RESEARCH HIGHLIGHTS

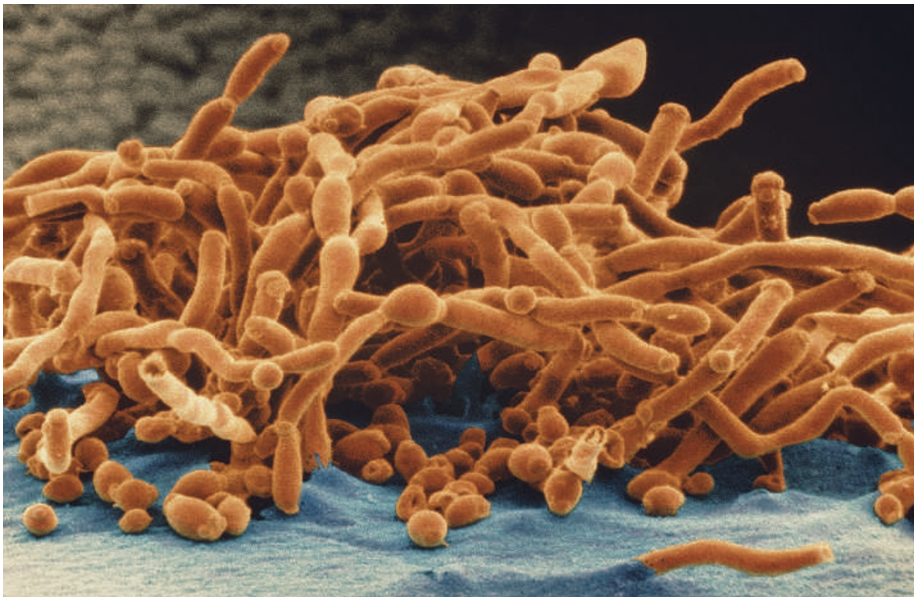
One to remember

Nature Immunol. doi:10.1038/ni1460 and doi:10.1038/ni1467 (2007)

A poorly understood population of T-helper cells — a type of cell that governs the immune system's ability to 'remember' pathogens — takes centre stage in two recent studies.

Both studies show that infection with the yeast pathogen *Candida albicans* (pictured) stimulates production of T-helper cells that make a protein called interleukin-17. Researchers led by Caetano Reis e Sousa of Cancer Research UK in London made the discovery in mouse cells, while a group led by Federica Sallusto and Giorgio Napolitani of the Institute for Research in Biomedicine in Bellinzona, Switzerland, worked with human cells.

Although interleukin-17 itself is well known, Sallusto and Napolitani's work represents the first characterization of the human cells that produce it.



D. SCHARF/SPL

CHEMISTRY

Ionic Etch-A-Sketch

Angew. Chem. Int. Edn doi:10.1002/anie.200700144 (2007)

Serendipity has struck, teaching chemists how to write an erasable pattern on the surface of an ionic liquid. Such patterns might offer promise as a data storage system, or act as templates for etching silicon chips.

Peter Licence at the University of Nottingham, UK, and his colleagues were using mass spectrometry to study ionic liquids (used as environmentally friendly solvents in some chemical syntheses) when they noticed that the particle beam from the spectrometer created a pattern of charge on the surface of a frozen ionic liquid. This happens because the beam knocks electrons from the material, leaving a charge deficit that the frozen liquid cannot dissipate. When the liquid melts, the charge spreads out and the pattern disappears.

CELL BIOLOGY

Life-prolonging vitamin

Cell **129,** 473–484 (2007)

In yeast at least, the molecular pathway that extends an organism's life when it is put on a diet can be induced — without calorie restriction — by a vitamin found in milk. So says a team led by Charles Brenner from Dartmouth Medical School in Lebanon, New Hampshire, and Jeffrey Smith from the University of Virginia Health System in Charlottesville.

