EDITORS' CHOICE

edited by Gilbert Chin

NEUROSCIENCE

Savings and Acquisitions

Having learned to ride as a child, even a sedentary adult can hop on a bicycle and pedal away without much practice. This phenomenon of rapid reacquisition of a motor skill is described in scientific terms as savings.

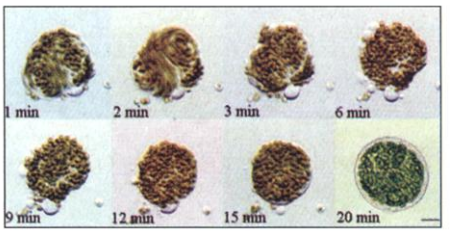
In a combined experimental and computer simulation study, Medina *et al.* analyzed the mechanisms underlying the savings observed in rabbits prompted to close their eyelids, a type of learning known to involve cerebellar pathways. In a typical Pavlovian paradigm, conditioned responses developed in the acquisition phase. During a subsequent period of extinction training, normal conditioned responses disappeared; however, a residual plasticity persisted for over 6 weeks and contributed to the savings during the reacquisition phase. The rate of reacquisition correlated with the magnitude of short-latency responses during the last extinction session before relearning. Pharmacological blockade that disconnected the cerebellar cortex confirmed the predictions of the computer simulation and indicated that the location of plasticity might be in the cerebellar interpositus nucleus. — PRS

J. Neurosci. **21**, 4081 (2001).

CELL BIOLOGY

Life After Life

Algae are composed of a branched community of giant multinucleate cells. As in all walks of life, algal cells may sustain life-threatening injuries such as a breach of cellular integrity. Kim *et al.* describe a process by which damaged giant cells of the green alga *Bryopsis plumosa* can regenerate multiple small cells from extruded protoplasm. In seawater, the extruded intracellular organelles coalesce, swirling around to rapidly become covered by a gelatinous envelope composed of polysaccharides. Inside this envelope, which appears to act as a temporary cell membrane, a new lipid-based membrane forms over the subsequent 9 to 12 hours. This rescue process appears to be a very efficient method of recovering from a potentially fatal situation—from a single damaged algal branch, approximately 1000 cells can form, 40% of which can go on to produce new plants. — SMH



The first 20 minutes of the regeneration process.

J. Cell Sci. **114**, 2009 (2001).

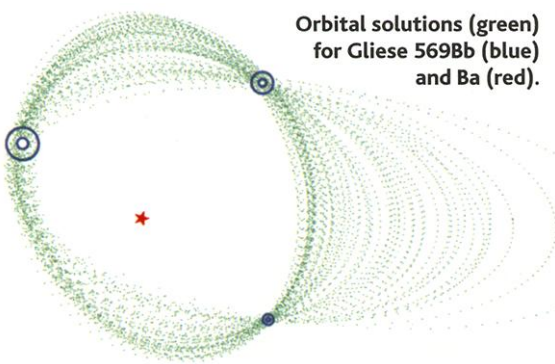
IMMUNOLOGY

Presenting the Alternatives

Studies using experimental infection models of *Mycobacterium tuberculosis*, the agent that causes tuberculosis, suggest that $CD8^+$ T cells may play an important role in controlling this disease. However, the noncytosolic location of this bacterium within infected macrophages impedes presentation of epitopes via the class I major histocompatibility complex (MHC) pathway. Thus, nonclassical pathways of presentation have been implicated in immune recognition of *M. tuberculosis*.

Chun *et al.* describe the participation of a new category of nonclassically restricted peptides in T cell recognition of *M. tuberculosis*. Candidates were identified by screening the bacterial genome for sequences exhibiting identity with *N*-formylated peptides already known to bind preferentially to the murine nonclassical MHC class Ib protein, H2-M3. Several of the identified peptides induced H2-M3 restricted $CD8^+$ cytotoxic lymphocyte (CTL) responses after priming in vivo. These CTLs could lyse infected macrophages, as well as peptide-loaded target cells, and also were present in mice infected with *M. tuberculosis*. Identification of similar pathways of *N*-formyl peptide presentation in humans might prove useful in the development of new vaccines. — SJS

J. Exp. Med. **193**, 1213 (2001).



Orbital solutions (green) for Gliese 569Bb (blue) and Ba (red).

SOURCE: (LEFT) KENWORTHY *ET AL.*, *ASTROPHYS. J.*, IN PRESS; (RIGHT) KIM *ET AL.*, *J. CELL SCI.* **114**, 2009 (2001)

ASTROPHYSICS

Weighing Three Brown Dwarfs

Brown dwarfs are failed stars; born with a low mass, they quickly ran out of deuterium for fusion and became dim cool remnants of stellar material. Although many brown dwarfs, including a few brown dwarf binary systems, have been identified, the mass of these objects and how they evolved are poorly understood.

In order to address some of these questions, Kenworthy *et al.* took a closer look at the brown dwarf binary system Gliese 569B. Using near-infrared bispectrum speckle interferometry techniques, they obtained spectra of the two dwarfs over a period of 1.5 years, which corresponds to about half of the orbital period of the system. Combined with infrared spectra, these results suggested that one of the binary dwarfs, Gliese 569Ba, may itself be composed of a tight binary system. This pair would orbit Gliese 569Bb at a separation of about 1 astronomical unit. In this model, orbital simulations indicate that each brown dwarf would weigh about 50 Jupiter masses and have similar luminosity and that this system would be young (only about 300 million years old). A three-brown-dwarf system would be consistent with current evolutionary models of how brown dwarf properties (mainly their mass and luminosity) change with time. — LR

Astrophys. J., in press.

