

RESEARCH HIGHLIGHTS

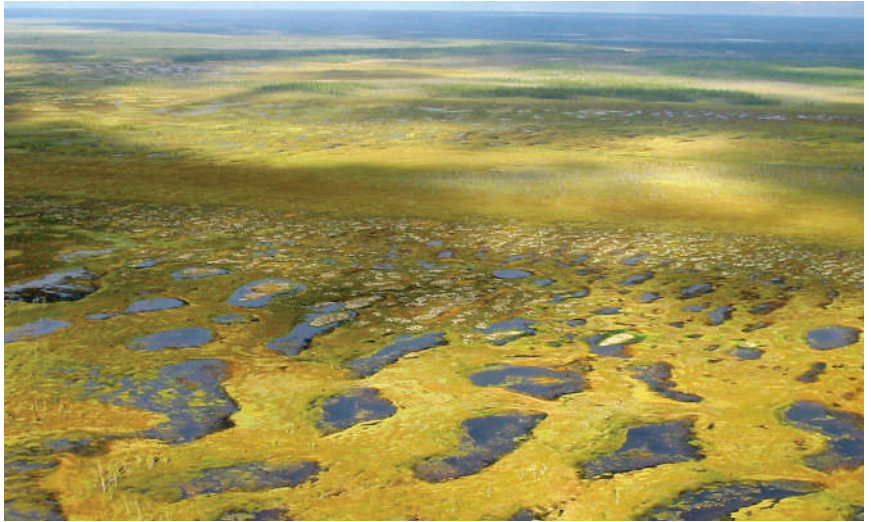
Go with the flow

J. Geophys. Res. **112**, G04S58 (2007)

Rising temperatures could increase nitrogen and phosphorus in the waters off Siberia's coast, altering local biological productivity, a study suggests.

Rivers that drain western Siberia's peatlands (pictured, right) wash nutrients into Arctic waters, and previous work has shown that global warming could lead to more dissolved organic carbon being carried north. Karen Frey at Clark University in Worcester, Massachusetts, and her colleagues sampled 96 Siberian streams. They estimate that levels of dissolved nitrogen and phosphorus, which also make the journey north, could both increase by between about 30% and 50% by 2100.

The extra nutrients are likely to rev up photosynthetic production in the Ob' and Yenisey bays.



K. E. FREY

DEVELOPMENTAL BIOLOGY

Miracle grow

Science **318**, 772-777 (2007)

Salamanders have the phenomenal ability to regenerate a lost limb from a mound of stem cells — or 'blastema' — that forms at the wound site, but only if nerves are present. A protein called anterior gradient (AG) bypasses this requirement and offers promise for regenerative medicine.

While examining AG expression at amputation sites in *Notophthalmus viridescens*, a type of salamander, Jeremy Brockes of University College London and colleagues discovered that when there's no nerve, there's no AG. Strikingly, the introduction of AG into denervated blastemas rescued limb regeneration (pictured below), although the limbs were not fully functional.



If blastemas could be engineered in mammals, propose the authors, then growth-promoting proteins such as AG could be used to trigger limb regrowth.

PALAEONTOLOGY

A predator for lunch

Proc. R. Soc. B doi:10.1098/rspb.2007.1170 (2007)

Fossil-hunters in Germany have dug up an amazing find — the oldest known example of a food chain with three links, or 'trophic levels'. The find, which dates back almost 300 million years, consists of the remains of a prehistoric fish, which was eaten by an amphibian, which in turn was gobbled up by a primitive shark.

The fossil record contains few documented predator-prey relationships, because digested remains in the gut of larger animals tend not to be preserved, explain researchers led by Jürgen Kriwet of Berlin's Natural History Museum. The fossil shark, a member of the species *Triodus sessilis* that was found near Saarbrücken in southwest Germany, actually contained the remains of two amphibian species, one of which had already feasted on a fish called *Acanthodes bronni*.

ASTRONOMY

Bigger galaxies earlier

Astrophys. J. **669**, 184-201 (2007)

Giant galaxies seem to have formed earlier than models suggest, say the authors of a new survey.

Roberto Abraham of the University of Toronto in Canada and his colleagues used images from the Gemini Deep Deep Survey and Hubble Space Telescope to study 144 galaxies between 3 billion and 6 billion years old. By examining the concentration of

starlight in each pixel of the images, the team was able to classify the galaxies by shape.

The results show that, contrary to some predictions, most of the early Universe's stars resided in large elliptical galaxies. The findings will help astronomers rethink models of galaxy formation.

NANOTECHNOLOGY

Inside story

Nature Nanotechnol. doi:10.1038/nnano.2007.347 (2007)

How toxic are carbon nanotubes? That's one of the pressing questions in assessing possible risks of nanotechnology, which has applications in medicine. But the matter is hard to study at the cellular level, because it is tricky to spot nanotubes entering cells. Unless they are fluorescently labelled, the carbon tubes are hard to distinguish from carbon-based cell structures such as membranes.

Using a combination of electron and optical microscopy, Alexandra Porter at the University of Cambridge, UK, and her team have now obtained clear evidence of single-walled nanotubes — which are only 0.6–3.5 nanometres in diameter — entering human cells. They found that, once inside cells, nanotubes accumulate in the cell cytoplasm and nucleus, where they cause cell death.

