Prosthetic Hands, Robot Trousers and Biosensors - £5.3 Million for Healthcare Tech Research

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A prosthetic hand controlled by the nervous system, robotic clothing to help people with walking, and biosensors to monitor how patients use equipment or exercise during rehabilitation are the focus of three research projects awarded £5.3 million by the Engineering and Physical Sciences Research Council (EPSRC).

The three innovative research projects start work in the spring and are led by Newcastle University, the University of Bristol and the University of Warwick working with 15 other university partners.

UK scientists and clinicians devised the research after being challenged to transform the design and development of assistive and rehabilitative devices using EPSRC's creative workshop approach, known as a sandpit.

Philip Nelson, Chief Executive of EPSRC said; "These research studies will improve patients' lives, allow greater independence and benefit patients with a wide range of mobility and co-ordination difficulties. With the UK's ageing population and a rise in disabilities, this highlights one area of EPSRC investment in healthcare research which has a national impact."

The three projects are:

Enabling Technologies for Sensory Feedback in Next-Generation Assistive Devices (EP/M025977/1) Research at Newcastle University, University of Essex, Imperial College London, Keele University, University of Southampton and University of Leeds. Awarded £1.4 million

The Newcastle-led team will develop a prosthetic hand which will give users a sense of feedback. The team will build fingertip sensors to give the prosthesis a realistic sense of touch, including pressure, shear and temperature. In addition, a 'virtual hand' will provide information on the sense of the hand's position and movement, known as proprioception. Finally, the system will translate the signals to a form the brain understands and stimulate the nervous system to help the user control the hand.

Building this level of feedback into prosthetic devices will enable much higher levels of function for people who have lost their limbs, than is currently available.

Using an advanced prosthetic hand would help people to naturally reach out and pick up a glass, for example, whilst maintaining eye contact in a conversation, or pick up an apple without bruising it. This will advance the field of prosthetics, provide enhanced function to prosthesis users and decrease the learning time involved when acquiring a new device. The technology will also have applications for patients with neurological conditions where reduced sensation is a factor.

Wearable Soft Robotics for Independent Living**(**EP/M026388/1) Research at the University of Bristol, University of the West ofEngland, University of Nottingham, University of Leeds, University of Strathclyde, University of Southampton and Loughborough University. Awarded £2 million

The research team will develop soft robotic clothing to enable those with mobility impairments, disabilities and age-related weakness to move easily and unaided and to live independently and with dignity. The end results will be easy to use, comfortable, adaptable and meet the user's individual mobility needs.

Smart trousers could help vulnerable people avoid falls by supporting them whilst walking, give people added bionic strength to move between sitting and standing positions, and help people climb stairs which were previously insurmountable. They could replace the stair lift in the home and other bulky and uncomfortable mobility and stability aids. Ultimately they have the potential to free many wheelchair users from their wheelchairs.

This intelligent clothing or 'second skin' will use artificial 'muscles' made from smart materials and reactive polymers which are capable of exerting great forces. This will be developed using the latest wearable soft robotic, nanoscience, 3D fabrication, functional electrical stimulation and full-body monitoring technologies, all driven by the need of the end users, who will also be directly involved in the project. They will include control systems that monitor the wearer and adapt to give the most suitable assistance, working with the body's own muscles. For patients needing rehabilitation the smart clothing

can initially provide strong support and subsequently reduce assistance as the patient recovers mobility and strength.

Many existing devices used by people with mobility problems can cause or aggravate conditions such as poor circulation, skin pressure damage or susceptibility to falls, each of which is a drain on health resources. Wearable Soft Robotics has the potential to alleviate many of these patients problems and reduce healthcare costs.

Adaptive, Assistive Rehabilitative Technology: Beyond the Clinic (EP/M025543/1) The University of Warwick is partnering with Cardiff University, University of Kent, UCL (University College London), Oxford Brookes University, University of Salford and University of York. Awarded £1.86 million

Researchers will design and develop cheap, disposable, unobtrusive bio-sensors such as temporary tattoos and smart watches to use with patients who use wheelchairs or prosthetics, patients requiring rehabilitation, as well as older people.