BIOMEDICINE

Blood and Nerve

Vascular endothelial growth factor (VEGF) plays a key role in controlling the growth and permeability of blood vessels. When oxygen levels fall (hypoxia), VEGF is rapidly up-regulated, thereby ensuring that tissues are perfused adequately, through a promoter sequence in the *VEGF* gene called the hypoxia response element (HRE). Oosthuyse *et al.* generated mice that were lacking the HRE and therefore produced inadequate amounts of VEGF under

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hypoxic conditions. Surprisingly, the mice developed an adult-onset neurodegenerative disease with many of the characteristics of amyotrophic lateral sclerosis (Lou Gehrig's disease). The motor neuron degeneration in the mice appeared to be caused in part by a reduction in neural vascular perfusion, but cell culture studies supported the tantalizing possibility that VEGF served as a survival factor for motor neurons.

This connection to neuronal ischemia also was noted by Schratzberger *et al.* in a recent study of diabetic neuropathy, a frequent complication of diabetes in which patients experience loss of sensation in their lower extremities. Intramuscular injection of *VEGF* DNA in two animal models of diabetic neuropathy resulted in restoration of peripheral nerve function, and this reversal of symptoms correlated with an increase in nerve blood flow. Together, these studies raise the possibility that VEGF may have therapeutic applications well beyond those originally envisaged. — PAK

Nature Genet. **28**, 131 (2001); *J. Clin. Invest.* **107**, 1083 (2001).

APPLIED PHYSICS

Building Suspension Bridges

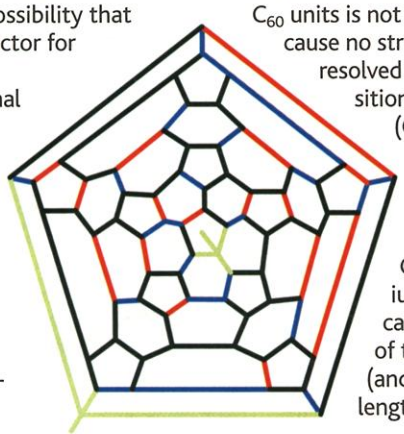
The successful development of microelectromechanical (MEM) systems will depend on robust techniques for forming mechanical structures readily and reproducibly on the micrometer scale. Strittmatter *et al.* demonstrate the ability to form suspended membranes of p-type GaN, a material whose large piezoelectric response and chemical resilience make it an ideal candidate for MEM applications, especially in harsh environments. The p-type GaN is deposited on a sacrificial layer of n-type GaN. When placed in aqueous potassium hydroxide and exposed to ultraviolet illumination, the n-type material becomes photosensitive and etches away, leaving a freestanding p-type layer. Regions of n-GaN shielded from illumination by patterned metal photomasks deposited on the p-GaN act as pillars to hold the bridge in place. Application of a small positive bias to the metal mask regions during the electrochemical etch results in an enhanced etch rate approaching 30 micrometers per minute. — ISO

Appl. Phys. Lett. **78**, 3226 (2001).

CHEMISTRY

C_{70} Ions in Chains

Fullerenes such as C_{60} and C_{70} are easily reduced and can accept a large number of negative charges. Dimeric, oligomeric, and polymeric $(C_{60}^{n-})_x$ ions have been studied, but the nature of the bonds linking the C_{60} units is not known precisely because no structural study has yet resolved all of the carbon positions; few studies of $(C_{70}^{n-})_x$ ions have been reported.



Schlegel diagram with increasing bond lengths (blue, black, red, green).

Brumm *et al.* have synthesized a linear polymeric C_{70}^{2-} species as a barium salt and have localized and refined all of the carbon atoms (and thus the bond lengths) of the fullerene cage. The C_{70} units form zigzagging chains that are connected by bonds between carbon atoms in the five-membered rings at the "ends" of the molecule (these are the rings through which the fivefold rotational axis runs). In a two-dimensional representation (Schlegel projection) of the C_{70} molecule, the central pentagon represents the C_{70} face closest to the reader, and the outermost pentagon represents the opposing face on the far side of molecule. The bond lengths indicate that the negative charges are not localized on specific carbon atoms. — JU

Angew. Chem. Int. Ed. **40**, 2069 (2001).

CLIMATOLOGY

Storms of the Centuries

Although Atlantic hurricanes frequently strike the southeastern United States and the Gulf of Mexico coast, some reach as far north as New England. The most recent devastating hurricane hit New England in 1938; the storm surge covered parts of Long Island, produced widespread destruction, and devastated many coastal areas. Donnelly *et al.* used the historical records of major New England hurricanes, which extend back to 1635, to develop a 700-year sedimentary record from a salt marsh in Rhode Island. Hurricanes with large storm surges deposited a clear sandy layer in the marsh. Dating these layers showed that major hurricanes, which produced storm surges that flooded the marsh, have occurred about once per century during this period. — BH

Geol. Soc. Am. Bull. **113**, 714 (2001).

CREDITS: BRUMM *ET AL., ANGEW. CHEM. INT. ED.* **40**, 2069 (2001)