# Breakthrough Spinal Injury Therapy With Help From AI and Robotics

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Using artificial intelligence (AI) and robotics, Rutgers University scientists enhanced the therapeutic power of an enzyme that helps spinal injury heal. The discovery could one day help spinal injury patients regain function faster.

Spinal injuries are notoriously difficult to treat. The body cannot repair the damage on its own due to a cascade of inflammation that produces scar tissue — and that dense tissue blocks the nerve cells from regrowing.

One promising therapy is Chondroitinase ABC (ChABC), an enzyme that is capable of digesting molecules within scar tissue to allow new tissue to grow.

"However, this therapy is significantly limited by very poor drug stability," says Adam Gormley, Ph.D., the project's lead investigator and an assistant professor of biomedical engineering at Rutgers.

In fact, the enzyme is so volatile it lasts for only three hours at body temperature, Gormley says. That means administering it multiple times, at high doses, for it to be effective — and that can be costly.

In their study, Gormley and his colleagues sought to stabilize the enzyme so it could work for much longer, digesting more scar tissue and promoting greater regrowth. To do that, they turned to AI.

## Choosing the Right Puzzle Piece

One way to stabilize an enzyme is to combine it with a copolymer, a molecule that can wrap around the enzyme and protect it from harsh environments. A copolymer binding to ChABC would allow it to function at higher temperatures.

"A major technical challenge has been finding copolymers that do this effectively when there are millions of possibilities," says Michael Webb, Ph.D., study coauthor and assistant professor of chemical and biological engineering at Princeton University. (Princeton collaborated on the project.)

Choosing the right one can feel like picking the correct puzzle piece from a giant heap, Gormley says.

That's where AI came in. Using an "active learning" algorithm, the researchers narrowed the options to 72 and, from those, chose the most promising.

Then they programmed robotics to manufacture the copolymer-enzyme combinations, automating what would otherwise be a time-consuming process.

While several copolymers worked well, the most encouraging was able to keep the enzyme working for up to a week, the researchers report.

"It's the stability that's really key here," says Webb. "That's been a major technical challenge, to get just the right molecule that allows ChABC to remain stable for a longer period of time."

## New Hope for Spinal Injury Patients

A treatment that promotes tissue regeneration for a whole week could be game-changing for spinal injury patients — both for tackling chronic scars in disabled patients and for preventing scars from forming in new patients, says Gormley.

Further studies are needed to improve drug design before preclinical animal trials can occur, says Gormley. After that, if outcomes are successful, human trials will follow.

**Sources:**

Adam Gormley, Ph.D., assistant professor of biomedical engineering at Rutgers University

Michael Webb, Ph.D., assistant professor of chemical and biological engineering at Princeton University

Advanced Healthcare Materials. (2022). Machine-Assisted Discovery of Chondroitinase ABC Complexes toward Sustained Neural Regeneration.

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