EDITORS' CHOICE

edited by Gilbert Chin

APPLIED PHYSICS

Flash Memory

In CDs and DVDs information is stored in a single plane, but the use of stacked planes within an optically writable material offers the opportunity to attain information storage densities some two orders of magnitude greater. Stacked memories have relied so far on sophisticated confocal optics for writing and reading, both of which are somewhat limited by cross talk between adjacent planes. Watanabe *et al.* report a simpler technique that is based on observing photoluminescence from photomodified regions in silica, which allows them to use just a single objective lens for the writing and read-out processes. High-powered 120-femtosecond laser pulses at 800 nm create a defective region (the bit or voxel) about 1.4 μm in diameter via multiphoton absorption. Illumination with the same wavelength light, but at much lower intensity, makes the voxel photoluminesce. Cross talk between bit planes is also suppressed, so that bit planes only 3 μm apart can be resolved. — ISO

Appl. Phys. Lett. **77**, 13 (2000).

MICROBIOLOGY

Daylight Robbery on the High Seas

Mesodinium rubrum is a common ciliate member of marine plankton and contributes to non-toxic red tides. Its classification is problematic as it contains several non-ciliate mitochondria and chloroplasts, apparently has no nucleus, and seems to be an obligate phototroph. It does have some capacity to synthesize chlorophyll and, unlike other plastid-retaining ciliates, can use inorganic nutrients dissolved in the water column.

Gustafson *et al.* succeeded in culturing this rather fragile organism and found that cultures would grow only in the presence of a cryptophyte alga, *Teleaulax acuta*. Despite its mouthless state, the ciliate was able to ingest the algae and, as a result, changed from colorless to bright pink. Several days after a binge, a *M. rubrum* culture had preferentially retained the cryptophyte's plastids, actively multiplied, and doubled its photosynthetic capacity. The ciliate seems to appropriate the plastids to replace aging plastids or to top up after several rounds of cell division, hence maintaining itself by a life of crime. — CA

Nature **405**, 1049 (2000).

VIROLOGY

A Promising Pesti-cide?

Pestiviruses are single-stranded RNA viruses that cause serious and sometimes fatal illness in domesticated livestock. The viruses are highly transmissible, and, because there are currently no effective antiviral drugs, pestivirus infections inflict a significant economic toll worldwide.

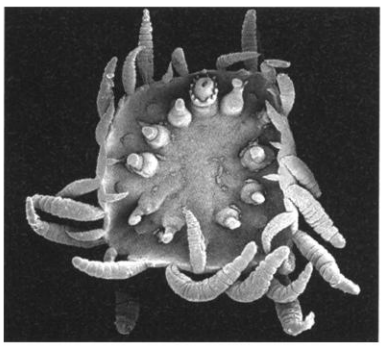
Baginski *et al.* have identified a small molecule that potently inhibits replication of a prototypic pestivirus, bovine viral diarrhea virus, in cultured cells (50% inhibition at 20 nanomolar). The compound, a triazinoindole designated VP32947, specifically targets the virally encoded RNA-dependent RNA polymerase, possibly by interfering with recognition of the RNA substrate, with no apparent toxicity to the host cell. Not only does VP32947 represent a promising lead compound for combating pestivirus infection, it also may assist drug discovery efforts for human hepatitis C virus (HCV), which shares many molecular features with pestiviruses and has been estimated to affect 170 million people. — PAK

Proc. Natl. Acad. Sci. U.S.A. **97**, 7981 (2000).

EVOLUTION

A Puzzling Metazoan Body Plan

The myzostomids are an enigmatic and anatomically bizarre group of marine animals, found in symbiotic or parasitic association with echinoderms from Ordovician to modern times. Their unusual acoelomate, incompletely segmented body plan—the result of their long history of obligate association—has caused two centuries of dispute amongst systematists. Myzostomids have been considered as annelids, sometimes within the polychaetes, sometimes not. More recently, workers have classed them as a separate phylum allied to the annelids.



Myzostoma martenseni.

Eeckhart *et al.* have acquired molecular data from two components of the protein synthetic machinery, the small ribosomal subunit RNA gene (SSU) and the elongation factor-1α gene, and throw new light on the phylogenetic relationships of the myzostomids. They confirm that the myzostomids are not nested within the annelids. More surprisingly, they find that the myzostomids have no close links to the annelids at all; instead, they are more closely allied to the flatworms.

This result suggests that the key morphological features—segmentation, coeloms, etc.—used to classify the animal kingdom might not be as conservative as hitherto thought. If, as has apparently happened in the myzostomids, these features can be independently gained or lost during the course of evolution, our view of the evolution of body plans and the relationships of the animal phyla may become more complicated. — AMS

Proc. R. Soc. Lond. B **267**, 1383 (2000).

