Aquatic ecology

Growth prospects for algae

Ecol. Lett. doi:10.1111/j.1461-0248.2004.00597.x (2004)

The amount of CO_2 in the atmosphere could double over the coming century. How will that affect photosynthesis by the world's phytoplankton?

Peter Schippers *et al.* modelled the uptake of carbon by five marine and two freshwater species of alga. They calculated the organisms' rates of carbon uptake at today's atmospheric CO_2 concentration and at an increased concentration, taking into account the effect this uptake would have on the carbon chemistry of the surrounding water and the subsequent availability of carbon in the form of dissolved CO_2 and bicarbonate ions. They found that when algae take up large amounts of carbon, the pH of the water increases sharply, the water CO_2 concentration falls, and the amount of CO_2 entering the water becomes proportional to the concentration of CO_2 in the atmosphere.

From their results, and assuming nutrients are not limiting, Schippers *et al.* conclude that carbon uptake by phytoplankton could double with a doubling of atmospheric CO_2 — and that the incidence of harmful algal blooms would increase. **Lucy Odling-Smee**

Astronomy

Illuminating the dark age

Preprint at http://arXiv.org/abs/astro-ph/0312134 (2004)

After the Big Bang, but before the first stars ignited, the Universe was shrouded in darkness. Quasars — among the brightest and most distant objects known — illuminated the Universe when it was less than a billion years old. Their light bears the imprint of absorption by neutral hydrogen gas in the early Universe.

Abraham Loeb and Matias Zaldarriaga propose that there may be a similar imprint of the even earlier Universe, borne by the cosmic background radiation, that captures the depths of the cosmic dark age. When the Universe was between 20 million and 100 million years old, neutral hydrogen gas would have resonantly absorbed cosmic background radiation, the residual echo of the Big Bang. If this absorption pattern could be mapped across the sky, it would reveal how the neutral hydrogen was distributed in the dark-age Universe.

Today, say Loeb and Zaldarriaga, that information is to be found at radio wavelengths, from 6 to 21 metres, which are difficult to observe using current technology. The next generation of telescopes might, however, catch these radio waves, and illuminate the dark age. **Mark Peplow**

C. PENNA/CUBOIMAGES

Plant genetics

Grape expectations

Science **304,** 982 (2004)

Black and red grapes owe their colour to red pigments — anthocyanins — in their skins. According to one account, the white varieties arose as the plants producing red-skinned fruit picked up pigment-altering mutations. From their investigations, however, Shozo Kobayashi *et al.* hypothesize that black grapes gave rise to white grapes, which in turn yielded red varieties.

The team analysed the genetic make-up of different coloured varieties and found that white grapes contain a string of intruder DNA, called a retrotransposon, inside a gene that normally promotes pigment production. As a result, the gene's expression is blocked and the grape becomes white rather than black. Red grapes developed from white varieties as they lost the retrotransposon, picking up a second mutation that switched pigment production back on.

Kobayashi and colleagues argue that mutations in a single gene determine skin colour in grapes, and suggest that the same mutant gene has spread among most, if not all, white varieties in the world. **Helen R. Pilcher**

Physics

A quantum transistor

Phys. Rev. Lett. **92,** 176801 (2004)

Transistors are an integral part of logic gates, the basic electronic components of computer circuits. A quantum transistor could potentially process quantum bits in which data may exist in both 'on' and 'off' states at the same time, thus multiplying computing power.

J. C. Chen *et al.* have made such a quantum transistor from two tiny discs of gallium arsenide. The discs, or 'quantum dots', have a diameter of about 200 nanometres, and are kept about 100 nanometres apart on an insulating wafer. Each holds a pool of 40 to 60 electrons, fed by an external circuit that delivers electrons one by one into the dots.

In experiments performed at 30 mK, Chen *et al.* added a single excess electron to each dot, the (unpaired) spin of that electron determining the spin of the dot itself — either 'up' or 'down'. Both dots were set up with matching spins. Then, by varying the gate voltage across the double-dot system, the authors tuned the interaction between the dots, such that their spins became entangled. This mixed configuration is both 'spin-up' and 'spin-down' — and so could be the basis of an electronic switch that is both 'on' and 'off'. **Mark Peplow**

Stem cells

Damage alert

J. Clin. Invest. **113,** 1364–1374 (2004)

Neural stem cells in mammalian brains are known to migrate to injured brain regions, perhaps to carry out repair. In a step towards potentially using these cells therapeutically, Lixin Sun *et al.* have identified a molecule that lures them to their destination.

The authors searched for genes that are expressed at higher levels in injured mouse brains than in healthy ones. From nearly 200 candidates, they homed in on one gene, which encodes stem cell factor (SCF) — a secreted protein that has already been linked to the division and migration of other stem-cell types.

Sun *et al.* confirmed that SCF is produced by damaged neurons and that the receptor for SCF, c-kit, is expressed on neural stem cells. They also showed that labelled stem cells move towards SCF after it is injected into a mouse's brain. The authors speculate that SCF might one day be used to boost migration of stem cells to sites of disease or damage in the brain or spinal cord. There, the cells might deliver therapeutic molecules, or be converted into new tissue by other chemical signals. **Helen Pearson**