

Journal of Environmental Monitoring

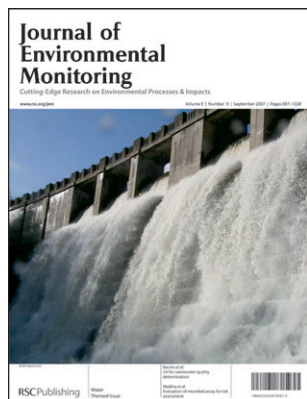
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IN THIS ISSUE

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Cover

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CHEMICAL TECHNOLOGY

T65

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Chemical Technology

September 2007/Volume 4/Issue 9

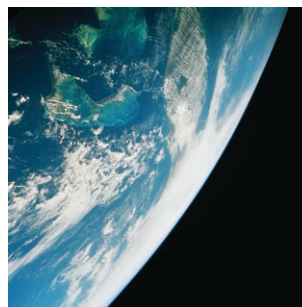
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NEWS

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News

Mike Sharpe provides a summary of the latest environmental news, literature and legislation.



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914

Water status monitoring of aquatic ecosystems in the context of the WFD

K. Clive Thompson of ALcontrol Laboratories, Rotherham, introduces the Water Framework Directive (WFD) themed issue. The themed issue articles were presented at the Water Status Monitoring of Aquatic Ecosystems in the context of the Water Framework Directive meeting held in Lille, France 12–14th March, 2007



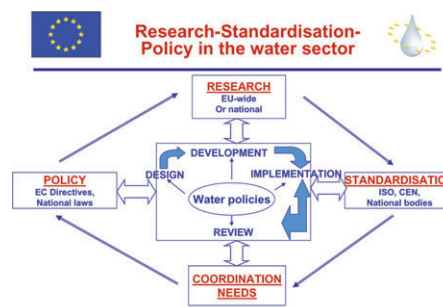
FOCUS

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Coordinating links among research, standardisation and policy in support of water framework directive chemical monitoring requirements

Philippe Quevauviller, Ulrich Borchers and Bernd Manfred Gawlik

This paper discusses on-going efforts to improve coordination among research, standardisation and policy in support of WFD implementation, with emphasis on chemical monitoring requirements.



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Analysis of short-chain chlorinated paraffins: a discussion paper

Francesca Pellizzato,* Marina Ricci, Andrea Held and Hendrik Emons

Towards a standardised method to improve the comparability of SCCP monitoring in support of the WFD: development of a method defined parameter for SCCPs.



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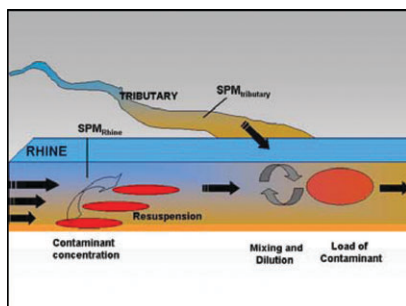
The inadequacy of monitoring without modelling support

Lisbeth Flindt Jørgensen,* Jens Christian Refsgaard and Anker Lajer Højberg

What are the possibilities and benefits of joint monitoring and modelling in present water management—what can be gained by joining forces?



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Risk assessment of contaminated sediments in river basins—theoretical considerations and pragmatic approach

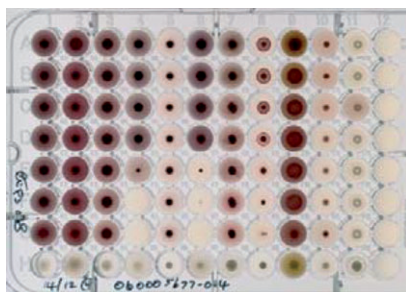
Susanne Heise* and Ulrich Förstner

This paper introduces a practical 3-step approach to river basin wide risk assessment of contaminated sediments, stressing the need to combine information on sediment stability with chemical and hydrological data.

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THEMED ISSUE PAPERS

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Intra-laboratory evaluation of Microbial Assay for Risk Assessment (MARA) for potential application in the implementation of the Water Framework Directive (WFD)

Kirit Wadhia,* Terry Dando and K. Clive Thompson

The MARA, a multi-species assay which allows measurement of toxic effects of chemicals and environmental samples, offers a potentially significant improvement on existing conventional ecotoxicity tests.

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Fast characterization of non domestic load in urban wastewater networks by UV spectrophotometry

Estelle Baurès,* Emmanuelle Hélias, Guillaume Junqua and Olivier Thomas

This original work describes a fast characterization of non domestic load in urban wastewater networks by UV spectrophotometry.

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Design of a new monitoring network and first testing of new biological assessment methods according to water framework directive

Mario Sommerhäuser,* Christoph Scharner, Hannes Schimmer, Anna Schindler, Kerstin Plantikow and Friederike Vietoris

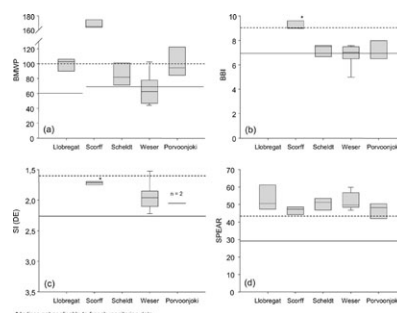
A pilot project in the Stever catchment area, Germany, served to develop an innovative monitoring network and to apply, for the first time in practise, new biological assessment methods.

