EDITORS' CHOICE

edited by Stella Hurtley

Muraroa atoll.

ECOLOGY/EVOLUTION

After the Catastrophe

The study of recolonization and succession after catastrophic disturbance can offer insights into the rules governing the assembly of ecological communities and how species interact during colonization and invasion, as well as the speed and trajectory of recovery. Catastrophes—and responses thereto—come in many forms.

Planes *et al.* followed the recovery of coral reef fish assemblages after a thoroughly unnatural catastrophe: the underground nuclear tests carried out at Mururoa atoll in the Pacific between 1976 and 1995. Typically, the pressure wave from each test caused the instant death of all fish within 2000 m of the test site, while leaving the reef structure unchanged. Even so, the fish diversity and abundance that are characteristic of undamaged reef were restored within 1 to 5 years by immigration and recruitment from neighboring areas, suggesting that reef structure is a vital factor in community assembly. In contrast, Pitman *et al.* document a very slow recovery after a catastrophic flood that probably took place in an Ecuadorian tropical rain forest five centuries ago; tree species number has yet to recover to half that of neighboring unaffected areas, and there is a greater abundance of light-demanding early-successional species. — AMS

Ecology **86**, 2578 (2005); *J. Trop. Ecol.* **21**, 559 (2005).

VIROLOGY

Keeping Your Enemies Close

The immune system's battle with the human immunodeficiency virus is now a familiar one, yet an equally important struggle takes place between host and virus within the cell. In particular, the cellular antiviral factors belonging to the APOBEC3 family of cytidine deaminases impair provirus function by peppering the viral genome with unwanted mutations through the replacement of guanine with adenine (G→A). To protect itself, HIV-1 has evolved a protein (Vif) that binds to and directs the degradation of APOBEC3G and APOBEC3F.

By scrutinizing viral sequences derived from patients and short-term viral isolates, Simon *et al.* identified naturally arising variants of the HIV *vif* gene at significant frequency. Some of these mutations caused loss of Vif activity, whereas others modified its function. Correspondingly, provirus sequences from certain individuals with Vif variation carried patterns of G→A replacement that were consistent with activity of APOBEC3G. In other cases, APOBEC3F or both enzymes appeared to be active in generating HIV mutations, suggesting that Vif variants were mediating partial and distinct inhibitory effects on APOBEC3 activity. Thus, rather than simply silencing the APOBEC3 proteins altogether, variation in Vif may allow it to employ the assistance of host factors in increasing viral sequence diversity within an infected individual. — SJS

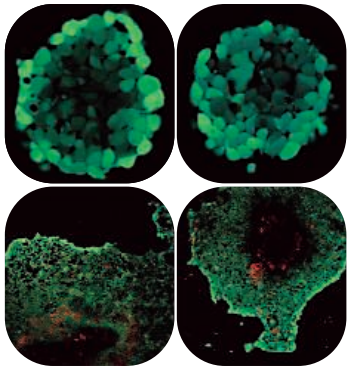
PLoS Pathog. **1**, 20 (2005).

CELL BIOLOGY

Long-Lived Cells

Long-term storage of cells at very low temperatures can be very costly.

Therefore, simple and reliable methods to maintain stable cells at ambient temperature would be desirable. Prior methods have used trehalose or glycan as additives for relatively short-term cell storage of air-dried cells from monolayers. Jack *et al.* now demonstrate storage of mammalian tissue culture cells at room temperature for up to 6 weeks. In this method, cells are grown in such a way that they cannot attach to the culture vessel surface and form three-dimensional multicellular aggregates. The surface cells of these "spheroids" become quiescent. The spheroids can then be stored on agarose under partial vacuum with antistatic control in the dark at room temperature. After rehydration, cells were able to recover and grow when cultured further. Cell survival and recovery after rehydration depend on endogenous cytokine production and the subsequent activation of JNK and NF–kappa B signaling. Hopefully, the ability to induce metabolic arrest in human cells without chemical intervention will be useful to study cell cycle control and aging as well as other metabolic processes and disease. — BAP



Outgrowth of cells from spheroids before (left) and after (right) storage. Dead cells are stained red.

