RESEARCH HIGHLIGHTS

ORGANIC CHEMISTRY

Ring leaders

Angew. Chem. Int. Edn doi:10.1002/anie.200701551 (2007)

Chemists in the United States report an improved procedure for preparing boronate esters — starting materials for making the many molecules that contain linked aromatic rings.

The preferred route to boronate esters is from readily available aryl chlorides. But existing processes require high temperatures and don't work for all substrates. By changing the catalysts used, Stephen Buchwald and his colleagues at the Massachusetts Institute of Technology, Cambridge, prepared boronate esters from aryl chlorides at room temperature. Their method also works for a wider range of molecules than the previous method.

Finally, they react two aryl chlorides together, through a boronate ester intermediate, to create 'biaryl' compounds. This is the first time that this desirable transformation has been achieved directly from two aryl chlorides.

CHEMICAL BIOLOGY

Smart drops

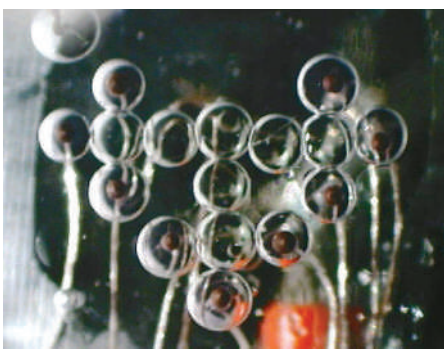
J. Am. Chem. Soc. doi:10.1021/ja072292a (2007)

Artificial cell-like compartments can be linked into networks that act as devices, show Matthew Holden of the University of Oxford and his co-workers.

Each compartment is a water droplet, typically less than 1 millimetre across, surrounded by a lipid monolayer and immersed in oil (pictured below). When two droplets stick together, they are separated by a cell-membrane-like lipid bilayer, which can host membrane proteins such as ion channels that allow communication between the 'cells'.

The researchers created a chain of three droplets containing solutions of different ions with channels in the connecting walls to pump the ions. This acted as a 'biobattery', generating a current. Also, a network of droplets connected through the light-sensitive proton pump bacteriorhodopsin offered an electrochemical light-meter that mimics light-detecting retinal cells.

M. HOLDEN



Assorted fungi

Mycol. Res. **3,** 509–547 (2007)

A concerted effort by 67 researchers based in 13 countries to sort out the taxonomy of fungi has reached its conclusion. The hope is that the new classification, which divides the kingdom Fungi into 195 taxa, will clear up naming confusion in the literature and bring about consistency across online databases.

To devise the classification, David Hibbett of Clark University in Worcester, Massachusetts, and his colleagues sorted through molecular data on different fungal species and examined the history of their nomenclature. Their effort, part of the 'Assembling the Fungal Tree of Life' project, should provoke some changes. For example, the researchers propose that the phylum Zygomycota, which includes the 'sugar' moulds found on fruit, is disbanded and its taxa shared among other groups.

D. HIBBETT

MEDICINE

Brain boost

Lancet **369,** 2097–2105 (2007)

A preliminary gene-therapy trial has improved brain function in patients with Parkinson's disease.

Parkinson's disease causes neuronal degeneration, loss of motor control, and reduced levels of an important neurotransmitter known as GABA. Matthew During of Ohio State University in Columbus and his colleagues placed a gene important for GABA production, called glutamic acid decarboxylase, into a virus. They then injected the virus into a specific region of the brain, on one side only, in 12 patients with Parkinson's disease.

The phase I trial was designed to test safety rather than efficacy, but brain scans and motor-control tests showed that function in the injected side of the brain improved relative to the side that had not received the gene. No patients died or developed new neurological deficits.

CANCER BIOLOGY

To drug the undruggable

EMBO J. doi:10.1038/sj.emboj.7601744 (2007)

An antibody fragment can hit a cancer target that many have been deemed 'undruggable', say scientists in the United Kingdom.

Mutations that activate Ras proteins show up in as many as 30% of cancers, but the difficulty of blocking their protein–protein interactions inside the cell had made them seem intractable targets.

Terence Rabbitts, now at the Leeds Institute of Molecular Medicine, and his colleagues report that an antibody fragment, dubbed iDab#6, jams mutant Ras by blocking a key interaction site. In mice injected with human tumour cells, tumour growth stopped if the cells expressed the antibody fragment.

Delivering the genetic material to express iDab#6 in human patients would be a challenge, but the team's characterization of the Ras–antibody interaction may also help small-molecule drug development.

CELL BIOLOGY

Numbing the pain

Neuron **54,** 905–918 (2007)

Intense pain can switch off the ion channels that sense it by flipping a molecular toggle,

researchers report. The ion channel TRPV1 regulates the flow of ions such as calcium into nerve cells in response to heat and acidity, mediating the feeling of burning pain. Rachelle Gaudet and her colleagues at Harvard University in Cambridge, Massachusetts, determined the structure of a TRPV1 region that protrudes into the cell, known as the ankyrin-repeat domain. They found that it binds to one or other of two signalling molecules: ATP or the calcium sensor calmodulin.

The channel responded to repeated stimulation when bound to ATP, but its response was deadened by calmodulin. The team proposes that the high intracellular calcium levels that follow channel stimulation favour calmodulin binding and thus channel desensitization.