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Water quality indices across Europe—a comparison of the good ecological status of five river basins

Peter Carsten von der Ohe,* Andrea Prütz,
Ralf Bernhard Schäfer, Matthias Liess, Eric de Deckere
and Werner Brack

Comparison of the “good ecological status” of five river basins in Europe.



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Biomonitoring with *Gammarus pulex* at the Meuse (NL), Aller (GER) and Rhine (F) rivers with the online Multispecies Freshwater Biomonitor[®]

A. Gerhardt,* C. Kienle, I. J. Allan, R. Greenwood,
N. Guigues, A.-M. Fouillac, G. A. Mills and
C. Gonzalez

The novel Multispecies Freshwater Biomonitor[®] (MFB) has for the first time successfully been applied and calibrated in comparison with other biological and chemical online tools at three different European rivers.



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An overview of pharmaceuticals and personal care products contamination along the river Somes watershed, Romania

Zaharie Moldovan,* Gabriella Schmutzer, Florina Tusa,
Roxana Calin and Alfredo C. Alder

The mass flows of selected pharmaceuticals and personal care products (PPCPs) have been studied in the aqueous compartment of the river Somes in Romania



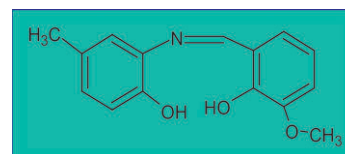
REGULAR RESEARCH PAPERS

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The sensitive and selective determination of aluminium by spectrofluorimetric detection after complexation with *N*-*o*-vanillidine-2-amino-*p*-cresol

Derya Kara, Andrew Fisher and Steve J. Hill*

A new Schiff base, *N*-*o*-vanillidine-2-amino-*p*-cresol, has been used in a novel selective spectrofluorimetric method for the determination of trace levels of aluminium. The reaction is around 70 times faster than the standard lumogallion method.



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**Soil pollution by PAHs in urban soils: a comparison of three European cities**

E. Morillo, A. S. Romero, C. Maqueda, L. Madrid, F. Ajmone-Marsan, H. Grcman, C. M. Davidson, A. S. Hursthouse and J. Villaverde*

Polycyclic aromatic hydrocarbons (PAHs) were determined in urban soil samples from three European cities. The application of harmonised procedures for sampling, extraction and PAH determination were conducted to assess inter-laboratory comparability.

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**Multi-residues analysis of pre-emergence herbicides in fluvial sediments: application to the mid-Garonne River**

Damien A. Devault, Georges Merlina, Puy Lim,* Jean-Luc Probst and Eric Pinelli

The development of techniques of extraction and purification for pre-emergent herbicides present in sediments allowed a first approach of their contamination of the mid-Garonne River.

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**Spatial and temporal trends of polycyclic aromatic hydrocarbons in wild mussels from the Cantabrian coast (N Spain) after the *Prestige* oil spill**

José Antonio Soriano, Lucía Viñas,* María Angeles Franco, Juan José González, Manh Hieu Nguyen, Josep María Bayona and Joan Albaigés


The determination of PAHs in tissues of wild mussels allowed an estimation of the spatial and temporal impact of the *Prestige* oil spill as well as the background pollution and hotspots along the Spanish Cantabrian coast.

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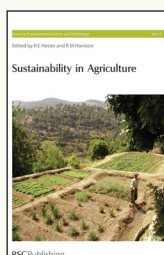
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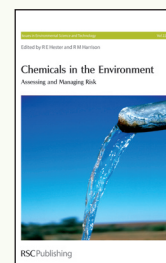
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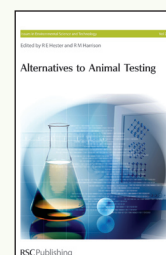
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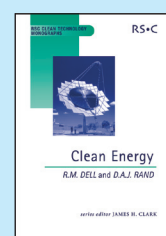
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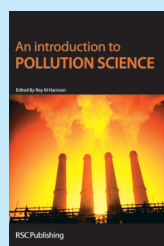


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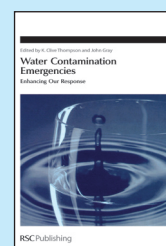


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By *J Gray and K C Thompson*

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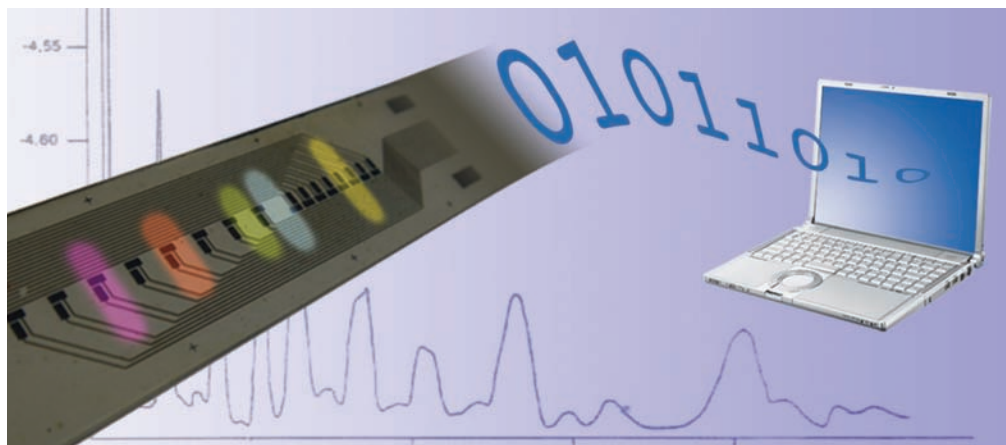
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Chemical Technology

