EDITORS' CHOICE

edited by Stella Hurtley

ATMOSPHERIC SCIENCE

Carbon Budgeting

Forests take up an average of more than 2 gigatons of fossil-fuel–generated carbon per year. Because relatively few measurements of CO_2 fluxes have been made over entire continents, it is difficult to determine whether temperate forests in the Northern Hemisphere or tropical forests represent the largest carbon sink. Such measurements are difficult because each day there is alternate uptake and release of CO_2 by vegetation, and because there may be surface fluxes of CO_2 over the landscape.

In an attempt to overcome such difficulties, Chou *et al.* present a conceptual framework for using atmospheric measurements made with aircraft to determine fluxes of CO_2 from a continental land area. Using measurements of CO_2, O_3, and CO made over central and eastern Amazonia late in the wet season of 1987, the carbon budget of a substantial area of central Amazonia was shown to be close to balance. Below 3 km, regional fluxes of CO_2 cause atmospheric concentration gradients that can be quantified by systematic aircraft soundings, which should provide important input for global studies of CO_2 uptake. — HJS

J. Geophys. Res. **107**, 4614 (2002).

MATERIALS SCIENCE

Getting Packed

Many spherical objects, including colloids, surfactants, and polymer micelles, will pack into lattices under the right conditions of temperature and concentration. Many of these systems will undergo an order transition with changing temperature, transforming, for example, between closed packing [i.e., face-centered cubic (fcc)] and body-centered cubic (bcc) packing. For atomic and colloidal systems, the number of particles is conserved, so that the transformation must occur by particle rearrangement. However, micelles can undergo fusion, fission, or shrinkage or simply dissolve.

Bang *et al.* examined a polystyrene-polyisoprene diblock copolymer as it was thermally driven between the fcc and bcc phases. The transformation occurred epitaxially, through slippage along close-packed planes, and not by a substantial change in the composition of the micelles. The transition was probably driven by a decrease in the solvent selectivity with increasing temperature. The solvent entered the isoprene-rich micellar core, which would predominantly cause the micelles to swell, pushing the system to the looser bcc lattice. The similarity of the polymeric transitions to other atomic systems supports the notion that the bcc phase is thermodynamically preferred near the melting temperature. — MSL

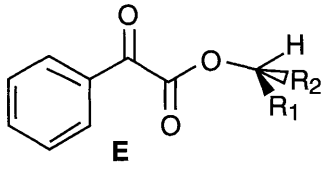
Phys. Rev. Lett. **89**, 215505 (2002).

CHEMISTRY

Steric Triplets

Time-resolved infrared spectroscopy has provided organic chemists with a wealth of information on short-lived intermediates that appear during chemical reactions. One well-studied system is that of the alkylphenylglycolates, which after absorption of an ultraviolet photon form a triplet state whose evolution to form products such as ketenes can be followed on a time scale of hundreds of nanoseconds.

Merzlikine *et al.* have now examined these spectral changes at higher resolution and find evidence for the formation of two different np* triplet states that differ in lifetime by about an order of magnitude and arise from the stereochemistry of the alkyl group. Both conformers can decay intermolecularly, but only the shorter-lived *Z* intermediate decays through an intramolecular pathway (a Norrish Type II elimination) set up by the proximity of the alkyl group to the rest of the molecule. — PDS



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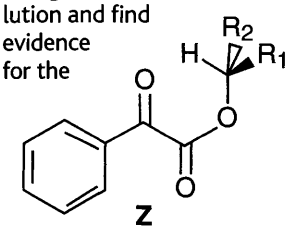


Z

J. Am. Chem. Soc. 10.1021/ja282792 (2002).

Eruption within the Vatnajökull Glacier on 3 October 1996.

CREDIT: (PHOTO) SR GISLASON/UNIVERSITY OF ICELAND AND J. SIGURDSSON

GEOCHEMISTRY

Fire and Ice

Two of the largest aerosol-producing eruptions of the 20th century occurred in Agung, Java, and Pinatubo, Philippines, and each altered the global CO_2 budget.

Now Gíslason *et al.* have estimated the importance of submarine eruptions on the CO_2 budget by measuring the effects of a subglacial eruption. In October 1996, a 13-day volcanic eruption occurred beneath about 500 m of ice within the Vatnajökull Glacier, Iceland. About 3 cubic km of ice melted, and the meltwater, containing about one million tons of dissolved magmatic species, including CO_2, flowed through a channel into the Grímsvötn subglacial lake. The lake was catastrophically drained in a 2-day flood, releasing the meltwater into a subaerial river network that emptied into the ocean. About half of the measured carbon flux from the eruption will be added to the global CO_2 budget; however, there may have been a transient net CO_2 removal from the ocean and atmosphere right after the eruption because of carbonate deposition and biological fixation. — LR

Chem. Geol. **190**, 181 (2002).