BIOCHEMISTRY

A new last resort

J. Am. Chem. Soc. doi:10.1021/ja068602r (2007)

The arms race between antibiotics and bacteria has yielded bugs that are impervious to vancomycin, the antibiotic 'of last resort'. Now, researchers have found a simple way to create vancomycin-like compounds that are up to 40 times more potent than their predecessor.

Vancomycin comprises a loop of three amino-acids with two attached sugars. Jon Thorson of the University of Wisconsin-Madison and his colleagues produced eight vancomycin variants by adding various glucose molecules containing 'lipid-like' hydrocarbons to vancomycin's amino-acid backbone.

Biological activity against vancomycin-resistant bacteria was highest when the hydrocarbon was attached at the third or fourth carbon of the glucose molecule. The method provides a way of generating libraries to optimize antibiotics for targeting resistant pathogens.

CELL BIOLOGY

Act in two parts

Science **316,** 1749–1752 (2007)

Researchers have unpicked a mechanism of actin's dual function in cells.

Actin is a major component of a cell's cytoskeleton and a regulator of gene expression. These functions are linked through a protein known as MAL that binds actin and that normally shuttles between a cell's nucleus and cytoplasm.

When a cell is preparing to divide, actin assembles into cytoskeletal polymers. The resulting drop in free actin levels causes MAL to accumulate in the nucleus, where it promotes the expression of growth-related genes.

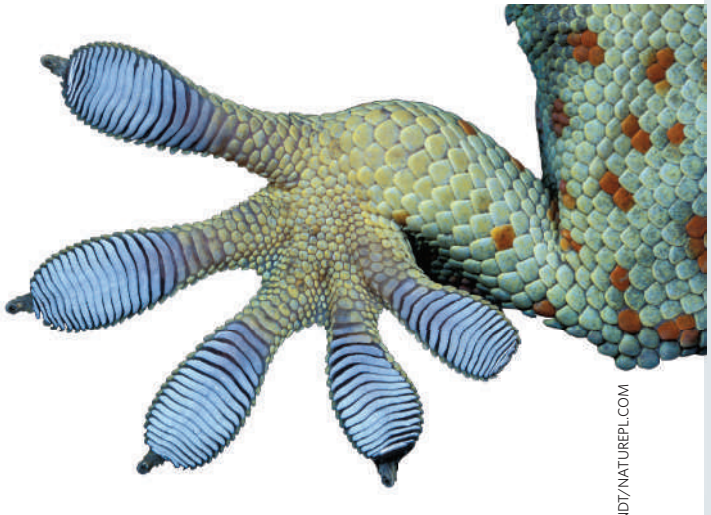
Richard Treisman and his colleagues at Cancer Research UK's London Research Institute show that MAL accumulates in the nucleus because its export to the cytoplasm requires it to be bound to nuclear actin. The team also shows that actin binding to MAL in the nucleus inhibits gene expression.

MATERIALS SCIENCE

Geckos outstuck

Proc. Natl Acad. Sci. USA **104,** 10792–10795 (2007)

A reuseable adhesive tape four times stickier than gecko feet has been made by Ali Dhinojwala at the University of Akron, Ohio, and his colleagues.



I. ARNDT/NATUREPL.COM

Gecko feet stick to surfaces using pads covered with rod-like protrusions called setae, which split at their end into smaller filaments known as spatulas, just a few nanometres thick. These fine hairs penetrate every crevice on a surface, then stick via van der Waals forces.

Carbon nanotubes, which are strong and stiff, have previously been identified as candidate hairs for a synthetic gecko pad; now Dhinojwala and his team have marshalled them into pillar-like clusters with square cross-section, copying the hierarchical organization of setae. One square centimetre of tape covered with these structures can support nearly 4 kilograms.

JOURNAL CLUB

Achim Müller
University of Bielefeld, Germany

A chemist finds beauty in molecules that resemble an early model of the Solar System.

Since Plato's time, people have been fascinated by the beauty of highly symmetrical objects. The symmetry of the C_{60} buckyball surely contributed to scientists' tremendous interest in this spherical molecule. Indeed, I was convinced that the discovery of C_{60} would induce a rush among chemists to search for other symmetrical structures.

That rush may not have happened, but scientists have still turned up some surprising highly symmetrical structures. A recent report from researchers at Xiamen University in China (X.-J. Kong *et al. J. Am. Chem. Soc.* **129,** 7016–7017; 2007) describes a cluster in which beauty cages beauty; it consists of an icosidodecahedron of nickel ions, having 20 triangular faces and 12 pentagonal faces, inside of which sits a dodecahedron of lanthanum ions.

The team describes the magnificent structure as 'Keplerate', a term that I and my colleagues first used around ten years ago to describe structures that contain Platonic and Archimedean solids (regular polyhedra, and polyhedra with two types of face, respectively) one inside another, like Russian dolls. It honours Johannes Kepler, who in the sixteenth century developed a model of the cosmos in which "the radii of the successive planetary orbits are proportional to the radii of spheres that are successively circumscribed around and inscribed within the five Platonic solids".

Another recent report found these same shapes — the icosidodecahedron and dodecahedron — in Keplerate-type arrangements in quasicrystals (H. Takakura *et al. Nature Mater.* **6,** 58–63; 2007). Such crystals are still poorly understood. I hope that future work will correlate these materials' properties with their beauty.

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