Photosensor array allows quality and quantity of mixture to be measured

Smart TLC



Italian researchers have developed a thin layer chromatography (TLC) plate that allows them to identify not only the presence of different components in a mixture, but also how much of each component is present.

Chromatography is a versatile and powerful technique that separates mixtures into individual components according to their different binding affinities to a

mobile and a stationary phase. Augusto Nascetti and colleagues at the University of Rome put the stationary phase of a TLC plate and amorphous silicon photodiodes on the same glass substrate to make the plate 'active' and allow real-time monitoring of the separation process.

In their technique, the team irradiate the plate with ultraviolet radiation while the separation

The intensity of the fluorescent signal is used to calculate the quantities present

is taking place. This excites the fluorescence of the different components of the mixture being analysed. The intensity of the fluorescence signal is proportional to the peak height detected and this can be used to determine the quantity of each component in the mixture.

According to Nascetti the preliminary results 'suggest that the proposed system can effectively add value to conventional TLC technology'. The technique operates on a small scale and requires only small amounts of eluents, which reduces both the cost and any risks associated with the use of harmful solvents. Advantageously, the plate can also be easily incorporated into a portable field device. Potential applications include uses in food quality control such as early detection of toxins in wine.

Kathryn Lees

Reference

D Caputo *et al*, *Lab Chip*, 2007, **7**, 978 (DOI: 10.1039/b709145a)

In this issue

China's pollution headache

Coal is the culprit in a year-long study of Chinese cities

Mars rocks

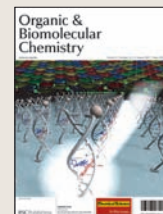
Laser-induced breakdown spectroscopy improved for mission

Instant insight: The shape of things to come

Paul Midgley and colleagues discuss using nanotomography to take a 3D glimpse of the nanoworld

Interview

Jim Heath talks about the discovery of C₆₀ and his more recent adventures



The latest applications and technological aspects of research across the chemical sciences

Application highlights

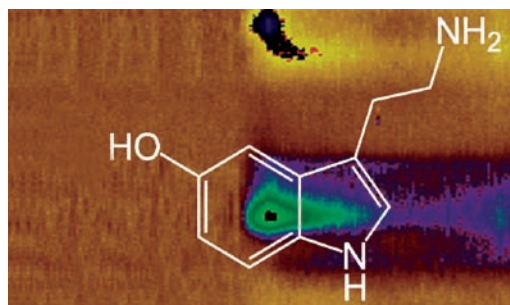
Important neurotransmitters can be studied simultaneously

Dual detection

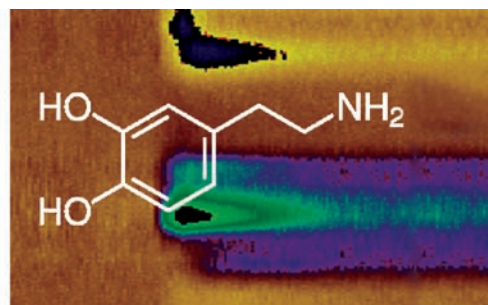
Scientists in the US have developed a sensor that can detect dopamine and serotonin simultaneously *in vivo* for the first time.

Dopamine and serotonin are important neurotransmitters. Serotonin is known to regulate sleep and is a common target for depression medication. Dopamine has been linked to locomotion, reward and motivation, and is a common target for illicit drugs. The death of dopamine receptors is the cause of Parkinson's disease. However, the two are inherently linked; cocaine is known to act on both dopamine and serotonin transporters, for example. Consequently, the simultaneous, rapid, *in vivo* detection of these compounds is a requirement if their interactions in the brain are to be understood.

However, using electrochemistry to detect both compounds simultaneously has proven difficult, due to the compounds' similar oxidation potentials. Detecting dopamine causes fouling by serotonin, while methods to avoid serotonin fouling prevent dopamine



Serotonin (left) and dopamine (right) give different electrochemical signals at carbon nanotube electrodes



detection.

Now, Jill Venton and Kumara Swamy at the University of Virginia have developed carbon nanotube modified microelectrodes that can detect serotonin and dopamine at the same time.

'We showed that carbon nanotube sensors have increased sensitivity for dopamine and serotonin and are more resistant to fouling by oxidative products of serotonin,' explained Venton.

Mark Wightman, an expert in neurochemistry and electrochemistry at the University of North Carolina, Chapel Hill, US, appreciated the significance of their new technique. '*In vivo*

voltammetry at carbon-fibre microelectrodes provides the only way to follow the release and uptake of neurotransmitters in the brain as they control rapid behaviours on a second-to-second time scale,' he said. 'This new approach by Venton ... has several advantages.'

