Articulo 5

PRÓTESIS DE HIPOCAMPO: LA PRIMERA PRÓTESIS CEREBRAL DESARROLLADA

En el número de la revista New Scientist correspondiente al 15 de marzo de 2003, unos científicos norteamericanos (de la Universidad de California en Los Ángeles) muestran la primera prótesis cerebral desarrollada hasta ahora, diseñada para realizar las mismas funciones que el hipocampo.

Se presenta este dispositivo, un implante consistente en un microchip de silicio. A diferencia de otros dispositivos como los implantes cocleares, que simplemente estimulan la actividad cerebral, esta prótesis llevará a cabo los mismos procesos que la parte dañada del cerebro a la que reemplazan.

Los investigadores van a probar el nuevo dispositivo en tejido procedente de cerebros de rata, y después en animales vivos. Si tuviesen éxito, esperan utilizarlo para ayudar a personas que hayan sufrido daño cerebral tras un ictus.

Esto podría acarrear preocupación desde el punto de vista ético, y ya se ha aducido que cualquier dispositivo que reproduzca el funcionamiento del cerebro humano estará abocado a problemas legales, y no actuará sólo sobre la memoria, sino también en el estado de ánimo, principios y conciencia de los posibles receptores.

Estos científicos han elegido el hipocampo, la parte del cerebro más ordenada y estructurada, y una de las más estudiadas (pinche aquí para ver sus funciones). El hipocampo parece codificar las experiencias de manera que se almacenen después en otras partes del cerebro en forma de recuerdos. Es por esta razón que los investigadores afirman que será relativamente fácil comprobar la eficacia del dispositivo. Si alguien portador de esta prótesis recuperase la capacidad de almacenar nuevos recuerdos, sería obvio que el dispositivo funciona.

El equipo tuvo que superar muchas dificultades a lo largo de los 10 años que ha llevado su desarrollo. Por ejemplo, se desconoce de qué manera codifica el hipocampo la información, así que los investigadores tuvieron que estimular cortes de hipocampo de rata millones de veces para ver qué estímulo eléctrico se correspondía con cuál respuesta eléctrica.

Tras procesar la información procedente de varios cortes, el equipo pudo producir un modelo matemático del hipocampo, que entonces copiaron a un microchip.

Una vez que lo prueben en seres vivos (ratas y quizá monos), la prueba real será ver si el animal presenta cambios en su comportamiento o lo mantiene.

Si esto funcionase, otro aspecto para la controversia sería el cómo poder olvidar aquellas cosas que sería mejor olvidar: el olvido fisiológico es uno de los procesos más beneficiosos que poseemos los humanos.

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WORLD'S FIRST BRAIN PROSTHESIS REVEALED

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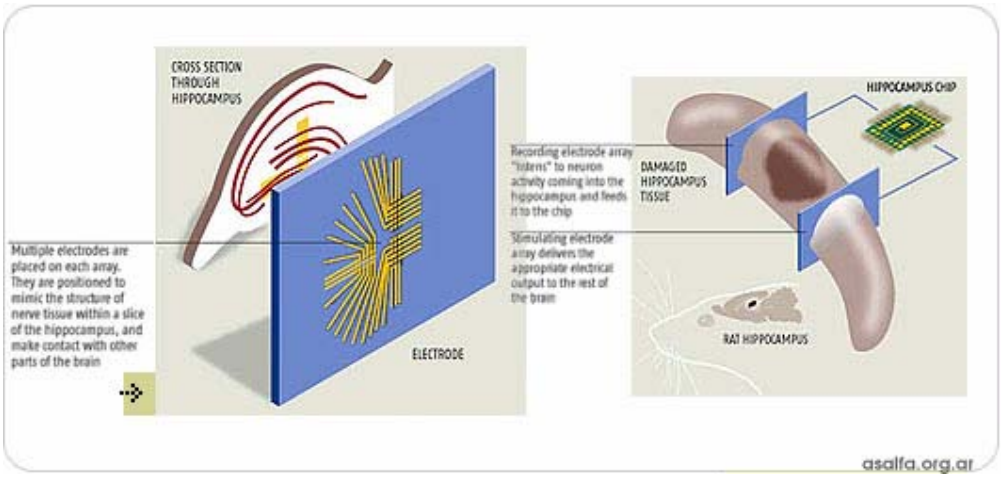
The world's first brain prosthesis - an artificial hippocampus - is about to be tested in California. Unlike devices like cochlear implants, which merely stimulate brain activity, this silicon chip implant will perform the same processes as the damaged part of the brain it is replacing.



The prosthesis will first be tested on tissue from rats' brains, and then on live animals. If all goes well, it will then be tested as a way to help people who have suffered brain damage due to stroke, epilepsy or Alzheimer's disease.

Any device that mimics the brain clearly raises ethical issues. The brain not only affects memory, but your mood, awareness and consciousness - parts of your fundamental identity, says ethicist Joel Anderson at Washington University in St Louis, Missouri.

The researchers developing the brain prosthesis see it as a test case. "If you can't do it with the hippocampus you can't do it with anything," says team leader Theodore Berger of the University of Southern California in Los Angeles. The hippocampus is the most ordered and structured part of the brain, and one of the most studied. Importantly, it is also relatively easy to test its function.

The job of the hippocampus appears to be to "encode" experiences so they can be stored as long-term memories elsewhere in the brain. "If you lose your hippocampus you only lose the ability to store new memories," says Berger. That offers a relatively simple and safe way to test the device: if someone with the prosthesis regains the ability to store new memories, then it's safe to assume it works.

Model, build, interface

The inventors of the prosthesis had to overcome three major hurdles. They had to devise a mathematical model of how the hippocampus performs under all possible conditions, build that model into a silicon chip, and then interface the chip with the brain.

No one understands how the hippocampus encodes information. So the team simply copied its behaviour. Slices of rat hippocampus were stimulated with electrical signals, millions of times over, until they could be sure which electrical input produces a corresponding output. Putting the information from various slices together gave the team a mathematical model of the entire hippocampus.

They then programmed the model onto a chip, which in a human patient would sit on the skull rather than inside the brain. It communicates with the brain through two arrays of electrodes, placed on either side of the damaged area. One records the

electrical activity coming in from the rest of the brain, while the other sends appropriate electrical instructions back out to the brain.

The hippocampus can be thought of as a series of similar neural circuits that work in parallel, says Berger, so it should be possible to bypass the damaged region entirely (see graphic).

Memory tasks

Berger and his team have taken nearly 10 years to develop the chip. They are about to test it on slices of rat brain kept alive in cerebrospinal fluid, they will tell a neural engineering conference in Capri, Italy, next week.

"It's a very important step because it's the first time we have put all the pieces together," he says. The work was funded by the US National Science Foundation, Office of Naval Research and Defense Advanced Research Projects Agency.

If it works, the team will test the prosthesis in live rats within six months, and then in monkeys trained to carry out memory tasks. The researchers will stop part of the monkey's hippocampus working and bypass it with the chip. "The real proof will be if the animal's behaviour changes or is maintained," says Sam Deadwyler of Wake Forest University in Winston-Salem, North Carolina, who will conduct the animal trials.

The hippocampus has a similar structure in most mammals, says Deadwyler, so little will have to be changed to adapt the technology for people. But before human trials begin, the team will have to prove unequivocally that the prosthesis is safe.

Collateral damage

One drawback is that it will inevitably bypass some healthy brain tissue. But this should not affect the patient's memories, says Berger. "It would be no different from removing brain tumours," where there is always some collateral damage, says Bernard Williams, a philosopher at Britain's University of Oxford, who is an expert in personal identity.