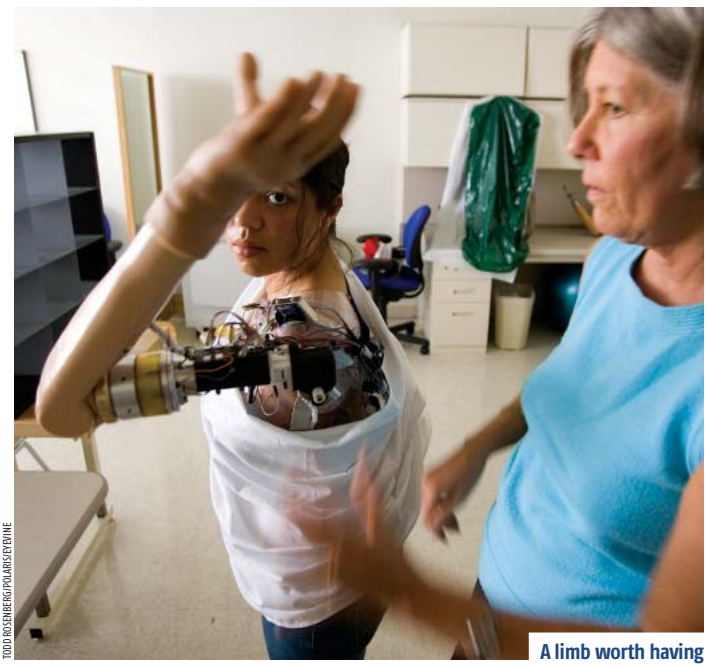
Artificial arms that move at the speed of thought



TODD ROSENBERG/POLARISEYELINE

A limb worth having

PROSTHETIC limbs controlled by thought alone could soon be capable of vastly more complex movements, including a choice of different hand grasps and shoulder and elbow rotations.

In February, Todd Kuiken and colleagues at the Rehabilitation Institute of Chicago announced promising results from the first human trials of prosthetic limbs based on an approach known as targeted muscle re-innervation.

To equip a patient with a TMR prosthetic arm, they cut the redundant nerves serving nearby chest muscles that once helped support and move the missing limb. Then they separate out the motor nerves in the arm stump that used to control the patient's arm and connect them to the chest muscle instead. Four to six months later, patients only have to think of moving their arm or hand, and signals produced in the brain that would have prompted their old limb to move now flow into the chest muscles. The resulting contractions are detected by an array of electrodes sitting on the skin and used to control the motorised prosthetic arm. Volunteers who tested the TMR system performed a variety of tasks far more quickly and intuitively than with conventional prosthetics, which are controlled by muscles in the back (*New Scientist*, 10 February, p 21). "My original prosthesis wasn't worth wearing, this one is," said volunteer Claudia Mitchell (pictured). With these first-generation arms, volunteers can only open and close the hand and bend and extend the elbow.

As the next step towards prosthetics with a greater range of movement, Kuiken's team hooked volunteers up to the same array of electrodes and asked them to imagine making a broad range of movements. Instead of just looking for patterns in the amplitudes of the signals to differentiate between movements, as they did in the first generation of limbs, the team built pattern recognition software that also took the frequency and timing of the signals into account.

In a future issue of the *Journal of Neurophysiology*, they report how this software allows them to distinguish between the electrical signals produced by 16 different arm, hand and finger movements with 95 per cent accuracy.

Before these signals can be used to command prosthetic limbs, pattern recognition will have to be faster. Once the detected signal can be turned into a motor command in real time, amputees will be able to produce a range of different hand grasps and rotate their wrists, elbows and shoulders in multiple directions, says Kuiken. "This will allow amputees to control more complex robotic arm systems intuitively."

Team member Ping Zhou predicts it could be ready for testing by injured soldiers within two years. **Robert Adler** ●

'Poor man's broadband' has a turn of speed

IT'S not often that you get to go faster by avoiding the superhighway, but soon students in Pakistan will be able to download big files faster by avoiding the internet.

Instead of using expensive broadband or slow, unreliable dial-up connections, students at Lahore University of Management Sciences (LUMS) will try out a new system, dubbed "poor man's broadband" (PMB). It allows computers to link to each other directly for faster downloads, and it works as long as at least one computer running the trial software has already downloaded the desired file from the internet. The system should also reduce the university's risk of overloading the bandwidth supplied by its internet service providers (ISPs).

PMB is a mixture of peer-to-peer (P2P) software – touted as the internet's future (*New Scientist*, 13 October, p 28) – and pre-internet techniques, whereby users dialled other computers directly to exchange files. It is based on P2P software called BitTorrent, which allows computers to talk directly to each other and swap chunks of files. The snag is that BitTorrent requires that all computers be connected to the internet to swap files – a luxury in Pakistan. So LUMS computer scientist Umar Saif tweaked BitTorrent to create the new system.

"The computers 'gossip' about which PCs they have called in the past"

Saif's version allows computers to "gossip" about which PCs they have called in the past, and which computer had what files. Gossiping happens every time computers connect to make a transfer, ensuring the entire network is kept updated.

PMB users still surf the web as usual, but when they try to download a large file, the software checks its gossip logs to see if it can call another computer directly for a faster download. "Trials so far show this can be more than five times faster than the internet [alone]," says Saif.

The system will mainly help in the download of software patches and free educational materials, like MIT's Open Course Ware, says Saif, because they are large files likely to be found on local computers.

After the university trial, Saif intends to try a city-scale test and hopes to interest other countries with poor internet infrastructure. He is also in talks with PTCL, the largest ISP in Pakistan, about using his idea. Tom Simonite ●