Although it is still unclear how the carbon nanotubes increase resistance to fouling Venton hopes the microelectrodes will allow further studies of dopamine and serotonin in the brain.

'The next challenge,' she said, 'is to create even smaller, nanotube-based electrodes to more closely approach the small size of synapses.' Edward Morgan

Reference

B E K Swamy and B J Venton, *Analyst*, 2007, DOI: 10.1039/b705552h

Polymer replaces oxide material in display cathode

Flexible electrodes

New bendy LEDs don't crack under the strain.

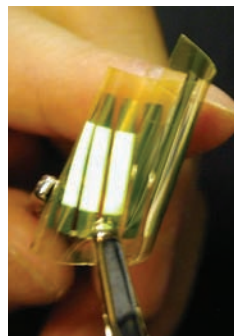
Electrodes made from conducting polymers make LEDs more flexible, according to a team from Imperial College London, UK.

Polymer LEDs consist of layers of light-emitting polymer sandwiched between two electrodes. Although various studies have tried to build polymer LEDs on flexible substrates, the electrode materials cannot always cope with being bent. One of the most commonly used cathode materials, indium tin oxide (ITO), is quite brittle, and tends to crack when the LED is flexed. ITO films are usually made by evaporation at high temperatures, but when working with plastic substrates the temperature has

to be kept much lower to avoid melting the plastic, and ITO films made at these lower temperatures tend to be of low quality.

The Imperial team replaced the ITO cathode with a conducting polymer layer, made from poly(3,4-ethylenedioxythiophene) and polystyrenesulfonate. They built their LEDs on overhead projector transparencies, and succeeded in making bright yellow LEDs which work even when tightly rolled up into a tube.

'The main challenge now is to drive up the conductivity of the polymer anode to the point where it actually starts to compete with ITO. This won't be easy but we have a few ideas up our sleeves,' said John deMello, who led the research.



Bendy LEDs have a future in biomedical devices

Reference

J Huang et al, *J. Mater. Chem.*, 2007, DOI: 10.1039/b705918n

'The other issue is LED lifetime. The organic layers are extremely air-sensitive so finding an effective way of protecting the devices inside flexible, transparent packaging is going to be absolutely crucial.'

Commercial applications are already on their way for these LEDs, added deMello. 'The technology has recently been licensed to a start-up company called Molecular Vision, who are using it to develop a new line of disposable diagnostic devices for health care testing. They're combining the LEDs with flexible photo-detectors (also developed at Imperial) to create ultra-miniaturised low cost sensors for the analysis of blood and urine.' Clare Boothby

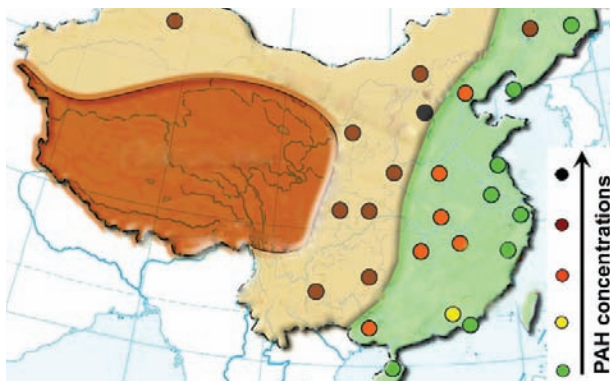
A year-long study of pollution in cities finds coal is the culprit

China's pollution headache

Chinese scientists have found concentrations of polycyclic aromatic hydrocarbons (PAHs) in some Chinese cities to be among the highest in the world, exceeding proposed EU air-quality standards in many cases.

PAHs are formed from the incomplete burning of fossil fuels and the International Agency for Research in Cancer has classified some of them as probable human carcinogens.

As China is the world's most populated country and largest consumer of coal, and its number of vehicles is growing along with its economy, Gan Zhang and co-workers set out to conduct a large-scale study of PAH levels across the whole of China, comparing 36 cities (and three rural locations) across all four seasons of 2005. The team, based mainly at Guangzhou



Institute of Geochemistry, found that levels were greatest in cities on higher ground (in north and north-west China), which had colder winters and burnt more coal.

Kevin Jones, of Lancaster University, UK, worked on the study and described this negative correlation between the average

Pollution levels were greatest in areas with colder winters

annual PAH concentrations and annual average temperature as 'significant' and explained that, although several factors acting in combination influenced air concentrations, 'winter time PAH concentrations correlated with estimated coal consumption'.

Ian Colbeck, director of the Centre for Environment and Society at the University of Essex, UK, said Zhang's study was 'another example of the adverse impact on the environment as a result of China's drive to increase industrial output'.

