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Scientists invent microscopic operating table for 1mm worm

By Roger Highfield, Science Editor
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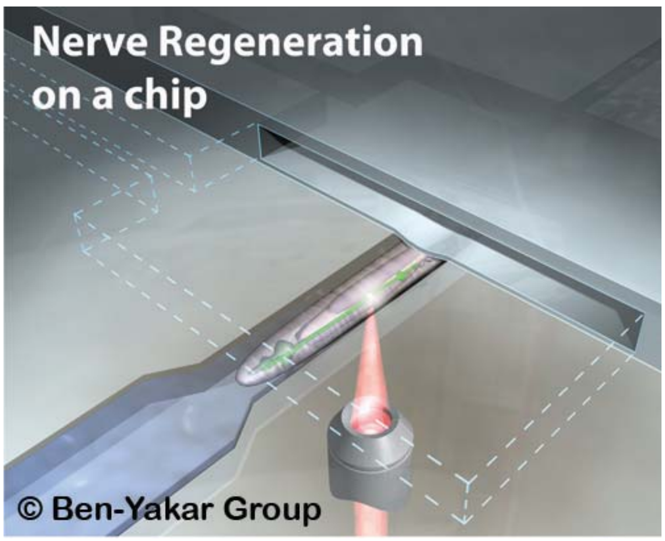

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Artist's impression of a worm trapped in the microfluidic device, undergoing laser microsurgery

A tiny operating table has been devised by scientists to carry out nerve surgery on the best understood worm on the planet.

A decade ago the worm wriggled into the history books when scientists announce they have decoded its entire genetic blueprint, marking the first time that the genetic instructions have been spelt out for an animal that, like humans, has a nervous system, digests food, and has sex.

Now a special microchip that can immobilize the one millimetre long transparent worm Caenorhabditis elegans so that scientists can perform laser nanosurgery to sever individual nerves and study their regeneration is reported in Nature Methods, a technique that will be a boon for spinal repair in humans since the worms have many things in common with the scientists who study it.

Using old fashioned methods it took 1500 scientists in 250 labs 15 years and £30 million to "read" every letter of the genetic code of the nematode worm, revealing that the instructions to build a worm is spelt out by 97 million genetic letters corresponding to 20,000 genes.

The effort won Briton Sir John Sulston the Nobel prize for understanding the worm, what he called "a microcosm of humanity in terms of the mechanism inside."

The team that reports the new work says that its basic nervous system and simple behaviours make it an ideal model for studying the fine function of the nervous system, both worm and human. The only problem was how to keep the worm still.

Dr Adela Ben-Yakar and colleagues from the University of Texas together with collaborators from the University of Michigan designed a chip with two compartments separated by a membrane that, under pressure from fluid in the chip, holds a worm perfectly still during surgery and imaging, flattening it too to make things even easier.

The worm can be released to a holding compartment and recaptured at will, and it can work with worms of different sizes. This meant that the authors could successfully cut individual nerves and image the regeneration. This is much kinder, more elegant and useful way to study the worms, they say.

Containing fewer than 1,000 cells and one millimetre in length, C. elegans seems very different from us but is built using remarkably similar principles, such as cell division, differentiation and death. Like us, it develops from embryo to adult, has a gut, nerves, muscles, skin, and around 40 per cent of its genes are closely related to ours.

The worm project began in 1963 when Dr Brenner first set out to unravel the entire genetic recipe of the worm at the Medical Research Council's Laboratory of Molecular Biology (LMB), in Cambridge. He was joined there by Sir John in the early 1970s.

Being multi-cellular, yet relatively simple, the worm allowed Sir John and colleagues to work out the fate of cells in development, in which new cells grow and others are culled by programmed cell death.

They tracked the way a single cell divides repeatedly to produce a typical adult hermaphrodite worm, revealing the lineage of every one of its 959 cells. They also showed that 131 cells died during development and how this is controlled by genes.