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Chemical Biology

NMR spectra of live bacteria

Nuclear magnetic resonance is proving a useful tool to study live and intact bacteria, says a researcher in the US. The technique can be used to examine complex systems such as cell walls.

W Li
Analyst, 2006, **131**, 777

Probing DNA mutations

A probe that detects mutations in DNA could help detect genetic diseases. Japanese scientists have used the probe to locate multiple missing bases in modified DNA.

H Kashida, H Asanuma and M Komiyama
Chem. Commun., 2006, 2768

Chemotherapy by numbers

Researchers in Spain have developed a method to monitor the effects of chemotherapy drugs on DNA. They claim the technique could lead to less aggressive treatments for cancer patients.

D G Sar *et al*
J. Anal. At. Spectrom., 2006 (DOI: 10.1039/b603434a)

Anions are the magic ingredient

Positively charged peptides can cross cell walls if the correct counterion is used. The peptides create pores in lipid bilayers and could be used in drug delivery, say researchers in Switzerland and Japan.

N Sakai, S Futaki and S Matile
Soft Matter, 2006, **2**, 636

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Research highlights

A low cost miniature device minimises contamination in DNA analysis

Cheap as PCR microchips

A chip for spotting bird flu in remote geographic areas could become a reality, claim scientists in Singapore. A group led by Pavel Neuzil at the Institute of Bioengineering and Nanotechnology has developed a device to amplify DNA that they expect to become a central part of a lab on a chip system.

The polymerase chain reaction (PCR) is used to multiply pieces of DNA in a sample using a repeated cycle of heating and cooling. Conventional lab based PCR equipment is bulky and slow, with large reaction tubes that make the process expensive. Neuzil has made a microPCR device that uses small (1μl) reaction samples placed on disposable glass slides, minimising contamination and reducing costs. Its small size means that the device can heat and cool the reaction quickly, which reduces the amount of by-products formed. Also, less power is needed to heat the smaller samples and Neuzil plans to exploit this by building a portable battery operated system.

Chip that amplifies DNA could be used to identify diseases such as bird flu

A potential use for the device is in identifying diseases, such as bird flu, in remote geographic areas, said Neuzil. Currently the detection process can take several days as samples are transferred to central laboratories. 'Using an on-site simple PCR system would speed up the whole process and help identify an infection outbreak,' Neuzil said.

Eric Lagally of the University of California, Santa Barbara, US applauds the work. The approach 'is an important step toward a microfluidic, portable PCR-based diagnostics system,' said Lagally.

Laura Howes

Reference
P Neuzil, J Pipper and T M Hsieh, *Mol. BioSyst.*, 2006, **2**, 292

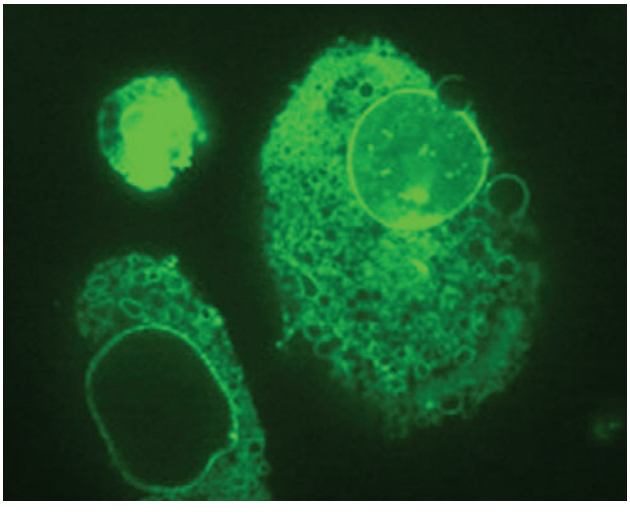
Fluorescent dots light the way for bio-labelling

Nanoparticles illuminate cell machinery

Researchers in Ireland have made nanoscale crystals that can be used to image components inside living cells. Yurii Gun'ko and colleagues from the University of Dublin prepared crystals of cadmium telluride (CdTe) that can enter white blood cells and illuminate the cell machinery.

Nano-sized CdTe crystals are examples of quantum dots. Quantum dots (QDs) are fluorescent semiconductor nanocrystals, which give off light at particular wavelengths, depending on their size and composition. Gun'ko's group wanted to develop QDs that could be used to image cells. To do this they fine tuned the known method for making CdTe QDs so that they emitted more light.

Traditional methods for detecting biological compounds involve tagging them with radioactive markers or fluorescent dyes. These tags have complications, such as high cost and deteriorating activity on prolonged exposure to light. In contrast, QDs are relatively stable to light and offer considerable advantages for bio-labelling, said Gun'ko.