The study will collect data and monitor how patients use equipment provided to them, and also measure how they follow exercise advice at home, for example, after a stroke or accident. The research will also develop software that uses the biosensor information to support users with their equipment or exercises in their own home. Currently there is no picture of what happens after a patient leaves the clinic. Anecdotally, poor use of equipment or not following physiotherapy guidance on exercise can lead to more complex health problems.

The information will benefit patients and enable them to leave hospital sooner and enable clinicians and medical technologists to understand conditions, better support patients in their home environment, and improve or adjust the design of equipment for patients.

Christopher James, project lead, and Professor of Biomedical Engineering, University of Warwick said: "The new information we will gain from this research will be invaluable, and through a feasibility study, it is our aim to produce a system ready for future technical/clinical trials within the NHS."

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Notes to editors:

Media Contacts: For images please contact the EPSRC Press office on 01793 444 404 or email pressoffice@epsrc.ac.uk

Images available:

1. Prosthetic hand, and Dr Kianoush Nazarpour, Newcastle University
2. Biosensors smartwatch, University of Warwick
3. Biosensor watch worn by Professor Christopher James, University of Warwick

Contacts for interviews:

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3. University of Warwick Press Office contact Tom Frew tel: 0247 657 5910

Professor Christopher James, University of Warwick, email c.james@warwick.ac.uk

Statistics

There are 11.6 million disabled people living in the UK today (Office for Disability Issues estimates 2012). Nearly 6.5 million have mobility impairments; 6.3 million have an impairment of lifting and carrying; 2.7 million have impaired co-ordination.

EPSRC invests over £700 million into healthcare research out of its total current portfolio.

The Engineering and Physical Sciences Research Council (EPSRC) is the UK's main agency for funding research in engineering and the physical sciences. EPSRC invests around £800 million a year in research and postgraduate training, to help the nation handle the next generation of technological

change. The areas covered range from information technology to structural engineering, and mathematics to materials science. This research forms the basis for future economic development in the UK and improvements for everyone's health, lifestyle and culture. EPSRC works alongside other Research Councils with responsibility for other areas of research. The Research Councils work collectively on issues of common concern via Research Councils UK. www.epsrc.ac.uk

Newcastle University Newcastle University is a Russell Group University

Ranked in the top 1% of universities in the world (QS World University Rankings 2014)

Ranked 16th in the UK for global research power (REF 2014)

Ranked 22nd in The Sunday Times 2015 Good University Guide

The University of Bristol is one of the most popular and successful universities in the UK, and was ranked within the top 30 universities in the world in the QS World University rankings 2014.

Bristol is a member of the Russell Group of UK research-intensive universities, and a member of the Worldwide Universities Network, a grouping of research-led institutions of international standing.

The University was founded in 1876 and was granted its Royal Charter in 1909. It was the first university in England to admit women on the same basis as men.

The University is a major force in the economic, social and cultural life of Bristol and the region, but is also a significant player on the world stage. It has over 15,000 undergraduates and nearly 6,000 postgraduate students from more than 100 countries, and its research links span the globe.

Eleven Bristol graduates and members of staff have been awarded Nobel Prizes, including Sir Winston Churchill who was Chancellor of the University of Bristol from 1929 until 1965.

The University of Warwick is globally connected, forward-looking and entrepreneurial. We create new ways of thinking and achieving: making us stand out from our competitors and the more 'traditional universities' and creating an inspiring place to study and undertake research. In 2014, the Sunday Times named Warwick as University of the Year.

Warwick's School of Engineering is one of the leading unified engineering schools in the UK. Our integrated approach to engineering education brings together the key branches of engineering and draws upon research strengths in core engineering disciplines.

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