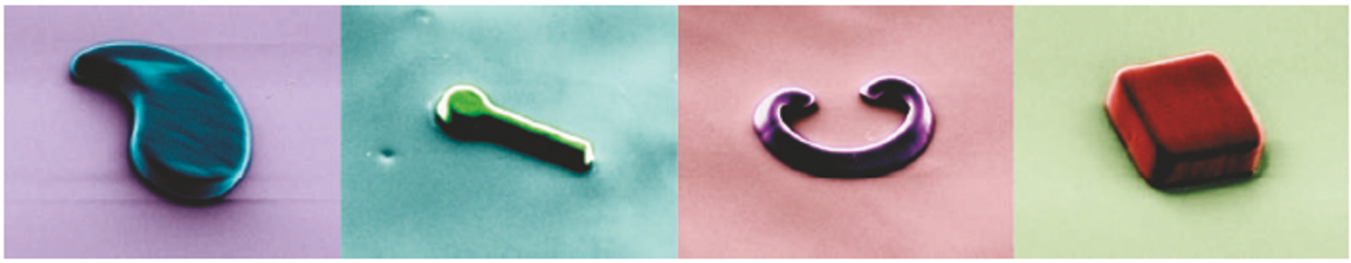
RESEARCH HIGHLIGHTS



Particles shape up

Nature Mater. doi:10.1038/nmat1617 (2006)

Swarms of polymer particles with curious shapes (pictured) can be easily synthesized using a new continuous-flow technique from researchers at the Massachusetts Institute of Technology. Such particles may be useful building blocks for photonic crystals and biomaterials.

Patrick Doyle and his colleagues created the sweet-shaped objects, just a few micrometres in size, using materials that can be polymerized by ultraviolet light.

The material was pumped through the channels of a microfluidic device while pulses of ultraviolet light were shone on to it through a mask defining the desired particle cross-section. This produced flat-sided particles, carried by the flow, at rates of up to 400,000 per hour.

GENETIC ENGINEERING

Blind mice

Neuron 50, 23–33 (2006)

One strategy for restoring vision lost to retinal degeneration is to turn surviving nerve cells into light sensors. Could a light-activated protein from green algae do the trick?

Zhuo-Hua Pan at the Wayne State University School of Medicine in Detroit, Michigan, and his colleagues used viral gene transfer to insert the protein channelopsin-2 into the retinal ganglion cells of rodents. The protein formed light-gated channels, leading to light-evoked electrical responses in the neurons that are normally insensitive to light.

The team also injected the viral vector into the eyes of genetically blind mice. They recorded light-induced responses in the visual cortex as well as the retina, suggesting that the signals can be transmitted to the rest of the brain. But further work is needed to determine whether this constitutes 'vision.'

BIOCHEMISTRY

Pass it on

Chem. Biol. 13, 329–338 (2006)

We already know that one kind of nucleic acid, such as DNA or RNA, can transfer nucleotide sequence information to another. Now researchers in the United States say that biochemical function can also be passed on.

Gerald Joyce and his team at the Scripps Research Institute in La Jolla, California, studied a particular ribozyme, an RNA molecule that contains genetic information and acts as an enzyme. They made a copy of the ribozyme that had the same sequence of nucleotides, but was instead made of DNA. The resulting enzyme did not function, but could be evolved to do so with a few mutations. Something analogous to this process might explain how early life made the transition from a postulated predecessor of RNA to form the 'RNA world.'

ASTRONOMY

Heavenly alchemy

Astrophys. J. 641, 1–20 (2006)

The Universe's first stars were much smaller than was once thought, according to a mathematical model of stellar chemistry.

Previous simulations of galactic evolution proposed that the first stars (called Population III) were more than 100 times as massive as the Sun. But such stars would live fast and die violently, producing none of the heavy elements such as barium that astronomers find inside the Population II stars that formed from their ashes.

Jason Tumlinson at the Yale Center for Astronomy and Astrophysics in New Haven, Connecticut, shows that Population III stars averaging between 10 and 40 solar masses would produce the observed chemical make-up of the long-lived second-generation stars, which are still around today.

MICROBIOLOGY

No sense of direction

Mol. Microbiol. 60, 417–426 (2006)

Vibrio cholerae cells from human stools have previously been shown to be more virulent than their laboratory-grown siblings. Now Andrew Camilli of the Tufts University School of Medicine in Boston, Massachusetts, and his colleagues have traced the phenomenon to the genetic modification of a single trait.

Camilli's group had shown before that expression of certain genes was reduced in stool-isolated *V. cholerae*. In this study, the team finds that the stool bacteria are unable to direct their swimming towards nutritional cues — a process known as chemotaxis. They linked this to reduced expression of *cheW-1*. It remains unclear, however, why impaired chemotaxis reduces the number of *V. cholerae* cells required for a successful infection.

EVOLUTION

March of the ants

Science 312, 101–104 (2006)

Today's taxonomic ant groups arose earlier than previously thought, more than 140 million years ago, according to the most comprehensive census yet of their evolutionary family tree. But they may not have diverged into the 11,800 species that now exist until much later — perhaps at the same time as flowering plants diversified and increased the ants' range of lifestyle options.

Researchers led by Corrie Moreau of Harvard University in Cambridge,

S. B. ARCHIBALD/HARVARD UNIV.

Massachusetts, compared corresponding sets of DNA sequences from a huge range of ant species. By evaluating the divergence between the sequences, they deduced how long ago the different groups emerged — and then went back to the fossil record (pictured) to check.

PHYSIOLOGY

What it takes to hibernate

Cell 125, 161–172 (2006)

Chipmunks have helped researchers to crack a tough nut — finding the proteins that control hibernation.

