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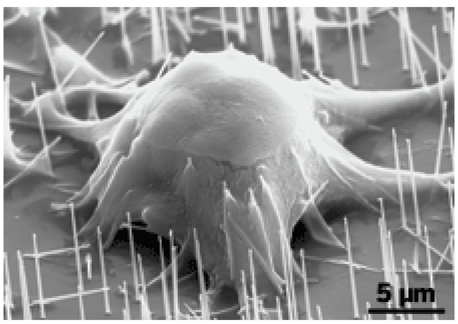
Science & Technology Concentrates

Cells grow on a bed of nails

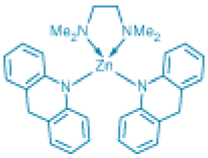


Putting cells on pins and needles is a way of getting foreign molecules into the cells, according to a team led by chemist Peidong Yang at the University of California, Berkeley, and medical researcher Bruce R. Conklin at the Gladstone Institute of Cardiovascular Disease in San Francisco (*J. Am. Chem. Soc.* **2007**, *129,* 7228). They hav been growing mammalian cells on arrays of silicon nanowires, each about 3-6 µm long and less than 100 nm in diameter (shown). As the cells settle out of the culture medium onto the bed of nanowires, the wires penetrate th cells without damaging them and without the application of any external force. The cells survive and proliferate, even after being impaled on the wires. By first depositing DNA onto the wires, the researchers are able to transf the genetic material into human embryonic kidney cells. The team expects that the delivery efficiency could be improved by adjusting the nanowires' surface chemistry. The nanowire arrays could also be used for drug delive and electrical stimulation and detection in cells, the scientists say.

Method identifies histone modifications

Post-translational modifications (PTMs) of histones—the protein spools that DNA is wound around—help regula gene expression. Figuring out whether combinations of these PTMs make up a histone code has been difficult because of the challenge of determining multiple PTMs simultaneously. The H3 histone has such a complicated PTM pattern that analyzing intact proteins via high-resolution mass spectrometry (MS) has been insufficient for characterization. Craig A. Mizzen, Neil L. Kelleher, and coworkers at the University of Illinois, Urbana-Champaig deal with the complexity by combining hydrophilic interaction chromatography (HILIC) with Fourier transform MS of only the first 50 residues of H3, where most of the known modification sites are located (*Nat. Methods,* DOI: 10.1038/nmeth1052). HILIC separates the histone subtypes first according to the degree of acetylation and then by the degree of methylation. The researchers identified more than 150 combinations of PTMs on one type of histone H3 found in human cancer cells. Many of these combinations had not been seen previously.

Direct fluorescence detects explosives



Few techniques can directly detect RDX and PETN, explosives that could be hidden in war zones and transportation hubs. Now, a new sensor can selectively identify these two common explosives by using a straightforward fluorescence method (*J. Am. Chem. Soc.* **2007**, 129, 7254). Trisha L. Andrew and Timothy M. Swager at MIT developed the sensor, which is based on a photochemical reduction of RDX (1,3,5-trinitro-1,3,5-triazacyclohexane, a component of the explosive known as C-4) and PETN (pentaerythritol tetranitrate). The sensor design emerged from efforts to mimic an enzymatic reduction mediated by NADH (the reduced form of nicotinamide adenine dinucleotide). That reaction was previously discovered in a microbe that naturally destroys RDX in contaminated wastewater. An NADH mimic that the researchers designed was unstable, but it led them t a stable zinc analog (shown, Me is methyl). The analog exhibits 80- and 25-fold increases in emission intensity a 480 nm when it reacts in acetonitrile with RDX and PETN, respectively. The zinc compound does not react with the explosive 2,4,6-trinitrotoluene (TNT).

Blowing bubbles for nanoelectronics

The key to realizing many of the proposed electronics applications of nanomaterials may be as simple as blowin bubbles. Blown-film extrusion—the bubble-blowing process used to make garbage bags—has now been used tc create large-area films of uniformly aligned inorganic nanowires and carbon nanotubes (*Nat. Nanotechnol.*, DOI: 10.1038/nnano.2007.150). The films can then be transferred to large crystalline wafers and flexible plastic substrates for use in electronic devices. Because nanowires and nanotubes tend to tangle, these materials have proven difficult to process for electronics applications, where uniformity is preferred. Guihua Yu and Charles M. Lieber of Harvard University and Anyuan Cao of the University of Hawaii at Manoa, Honolulu, found that when they used bubble-based processing on a homogeneous epoxy suspension of nanowires or nanotubes, they cou control both the density and alignment of the nanomaterials in the resulting films. The process "represents one c the most critical advances necessary" for realizing many applications of nanomaterials in electronics, according the team.

Cold receptor identified

Next time someone gives you the cold shoulder, take some solace in knowing which of your protein receptors detected it. Researchers at the University of California, San Francisco, have identified the principal detector of cold temperatures between about 12 and 26 °C on the basis of work done in mice (*Nature*, DOI: 10.1038/nature05910). The culprit, called TRPM8, is one member of a family of temperature-sensitive ion channels that can also sense chemical cooling agents such as menthol. TRPM8 or its human version is found in cells all over the mammalian body, including paws (or hands), the spinal cord, and even the cornea. The researchers, led by physiologist David Julius, came to their conclusions by comparing the cold aversion behavio of normal mice with that of mice in which TRPM8 had been knocked out. The mechanism by which TRPM8 senses cold is a "major question that will likely await further insights into the 3-D structure of the ion channel complex," Julius notes.

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