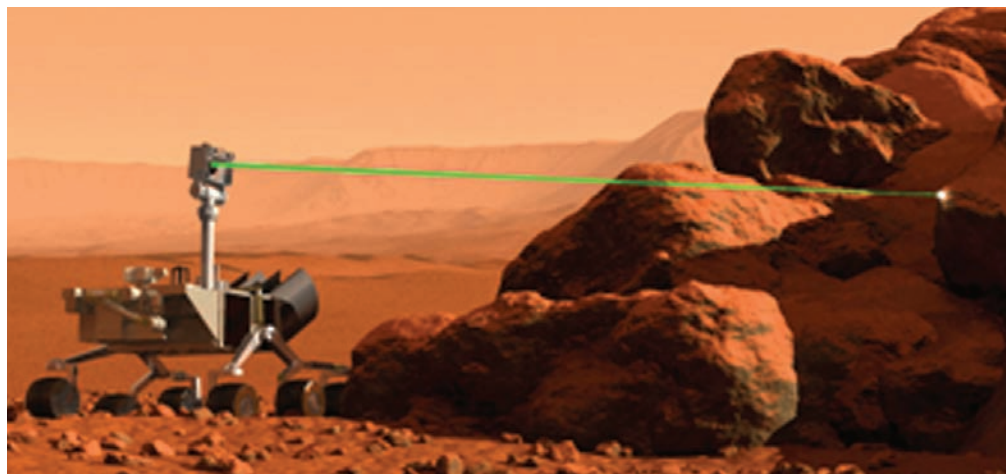
'The health implications of the high concentrations of PAHs in the densely populated Chinese cities are very significant,' added Colbeck. *Ian Gray*

Reference

X Liu *et al*, *J. Environ. Monit.*, 2007, DOI: 10.1039/b707977j

Laser-induced breakdown spectroscopy improved for mission

Mars rocks



The way in which the Mars Science Laboratory rover will identify Martian rocks has been tested by French scientists.

The Mars Science Laboratory rover is due to be launched in 2009. Its overall mission is to determine whether Mars is (or ever was) able to support microbial life. It

will carry an instrument called ChemCam, which will use laser-induced breakdown spectroscopy (LIBS) to remotely identify Martian rocks.

Jean-Baptiste Sirven, of the CEA Saclay, and colleagues tested chemometric methods for analysing LIBS spectra. A laser is used to

The Mars Science Laboratory rover will use a laser to vaporise the outer layer of Martian rocks

vaporise the dust-covered rock to get to the non-weathered layers below. The elements in the rock are excited by the laser and emit light at characteristic wavelengths. These spectra are then compared to spectra of known samples to classify the rock samples.

Sirven tried three different ways of statistically analysing the spectra. He found that a combination of methods would give the best results. At the start, a method that is able to differentiate between rocks of very similar composition would be used. Then, as the number of Martian spectra collected increases, a laboratory-calibrated model would become more accurate, as it became more representative of the planet geology. According to Sirven, the combined method correctly identifies over 99 per cent of samples.

Susan Batten

Reference

J-B Sirven *et al*, *J. Anal. Atomic Spectrosc.*, 2007, DOI: 10.1039/b704868h

Cancer markers monitored in real-time with a biocompatible device

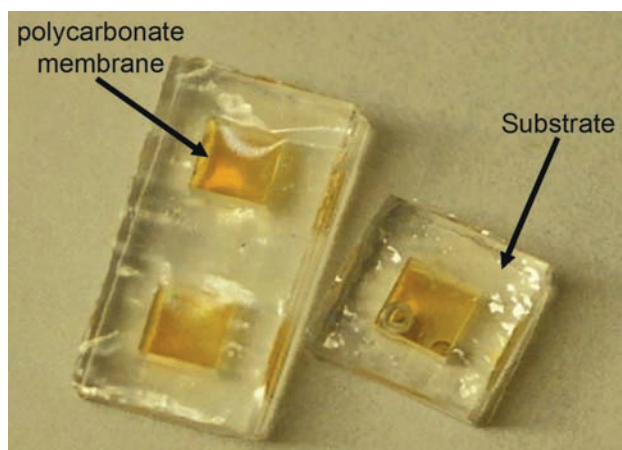
The only way is in

An implantable cancer sensor that uses a membrane to isolate cancer-detecting nanoparticles should help speed up diagnoses, according to researchers from the US.

Early diagnosis and choosing the right treatment are two of the most important factors in the fight against cancer. One of the best ways to monitor cancer is to look for so-called cancer markers – compounds which are produced by cancerous cells, but until now this has been done by performing blood tests or biopsies.

Michael Cima and colleagues from MIT and Harvard have come up with a way of testing for cancer markers in real-time which could make initial diagnosis quicker, and potentially give an indication of whether a particular treatment is effective.

Nanoparticles whose magnetic properties change in the presence of certain analytes (in this case the cancer markers) have been reported previously, but they have not been



Only the cancer markers can pass through the membrane – not the toxic nanoparticles

used in the body because of their stability and toxicity.

Cima's team solved this by encasing them in a polymer reservoir and semi-isolating them from the environment by using a membrane which only allows small molecules to pass. This allows the cancer markers in (and out) but the nanoparticles remain within the

device and are stable. 'We would hope to implant a device at the same time as performing a needle biopsy,' said Cima

Hsian-Rong Tseng from the University of California, Los Angeles, US, said 'The components of the device are already known to be biocompatible, so this can easily be utilised as an implantable sensor. The multiple wells mean that the measurements can easily be repeated improving the quality of the data obtained.'