Noriaki Kondo of the Mitsubishi Kagaku Institute of Life Sciences in Tokyo, Japan, and his colleagues watched more than 100 male chipmunks (*Tamias sibiricus*) go through their annual hibernation cycles, the oldest living for 11 years. Their patience paid off.

First, by keeping the chipmunks at a constant 5 °C, the researchers showed that hibernation occurred independent of temperature. Second, they discovered that levels of hibernation-specific protein complex (HPc), which is known to drop off in the blood at the beginning of hibernation, rose in the brain during the same time. Blocking HPc with antibodies either stopped or shortened hibernation.

DEVELOPMENTAL BIOLOGY

Baby's first steps

Dev. Cell 10, 451–459 (2006)

A molecular signal that distinguishes the mouse embryo's future head from tail appears earlier than had been thought, and without directions from the uterus.

The first clear sign of the body's axes was thought to emerge after five days of development and after implantation. Hiroshi Hamada of the Osaka University, Japan, and his colleagues show that a gene called *Lefty1* is switched on in the future head region of embryos at around four days — and that this also occurs when embryos are grown in culture, without the guidance of the uterine wall.

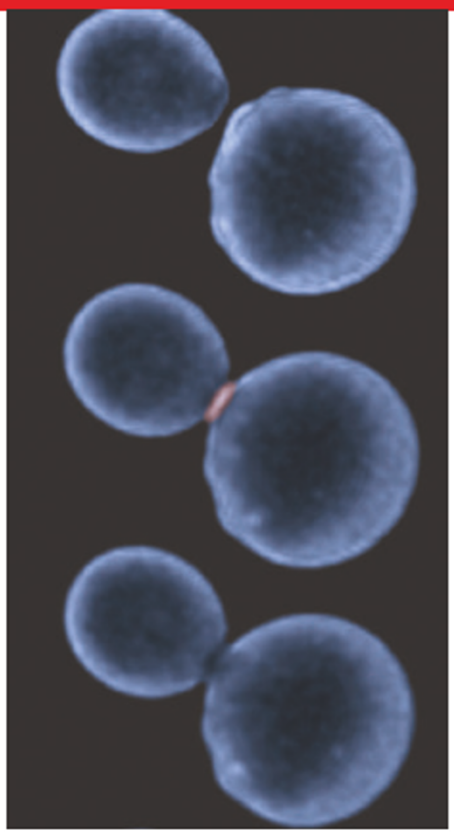
All mammalian embryos may use a similar mechanism to determine their body plan, the authors say.

CELL BIOLOGY

Cutting edge

Cell 125, 85–98 (2006)

Yeast cells have a signalling system that ensures chromosomes are safely hauled to their correct destinations before allowing the final step of cell division to go ahead, researchers have found.



M. MENDOZA & C. NORDEN, ETHZ; J. KUSCH

Yves Barral of the Swiss Federal Institute of Technology ni Zurich and his colleagues studied abscission in budding yeast (pictured above), the process during which the membranes between two nascent daughter cells pinch off. They found that a signalling system, which they called NoCut, delays abscission until the replicated chromosomes have been pulled apart into the daughter cells and are well clear of the closing membrane.

The system helps to stop chromosomes being broken during division. It could also be at work in mammalian cells, where it would be an important guard against the development of cancer.

SEMICONDUCTORS

Full of holes?

Phys. Rev. Lett. 96, 125505 (2006)

After years of effort, a delinquent semiconductor has been tamed. Researchers in the United States report evidence for p-type doping of indium nitride (InN).

P-type doping introduces positively charged conductors called 'holes' into a semiconductor. This is necessary for building devices such as solar cells, long-wavelength lasers and fast transistors, for which InN holds promise. But efforts to make p-type InN have been hampered by problems with measuring the result: surface electrons make the definitive test impossible to carry out.

Now researchers at the Lawrence Berkeley National Laboratory, California, and Cornell University in Ithaca, New York, have done a battery of experiments that suggest adding magnesium to the material does the job.

JOURNAL CLUB

Uta Passow
Alfred Wegener Institute, Bremerhaven, Germany

There's more to marine snow than meets the eye, says a biological oceanographer.

I will never forget my first dive in the open ocean. Weightlessly suspended in the blue waters of the Pacific, I was surrounded by a quiet, gentle drizzle of falling marine snow. The beauty of it almost took my breath away.

Marine snow (the subject I study) consists of composite particles, more than half a millimetre in diameter, made of cells, shreds of plankton feeding webs, faeces and minerals. It represents a critical link in the global carbon cycle: the sinking snow transports carbon from the upper ocean, and thus the atmosphere, to the ocean depths.

In calculating the snow's contribution to the carbon budget, scientists had assumed that the carbon flux depended only on the particles' solid content. But new evidence may force us to revise this view, leading to the conclusion that marine snow transports more carbon than previously believed.

Microbes degrade the solid matter in the snow as it descends, releasing carbon into the water. It was thought that this dissolved organic carbon would be left behind, so reducing the carbon flux with depth.

However, recent measurements have found high dissolved-organic-carbon levels in the funnel-shaped sediment traps used to collect marine snow, suggesting that some of the dissolved carbon can hitch a ride downwards (A. N. Antia *Biogeosciences* 2, 189–204; 2005).

Independent work supports this idea, demonstrating that marine-snow aggregates somehow retain solutes within their pores, despite being 99% holes (S. A. Goldthwait *et al. Mar. Ecol. Prog. Ser.* 305, 59–65; 2005). Clearly, the mysteries of the tiny islands of activity called marine snow are far from solved.