The researchers showed that the vitamin, called nicotinamide riboside, raises in yeast the levels of a molecule known as NAD (nicotinamide adenine dinucleotide). This, in turn, activates the anti-ageing protein Sir2. Yeast make use of the vitamin through molecular pathways that have some genes in common with humans, raising the possibility that supplements could be designed to enhance humans' longevity.

NEUROBIOLOGY

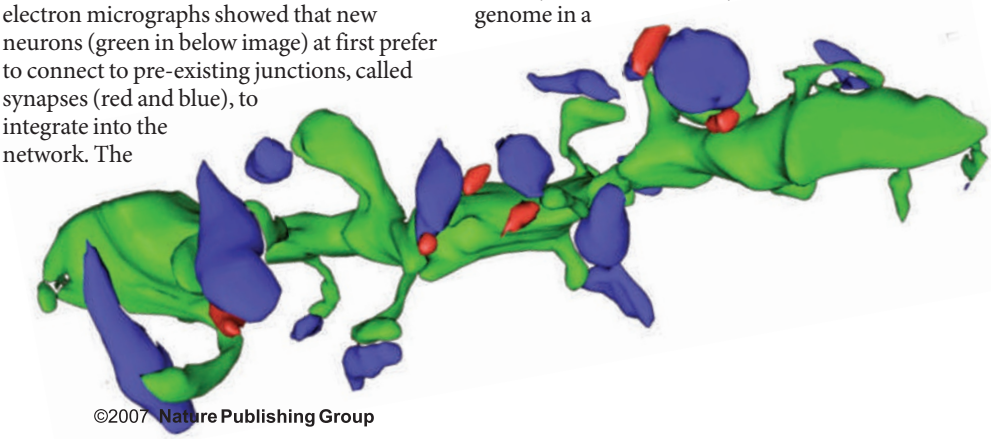
New to old

Nature Neurosci. doi:10.1038/nn1908 (2007)

Years after the discovery that adults can form new neurons, researchers have gotten a first glimpse into how those neurons are incorporated into the brain's neural network.

Fred Gage of the Salk Institute for Biological Studies in La Jolla, California, and his colleagues injected mice with a virus engineered to express a fluorescent protein in dividing cells, allowing them to identify newly generated neurons.

Three-dimensional reconstructions of electron micrographs showed that new neurons (green in below image) at first prefer to connect to pre-existing junctions, called synapses (red and blue), to integrate into the network. The neurons continued to modify their connectivity for up to 180 days, forming more new synapses as they aged.



DEVELOPMENTAL BIOLOGY

Embryos take control

PLoS Biol. **5,** e117 (2007)

During the first stages of development, embryos rely on RNA molecules inherited from the mother's egg to guide their growth. Stefano De Renzis and Eric Wieschaus of Princeton University, New Jersey, and their colleagues reveal details of how the embryo seizes control.

By studying fly embryos that are missing chromosomes or parts of chromosomes, the team shows that embryos actively break down many of the RNAs inherited from the mother. This happens as the embryo switches on its own copy of the corresponding gene. The researchers also identify a particular sequence of DNA that seems to be involved in activating the embryo's own genes. Together, these systems let the embryo switch on its genome in a

carefully controlled way, such that cells that start out identical can become different specialized cell types.

MATERIALS CHEMISTRY

Soaked up then spat out

J. Am. Chem. Soc. **129,** 5756–5759 (2007)

A material that will adsorb organic contaminants from water and then spit them back out on command has been devised by Steven Regen of Lehigh University in Bethlehem, Pennsylvania, and his colleagues. This ability to self-clean means the adsorbent could be used many times over for pollution extraction, without requiring any separate flushing steps.

The material consists of a network of crosslinked polymer chains to which surfactants are bound. At room temperature, the material is a waxy, solid-like gel, but when warmed gently (to above 30 °C or so) the surfactants adopt a fluid liquid-crystalline state. Chlorinated hydrocarbons, mimicking common toxic pollutants, are soaked up by the surfactants in their fluid-like state, then ejected by compaction of the network on cooling.

