Medical and Healthcare

**TECHNOLOGY & INNOVATION AWARDS 2011**

**SMARTNAIL**
Smith & Nephew, University College London, Royal National Orthopaedic Hospital

A telemetric nail that can monitor how well broken bones are healing has been developed through a collaboration involving engineers from medical device firm Smith and Nephew, and orthopaedic specialists from University College London (UCL).

Metallic bone implants — also known as intramedullary nails — have been used since the 1940s to treat fractures but have hitherto been mainly passive. The new device, dubbed SmartNail, uses sensors and processors to actively measure the stresses and strains on an injured bone. This data can then be downloaded by a wearable device.

Currently, clinicians rely on X-rays to monitor and diagnose fracture healing, a process that requires expert professional judgement and leaves the patient at risk of over-loading their fracture during a post-operative period. SmartNail will eliminate some of this risk by providing validated quantitative data about fracture healing.

The implant will record the direction of the exerted load, allowing physicians and patients to know exactly which type of activity triggers too much stress. The device will also be able to record high load events yielding data that could corroborate decisions about resumption of normal activities, a more scientific approach than subjective pain feedback from patients. It will also record temperature, so localised inflammation from a periprosthetic infection can be caught early.

Smith & Nephew believes that wireless communication between orthopaedic implants and an external system could dramatically change the way clinicians, surgeons and engineers interact with the body. The device is designed to present a more scientific approach to fracture healing.

**EXTERNAAL AORTIC ROOT SUPPORT**
Exstent, Imperial College London, Royal Brompton Hospital

Tal Golesworthy designed his own life-saving implant.

Patients with spinal cord injuries could one day move paralyzed parts of their bodies with a wearable robotic device controlled by a wireless chip implanted in the brain.

The technology is being developed through a £1m government-sponsored research programme involving academics from Leicester University, Newcastle University and Imperial College London.

The team has developed a low-power implantable chip able to monitor and wirelessly transmit the activity of the neurons of the brain that could usher in a new generation of assistive devices such as computers, robotic prostheses and wheelchairs.

**NEUROCHIP**
Leicester University, Imperial College, Newcastle University

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Until now, so-called brain machine interface (BMI) technology has relied on connecting intracortical electrodes to external amplifiers via wires passing through the skin. This approach breaches the body’s natural barrier to bacterial infections, presenting serious danger to patients and also requires powerful computers.

Thanks to a neural spike sorting algorithm developed by Leicester University, the ultra-low-power implantable chip currently under development has its own processing capability and thus significantly decreases the necessary bandwidth to be transmitted and allows low power wireless transmission.

The group believes that the low-power chip could be a key component in a variety of neural prostheses. Neural devices now constitute a $3bn a year industry that is predicted to grow twice as fast as the cardiac implant market.

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