Smart contact lenses could monitor bodily functions and detect disease

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A contact lens containing biosensors to measure and monitor a multitude of bodily functions - including signs of cancer - is edging closer to reality. This could reduce the need for blood tests and other methods of invasive monitoring.

The biosensors are based on a semiconducting material: indium gallium zinc oxide, or 'IGZO'. IGZO is used in electronics to allow for high-resolution smartphone screens and greater touch sensitivity. More recently, researchers have begun to investigate IGZO's potential biomedical applications.

An area in which IGZO seemed likely to prove useful was in testing blood glucose levels for diabetic people. While most people suffering from diabetes carry out regular 'prick tests' to monitor their blood glucose levels, continuous monitoring would help reduce the risk of complications.

A team led by Dr Gregory Herman, based at Oregon State University, developed an approach to fabricate biosensors containing a transparent sheet of IGZO transistors and glucose oxidase, an enzyme which breaks down glucose.

When glucose was present, it became oxidised, changing the PH of the mixture and affecting the electrical current in the IGZO transistor.

A biosensor based on this technology could be easily implanted under the skin, although it would be preferable to avoid invasive procedures, which are painful and could lead to infection. The alternative is to implant biosensors into contact lenses, which could then monitor blood sugar levels in tears. The researchers developed nanostructures within the biosensor to increase sensitivity. This compensates for the lower blood glucose levels in the eye.

"These biosensors probably won't put blood labs out of business," said Dr Herman, "but I think that we can do a lot of diagnostics using information that can be extracted from tear drops in the eye."

The researchers' work is being presented at the 253rd National Meeting & Exposition of the American Chemical Society. Their technology could be ready for animal testing within a year.

The compact biosensor system could allow for great versatility. In theory, 2,500 biosensors could fit in a 1mm square patch of contact lens; each monitoring a different bodily function. The biosensors are already being tested to measure a key indicator of kidney function, and the researchers hope that it could also be used to detect early indicator of cancer and other serious conditions.

The smart contact lenses, when fully developed, would be able to transmit live health information to a smartphone using Bluetooth or Wifi.