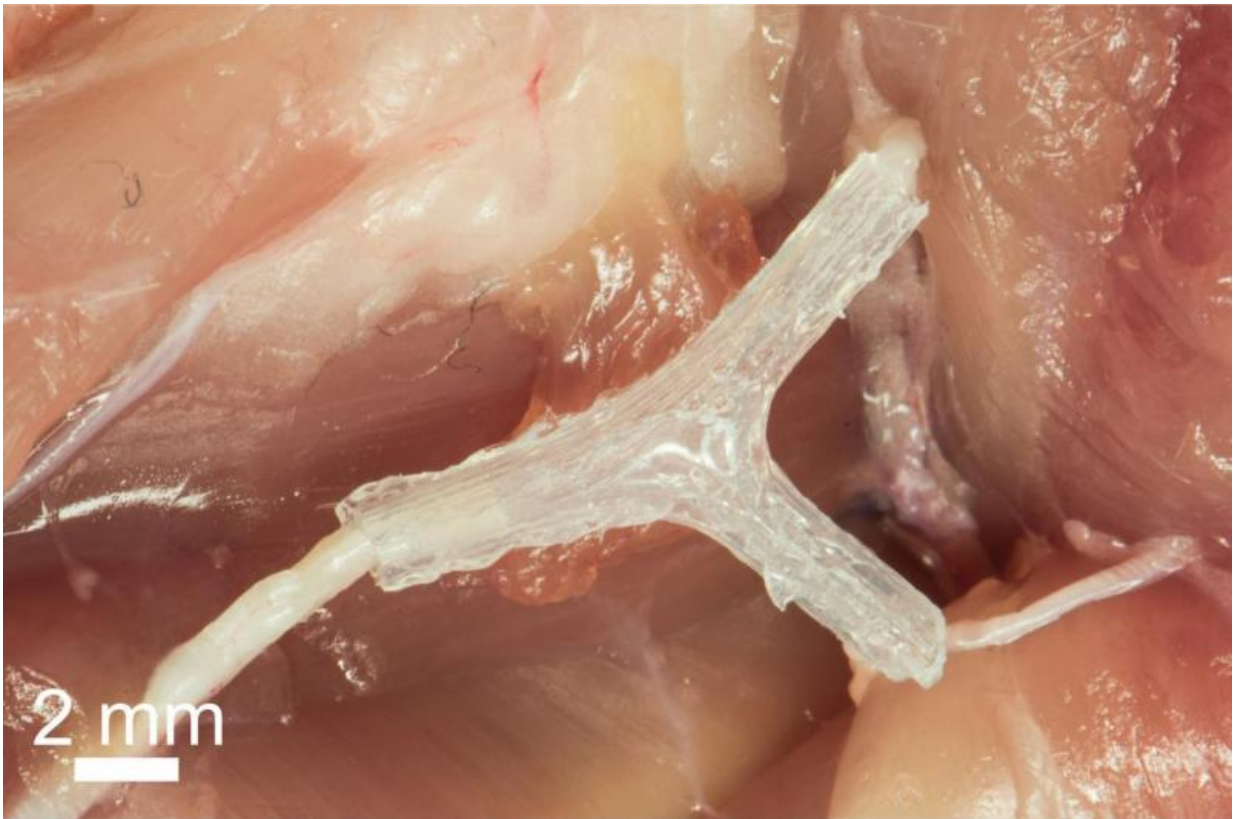


3-D printed guide helps regrow complex nerves after injury

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3-D printed nerve regeneration pathway implanted in a rat helped to improve walking in 10 to 12 weeks after implantation. Credit: University of Minnesota College of Science and Engineering

A national team of researchers has developed a first-of-its-kind, 3D-printed guide that helps regrow both the sensory and motor functions of

complex nerves after injury. The groundbreaking research has the potential to help more than 200,000 people annually who experience nerve injuries or disease.

Collaborators on the project are from the University of Minnesota, Virginia Tech, University of Maryland, Princeton University, and Johns Hopkins University.

Nerve regeneration is a complex process. Because of this complexity, regrowth of nerves after injury or disease is very rare, according to the Mayo Clinic. Nerve damage is often permanent. Advanced 3D printing methods may now be the solution.

In a new study, published today in the journal *Advanced Functional Materials*, researchers used a combination of 3D imaging and 3D printing techniques to create a custom silicone guide implanted with biochemical cues to help [nerve](#) regeneration. The guide's effectiveness was tested in the lab using rats.

To achieve their results, researchers used a 3D scanner to reverse engineer the structure of a rat's sciatic nerve. They then used a specialized, custom-built 3D printer to print a guide for regeneration. Incorporated into the guide were 3D-printed chemical cues to promote both motor and sensory [nerve regeneration](#). The guide was then implanted into the rat by surgically grafting it to the cut ends of the nerve. Within about 10 to 12 weeks, the rat's ability to walk again was improved.

"This represents an important proof of concept of the 3D printing of custom nerve guides for the regeneration of complex [nerve injuries](#)," said University of Minnesota mechanical engineering professor Michael McAlpine, the study's lead researcher. "Someday we hope that we could have a 3D scanner and printer right at the hospital to create custom nerve

guides right on site to restore [nerve function](#)."

Scanning and printing takes about an hour, but the body needs several weeks to regrow the nerves. McAlpine said previous studies have shown regrowth of linear nerves, but this is the first time a study has shown the creation of a custom guide for regrowth of a complex nerve like the Y-shaped sciatic nerve that has both sensory and motor branches.

"The exciting next step would be to implant these guides in humans rather than rats," McAlpine said. In cases where a nerve is unavailable for scanning, McAlpine said there could someday be a "library" of scanned nerves from other people or cadavers that hospitals could use to create closely matched 3D-printed guides for patients.

More information: "3D Printed Anatomical Nerve Regeneration Pathways," *Advanced Functional Materials*, 2015.

Provided by University of Minnesota

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