EDITORS' CHOICE

edited by Gilbert Chin

EVOLUTION

Sorting Cats with Fats

Phylogenetic relationships among organisms routinely are assessed using morphological characters and, increasingly, DNA sequence data. Where these two techniques produce similar phylogenetic trees, the systematist can be confident that the result is robust; however, consensus is not always achieved. For example, molecular and morphological data have failed to produce agreement about relationships within the cat family (Felidae).

Puma concolor.

Bininda-Emonds *et al.* derive the basis for a new cat phylogeny using another set of data—the chemical cues secreted from the felid anal scent glands, by which the cats recognize their own species. Comparative analysis of the lipid components of this chemical cocktail from 16 felid species produced strikingly consistent results, indicating a strong phylogenetic signal from these compounds. Relationships between many cat species can now be established with more confidence, allowing systematists to focus more closely on the remaining problem areas—especially the phylogenetic positions of the puma and the cheetah. — AMS

Biol. J. Linn. Soc. **72**, 1 (2001).

NEUROSCIENCE

Synchronization During Movement

It has been thought that the relevant code the brain uses to store and process information is the rate at which neurons fire action potentials, or spike. Recently, this idea has been challenged by suggestions that information also may be encoded in the synchronous discharge of assemblies of neurons. Baker *et al.* simultaneously recorded action potential trains from a large number of neurons in the primate motor cortex during a complex movement task that required precise finger coordination interspersed with hold periods. Using the novel statistical technique of time-resolved cross-correlation, they could distinguish genuine changes in synchronization from others that arose from simple co-activation of neurons during the task. They found that synchrony among neurons was maximal during the hold period of the task and that synchrony between trains of action potentials had both oscillatory and nonoscillatory components. Thus, synchrony on a moderate timescale (10 milliseconds) may offer an important mechanism for motor control. — PRS

J. Neurophysiol. **85**, 869 (2001).

GEOPHYSICS

A Bumpy Ride After Deicing

Several large and enigmatic earthquakes have occurred in the interior of tectonic plates, far from stresses that arise at the boundaries between plates. In some cases—particularly in Scandanavia and perhaps the recent earthquake in Antarctica—such intraplate seismicity has been related to the stress induced by unloading the crust after the melting of large ice sheets (deglaciation also has been linked, tentatively, to increased volcanic activity in some areas). Whether this process would produce earthquakes in areas not covered by the great ice sheets has been more difficult to discern.

Grollimund and Zoback now suggest that this process was responsible for seismicity at the New Madrid (Missouri) seismic zone, which was south of the Laurentide Ice Sheet. Although seismicity seems to begin in the region around the time of deglaciation, previous work had concluded that the stresses induced by melting glaciers to the north were too low. By modeling the bending of the lithosphere, the authors suggest that deglaciation increased seismicity by a factor of about three in the region and that the high seismicity should continue in the region for the next few thousand years. — BH

Geology **29**, 175 (2001).

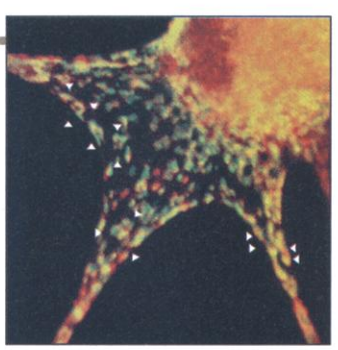
CELL BIOLOGY

Tags for Traffic and Transport

That the Rab family of GTPases functions in the targeting of intracellular vesicles during membrane traffic is well established. Several groups now have extended the remit of the Rab family into the motility arena. Each type of intracellular vesicle is identified by a set of Rab proteins; these specify where it has come from and where it should go. The protein Rab 27a specifically marks two types of secretory lysosomes, the melanosomes (pigment granules) in melanocytes and the cytotoxic granules in cytotoxic T lymphocytes (CTLs).

In CTLs, Stinchcombe *et al.* and Haddad *et al.* show that Rab27a is required for the correct localization and secretion of cytotoxic granules. They also show that these processes are disrupted in *ashen* (possessing a mutated Rab27a) and *gunmetal* (carrying a defective Rab-modifying enzyme) mice, which serve as animal models for the Grischelli and Hermansky-Pudlak syndromes, respectively. From experiments in melanocytes, Hume *et al.*, Bahadoran *et al.*, and Wu *et al.* show that Rab27a mediates the correct localization of melanosomes to the periphery of the cell via interaction with the motor protein myosin Va. — SMH

J. Cell Biol. **152**, 825; 835; 795; 843 (2001); *J. Cell Sci.*, in press.



Rab27a (red) and a melanosome marker (green) colocalize at the periphery of normal melanocytes.

