EDITORS' CHOICE

edited by Gilbert Chin

MOLECULAR BIOLOGY

Finding Rare Transcripts

With gene identification algorithms still being refined, there is interest in finding new tools that can locate genes (and especially the product transcripts) within the human genome. Approximately 10 years ago, the use of expressed sequence tags (ESTs) was described; currently the public EST database contains nearly 4 million entries.

Camargo *et al.* have used an approach, called ORESTES, that complements existing strategies and now describe 700,000 tags. Whereas ESTs tend to be derived from the ends of transcripts, the ORESTES protocol generates tags more frequently from the centers of transcripts, within the coding regions. Furthermore, although the probability of finding an EST corresponding to a gene is related to the level of expression of that gene, ORESTES is better at detecting genes expressed at low abundance. At least 150,000 of these tags, although clearly derived from the human genome, had no counterpart in the publicly available collections of transcripts. Although the technique is labor-intensive, requires highly purified RNA, and can generate PCR artifacts, the demonstration that a set of ORESTES markers can serve as a scaffold that can then be joined together to form a complete transcript sequence shows the promise of the approach. — BJ

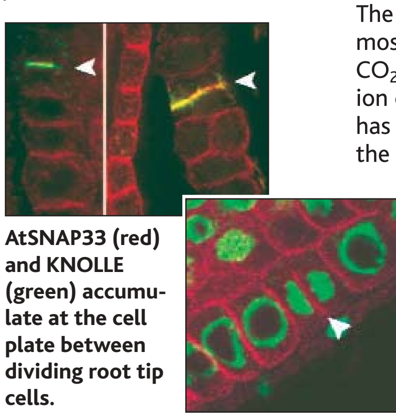
Proc. Natl. Acad. Sci. U.S.A. **98**, 12103 (2001).

PLANT SCIENCE

Action at the Plate

During the final stage of cell division (cytokinesis) in plants, a cell plate composed of cellular membranes forms between the two nuclei and fuses to separate the daughter cells. In *Arabidopsis*, KEULE and KNOLLE, two homologs of mammalian SNARE proteins known to be involved in cellular fusion reactions, participate in the fusion events of cytokinesis. Lack of either protein precludes the growth of mutant plant cells in callus culture, as well as the formation of viable plants.

Heese *et al.* now describe a protein termed AtSNAP33,



AtSNAP33 (red) and KNOLLE (green) accumulate at the cell plate between dividing root tip cells.

which is a homolog of another mammalian SNARE, SNAP25. The protein interacts directly with the cytokinesis-specific KNOLLE at the cell plate. When AtSNAP33 function was blocked, the leaves of these mutant plantlets became necrotic, leading to plant death before flowering. Two other SNAP25 homologs may compensate partially for loss of AtSNAP33 in cytokinesis; however, the presence of improperly divided cells eventually weakens plant structures, and death follows. — SMH

J. Cell Biol. **155**, 239 (2001).

PALEOCEANOGRAPHY

An Uncompromised Carbonate Record

The strong dependence of atmospheric partial pressure of CO_2 (pCO_2) on the carbonate ion content of the deep ocean has made reconstruction of the temporal evolution of deep-water carbonate chemistry over glacial cycles an important goal for paleoceanographers. Past variations of deep-ocean CO_3^{2-} concentrations are recorded in many marine sediments, but most records are compromised by problems such as low sedimentation rates, chemical erosion, and bioturbation.

Hodell *et al.* demonstrate that the carbonate record from a single site in the deep South Atlantic (Ocean Drilling Program Site 1089) represents a qualitative, high-resolution record of the temporal evolution of the carbonate saturation state of the deep sea. From the phase relations between the site 1089 carbonate signal and benthic $\delta^{18}O$, seawater Sr/Ca, and pCO_2, they conclude that sea level helps control carbonate compensation (the accumulation or dissolution of carbonate sediments in response to changes in the distribution of alkalinity and dissolved inorganic carbon) in the deep sea, and that carbonate compensation plays an important role in amplifying pCO_2 variations caused by other mechanisms. Additional measurements of dissolution indices as a function of depth may make it possible to determine quantitatively deep-sea carbonate ion changes and to evaluate their impact on pCO_2 variability over glacial cycles. — HJS

Earth Planet. Sci. Lett. **192**, 109 (2001).

