EDITORS' CHOICE

edited by Stella Hurtley

APPLIED PHYSICS

Stabilizing Miniaturized Memories

Increasing the bit density of magnetic devices by decreasing the size of the bit that is magnetically written on has yielded storage media operating at a density of about 1 gigabit per square centimeter. At higher densities and smaller bit sizes, however, the stored information on each bit, in the form of a magnetic orientation, becomes susceptible to thermally induced fluctuations and spontaneous reversals of the magnetization.

Lohau *et al.* report results from one possible solution in which the memory elements are patterned. Using an ion-beam, they divide a magnetic thin film of granular cobalt-chromium-platinum into an array of isolated square islands, with dimensions between 80 and 230 nm, corresponding to areal densities of 16 Gbit/cm^2 and 1.6 Gbit/cm^2, respectively. They find that bits with dimensions less than 130 nm comprise a single magnetic domain, can be individually addressed, and are relatively stable to thermal memory loss as compared to similar areas written to in the unpatterned region of the material. — ISO

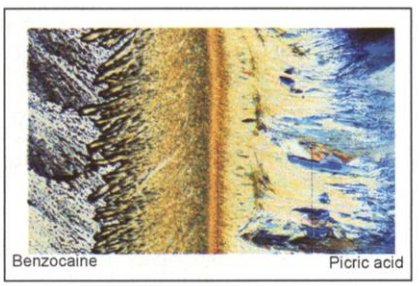
Appl. Phys. Lett. **78**, 990 (2001).

CHEMISTRY

Now You See It....

Many molecules can exist in several crystal forms (polymorphs) possessing different properties such as density, melting point, and vibrational spectra. It is often difficult to obtain crystals of a particular polymorph, and some have been known to "disappear"—after being obtained routinely for a while, suddenly difficulties will be encountered when trying to make them.

Henck *et al.* have developed a strategy for the rational analysis and control of the conditions under which certain polymorphs form—including those that have formerly "disappeared." In a case study of the benzocaine:picric acid system, a low-melting polymorph of this system had been reported to have "disappeared." Optical and thermomicroscopy were used to derive a phase diagram to guide crystal growth for examination by x-ray crystallography. The authors were consistently able to produce crystals of the "disappearing" polymorph. This strategy should now be applicable more generally to identify polymorphs, to develop robust procedures for obtaining individual polymorphs, and to prepare individual crystals for structure determination. — JU



Melting crystals change their form across the benzocaine:picric acid boundary.

J. Am. Chem. Soc., in press.

IMMUNOLOGY

Variety in the Message

Splicing of messenger RNA is critical for protein synthesis and requires binding of the SR family of splicing factors. SR factors are also thought to direct alternative splicing of certain RNAs, leading to changes in the structure and function of the resulting proteins. For the lymphocyte membrane phosphatase, CD45, a variety of splice options are possible, producing isoforms that differentially affect cell signaling.

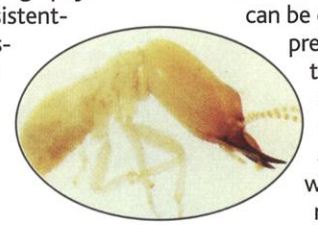
Wang *et al.* used conditional deletion of the gene for the SR splice factor, SC35, in mouse T cells, to study how control of splice variation in the RNA encoding CD45 might influence the biology of these lymphocytes. In the absence of SC35, the splicing of CD45 message was altered producing new CD45 isoforms that impaired T cell development. — SJS

Mol. Cell **7**, 331 (2001).

ECOLOGY/EVOLUTION

Symbiosis, Sociality, and Smell

The evolutionary theory of kin selection requires that social animals recognize their relatives so that altruistic behavior can be displayed preferentially toward kin. In social insects such as bees and ants, where nestmates are close relatives, a variety of heritable odor-based recognition mechanisms have been suggested.



Soldier termite.

Now, in termites, Matsuura has proposed a different kind of cue. The stimulus is still olfactory, but the source is unexpected —symbiotic bacteria inhabiting the insects' gut. The bacterial species present in the gut varies from colony to colony. Feces are routinely used by termites for nest construction and may thus provide the basis for nestmate recognition.

Manipulation of bacterial composition using antibiotics

CONTINUED ON PAGE 1667

GEOCHEMISTRY

Carrying Iridium Around the World

The Cretaceous-Tertiary (K-T) impact event occurred about 65 million years ago and is considered the main cause for the extinction of dinosaurs and other species at that time. Evidence for this impact includes the large impact crater detected at Chicxulub on the coast of the Yucatan Peninsula of Mexico and a globally distributed thin layer of clay minerals at the K-T boundary that contains shocked quartz and is relatively enriched in iridium.

