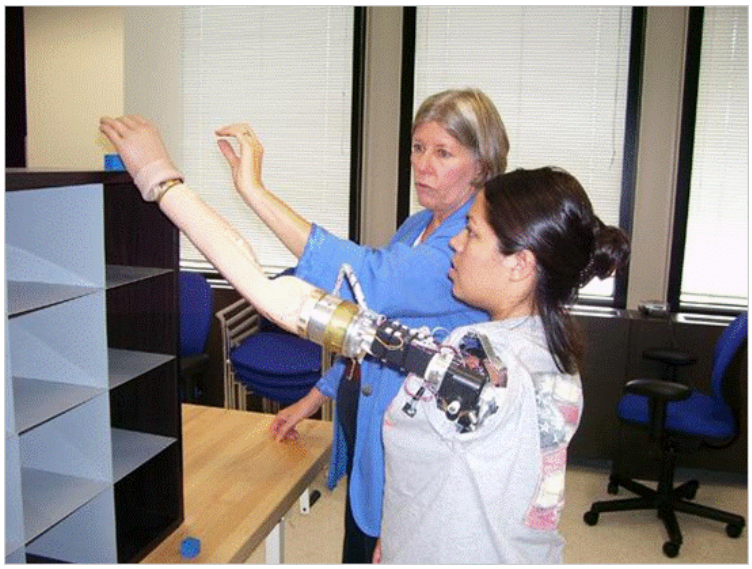
Woman with bionic arm regains sense of touch



Claudia Mitchell can control her bionic arm intuitively (Image: Todd Kuiken et al)

A prosthetic arm that moves and feels like the real thing is now a step closer thanks to a new surgical technique which allows the owner to intuitively control her limb and regain her sense of touch.

Surgeons working on a female amputee in Chicago, US, have re-routed the ends of the motor nerves – which once controlled her arm's movement – into the muscles in her chest and side. And the ends of the sensory nerves, which fed signals responding to heat and touch from her now-amputated arm to her brain, have been transferred to the skin on her chest.

Claudia Mitchell, a 26-year-old former US marine, is already able to control her prosthetic arm with more skill than is possible with conventional devices. She can carry out simple tasks intuitively, such as cutting up food, and at four times the speed of someone with a conventional prosthesis. And she has regained the sensation of having her arm touched when someone touches the patch of skin on her chest.

Most of the advanced prosthetic arms on the market are powered by myoelectric motors that respond to contraction of muscles in the chest and back. But these are limited, because they allow only one movement at a time, such as bending the elbow or opening the hand, and amputees must learn to contract their chest and back muscles to cause these movements.

Watch a video of the arm in action during a range of tasks, and another showing the prosthetic's startling advantage over a conventional device.

Use your imagination

To make the process more intuitive, Todd Kuiken and colleagues at the Rehabilitation Institute of Chicago developed a technique called "targeted muscle reinnervation". Motor nerves that once controlled the arm are transferred to nearby muscles, which are then fitted with myoelectric sensors to detect contraction.

"When the person imagines closing their hand, the signal goes down the nerve. Then we use that signal to control the prosthetic hand," explains prostheticist Laura Miller.

Three amputees have previously had their motor nerves redirected in this way, and are able to control their prosthetic arms much more effectively than conventional devices.

In one of these patients, sensory nerves that once fed from the arm grew into the skin nearby. So for Mitchell, who lost her arm in a motorcycle accident, the researchers decided to help this process along, and redirected the sensory nerves into the skin of her chest.

Transferred senses

The procedure was a success. Touch certain points on the patient's upper chest and she feels sensations as if from different fingers of her missing hand. She can even distinguish a range of pressures, temperatures and vibrations.

The idea is to use these transferred senses to provide sensory feedback from the prosthetic arm. This should allow more coordinated movements, Miller explains.

"Anybody who's ever tried to button their shirt when their hands are cold will know how important sensory-motor integration is," says Greg Clark, a bioengineer at the University of Utah in Salt Lake City, US, who is working to develop a similar system that uses electrodes to tap signals from nerves directly.

Before the senses can be used to provide feedback, a prosthetic arm must be built to pick up sensory input and transmit it to the portion of the chest that feels like the hand.

