

RESEARCH HIGHLIGHTS

ECOLOGY

A dusting of snow

Proc. Natl Acad. Sci. USA doi:10.1073/pnas.0900758106 (2009)

Dust deposited on mountain snow increases the amount of solar radiation absorbed, causing it to melt about a month earlier than clean white snow. Many ecologists have suspected that this leads to much earlier growth in previously snow-covered vegetation.

A team led by Heidi Steltzer at Colorado State University in Fort Collins set up 13 experimental plots in Colorado's San Juan Mountains, adding dust to some, scraping others clean, and covering some in dark fabric to control the timing of the thaw.

Contrary to expectation, the team found that after an early thaw — when temperatures were still freezing — vegetation didn't grow for more than two weeks. This delay, Steltzer says, might mean that nitrogen released in the melt could go to waste and may contribute to the elevated nitrogen levels seen in some alpine lakes.

EVOLUTION

Mary had a littler lamb

Science doi:10.1126/science.1173668 (2009)

Changes in a given species may be driven by evolution or by ecological changes. Discriminating between the two is fraught with difficulty.

Tim Coulson of Imperial College London and his colleagues say they have managed to tease out the different drivers for one such change. Soay sheep on the Scottish isle of Hirta, UK, have shrunk in size over the past 20 years, despite heavy sheep being more likely to survive when young.

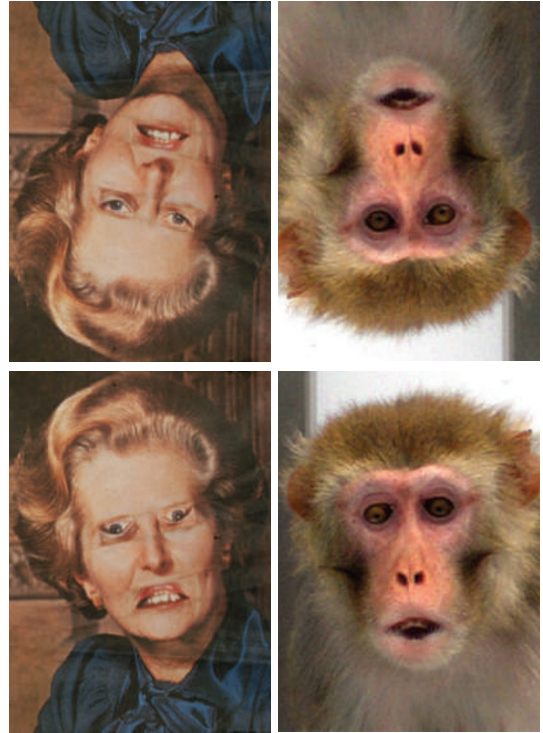
In analysing the different contributions to this size decrease, the researchers found that climate and population density explained most of the change, with natural selection underlying a smaller portion.

Picture imperfect?

Curr. Biol. doi:10.1016/j.cub.2009.05.067 (2009)

The human talent for recognizing differences in faces relies on how facial features are configured. But flip an image of a face, and alterations as drastic as inverted mouths and eyes aren't as noticeable — a phenomenon known as the Thatcher effect. Robert Hampton of Emory University in Atlanta, Georgia, and his colleagues recently demonstrated that the effect is present in another primate.

They monitored the length of time rhesus monkeys (*Macaca mulatta*) looked at pictures of monkey faces. Over time, the animals became less interested in all images, but they spent significantly more time looking at the strange, upright altered (Thatcherized) photos than they did looking at the same images upside down.



LEFT: P. THOMPSON PERCEPTION 9, 383–384 (1980)/PION, LONDON; RIGHT: B. BASILE/YERKES NATL. PRIMATE RES. CENTER

CANCER BIOLOGY

At rest in the bones

Cancer Cell 16, 67–78 (2009)

A cancer-promoting protein called Src helps breast-cancer cells to survive — sometimes for years — in the bone marrow.

Joan Massagué of the Memorial Sloan-Kettering Cancer Center in New York and his colleagues mined gene-expression data for 615 breast tumours. They found that cancers that relapsed five years or more after the initial cancer diagnosis bore a unique pattern of Src-regulated gene expression.

Reducing the amount of Src protein in human breast-cancer cells slows the outgrowth of these cells in bone in mouse models, but does not affect the growth of metastases in the lungs. Furthermore, Src-depleted cells are unable to suppress a cell-death pathway that is expressed in the bone marrow and so die off.

ASTRONOMY

A star is born

Astrophys. J. 699, 1300–1306 (2009)

The birth of young stars is shrouded in mystery because they tend to form at the centre of giant clouds of dust and hydrogen gas. Only light in the millimetre- and infrared-wavelength range can pass

through the clouds, and astronomers have historically lacked telescopes that are capable of clearly discerning those wavelengths.

Now, Jonathan Williams of the University of Hawaii and his colleagues have used the latest generation of telescopes to capture a high-resolution view of a nearby star-forming cluster. They found five objects in the cluster, including a bright protostar and a starless, collapsing core of gas. The observations show that a single cluster can give birth to a plethora of different protostellar types, and may help to give astronomers a better understanding of the birthing process.

GENOMICS

Closing in on cholesterol

Cell Metab. 10, 63–75 (2009)

In an attempt to uncover genes that regulate cholesterol levels in cells, a team of researchers has used a bevy of screening approaches and identified transmembrane protein 97 (TMEM97) as a new candidate for cholesterol regulation.

The researchers, led by Rainer Pepperkok and Heiko Runz of the European Molecular Biology Laboratory in Heidelberg, Germany, and the medical faculty of the University of Heidelberg, depleted cholesterol from cells and looked at the response in gene



expression. They then performed literature searches and used RNA-silencing techniques to further narrow down their results.