Wdowiak *et al.* performed a series of cryogenic Mössbauer spectroscopic measurements on samples from the uppermost section of the boundary layer collected from sites in Central and North America and in Europe. These upper sections are distinctly redder than the lower sections and enriched in hydrous iron oxides or iron sulfates. The spectroscopic data identifies nanometer-size particles (nanoparticles) of goethite (α-FeOOH) in most of the samples while the sections sampled in Italy are enriched in hematite (α-Fe_2O_3). These nanoparticles may represent the vaporized remnants of the impactor. Modeling suggests that most of the impactor probably was vaporized, and small particles left over from this ejection and vaporization may have settled out of atmosphere at a later time, which would help populate the globally distributed boundary layer. Thus, these nanoparticles may provide clues to the composition of the impactor, which is unknown, and information about the dynamics of the event. These nanoparticles also may be the carrier phase for the iridium, a siderophile element, whose microstructural location also is unknown. — LR

Meteorit. Planet. Sci. **36**, 123 (2001).

SOURCE: (TOP) HENCK *ET AL., J. AM. CHEM. SOC.* IN PRESS; (BOTTOM) IMAGE: TIMOTHY G. MYLES, PH.D., UNIVERSITY OF TORONTO

affected recognition patterns, and termites exposed to bacterial extracts from other colonies were later attacked by their own nest-mates. Thus bacterial symbiosis may have ramifications beyond digestive cooperation. — AMS

Oikos **92**, 20 (2001).

MICROBIAL ECOLOGY

Desert Rescue

The sustainability of Mediterranean ecosystems is threatened by the factors that make them special—long hot dry summers, occasional drenching rain, and human activity. These ecosystems are characterized by specialist shrub communities, in which legumes are key. The leguminous shrubs succeed because they are host to fungal and bacterial symbionts that allow the plant to scavenge for nitrogen and phosphorus in poor, arid soils, as well as helping to stabilize the soil structure and retain water.

Requena and colleagues examined microbial soil communities in desertified areas of Almeria in southeastern Spain. Young plants were inoculated with strains of arbuscular mycorrhizal fungi and species of nitrogen-fixing *Rhizobium*. Five years later, the plants inoculated with native mycorrhizae were twice as large as those denied a symbiont or given an exotic fungus. There were also significant improvements in the physicochemical properties of the soil around the plants. So, to bring damaged land back from the brink of desert, it is not enough to sprinkle it with water and add plants—the microbial community must also be restored. — CA

Appl. Environ. Microbiol. **67**, 495 (2001).

CELL BIOLOGY

Merging Mitochondria

Mitochondria lead a dynamic life involving multiple fusion and fission events to ensure that all of the mitochondria within a cell remain equivalent. Whilst these processes have been observed microscopically, little is known about the molecular mechanisms involved. Fusing two mitochondria poses a topological dilemma: each mitochondrion is bounded by two membranes, so how can both sets of membrane be fused in a coordinated fashion?

Fritz *et al.* may have found the answer, in the shape of a protein known as Fzo1. This protein is critical for mitochondrial fusion and appears to be able to link the inner and outer mitochondrial membranes. If, during mitochondrial fusion, the two membranes were joined, only a single fusion event would be needed to generate faithfully fused mitochondria. Whether Fzo1 is itself the fusogen remains to be determined, but it appears to possess the required characteristics, and may well be in the right place at the right time. — SMH

J. Cell Biol. **152**, 683 (2001).

HIGHLIGHTED IN *SCIENCE*'S SIGNAL TRANSDUCTION KNOWLEDGE ENVIRONMENT

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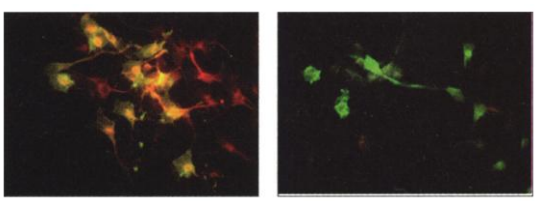
Neurogenin Inhibits Astrogenesis

In generating neurons and glia from neural stem cells developmental choices must be made. Neurogenin is a transcription factor involved in promoting neuronal differentiation by increasing the expression of neuronal genes. Glial differentiation results from the activation of the Jak/STAT pathway downstream of two cytokines, LIF and CNTF, and from activation of a Smad pathway downstream of bone morphogenic protein.

Now Sun *et al.* show that neurogenin also actively inhibits glial differentiation by mechanisms that do not require it to bind DNA. Instead, neurogenin interacts with the transcription coactivator CBP/p300 and the transcription factor Smad1 to prevent the formation of a CBP/p300-Smad1-STAT3 complex required for the induction of glial-specific genes. Overexpression of neurogenin in neural stem cell cultures suppressed phosphorylation of STAT1 and STAT3 in response to LIF and CNTF. Thus, neurogenin acts independently as a transcriptional activator for neurogenesis and as a signal transduction inhibitor in glial differentiation. — JN

Cell **104**, 365 (2001).



Differentiating cells infected with a virus (green) so that they express mutant (left) or normal neurogenin (right) only express an astrocyte marker (red) in the absence of normal neurogenin.

CREDITS: SUN *ET AL.*, *CELL* **104**, 365 (2001).