ARC Centre of Excellence for Electromaterials Science

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Novel treatments to aid diabetics

A patch that relieves diabetics of finger prick testing and a contact lens that incorporates a glucose sensing capability are two new ideas for changing the management of diabetes.

Professor Dermot Diamond, of Dublin University, who is leading a team researching these ideas, outlined the emerging technology.

“For example, a diabetic puts a patch on his/her arm; this patch can access fluid through the skin and pass this fluid through a microfluidic chip to a detector that measures the glucose level accurately, and transmits the data wirelessly to a cloud database,” he said.

Professor Diamond highlighted the benefits of the device.

“(Currently) diabetics need to take a blood sample, usually by finger prick. This enables glucose to be measured pretty accurately, but it’s a single measurement at a point in time, not continuous, and for diabetics, peripheral blood flow is usually impaired; also skin becomes hardened over time as this is done several times per day.”

The patch approach uses a sample called interstitial fluid (which contains glucose), rather than blood, which is drawn through the skin into the patch via microneedles without causing bleeding.

Professor Diamond said that commercial systems already available claim the patch approach allowed glucose to be monitored continuously for a period of up to one week and then it was replaced.

The contact lens model use is one-day, as the lenses are typically disposable.

Professor Diamond said his team’s research, while in its infancy, was extremely promising, due to the availability of new flexible techniques for rapid prototyping and materials characterisation.

“There are concerns around how well the fluid glucose in the eye (contact lens) and in the skin (patch) represents the true blood glucose level, and around keeping the sensor calibrated accurately during use, but there are tricks to help in this regard.”

For example, keeping the devices low-cost, with a limited period of use through regular replacement is attractive for practical applications.

The patch system and other proposed devices use a technology called microfluidics, which deals with the manipulation of fluids, by mixing, separating, or reacting, for example, in

channels that might be as small as 1/1000th of a millimetre thick (think inkjet printing as an example).

Professor Diamond said his team's goals for the short term were to demonstrate that they could make vastly better platforms that could remotely sense molecules, operate autonomously and make the resulting data remotely available through cloud-based systems.

Professor Dermot Diamond is a funded investigator at the INSIGHT Centre and director at the National Centre for Sensor Research, Dublin City University, Ireland and will present on these developments at the 10th Annual International Electromaterials Science Symposium at the University of Wollongong on February 11.

About the International Electromaterials Science Symposium

This symposium brings together leading researchers engaged in ground-breaking materials science. Applications that will be presented include solar and hydro-energy generation, printing 3D structures, building ultra-strong electrolyte gels and muscle regeneration through electrical stimulation of cells.

About the ARC Centre of Excellence for Electromaterials Science (ACES)

Led by Australian Laureate Fellow Professor Gordon Wallace, ACES is the pre-eminent world centre for electromaterials science. Using state-of-the-art additive fabrication, ACES is at the forefront of new electrochemical device development for energy conversion/storage and medical bionics.

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