Tiny computers go where no computer has gone before

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A major breakthrough in the use of molecules as information processors is to be announced at this year's BA Festival of Science in Dublin. Nanotechnology experts are exploring the capabilities of molecules that act like conventional computers but can operate in tiny places where no silicon-based chip or semiconductor can go. Now, for the first time, they have used these molecules to perform logic operations and process information in spaces a few nanometres across.

This advance has been achieved by chemists at Queen's University Belfast, with funding from the Engineering and Physical Sciences Research Council (EPSRC). Professor Amilra de Silva, Chair of Organic Chemistry at the university, says: "Computing isn't just confined to semiconductors. Molecules have been processing information ever since life has been around on our planet. Harnessing this remarkable ability really does have the potential to make a big difference to people's lives."

Molecular information processors placed in nano-spaces can gather, process and supply valuable data on how chemistry and biology function at this tiny scale. Molecules can also be used as information processors in medical and other applications. Portable blood gas analysers incorporating early breakthroughs in this field are already in use, with total sales of relevant sensor components already reaching US$35 million.

When the right chemical inputs (e.g. sodium or potassium ions) and ultra-violet, blue, green or red light are applied, the artificial molecules used

by the team respond by emitting light. This 'signal' can be analysed using a fluorescence spectrometer or even the eye to provide data about the molecule's environment. Different types of these information processors respond to different chemical inputs and different colours of light.

The underlying principle is based on photosynthesis – the process whereby plants use sunlight to produce food for themselves and for us – and is known as photo-induced electron transfer (PET). In PET, light causes electrons to move from one place to another. The speed of this process can be controlled by chemical means.

The Queen's University Belfast team is now focusing on improving the complexity of the logic operations that can be performed. Professor de Silva will be discussing the team's work and illustrating current capabilities at the BA Festival on 7th September.

Source: Engineering and Physical Sciences Research Council