Research highlights

A fluorescent tag may offer a way to 'watch' drug delivery in the body in real time

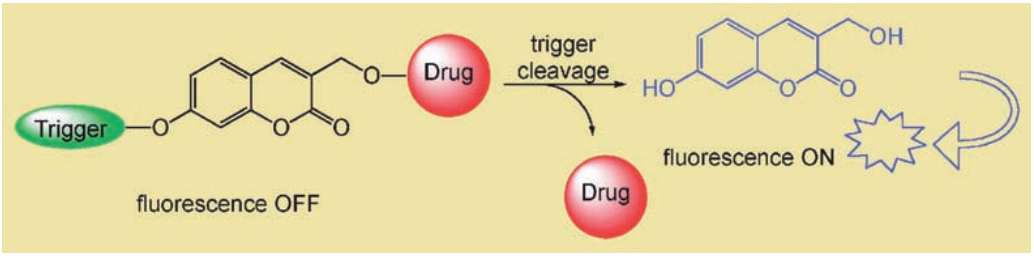
Monitoring drug release as it happens

A drug delivery system that could track the fate of drugs in the body has been developed by scientists in Israel.

Drug delivery systems transport medications to specific parts of the body and control the rates at which they are released. They overcome common problems associated with traditional drug treatments such as that of poor solubility or undesired side-effects.

Understanding just how the drug is released from the delivery vehicle is crucial for achieving good results. 'Tto date, this process could only be studied indirectly inside living organisms,' says Doron Shabat of Tel-Aviv University. 'Since the behaviour of drug delivery systems can vary extensively, depending on their surroundings, it is highly important to study them in their actual functional environment,' he adds.

Shabat and colleagues have designed a reporting drug delivery system that allows the direct, real-time visualisation of the drug release process in a non-invasive manner and have demonstrated its use in vitro. 'As a result, the process of drug release could be imaged for the first time, in real-time, inside living organisms,' says Shabat.



Fluorescence is turned on as soon as the drug leaves the delivery vehicle

Shabat's system produces a fluorescent signal that depicts the status of the drug molecule. While the drug molecule is connected to the delivery vehicle, the fluorescent signal is off. On its release, the fluorescent signal is turned on and can be immediately detected and imaged.

Rui Moreira, an expert in drug delivery systems (prodrugs) at the University of Lisbon, Portugal, welcomes the work. 'Real-time monitoring of prodrug activation allows a much closer insight to the kinetics in whole-cell systems. Gathering activity and activation data in a single set of experiments will speed up the design of more effective prodrugs,' he says.

Shabat says the next task will be using linkers that fluoresce at longer wavelengths to monitor drug release in vivo.

Sarah Corcoran

Reference
R Weinstain *et al*, *Chem. Commun.*, 2010, **46**, 553 (DOI: 10.1039/b919329d)

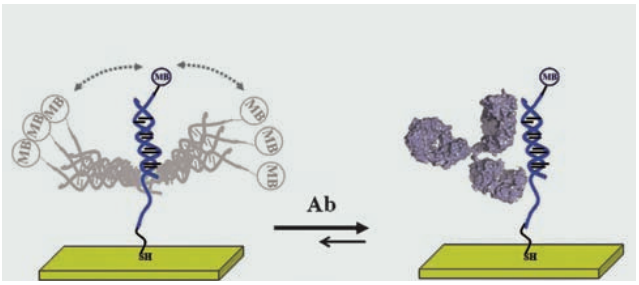
Bendy DNA probes allow fast detection of autoimmune disease biomarkers

Simple biosensors monitor immune disease

US and Italian researchers have developed a new sensor that tracks the progression of autoimmune diseases while dramatically reducing analysis time and requiring no extra reagents.

In autoimmune diseases like systematic lupus erythematosus – a disease that affects more than five million people worldwide – the body's immune system turns on itself and produces anti-DNA antibodies that attack various organs. While the quantification of antibodies in the bloodstream plays an important role in monitoring the severity of the illness, current detection methods such as enzyme-linked immunosorbent assay (ELISA) must be performed by skilled clinicians and require hours or even days to generate a result.

Francesco Ricci and colleagues at the University of Rome Tor Vergata have developed a biosensor electrode that can quickly detect anti-DNA antibodies. The sensor uses a short sequence of single-stranded DNA which has been modified at one end with a redox-active tag. The other end of this DNA probe is modified with a thiol group that forms a strong bond to a gold electrode surface.



The flexibility of the DNA probes is altered by antibody binding, changing the sensor response

For efficient electron transfer to occur, the DNA must bend to allow the redox probe to touch the electrode surface. When anti-DNA antibodies in the sample bind to the DNA, the probe is much less flexible and reduces the efficiency with which the redox tag collides with the electrode. This interrupts electron exchange between the probe and the electrode, reducing the electrical current .

Arben Merkoçi, an expert at designing biosensors at the Catalan Institute of Nanotechnology in Spain, says 'this is a proof of concept of a very interesting alternative for the detection of antibodies against single and double-stranded DNA. It could open the way to develop novel assays for other analytes with interest for clinical applications.'

Ricci is keen to optimise the sensor design and hopes to commercialise the technology. 'The possibility of having miniaturised sensors, low cost and portable instrumentation, and of processing large numbers of samples in a time-effective way is a huge advantage of the electrochemical approach over other techniques which make it among the most suitable for point-of-care testing,' he states. *David Sharpe*

Reference
F Ricci *et al*, *Chem. Commun.*, 2010, DOI: 10.1039/b922595a