MOLECULAR BIOLOGY

Internal Affairs

Most messenger RNAs (mRNAs) contain a 5′ cap structure that serves as the recognition point for the assembly of a ribosomal initiation complex. Some viruses utilize an RNA sequence motif known as an internal ribosome entry site (IRES) to short-circuit the usual assembly pathway (see Spahn *et al.*, Reports, this issue), and some eukaryotic mRNAs (particularly those needed during times of stress) have been found to contain an IRES, too.

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SOURCE: (TOP) CORBIS; (BOTTOM) BAHADORAN *ET AL.*, *J. CELL BIOL.* **152**, 843 (2001).

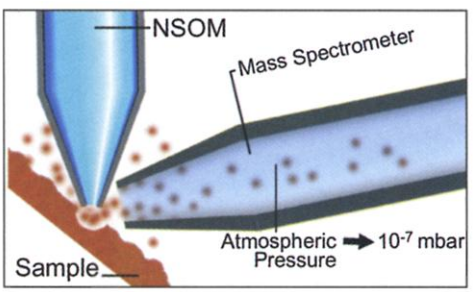
Zhou *et al.* present evidence for a functional IRES in two yeast mRNAs, although in these cases the mechanism of ribosome recruitment may involve base pair formation with the ribosomal RNA rather than a ribosome—mRNA secondary structure interaction. Pinkstaff *et al.* identify an IRES in five mRNAs localized to neuronal dendrites, in which activity-dependent translation has been proposed as a mechanism for long-term changes in synaptic efficacy. — GJC

Proc. Natl. Acad. Sci. U.S.A. **98**, 1531 (2001); *Proc. Natl. Acad. Sci. U.S.A.* **98**, 2770 (2001).

CHEMISTRY

Ambient Nanoscale Mass Spectrometry

Surface analysis by mass spectrometry often is limited in spatial resolution. High resolution (~60 nanometers) can be achieved if tightly focused ion beams are used to desorb surface species, but such approaches require putting the sample under high vacuum. Laser microprobe analysis can be used for samples under ambient conditions, but the resolution is limited to ~2 μm and more typically is ~25 μm. Stöckle *et al.* have used near-field scanning optical microscopy (NSOM) tips not only to image surfaces but also to deliver laser pulses



Laser pulses (NSOM) release surface molecules.

that desorb surface species into the ambient environment. The desorbed species are then taken up through a microscale nozzle into a mass spectrometer. The sampled area can be re-imaged with the NSOM apparatus. They achieved spatial resolutions of 200 nm and were able to detect quantities as small as 2 attomoles. — PDS

Anal. Chem., in press.

CLIMATOLOGY

As Different as Night and Day

Sea surface temperature (SST) is one of the most important quantities used in reconstructions of past climate. The strontium-calcium ratios (Sr/Ca) of the coral mineral aragonite is a widely used (if imperfectly understood) proxy for SST, although calibrations of Sr/Ca performed on modern corals, for which accurate temperature records do exist, generally have confirmed the fidelity of the proxy.

However, a closer look at the mechanics of Sr/Ca variability in one type of massive, symbiotic coral reveals that kinetics, and not simply thermodynamics, play a role. Cohen *et al.* performed high-resolution ion microprobe analyses on samples of *Porites lutea* and found that the relation between Sr/Ca and temperature varied by a factor of nearly five between day and night. Only at night was the relation similar to that observed for inorganic (temperature-controlled) calcite precipitation. Because the bulk of the coral skeleton actually forms during the day, the possibility that the Sr/Ca of coral reflects the rate of photosynthetic symbiont-mediated calcification as well as chemical equilibrium means more sophisticated coral sampling strategies may be required. — HJS

Paleoceanography **16**, 20 (2001).

PHYSICS

Quantum Interference in Minibands

In a three-dimensional crystal, the periodicity of the lattice can give rise to the formation of electronic energy bands and band gaps. Artificial superlattices, such as those comprising an alternating stack of GaAs and AlGaAs layers, also are periodic and can form similar structures called minibands that are isolated by minigaps. In the presence of a magnetic field, electrons residing within the minibands of a spatially modulated two-dimensional electron system (2DES) may interact with each other. Quantum interference effects would be expected when electrons tunnel between minibands to form closed electron orbits, or when the electrons backscatter, which results in interference along open electron paths. However, a short spatial periodicity and a large electron density modulation in the 2DES have been difficult to achieve, which has made it hard to see such quantum-intereference effects.

Deutschmann *et al.* have succeeded in depositing a high-quality, spatially modulated 2DES along the edge of a stacked superlattice structure, where the controlled growth (with atomic layer resolution) of the superlattice provides the requisite spatial periodicity. The observed oscillations in the magnetotransport data are consistent with quantum-interference effects along closed orbits associated with the artificial lattice. — ISO

Phys. Rev. Lett. **86**, 1857 (2001).

CREDITS: STOCKLE *ET AL.*, *ANAL. CHEM.*, IN PRESS.