MICROBIOLOGY

RNAi on the offensive

Nature Biotechnol. doi:10.1038/nbt1352; 10.1038/nbt1359 (2007)

A new and easy way to fight plant pests using RNA interference (RNAi) has been suggested by two groups working independently.

RNA interference occurs when short

pieces of RNA are introduced into a cell, where they bind to a target RNA sequence, decreasing the expression of that sequence and of its encoded protein. Xiao-Ya Chen and colleagues at the Shanghai Institutes for Biological Sciences in China used this technique to target an enzyme in cotton bollworms that confers resistance to the cotton plant's chemical defences. When plant leaves containing a trigger RNA were fed to the cotton bollworms, the worms were unable to make as much of their defensive enzyme against the cotton toxin, and their growth was stunted.

James Roberts of Monsanto Company in Chesterfield, Missouri, led a team that took its experiments all the way to the field. The group engineered corn plants that express short RNAs targeted against an essential enzyme found in the western corn rootworm. They then allowed corn rootworm larvae to dine on engineered and non-engineered plants for three weeks, and found that the engineered plants had much less root damage (pictured below, right) than their unprotected counterparts (left).



CHEMISTRY

Green cleaver

Science **318**, 783–787 (2007)

An iron compound that can selectively break carbon–hydrogen bonds in organic compounds looks set to pave the way for easier — and greener — syntheses.

The carbon–hydrogen bond is ubiquitous in organic molecules. Breaking it open to add other chemical groups generally requires a catalyst. Often, in more complex molecules, the bond has to be made more reactive and other parts of the molecule need to be shielded from activity before the catalyst can do its job. Both these steps involve potentially toxic reagents.

Christina White and Mark Chen at the University of Illinois in Urbana have unveiled an iron catalyst that can oxidize carbon–hydrogen bonds using only hydrogen peroxide, which is relatively benign. The catalyst can target specific bonds, even in complicated molecules. For each molecule, this selectivity is based largely on the inherent reactivity of the bonds and how accessible

the bonds are to the catalyst.

GENETICS

Light release

Nature Chem.

Biol. doi:10.1038/nchembio.2007.44

(2007)

Manipulation of the genetic code has allowed researchers in San Diego, California, to produce proteins in which the amino acid serine is

'photocaged'. Changes to the genetic coding and translational mechanisms in the yeast *Saccharomyces cerevisiae* can be used to produce proteins in which an extra chemical group masks a specific serine residue, report Peter Schultz and his colleagues at the Scripps Research Institute and the Novartis Research Foundation. The masking group can later be removed by exposure to visible light.

By selectively illuminating such cells, and thus choosing when to expose the serine residues, the researchers were able to study the circumstances under which Pho4, a transcription factor, is phosphorylated. They suggest that this means of exerting fine control over protein function *in vivo* could have wide applicability, and expect in time to apply it to other amino acids and cell types.

MICROBIOLOGY

Divide and conquer

Chem. Biol. **14**, 1119–1127 (2007)

Researchers have found a new treatment that fights *Staphylococcus aureus* infections in mice by shutting down lines of communication among bacterial cells.

Antibiotic-resistant forms of *S. aureus* pose an escalating public health threat. Kim Janda and his colleagues at the Scripps Research Institute in La Jolla, California, report a new type of antibiotic: an antibody that binds to a signalling molecule *S. aureus* use to communicate with each other. This communication, known as quorum sensing, regulates the production of some proteins associated with virulence.

The antibody reduced production of one such protein, α -haemolysin, and inhibited the breaking apart of red blood cells in bacterial cultures. It also prevented *S. aureus*-induced skin lesions in mice, and fully protected mice against lethal doses of the bacterium.

JOURNAL CLUB

Brian J. Enquist
University of Arizona, Tucson,
Arizona USA

An ecologist wonders how biotic feedback matters to global-change research.

I have increasingly been drawn to the question of how the biotic world responds to climatic change. In the face of environmental change, biology responds — organisms often compensate, adapt and change the nature of their ecologies. But exactly

how important is this biological feedback to how ecosystems respond to a warmer world?

My colleagues and I have called for a need to focus on quantifying the importance of what we call the three As — acclimation, adaptation and assembly — on ecosystem-level processes such as carbon flux.

Acclimation is a plastic response by an organism to a change in the environment, whereas adaptation is the end result of natural selection in populations. Assembly is how species come to dominate a local environment and is the result of ecological interactions. We

know that all these processes are affected by changes in climate. The end result of the three As is a group of species that live in a given location and control the flow of resources and energy.

These processes operate on differing time scales and have mostly been studied in isolation. However, two fascinating papers (K. Ishikawa *et al.* *New Phytol.* **176**, 356–364; 2007, and C. Campbell *et al.* *New Phytol.* **176**, 375–389; 2007) assess the role of both acclimation processes and between-species adaptation in the responses of photosynthesis

and respiration to changing temperature. Remarkably, they find that acclimation and adaptive responses seem to compensate for temperature-driven changes in carbon flux.

Putting these two As together with how species assemble in ecological communities will probably reveal generalities in how evolutionary biology and plant-community ecology matters in global change.

Discuss these papers at <http://blogs.nature.com/nature/journalclub>