Nanocrystals are used to image white blood cells

The enhanced light emission of Gun'ko's QDs and their potential use in specific bio-labelling was down to the improved synthetic method adopted by the group. Organic sulfur-containing ligands were attached to the surface of the QDs, to improve their stability inside living cells. Also, the QD surfaces were patterned by a technique called photoetching which increased their fluorescence.

Gun'ko said that the research demonstrates the great potential of CdTe QDs as probes for *in vitro* labelling in living cells. This will be especially important in medicine for the detection of specific biomolecules and cell components, he said. 'In the long term this research might enable us to understand pathways of penetration by small toxic particles and viruses into immune cells and help in diagnostic recognition and treatment of cancer, HIV and other diseases.'

Katherine Vickers

Reference
S J Byrne *et al, J. Mater. Chem.*, 2006, **16**, 2896

Honeycomb container used to monitor responses of single cells

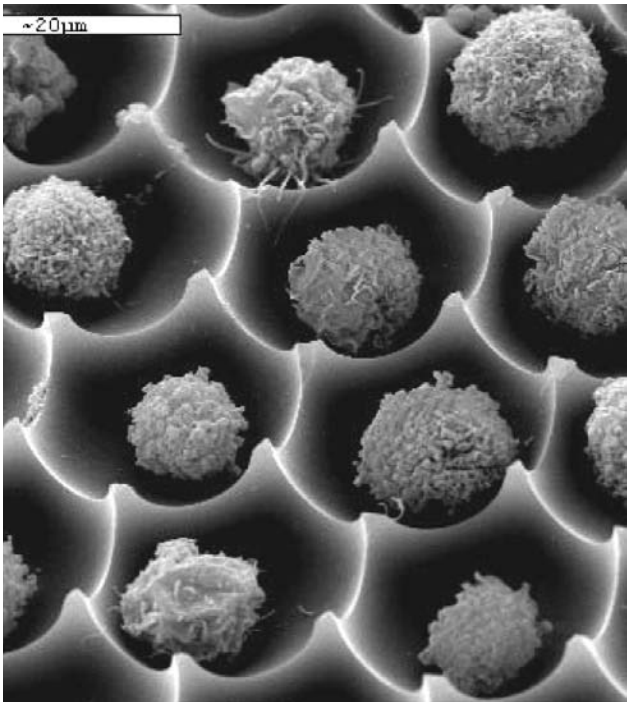
Cells leading separate lives

Researchers can keep a close eye on individual cells for several days thanks to a honeycomb cell container.

Scientists in Israel and the US have built an array of hexagonal bowls, each the correct size to hold a single cell. The bowls have half-moon walls which hold the cells in place but allow chemicals to flow over them. Single cells can be studied separately, said head of the team Mordechai Deutsch at Bar Ilan University. 'Each cell actually acts as a laboratory.'

The team's aim was to examine individual cells without the background signal from other cells in the sample. Because different cells can react to a change at different speeds and times, being able to study a single cell should make biological processes easier to follow and understand, said Deutsch.

The container can be used to follow the growth and health of cells and to observe their long-term responses to drugs. Current methods for long term study of individual cells involve tethering them in place, which can change the way they behave, or watching them constantly to keep track of which cell is which. Deutsch foresees applications of the honeycomb container in drug discovery and cell therapy.



Cells held in hexagonal bowls can be studied individually

Mike Shuler, a bioengineer at Cornell University, US, welcomes the team's method. 'Most other techniques are cumbersome and often have the potential to alter the cell's physiological response to controlled perturbations. Such a device should prove very useful for understanding the intrinsic variation in responses among members of a population of cells and the fundamental basis for such response,' said Shuler.

Clare Boothby

Reference
M Deutsch *et al*, *Lab Chip*, 2006 (DOI: 10.1039/b603961h)

Carbon footballs are potential drug delivery system for immunotherapy

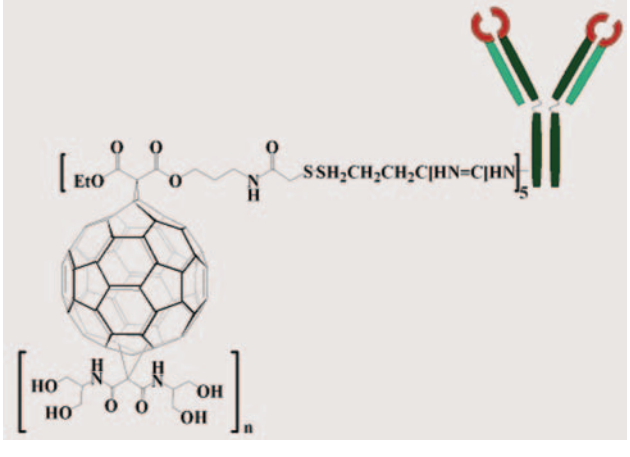
Buckyballs use antibody to target cancer

US researchers have shown that carbon nanostructures can be coupled to antibodies and could find use in targeted cancer therapies.