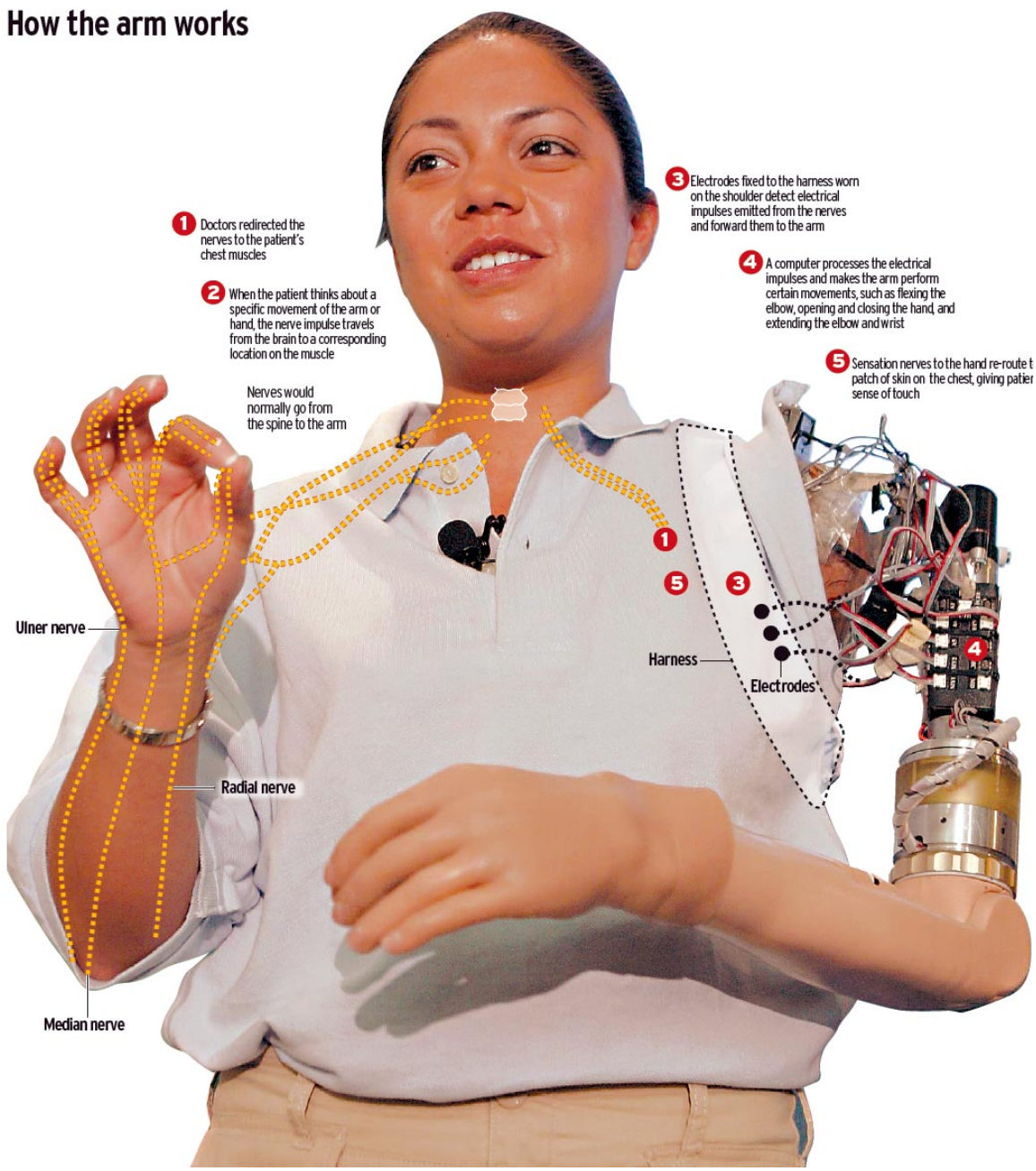
Kuiken's team is now working on a prototype device that transfers the feeling of pressure to the chest using a plunger-like mechanism, which they hope to begin testing in three to six months. Systems for transmitting vibrations and temperature are also in development.

Journal Reference: *The Lancet* (vol 369, p 371)

There are two videos of Claudia's arm available for download on You Tube the links are available on the New Scientist site, alternatively go to:

www.youtube.com/watch?v=xuIGX StjOJE

www.youtube.com/watch?v=OZX2EVE7Jrk



Picture reprinted courtesy of the Telegraph Media Group

limbs4life

1300 782 231