ECOLOGY/EVOLUTION

Secrets of the Trees

The annual variations in growth rates recorded in the incremental layers of wood in trees are an important source of information about past climatic patterns. A recently completed international dendrochronological project spanning the entire Holocene period (the past 10,000 years) provides an unparalleled record of climate change across northern Europe, from Ireland to Siberia. The ADVANCE-10K project garnered data from bog- and gravel-preserved pine, oak and larch, as well as from living trees,

CONTINUED ON PAGE 1683

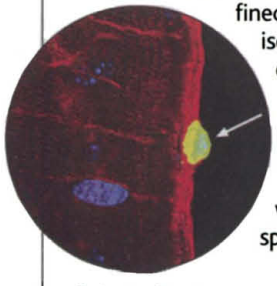
to produce high-resolution chronologies of parameters such as summer temperature, soil moisture, and river flood frequency. The patterns allow reconstruction of the geographical as well as temporal variations in climate, at new levels of spatial detail. — AMS

Holocene **12**, 639 (2002).

BIOMEDICINE

Stem Cell Help for Aching Muscles

The stem cells of skeletal muscle—satellite cells—are particularly well defined as they are easy to isolate and identify, occupying a niche between the plasma membrane and the basal lamina of each myofiber. To test whether this tissue-specific stem cell population could itself be renewed by stem cells from the bone marrow, LaBarge and Blau treated mice with whole-body irradiation to destroy the bone marrow and reintroduced new bone marrow cells that had been engineered to express green fluorescent protein (GFP). Two to six months later, 5% of the satellite cells in the tibialis anterior muscles were labeled with GFP. The cells expressed muscle-specific proteins and were diploid—ruling out their generation by fusion of myoblasts with the introduced bone marrow cells. These bone-marrow–derived muscle stem cells were also recruited to repair damaged muscle after exercise. Thus, stem cells throughout the body may be available to replenish tissues damaged in the course of daily life. — KK



A donor bone marrow–derived satellite cell expressing GFP (green) and a muscle-specific adhesion protein (red, merged white) is juxtaposed to a muscle fiber (left). A satellite cell expressing GFP (green) and a muscle-specific transcription factor (red, merged white) is associated with a repaired GFP-expressing muscle fiber (right).

CREDITS: LABARGE & BLAU, *CELL* 111, 589 (2002)

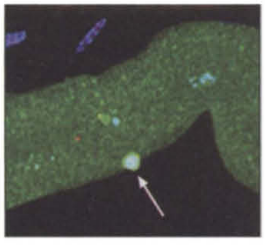
Cell **111**, 589 (2002).

GENETICS

Fat Bodies and Sex

Sex determination in the fruit fly *Drosophila* is mediated by an elaborate network of master regulators, including the transcription factor Doublesex. The target genes of these regulators are of great interest as they may shed light on the mechanisms that create sex-specific differences in morphology, physiology, and behavior.

By screening for genes that show sex-specific expression in the adult *Drosophila* head, two research groups have now identified several candidate targets of Doublesex. Intriguingly, these genes are not expressed in the brain, as had been expected, but in the fat body surrounding the brain. Among the male-specific target genes identified by Fujii and Amrein was *tsx* (for "turn on sex-specificity"), which encodes an odorant- or pheromone-binding protein. Ectopic expression of *tsx* in females reduced their receptivity to mating. Dauwalder *et al.* focused on the male-specific target gene *takeout*, which encodes a secreted protein that may bind small lipophilic molecules such as hormones. Inactivation of *takeout* in males reduced their courtship behavior. Thus fat cells near the brain may play a key role in fly mating behavior. — PAK



EMBO J. **21**, 5353 (2002); *Genes Dev.* **16**, 2879 (2002).

HIGHLIGHTED IN *SCIENCE*'S SIGNAL TRANSDUCTION KNOWLEDGE ENVIRONMENT

Science's stke www.stke.org

Caveolae Conducting Calcium

Caveolae are specialized membrane domains that are thought to function at the plasma membrane in endocytosis and have been found to contain relatively high concentrations of signaling molecules.

Isshiki *et al.* now present evidence that caveolae serve as preferential sites of Ca^{2+} influx across the plasma membrane when intracellular stores of Ca^{2+} are depleted. The calcium sensor yellow chameleon 3.1 was fused to the COOH-terminal end of caveolin-1 to target the sensor to caveolae. Ca^{2+} signals at the caveolae were compared to those from unmodified yellow chameleon in the cytoplasm or from another fusion protein that targeted the sensor to the plasma membrane. When Ca^{2+} was depleted from the endoplasmic reticulum of fetal bovine endothelial cells, Ca^{2+} entry into the cells occurred preferentially at caveolae, apparently though store-operated channels of the TRP family. — LBR

J. Biol. Chem. **277**, 43389 (2002).