Martin Leach from the Institute of Cancer Research, London, UK, said 'This is indeed an interesting advance, at present the diffusion across the membrane is slow, but if this can be improved, one could envisage truly real-time experiments where it will be possible to observe where and how chemotherapeutics work.'

Cima and his team continue to work closely with clinicians in developing this technology. *Stephen Davey*

Reference

K D Daniel *et al*, *Lab Chip*, 2007, DOI: 10.1039/b705143c

Single nucleotide polymorphs found quickly and easily

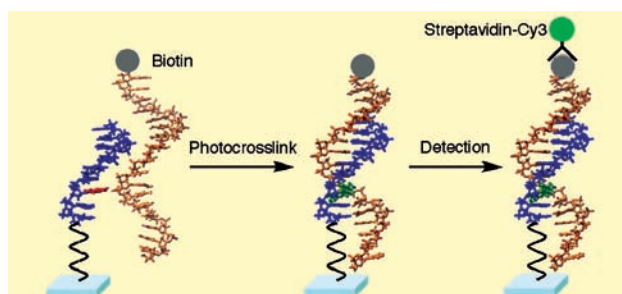
DNA chips detect disease

A DNA chip that can identify genetic mutations has been synthesised by Japanese scientists.

The most common form of genetic variation between individuals is caused by single-nucleotide differences in our DNA code. These are called single nucleotide polymorphisms (SNPs). SNPs can be used to identify disease genes and can highlight when a person is likely to develop a disease.

Kenzo Fujimoto and colleagues at the Japan Advanced Institute of Science and Technology have developed a simple and rapid method for identifying SNPs. They hope it could be the basis for automated diagnosis.

The method uses a short strand of DNA, known as an oligodeoxynucleotide probe, attached to a glass chip. The probe



contains DNA bases complementary to those in the DNA strand containing the SNP of interest, except that one base is replaced by a vinyl-containing nucleoside known as cvP. When Fujimoto placed the target DNA onto the chip and shone ultraviolet light on it, the cvP reacted with an adenine base on the target DNA, in a reaction known as photocrosslinking. Fujimoto

The blue DNA probe is crosslinked to the orange target strand

detected the photocrosslinked product using fluorescence imaging.

Photocrosslinking only occurs when all the bases on the probe are complementary to those on the target DNA, so if there is a mismatch in the strands the chip does not fluoresce.

'This method is an efficient reaction and proceeds with high sequence specificity,' said Fujimoto. 'Photochemical DNA manipulation is a highly original research theme.'

Hans-Achim Wagenknecht, of the University of Regensburg, Germany, said the work is a significant improvement for SNP detection. 'Such cheap, sensitive and reliable screening tools are needed to clinically diagnose genetic variations, infectious diseases and pharmacology,' he said. *Joanne Thomson*

Reference

T Ami *et al*, *Org. Biomol. Chem.*, 2007, DOI: 10.1039/b708264a

The shape of things to come

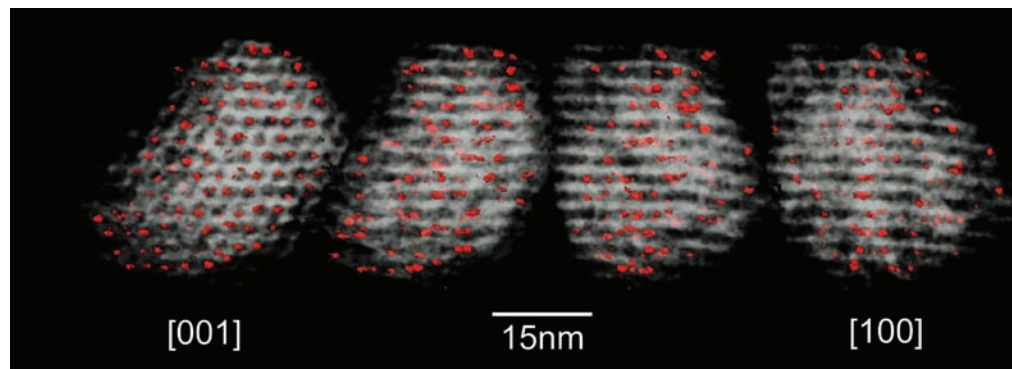
Paul Midgley, Edmund Ward, Ana Hungria and John Meurig Thomas discuss using nanotomography to take a 3D glimpse at the nanoworld

There is little doubt that medicine has benefited greatly from the ability to visualise the internal organs of the human body using a variety of radiation including X-rays, positrons, ultrasound and nuclear magnetic resonance. The invention of the 'cat-scan', or CT-scan, in the 1960s enabled such views to be further improved by allowing a full three-dimensional reconstruction of the internal architecture of the body. The basis behind the reconstruction is the technique of tomography, from the Greek word 'tomos' meaning 'slice' or 'section', in which a series of images, or projections, is used to create a three-dimensional view by back-projecting these images into a 3D space in a computer.

In the chemical sciences, relatively little advantage has been taken of tomographic techniques even though it has long been clear that the spatial resolution ultimately attainable by the use of X-rays and electron beams far exceed those associated with CT scans and NMR imaging of the human body.

