EDITORS' CHOICE

edited by Stella Hurtley

MOLECULAR GENETICS

Making Mito-Mice

Defects in mitochondrial DNA (mtDNA) are associated with human degenerative diseases, aging, and cancer. One difficulty in creating animal models for these diseases has been an inability to achieve stable transmission of exogenous mitochondrial DNA.

Inouye *et al.* fused vesicles derived from the brains of aged mice with a cell line whose mitochondria lacked DNA. Several such "cybrids" containing mtDNA deletion mutations were fused with mouse embryos and implanted into female mice. The resulting offspring contained around 5 to 40% mutant mitochondrial DNA, and the females were able to transmit the mutant DNA to their progeny. Whilst these mice demonstrated abnormalities distinct from those seen in human diseases, the mice did have abnormal mitochondria in their muscles. Most of the mice with large proportions of mutant mitochondrial DNA died of renal failure within 200 days, a problem rarely seen in human mitochondrial disorders. However, these mice have the potential to yield insights into the underlying mechanisms of pathology in human disorders. — BJ

Nature Genet. **26**, 176 (2000).

Mitochondrial mutant mouse with symptoms of anemia.

MICROBIAL ECOLOGY

Phage Wars

There are at least 10^{30} bacteria on the planet, and there are likely to be at least as many bacterial viruses or bacteriophages attacking them. Given this sheer weight of numbers, the predatory activities of phages should have global significance. Phages are also useful tools for gene transfer, and predicting their behavior under natural conditions is important.

Ashelford *et al.* over the course of three successive years made field experiments on soil-dwelling bacteria, *Serratia liquefaciens*, and their bacteriophages in sugar beet plots. Phage-infected bacteria were introduced to the plot. Shortly after inoculation the introduced phage numbers 'bloomed,' but fell dramatically as the sugar beet plants matured. This decline was accompanied by the explosive growth of another, much more virulent naturally occurring bacteriophage. The two phages apparently adopted different replicative strategies to compete for *Serratia* prey. Thus, a bacterium burdened with a phage can survive in nature as successfully as an uninfected bacterium, and an indigenous microbial community can be altered reproducibly by the release of a bacterium carrying a gene-transducing phage. — CA

Appl. Environ. Microbiol. **66**, 4193 (2000).

PHYSICS

Wave-Particle Detection

Photons, tiny units of light, can behave as particles or as waves. As their behavior is dependent on how they are detected, measurements have revealed either one state or the other but never both. Foster *et al.* now present a technique that draws the particle and wave aspects of photons together. In their system, a photon interacts with an atom in a quantum cavity to create an excited state. This excited state partially decays, emitting a photon that is subsequently detected to measure the particle behavior. This then acts as a trigger for the measurement of the decay of the residue left behind in the cavity. This residue, a true likeness of the original excited state in terms of phase, but smaller, can then reveal the wave properties of the emitted photon. — ISO

Phys. Rev. Lett. **85**, 3149 (2000).

OCEANOGRAPHY

Marine Biomarkers

Knowledge of the concentration of ^{14}C in the surface ocean is important for understanding ocean ventilation rates, deep water formation, variations in atmospheric ^{14}C inventories, abrupt climate changes, and changes in oceanic circulation. Measurements of sea-surface ^{14}C are typically made on the calcium carbonate found in planktonic foraminifera, corals, or bivalve shells. In some areas of the ocean, however, calcium carbonate is either not preserved or not produced, which makes it necessary to find other suitable phases for determining sea surface ^{14}C concentrations. One possible source of material is the organic fraction of marine sediments. However, the carbon contained in these sediments is isotopically heterogeneous due to the multiplicity of its origins.

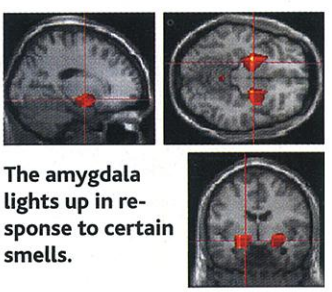
Now Pearson *et al.* have avoided this complication by analyzing a group of biomolecules from a single class of compounds. They identified eight sterols that accurately record the amount of ^{14}C in surface waters at the time of their synthesis. These marine biomarkers could make it possible to determine ^{14}C inventories of problem areas like the Southern Ocean, and to avoid vital effects and depth-dependent effects that sometimes interfere with the use of foraminiferal calcite. — HJS

Paleoceanography **15**, 541 (2000).

NEUROSCIENCE

Showing Up Emotions

Our senses are continuously bombarded with stimuli from the outside world. Some immediately arouse emotions such as pleasure, disgust, or fear and initiate behavioral responses aimed at seeking or avoiding continued exposure. To investigate the brain regions involved in processing emotional responses, Royet *et al.* presented the same individuals a range of pleasant, unpleasant, or neutral visual, olfactory, and auditory stimuli. Regional cerebral blood flow was measured by positron emission tomography. Emotionally charged stimuli caused increased activation of a core network of regions in the left hemisphere. The activated regions always included the orbitofrontal cortex, temporal pole, and superior frontal gyrus. The hypothalamus and the subcallosal gyrus were specifically activated by visual and olfactory stimuli, but not by auditory stimuli. Only emotionally charged smells, like lavender or mint, managed to activate the amygdala in both the left and right hemisphere. Thus there appears to be a core left hemispheric network of emotion processing regions that always gets activated



The amygdala lights up in response to certain smells.