Lon Wilson at Rice University, and colleagues, have taken the first step towards an immunotherapy system using fullerenes, nano-sized carbon spheres otherwise known as buckyballs.

In collaboration with a team led by Michael Rosenblum at the MD Anderson Cancer Center, Wilson coupled water soluble fullerenes to the antibody ZME-018. ZME-018 targets melanoma cells by binding to an antigen found on their surface. Wilson and Rosenblum found that their fullerene–antibody conjugate targeted cells containing the melanoma antigen almost as well as the free antibody.

What makes water-soluble fullerenes so attractive for therapeutics, said co-worker Jared Ashcroft, is their C_{60} cage structure. The cage can be used to contain drugs until they reach the cancer cells. Wilson said his group have spent years learning to load (and retain) medically-interesting agents into carbon nanostructures and now they are ready to test them on cancer cells. 'If our entire family of carbon nanostructures can be targeted to cancer cells, a new field of cancer detection and treatment may follow,' said Wilson.



The buckyball system binds to cancer cells

The researchers were particularly pleased to find that the attachment between ZME-018 and the fullerene did not involve a covalent bond. 'Because a covalent linkage is not needed for the antibody to interact with the fullerene,' said Ashcroft, 'it provides a simpler method of preparing the fullerene drug.'

Janet Crombie

Reference
J M Ashcroft *et al*, *Chem. Commun.*, 2006, 3004

Essential elements

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Impact factors of RSC Journals have risen by an average of 10%, according to newly-released ISI® figures*. Among the success stories is *Chem Soc Rev*, the general chemistry review journal: its impact factor rose by 27% to 13.7, placing it amongst the most highly cited review journals. Meanwhile *CrystEngComm* became the leading European journal in crystal engineering, with an impact factor of 3.5. *Dalton Transactions* remains the leading European general inorganic chemistry journal, while *Journal of Materials Chemistry*'s impact factor rose by a staggering 36%. *Organic & Biomolecular Chemistry*, now with an impact

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factor of 2.5, is confirmed as one of the leading European journals in the field. Finally *Lab on a Chip* consolidated its position: at 5.3, it is the second highest impact journal in the area of nanoscience and nanotechnology.

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*Data based on 2005 Impact Factors, calculated by ISI®, released June 2006

One small step for *Soft Matter*...

...one giant leap for interdisciplinary research. *Soft Matter* will separate from its host and become a solo publication in January 2007, it has just been announced.

Until now *Soft Matter* has been physically bound to print issues of *Journal of Materials Chemistry*, where it complemented the content of the top weekly materials research journal. Online hosting of *Soft Matter* in *Organic & Biomolecular Chemistry*, *Physical Chemistry Chemical Physics* and *Lab on a Chip* ensured the new journal received maximum attention from a broad and interdisciplinary audience right from the beginning.

These efforts have been fruitful: *Soft Matter* is already recognised as a major player in the soft matter field.

Editor, Carol Stanier explains, 'The move away from publication with *Journal of Materials Chemistry* is just one small step in our evolution – but with far reaching effects for research in the soft matter community. We believe our journal has made a giant leap in bridging the gap between researchers working at the fringes of the traditional disciplines of physics, chemistry, and biology.'

To find out more visit: www.softmatter.org/smallstep

And finally....

The Analyst is updating its scope to place greater emphasis on detection science, it has been revealed. Detection science - is it revolution or evolution?

The way we perceive analytical science is being revolutionised by the emergence of new areas. From diagnostic kits and the human genome project to homeland security, they bridge the gap between conventional analytical chemistry and fast moving fields like miniaturisation, sensors and detection. Often the scientists involved are from entirely different communities and don't necessarily regard themselves as analytical.

Certainly when you look through *The Analyst* archive, detection has always been present. 'Detection science is central and enabling to all science not just chemistry', says Editorial Board member Duncan Graham from the University of Strathclyde, '*The Analyst* is the natural home for the latest approaches to acquiring data across the scientific spectrum'. Michael Thompson, scientific editor from the University of Toronto adds 'the journal has consistently represented the best work published in the field of analytical chemistry'.

With over a century of experience, the journal remains true to the evolving needs of this community. What ever the future direction you can be sure that *The Analyst* will be leading the way.

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NASA

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