CLIMATE

Man-made and Natural Variation

Average global surface atmospheric temperatures have risen about 0.6°C over the past 150 years, although not in an uninterrupted fashion. How much of this is due to external factors (anthropogenic fossil fuel burning, solar variability, volcanic eruptions) versus an internal and natural variability of the climate system has been debated for years.

Andronova and Schlesinger attempt to quantify these contributions by using 135 years of data on atmospheric greenhouse gas concentrations, volcanic activity, and solar irradiation as boundary conditions for a simple climate/ocean model, and then by calculating the effects on Earth's radiation balance. They find that anthropogenic greenhouse forcing has become the dominant external factor, but a residual factor, presumably associated with the internal dynamics of the climate system, has influenced the global climate, too (see also Crowley *et al.*, Research Article, this issue, p. 270). The rapid rate of temperature increase that occurred between 1904 and 1944, and the cooling that took place from 1944 to 1976, are the results of

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SOURCE: EECKHAUT *ET AL., PROC. ROY. SOC. LOND.* **B267**, 1383–1392 (2000)

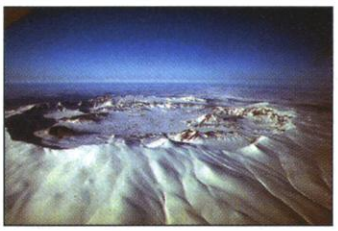
a powerful internal climate variation of unknown origin. This variation, with a period of 65–70 years, and which may be related to the North Atlantic Oscillation, augmented or retarded the steady trend to warmer conditions that greenhouse gases have caused. Therefore, caution should be exercised when looking at temperature trends, and a pause or even reversal of current warming should not be interpreted as evidence against global warming. — HJS

Geophys. Res. Lett. **27**, 2137 (2000).

GEOLOGY

Magmatic Intruders

Despite the apparent chaos of a volcanic eruption, the deposits of ash often present chemically distinct layers and tend to be silica-rich at the bottom and relatively silica-poor at the top. This chemical stratigraphy has been thought to reflect layering within the magma chamber; material near the top of the magma body should be ejected first and thus lie at the bottom of the ash deposits.



The Okmok caldera: mixed or layered?

A variety of processes have been proposed for how magma bodies might produce and collect light, silica-rich magmas at the top of the chamber. Eichelberger *et al.* suggest, however, that magma chambers need not be layered or zoned. They argue that the influx of a silica-rich magma into an existing magma chamber results in layering in ash flow tuffs—and perhaps even in the violent volcanic eruption itself. Processes analogous to those that occur when mafic magmas intrude into silicic ones may lead to the formation of intermixed magmas, which are then preserved in intrusive rocks, and result in much less violent eruptions. — BH

Geology **28**, 603 (2000).

CHEMISTRY

Electrons Take the Plunge

Ultraviolet radiation can create solvated electrons in water, but the dynamics of this process, which has important implications in chemistry and biology, have been difficult to unravel. Laenen *et al.* obtained mid-infrared spectra with femtosecond resolution and have identified two charge-transfer intermediates that precede the formation of a "wet electron." Excitation of water with 9–electron volt photons leads first to the formation of H_3O^+ and a complex between an OH radical and an electron. The complex, which has a lifetime of 110 femtoseconds, decays to form a trapped electron. This species then adds water-solvent molecules, forming the wet electron and then the fully solvated electron. These studies illustrate how even the simplest of solvation processes, surrounding a bare electron with a water-solvent cage, can be an intricate, multistep reaction. — PDS

Phys. Rev. Lett. **85**, 50 (2000)

HIGHLIGHTED IN *SCIENCE*'S SIGNAL TRANSDUCTION KNOWLEDGE ENVIRONMENT

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Requirement for Neurotrophin Signal

Death from Niemann-Pick type C (NP-C) disease is caused by progressive neurodegeneration. The gene mutated in NP-C is thought to be involved in regulating cholesterol metabolism, and cholesterol is important for the formation of lipid rafts that have been suggested to be sites of organization of signal transduction complexes in the plasma membrane. Henderson *et al.* find that cholesterol metabolism in neurons from *npc*^{nih} mice (a model for the human disease) is deficient and that these cells no longer exhibit neurite outgrowth in response to brain-derived neurotrophic factor (BDNF), which in normal cells binds to the TrkB receptor and induces its autophosphorylation. The lack of response to BDNF could be mimicked in wild-type cells by depleting the cells of cholesterol, strengthening the idea that cholesterol plays an important role in promoting cell signaling in response to neurotrophic factors. The data provide a mechanistic link between altered cholesterol metabolism and neurodegeneration, and may offer a clue to the connection between apolipoprotein E alleles and Alzheimer's disease. — NG *J. Biol. Chem.* **275**, 20179 (2000).