CONTINUED ON PAGE 675

SOURCE: (LEFT) INOUYE *ET AL.*, *NATURE GENET.* **26**, 176 (2000); (RIGHT) ROYET *ET AL.*, *J. NUEROSCI.* **20**, 7752 (2000).

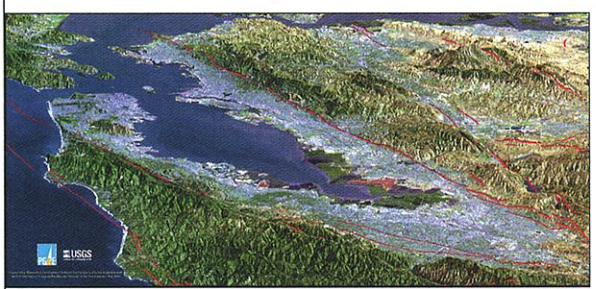
in addition to other areas that appear to be specific for individual senses. — PRS

J. Neurosci. **20**, 7752 (2000).

GEOPHYSICS

Rupture Directions

If you apply stress to a rock, a rupture may propagate along a zone of weakness, for example along a small fracture or a boundary between different minerals. While it is relatively easy to study the growth and direction of rupture in rocks in a laboratory, it is more difficult to study ruptures in Earth's crust.



The San Andreas Fault in the bay.

Rubin and Gillard have been able to measure the direction of rupture along the San Andreas Fault by analysis of precisely located earthquakes. Using a waveform cross-correlation technique, they determined the location of about 4300 earthquakes along 50 kilometers of the San Andreas Fault, just south of the San Francisco Bay area. As the earthquake sites could be located within meters whereas the ruptures extend for hundreds of meters, the direction of rupture could be measured. Ruptures tended to travel more easily in the direction of the weaker material. Along the San Andreas Fault, the weaker material is either the North American plate rocks, which have a lower velocity than the Pacific plate rocks, or fault gouge, which is finely crushed and fractured rock squeezed between the two plates. — LR

J. Geophys. Res. **105**, 19095 (2000).

ORGANIC SYNTHESIS

Sugarcoated DNA

Carbohydrate modifications of DNA have been observed in biological systems, and may perhaps be useful in oligonucleotide therapeutics or in the development of DNA-based materials. The synthetic modification of DNA with carbohydrate has been demonstrated, but no general route for synthesis of such hybrid molecules has existed.

Sheppard *et al.* have now developed such a strategy. First they prepared mono- and disaccharide phosphoramidite derivatives and then conjugated them to terminal or internal positions of oligonucleotides using solid phase synthesis. The nucleoglycoconjugate molecules form substrates for DNA-manipulating enzymes, thus enabling the synthesis of large DNA molecules with specific carbohydrate modifications. The hybrid materials combine the coding ability of DNA with the recognition ability of carbohydrates and may be used to enhance the specificity and efficiency of therapeutic oligonucleotide delivery to the cell. — JU

Angew. Chem. Int. Ed. **39**, 3660 (2000).

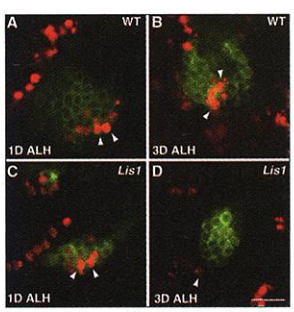
CELL BIOLOGY

Lis1 Lis1 Lis1

A variety of brain disorders have been linked to the lack of one functional copy of the Lis1 gene. The function of the Lis1 protein itself has not been clear. Now three independent studies have characterized some of the cellular processes in which Lis1 is implicated.

Because a total genetic knockout of Lis1 is fatal, Smith *et al.* generated heterozygous Lis1 knockout mice and examined their phenotype. They observed a role for Lis1 in regulating cytoskeletal dynamics. Lis1 interacts with the microtubule motor dynein and normal levels of Lis1 were important in promoting neuronal migration and axon growth.

Faulkner *et al.* focused on the effects of expressing Lis1 protein in cultured mammalian cells. They also found an interaction between Lis1 protein and dynein and demonstrated that high levels of Lis1 protein interfered with mitosis. Liu *et al.* found that *Drosophila* Lis1 was required for proliferation of neuroblasts and for the development of normal neuronal dendrites and for axonal transport.



Neuroblasts (green) with reduced levels of Lis1 (Lis1) show impaired proliferation (orange).

Thus, Lis1 is a key player in neuronal motor dynamics both at the level of neuronal cell proliferation and at the level of ongoing motor-driven processes in neurons. — SMH

Nature Cell Biol. **2**, 767; 784; 776 (2000).

CREDITS: (LEFT) USGS; (RIGHT) SMITH *ET AL.*, *NATURE CELL BIOL.* **2**, 776 (2000).