Just as the morphology and size of organs is of key importance in the human anatomy, in nanoscience and nanotechnology the size and shape of an object may play a key role in determining its electronic and chemical behaviour. There are many examples where the physical and chemical properties of nanocrystals and clusters deviate significantly from their bulk crystalline phase. Gold in its bulk state displays no catalytic activity and yet in nanoparticle form it is an extremely good catalyst for selective oxidation of hydrocarbons and the complete combustion of carbon monoxide in air. The shape or crystal morphology can be equally important, such as in ceria nanoparticles for automotive catalysis.

The shape, size and distribution of nanoparticles and nano-structures are all key to their function and the



need for tomographic methods applicable to chemical systems (ranging from the physical to the biological) is therefore pressing, just as it is in the engineering and earth sciences.

In our Critical Review¹ we investigate nanotomographic methods that are open to the materials-oriented chemist and present a range of illustrative examples taken from nanoscale chemistry, along with contiguous sub-disciplines encompassing parts of biology and medicine.

We focus mainly on electron tomography (of which there are several variants), and its life sciences application, such as the study of cellular organelles, magnetotactic bacteria and the nuclear pore complex, and in the physical sciences, including supported catalysts, nanoalloys and binary II–VI compounds and polymers. Three-dimensional spatial resolution of 1 nm³ is now possible and efforts are afoot worldwide to reach atomic resolution in three dimensions using electron tomography. In anticipation of future developments, we also outline the rudiments of tomography via transmission X-ray microscopy, a technique that will undoubtedly be of tremendous importance, especially with greater access to next-generation synchrotron X-ray

A montage of projections of a scanning transmission electron tomogram. It shows a selective hydrogenation Ru₁₀Pt₂ nano-catalyst in which the distribution of nanoparticles (red) is revealed within a mesoporous silica support (white). A mean particle size of 100 atoms indicates the zeptogram (10⁻²¹ g) sensitivity of this 3D imaging technique

sources, such as the new Diamond Light Source in the UK. Other nanotomographic techniques highlighted in the review include atom probe field-ion microscopy (APFIM), a destructive technique applicable to conducting and semi-conducting samples. It uses time-of-flight mass spectrometry to identify single ions combined with position sensitive detection to produce a sensor capable of determining three-dimensional information with excellent resolution in both location and chemical identity. Serial sectioning, in which a three-dimensional model may be constructed from a series of slices, is possible with techniques such as atomic force microscopy and scanning electron microscopy (SEM), coupled with a focussed ion beam (FIB) workstation.

The need for three-dimensional visualisation and analysis at high spatial resolution is likely to increase as nanoscience and nanotechnology become increasingly important – nanotomography will play a key role in understanding structure, composition and physico-chemical properties at the nanoscale.

Read the full Critical Review 'Nanotomography in the chemical, biological and materials sciences' in issue 9 of Chemical Society Reviews.

Reference
1 P A Midgley et al, *Chem. Soc. Rev.*, 2007, **36**, 1477 (DOI: 10.1039/b701569k)

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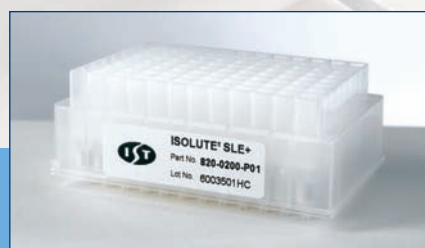
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Technology in a bottle

Jim Heath talks to Alison Stoddart about the discovery of C_{60} and his more recent adventures



Jim Heath

Jim Heath is Elizabeth W Gilloon professor of chemistry at California Institute of Technology, US, and director of the NanoSystems Biology Cancer Center. His current research spans many areas including nanotechnology, molecular electronics and cancer diagnosis. During his graduate studies with Richard Smalley, Jim was the principal student involved in the discovery of C_{60} .

What prompted you to study nanotechnology?

When I started it wasn't a field. As a graduate student, I was the guy who discovered C_{60} . That became one of the poster children of nanotechnology. Then, almost by accident I moved into the area. I worked at IBM for a while – synthesising silicon nanoparticles. I guess I fell in love with nanotechnology.

Can you describe the experiment where you saw C_{60} for the first time?

We were trying to emulate the surface of a carbon star. This was Harry Kroto's idea. We vaporised carbon with a laser in an environment that contained some of the small molecules that surround a carbon star, and then expelled it into a vacuum so we froze the chemistry very quickly. The first time I put carbon in the machine, I saw C_{60} . We had seen interesting clusters of systems before, but this looked unusual. So, even though we were focusing on small clusters, we decided to always monitor C_{60} . As Harry and I worked on the machine, we realised that C_{60} was a special molecule. I came to the conclusion that it was a closed ball. We had a long debate one day about its structure, we checked out books by Buckminster Fuller and Richard Smalley came up with the structure that night.

It took a while for the scientific community to accept the structure of C_{60} , why was this?

Our experiment was exotic but I thought we had an airtight case. It explained beautifully C_{60} , C_{70} , why we only saw even numbered carbon clusters and why the clusters weren't stable below a certain size. But chemists like to see X-ray crystal structures and NMR spectra and we didn't have these. We only had about 1000 molecules at any given time. But science works by people doubting what you do and pushing you forward.

