For decades, a simple and convenient way of enabling people with diabetes to monitor their own blood sugar levels has eluded medical science. But now advances in nanometrology – measuring at the nanoscale – are bringing the prospect within reach with ‘smart’ tattoos.

The routine of taking and testing finger-prick blood samples is just one unwelcome consequence of contracting diabetes. Currently, it represents the only practical way for most sufferers to manage their glucose levels. However, not only does it cause daily discomfort, it doesn’t provide continuous data that can highlight dangerous swings in glucose.

**IMPACT ON HEALTHCARE**

- ‘Smart’ tattoos constantly monitor molecular-level changes in glucose levels.
- Extremely accurate, highly sensitive nanoscale devices of this kind have the potential to play a major role in many fields of future healthcare provision.

**Continuous monitoring**

In recent years, continuous glucose monitoring has been available for selected patients using needle-type sensors inserted under the skin, but these have yet to achieve optimal accuracy and reliability, or widespread use.

So the potential benefits of a radical new technique that not only eliminates the need for blood samples, but also delivers information non-stop are easy to appreciate.

With support from the Research Councils UK Nanoscience Programme, researchers at the University of Strathclyde and King’s College London are developing ‘smart’ tattoos that can be injected just under the outer layer of skin.

Once in place, they function like a tiny laboratory, constantly monitoring molecular-level changes in glucose concentrations within the body.

Professor David Birch of the University of Strathclyde explains: “The tattoo technology, developed by our collaborators at King’s College London, led by Professor John Pickup, contains a special protein encapsulated between nano-layers of carefully selected chemicals. When the protein comes into contact with glucose molecules under the skin, it binds with them and emits a tiny burst of light invisible to the naked eye.

“The light then decays away. But the rate of decay is determined by the precise level of glucose the protein encounters and this, in turn, tells us exactly what the glucose level in the blood must be.”

A hand-held device placed close to the skin can collect this information and use it to provide an instant glucose reading. This can be consulted as often as required. The user can then take whatever action is necessary (e.g. give themselves an insulin injection) to restore their glucose levels to normal.

**Enabling healthier lives**

The technique is now being taken forward by a programme of follow-on research, with first-stage clinical trials planned.

“Over four million people worldwide die from diabetes or diabetes-related conditions every year,” says Professor Birch. “By allowing people with the disease to manage it more effectively and with less discomfort, our technique could improve their health and quality of life, while taking some of the strain off healthcare resources.”

For more information about EPSRC and the impact it is making visit www.impactworld.org.uk
IMPROVING QUALITY OF LIFE FOR PEOPLE WITH DIABETES