



Reconnecting body and brain: Europe's breakthrough in reversing paralysis

Once considered impossible, restoring movement after paralysis is becoming a reality thanks to EU-funded researchers who have developed a device that reconnects the brain to the body.

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Spinal cord injury (SCI) remains one of the most devastating neurological conditions, severing communication between the brain and the body and leaving millions worldwide with permanent paralysis.

Despite decades of research, restoring movement after spinal cord injury has remained one of neuroscience's most intractable problems.

An EU-funded initiative supported by the European Innovation Council offers a new route: a fully implantable brain-spine interface that reconnects mind and body, offering fresh hope against paralysis.

"Treating patients with paralysis remains one of the greatest challenges of humanity," said Professor Grégoire Courtine, the neuroscientist at the École Polytechnique Fédérale de Lausanne, Switzerland, who led the breakthrough research.

He said researchers have tried for decades – and failed – to regrow neurons and fibres with biological approaches.

"We have completely changed the approach. Instead of trying to repair the actual injury, we are focusing on what is intact below the injury, but disconnected from the brain," added Courtine, who has pioneered new ways to restore movement after paralysis using spinal stimulation and neurotechnology.

A digital bridge across the injury

The EU-funded ReverseParalysis project, built around research led by Courtine, has developed a new generation of brain-spine interfaces designed to restore both lower- and upper-limb function in people living

with SCI.

Rather than relying on damaged nerve pathways, the system creates a “digital bridge” that links brain and spinal signals directly. By combining advances in neuroscience, bioengineering and AI from teams in the Netherlands, Switzerland and France, the technology bypasses the site of injury, allowing nerve communication to resume.

After SCI, movement signals from the brain can no longer reach the muscles. In this approach, a small implant reads signals from the brain’s motor cortex, translates them into commands, and relays them to a spinal implant positioned below the injury.

This delivers precise electrical stimulation to the nerves controlling muscles, so that thinking “walk” triggers the legs to move.

Until recently, most technologies focused on helping people adapt to paralysis – wheelchairs, walkers or exoskeletons – rather than restoring movement itself.

From breakthrough to first steps

Under the care of neurosurgeon Professor Jocelyne Bloch at Lausanne University Hospital, the first patient to receive the prototype implant was David Mzee, a sports education student paralysed in a gymnastics accident.

In the run-up to surgery, he was competing at the Wheelchair Rugby World Cup. Courtine attended one of his matches with his newborn daughter.

“David looked her straight in the eye and said, ‘I will walk before you’,” said Courtine. “Eight months later, on a beautiful day at Lake Geneva, he did exactly that. He made the first steps ever in the history of paralysis patients. It was a very, very special moment.”

Not only did Mzee learn to stand and walk with support, he also went on to qualify as a sports teacher and now works at a vocational school.

“I’m still dependent on a wheelchair, but with a spinal cord injury at the neck level, every small improvement makes a big difference. Each bit of regained function really counts,” Mzee said.

Building on this breakthrough, the three-year ReverseParalysis project, completed in 2025, achieved results once considered out of reach: two people with complete spinal cord injuries regained the ability to stand and walk, while two others recovered movement in their arms and hands, allowing them to perform everyday tasks again.

Dr Vincent Delattre, co-founder of ONWARD Medical, a neurotechnology company based in Eindhoven, the Netherlands, which coordinated the ReverseParalysis project, is now working to turn these laboratory results into a product for clinical use.

“One of our participants was able to eat something by himself for the first time in years,” he said. “He picked up a sausage and took a bite. When you see the smile on that person’s face, that is enough to drive everything we do.”

Relearning movement

For people living with SCI, even small gains in mobility can transform daily life, reducing dependence on carers and restoring a sense of autonomy.

Yet SCI is highly complex: injuries vary in location and severity, making it difficult to decode brain signals accurately and translate them into smooth, natural movement. Each success also revealed how much there is still to understand about relearning lost skills.

To tackle this, the ReverseParalysis team integrated machine learning algorithms that adapt to each individual user. These systems continuously refine how brain signals are interpreted, improving performance over time. Advances in electrode design have also enabled precise targeting of neural pathways within the spinal cord.

“It is not a cure; it is a first step in a recovery process,” said Delattre. “With intensive training, patients can improve and may even regain some function without stimulation.”

Expanding the horizon

The team is now applying its expertise to other challenges linked to paralysis. One focus is stabilising blood pressure, a common but often overlooked complication of SCI that can cause dizziness and fatigue, and reduce quality of life.

Using targeted spinal stimulation, the researchers aim to help patients sit upright for longer, take part in therapy and carry out daily activities more safely.

The technology may also benefit stroke survivors. While a stroke does not damage the spinal cord, it disrupts the brain’s ability to control movement. The goal is to strengthen and stabilise the remaining signals to restore function.

The next challenge for ONWARD Medical is to turn specialised laboratory systems into practical, self-contained devices that can be widely used in clinical settings. This step – making the technology accessible to more patients – may still be 5 to 10 years away.

As Delattre puts it, the boundaries of recovery after SCI are shifting. “We are pushing beyond the limits of what was previously thought possible.”

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More info

- [ReverseParalysis \(CORDIS\)](#)
- [ReverseParalysis project website](#)
- [EU Disability Strategy 2021–2030](#)