Were you surprised that C_{60} became so popular?

C_{60} was a curiosity until 1991. Then Huffman and Krätschmer made solid-state C_{60} in gram-sized amounts. In fact, the surprise with C_{60} was how easy it was to make. Suddenly hundreds of groups worldwide were involved with C_{60} . This explosion was the power of having something interesting plus having something in a bottle. This made me realise that I didn't want to do gas phase chemical physics but I wanted to do something in a bottle.

What are your current research interests?

We work in the area of molecular electronics – making perfect electronic circuits that are macromolecular in dimension. In addition, we can make superconductors and thermoelectrics. A thermoelectric converts a temperature difference into a voltage – like an engine with no moving parts or it does the reverse and acts as a coolant. It turns out that solid-state thermoelectrics have limited uses because they aren't very efficient. If you could make them efficient then the rewards are amazing. We have made materials from oxygen and silicon that are close to the world record for thermoelectrics. These could be used in energy recovery systems in computer chips so wasted energy could be recycled.

I also work with cancer. Our goal is to translate molecular network models of cancer that describe how the disease evolves into tools that can be used in the clinic. We want to be able to do 1000 measurements from a finger prick of blood and at a fraction of a penny per measurement. We have made devices that are used by clinicians but it will be a similar advance as for computer chips. Right now, we can take a finger prick of blood and in a few minutes we do about 20 measurements and we ought to be able to do 40 next year. Our devices have no moving parts, they are made of just glass and plastic, because we want them to be practically free.

These two projects aim to tackle at least pieces of major global problems – energy and world healthcare.

What is your ultimate goal in the cancer project?

Take diabetes – it's a disease which has been transformed by technology over the last few years because you can monitor your glucose levels and take control of the disease. I would be interested to know if you could do this for cancer. It may be possible to detect cancer early on, before clinical signs, and you can always cure it at that point.

What is the secret of being a successful scientist?

It is important to be a good experimentalist, pick the right problems, look across different fields and collaborate with other scientists. When picking a problem, the pathway must be richer than the problem itself – so you have a chance of discovering something interesting along the way. It also helps to recognise when you are lucky.

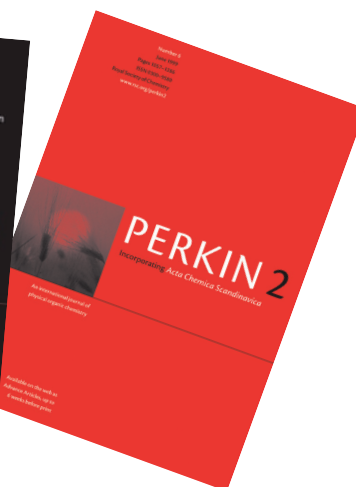
Essential elements

Five fast and first-rate years

As celebrations for the fifth year of publishing for *Organic & Biomolecular Chemistry* (OBC) continue, RSC Publishing staff have been reflecting on the activities and successes.

Launched in 2003, OBC was built on the foundations laid by its predecessors *Perkin Transactions 1* and *2*. The intention was to ensure a strong international presence in the organic community – which has already been fulfilled. Not only does OBC have a competitive impact factor of 2.874, it also boasts quicker publication times than any of its competitors.

'The achievements over the first five years have been tremendous,' commented OBC editor Vikki Allen, 'and with the continued help of our authors, referees and readers we anticipate a first-rate future.'



As part of the celebrations for five successful years of publishing, the journal has featured a series of 'Top 5 articles' from a variety of geographic areas, plus members of the Editorial Board have selected their favourite five articles published in the journal

since launch.

Benjamin List, the winner of the 2007 OBC Lecture Award, spoke about the challenges for chemists during his lecture on organocatalysis at the 20th International Symposium: Synthesis in Organic Chemistry in July. Whatever the future

challenges across the broad organic spectrum of synthetic, physical and biomolecular chemistry, articles published in OBC are sure to be at the forefront.

Read more at www.rsc.org/obc

Packed with energy

One of the major challenges for the twenty-first century is the development of cleaner, sustainable sources of energy. The chemical sciences will play a critical role in successfully overcoming such issues, and the RSC is devoted to addressing them and working toward a better, cleaner future.

For more news on energy related research from RSC Publishing, please visit www.rsc.org/energy

Issue 30 of *Journal of Materials Chemistry* hosts a theme issue dedicated to New Energy Materials. Guest edited by M. Saiful Islam (University of Bath, UK) and including contributions from a range of internationally acclaimed authors, the issue highlights some of the latest developments in energy conversion and storage technologies making it a must-have for all scientists interested in energy research.

With the fastest publication rates in the industry and a soaring impact factor of 4.287 (a staggering increase of 58% over the past 2 years), *Journal of Materials Chemistry* has a well deserved reputation for excellence in the field.

Materials chemistry will play a critical role in developing



energy-related applications and therefore it is particularly timely to publish a focused set of articles covering this. The issue contains more than 20 articles on a range of topics, including: fuel cells, lithium-ion batteries, solar cells and hydrogen storage, and additionally hosts several feature, application and highlight articles.

Further information can be found at www.rsc.org/materials

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