J. Cell Physiol. 10.1002/jcp.20499 (2005).

APPLIED PHYSICS

Carrier Dynamics Under the Microscope

The performance of electronic devices such as thin-film transistors or semiconductor-based light-emitting diodes depends crucially on the dynamics and spatial distribution of the carriers throughout the device. In the case of light-emitting diodes, carriers can be lost because of both radiative and nonradiative recombination. Although imaging the radiative losses is fairly straightforward, imaging the nonradiative recombination centers presents more of a challenge. Okamoto *et al.* have developed a pump-probe technique based on scanning near-field optical microscopy and use it to image, on the submicrometer scale, the radiative and nonradiative recombination centers throughout the active layer of an indium-gallium-nitride quantum-well–based light-emitting diode. Knowledge of the relative contributions

CONTINUED ON PAGE 593

CREDITS: (TOP) SERGE PLANES; (BOTTOM) JACK *ET AL.*, *J. CELL PHYSIOL.* 10.1002/JCP.20499 (2005)

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from these radiative and nonradiative recombination centers can be expected to lead to improvements in device performance as that information is fed back into the materials preparation and device design. — ISO

Appl. Phys. Lett. **87**, 161104 (2005).

EARTH SCIENCE

Salt and Sustainability

Agriculture in many semi-arid areas of the world requires irrigation—from either stored snowmelt or groundwater. High evaporation rates in turn lead to the accumulation of salts in the soil that hinder productivity and can degrade water quality downstream and, over time, potentially in groundwater. Salination of soils is affecting critical agricultural areas such as the Nile Delta and central California. Schoups *et al*. present a model of the hydrologic history of the San Joaquin Valley, California, that accounts for the salt deposition in soil, the salinity of surface- and groundwater, and the history of water use during the past 60 years. By including information about the shifts in irrigation sources and about extreme droughts, the model accurately predicts the local distribution of salt in the San Joaquin soils. Although the amount of salt in the soils has held steady recently, the model suggests that recharge waters moving through these deposits are increasing the salinity even of deep aquifers, and will likely continue to do so, posing a major problem for the sustainability of agriculture in this region. — BH

Proc. Natl. Acad. Sci. U.S.A. 10.1073/pnas.0507723102 (2005).

NEUROSCIENCE

Adenosine and Sleep

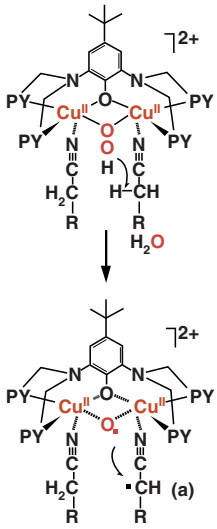
Slow-wave sleep is intricately linked to sleep depth, sleep consolidation, and sleep quality. Slow-wave sleep is also a good measure of the need for sleep, and it is tightly regulated during development. There is accumulating evidence that the neuromodulator adenosine plays an important role in sleep and sleep regulation. Retey *et al*. analyzed the sleep phases and associated EEG patterns of study participants with different genetic variants of the adenosine-metabolizing enzyme adenosine deaminase and of the adenosine A_{2A} receptor. A frequent functional polymorphism in the gene encoding adenosine deaminase contributes to the high inter-individual variability in sleep intensity. Slow-wave sleep was longer and sleep was more intense in participants with the 22G/A genotype than in those with the G/G genotype. Investigation of the A_{2A} receptor polymorphism revealed that the EEG power in the 7.5- to10-Hz frequency range was higher in individuals with the 1976C/C genotype than in others expressing the T/T genotype. However, this difference was observed during the different sleep phases as well as during the waking state. Thus, several aspects of the well-known inter-individual variability in human sleep and the need for sleep are associated with polymorphisms in the adenosinergic system. — PRS

Proc. Natl. Acad. Sci. U.S.A. **102**, 15676 (2005).

CHEMISTRY

Oxidizing Organic Cyanides

Copper monooxygenases can use O_2 to hydroxylate a wide variety of substrates; for example, dopamine α-monooxygenase can convert benzylcyanide to benzaldehyde and cyanide. Li *et al*. have synthesized a dicopper complex that can hydroxylate nitriles. A binucleating ligand was used that binds two Cu(I) ions through three N atoms and thus allows each Cu(I) to also coordinate a nitrile; an OH on the bridging portion of the ligand is noncoordinating. Addition of O_2 at –80°C in nitrile solvent produced a hydroperoxide-bridged Cu(II) species in which the alkylamino N atoms no longer bind the Cu atoms. Warming to room temperature forms the aldehyde from one solvent nitrile, apparently by first eliminating water to form an α-hydroxynitrile that rearranges to leave one Cu(II) with a cyanide ligand. This species then dimerizes to form a tetranuclear Cu(II) complex. — PDS



Reaction scheme.

J. Am. Chem. Soc. 10.1021/ja054948a (2005).

CREDITS: LI *ET AL.*, *J. AM. CHEM. SOC.* 10.1021/JA054948A (2005)

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