The team focused on TMEM97 because it is highly expressed in sterol-depleted cells and is targeted by sterol-response-element binding proteins, which also activate other cholesterol regulatory genes. Knocking down its expression led to decreased cholesterol uptake and lowered cholesterol levels in cells. The authors suggest that their combined screening technique offers a powerful method for pinpointing genes in particular pathways.

MICROBIOLOGY

Supershedding mice

Infect. Immun. doi:10.1128/IAI.00558-09 (2009)
Clostridium difficile, a spore-forming anaerobic bacterium that inhabits the gut of as many as 5% of humans, is a leading cause of antibiotic-induced diarrhoea.

When a carrier takes antibiotics, these can wipe out other gut microbiota and send *C. difficile* into overdrive, which can lead to rampant spread of the bacterium in hospital settings. Trevor Lawley of the Wellcome Trust Sanger Institute in Hinxton, UK, and his colleagues have developed a new mouse model for the condition.

Between two and three days after treatment with the antibiotic clindamycin, mice carrying *C. difficile* shed a million-fold more spores in their faeces than before. More than half of the mice retained this 'supershedder' status for several weeks. Uninfected mice housed with supershedders became carriers themselves; because the bacterial spores are ethanol resistant, cages had to be thoroughly cleaned with sporicides.

GEOLOGY

Earth-shattering research

Geology 37, 615–618 (2009)

How does a rock weather away into clay? Usually, it is helped along by fungi, in a process now examined in detail by Steve Bonnevillie at the University of Leeds, UK, and his colleagues.

The team grew tree seedlings and a symbiotic fungus *Paxillus involutus* in an experimental set-up that included the mineral biotite, and followed the action with high-resolution microscopy. The fungus enhances the weathering of biotite, not by exuding chemically active substances as

was previously thought, but by physically disrupting the structure of the mineral with its hyphae. This is followed by chemical changes as the fungus removes potassium and oxidizes iron within the mineral. Soon, the rock is no more.

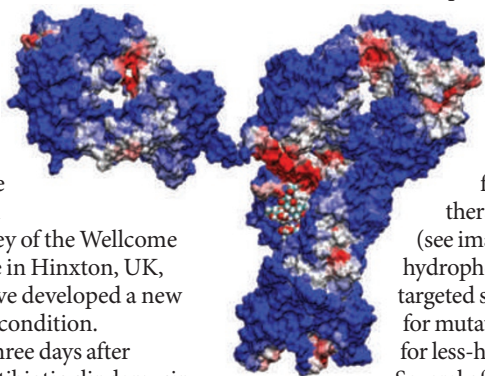
COMPUTATIONAL BIOLOGY

Unstuck by design

Proc. Natl Acad. Sci. USA doi:10.1073/pnas.0904191106 (2009)

Computational predictions could make it easier to design biopharmaceuticals that don't stick together. Aggregation can destroy the effectiveness of antibody-based drugs or, worse, spur an unwanted immune response. But current methods to stabilize antibodies involve trial and error, which can be costly.

Bernhardt Trout of the Massachusetts Institute of Technology in Cambridge and his colleagues have developed a method to predict the exposed areas on a protein that are hydrophobic and make it more likely to clump in solution. The researchers made these predictions for two different therapeutic antibodies (see image left; red represents hydrophobic patches) and targeted specific amino acids for mutation, swapping them for less-hydrophobic versions. Several of their creations were more stable than the originals.



NATL ACAD SCIENCES

NEUROLOGY

Feeling out autism

Nature Neurosci. doi:10.1038/nn.2356 (2009)

Children with autism spectrum disorder (ASD) may rely more on physical feedback than visual cues when performing tasks.

Reza Shadmehr at Johns Hopkins University in Baltimore, Maryland, and his colleagues asked children with ASD and children with typical development to play a video game in which they learn to use a robotic arm to capture animals. As training progresses, a force is applied to the arm that the children must correct for. In some instances, the corrective force that the children apply was measured, revealing how their brains build a generalized mental model of the way in which the robotic arm works.

Those children with ASD who were most reliant on the physical feedback to build this mental model had larger deficits in motor control, imitation and even social function.

JOURNAL CLUB

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A bioengineer gets schooled by *Escherichia coli*.

The ability to learn from situations and to predict certain outcomes sets us apart from many living things. It prevents many of us from chasing balls into busy streets or placing bottles of ethanol near Bunsen burners. Still, it didn't stop thousands of US researchers submitting applications for the National Institutes of Health's Challenge Grants — funded by President Barack Obama's economic stimulus package — despite an expected success rate little better than one or two per cent.

To enjoy the benefits of learning and predictive behaviour, we usually assume that you need a nervous system or at least a neuron. So it was surprising to read that Saeed Tavazoei at Princeton University, New Jersey, and his colleagues have demonstrated that bacteria can learn and exhibit anticipatory behaviour (I. Tagkopoulos *et al.* *Science* 320, 1313–1317; 2008). They show computationally and experimentally that *Escherichia coli* can learn temporal correlations between environmental stimuli — for example, that an increase in temperature is followed by a decrease in oxygen levels — allowing the bacteria to predict and prepare for future environmental changes.

The researchers show that this associative learning is accomplished by rewiring of biochemical networks. Strikingly, they also show that, like many of us, *E. coli* quickly 'unlearn' (in fewer than 100 generations) what they had learned in a new situation.

Now we know that bacteria can be taught such tricks, it will be interesting to see if we can use novel combinations of environmental stimuli to train microbes to efficiently convert biomass into energy sources, such as hydrogen or butanol. By providing *E. coli* with such an educational stimulus package, we may be able to boost the global economy.

Discuss this paper at <http://blogs.nature.com/nature/journalclub>