QUANTUM PHYSICS

Broken theory

Phys. Rev. Lett. **98,** 172001 (2007)

A group in Japan has, for the first time, carried out a computer simulation of quantum chromodynamics (QCD) that probes spontaneous symmetry breaking.

QCD is a theory that describes how fundamental particles known as quarks interact. Researchers have long theorized that the breaking of so-called chiral symmetry can explain how quarks combine to form light particles known as pions. A similar process is believed to endow protons and neutrons with their mass.

It is impossible to directly calculate the effects of chiral symmetry breaking from QCD's equations, but the researchers show that they could test some predictions in a numerical simulation. The work, which took six months, was done on part of the Blue Gene L supercomputer at Japan's High Energy Accelerator Research Organization (KEK) in Tsukuba.

CELL BIOLOGY

Cold channels

Neuron **54,** 371–378 and 379–386 (2007)

Feeling cold? Blame your ion channels. Two research groups have shown in mice that an ion channel known as TRPM8 is part of the mechanism by which mammals detect and avoid cold temperatures.

Previous studies in cells had shown that TRPM8 is activated when the temperature falls below around 27 °C, and by reagents such as menthol that create a cold sensation. Now separate teams led by Ardem Patapoutian at the Scripps Research Institute in La Jolla, California, and by Ning Qin of Johnson & Johnson Pharmaceutical Research and Development in Spring House, Pennsylvania, have confirmed its role *in vivo*. Both groups report that mice lacking TRPM8 are less likely to avoid cold environments than normal mice.

The ion channel also seems to have a role in cold's analgesic effect.

WILEY-VCH

ANALYTICAL CHEMISTRY

Lifestyle fingerprinting

Angew. Chem. Int. Edn doi:10.1002/anie.200700217 (2007)

A fingerprint could reveal not just who you are but what you get up to, thanks to a simple procedure developed by David Russell and his colleagues at the University of East Anglia in Norwich, UK.

They show that gold nanoparticles labelled with antibodies can detect trace amounts of substances secreted in the sweat of a fingerprint, such as metabolites produced when a drug gets broken down in the bloodstream.

When a smoker's fingerprint is treated with nanoparticles coated with antibodies for the nicotine metabolite cotinine, for example, and then with fluorescent marker molecules that also bind to the nanoparticles, the fingerprint shows up in fluorescent images in great detail (pictured above). The technique is quick and potentially portable.

JOURNAL CLUB

Bonnie Jacobs
Southern Methodist University, Dallas, Texas, USA

Fossils from ancient forests in Africa provide a palaeobotanist with insight into past climates.

I have spent many years collecting and studying fossil plants from regions in or near eastern Africa's rift valley, which runs southwards from Ethiopia to Kenya, and beyond.

These fossils provide evidence of ancient forests that once linked their living counterparts, the forests that today lie to the east and west of the rift. They also highlight past shifts in the region's climate, thought to be a driver of human evolution in the area, as grasslands became more common.

But were regional climatic changes mainly the result of changes in global climate? Or were they more to do with the development of the rift itself?

From Kenya's arid rift, I have studied 12.6-million-year-old fossils of Cola and Dioscorea (wild yam), plants that today grow side-by-side in much wetter African environments. The rift is an obvious culprit for drying here: the valley lies in the rain shadow of the rift's elevated margins.

More recently, my students and I have found much older examples of the same plant genera on the northwestern Ethiopian plateau, which has a long dry season.

The plateau is not in a rain shadow, but a recent modelling study (P. Sepulchre *et al. Science* **313,** 1419–1423; 2006) surprised me by demonstrating that even moderate elevational changes could account for today's drier climate here, too.

It suggests that the high Ethiopian plateau acts as a barrier to incoming moist air masses, and need only have been 400–1,000 metres lower than today for the plants we found fossilized there to have flourished.

Other factors would surely have played an important part, but this work highlights palaeoaltitude as a significant driver of the region's climate.