MICROBIOLOGY

Have Your DNA and Eat It Too

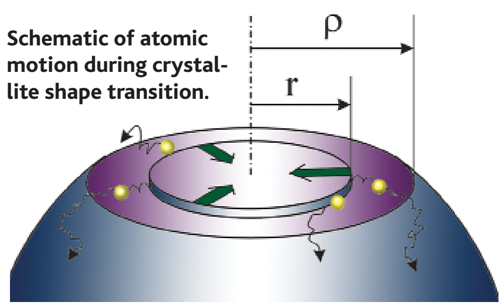
Bacteria readily consume extracellular DNA by various mechanisms. The acquisition of foreign DNA contributes to horizontal gene transfer and is of experimental utility. Finkel and Kolter now offer data to show that homo- and heterospecific DNA can fully

PHYSICS

Peeling away Facets

The stability of microcrystallites in response to changes in external conditions is an important issue in nanotechnology and microfabrication. Thürmer *et al.* used variable-temperature scanning tunneling microscopy to observe the transition of a lead crystallite on a ruthenium (0001) surface from one stable state to another. At temperatures between 500 and 550 K, micrometer-sized crystallites of lead are spherical. A rapid drop in temperature (to between 353 and 423 K) changes the chemical potential of the step free energy (which depends on the distances ρ and *r*) and leads to a shape transition that preserves volume. A (111) facet forms on top of the lead crystallite as material is transferred layer by layer to the sides of the crystallite. Sequential peeling of the top layer slows as the new stable shape is reached and the difference in chemical potential diminishes. — PDS

Schematic of atomic motion during crystallite shape transition.



Phys. Rev. Lett. 10.1103/PhysRevLett.87.186102.

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SOURCE: (LEFT) HEESE ET AL., J. CELL BIOL. 155, 239 (2001); (RIGHT) THÜRMER ET AL., PHYS. REV. LETT. 10.1103/PHYSREVLETT.87.186102

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support the growth of *Escherichia coli* in the absence of other nutrients. Not all bacteria, including *E. coli,* are naturally competent for genetic transformation; after all, recombination with heterologous DNA is risky. Tellingly, for several species, competence (mediated by the *com* family of genes) is induced only by starvation. Despite lacking natural competence, *E. coli* possesses *com* gene homologs that, if mutated, destroy its capacity to compete with wild-type bacteria during stationary phase, presumably because the mutants no longer can eat the DNA released into the medium from dying bacteria. — CA

J. Bacteriol. **183**, 6288 (2001).

GEOCHEMISTRY

Making a Meal of Minerals

Bacteria influence a variety of chemical reactions in soils and rocks, and many of these bacteria obtain metabolic energy through oxidation-reduction reactions associated with metal atoms that are trapped in minerals. A better understanding of these processes will require further examination of how bacteria attach to and interact with metal-containing minerals. Several papers, collected from two recent conferences by Haas and Fein, address the interaction between bacteria, particularly those that reduce or oxidize iron, and host silicate minerals in reactions ranging from weathering to the formation of stalagmites in caves to mineral deposition. There is a close correspondence between environmental conditions, such as pH, and the rate of solution or dissolution. Several studies have found that other minerals, particularly iron oxides, form during bacterial metabolism on silicate minerals and complicate these interactions. — BH

Chem. Geol. **180**, 1 (2001).

NEUROSCIENCE

The Well-Networked Synapse

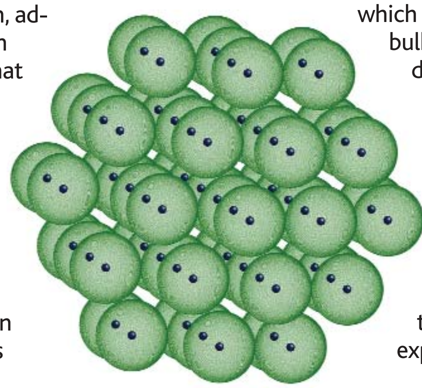
Neuronal function relies on precisely apposed synaptic contacts between the upstream cell, which releases transmitters via synaptic vesicle exocytosis, and the downstream cell, which harbors the receptors occupied by the transmitters. Recent studies have begun to lay a biochemical foundation for the interpretation of classical electron microscopic observations of networks of electron-dense material on the cytoplasmic surface of the presynaptic membrane. Phillips *et al.* describe the isolation of a "presynaptic particle web" from mammalian brain; this web consists of 50-nanometer particles within a mesh of thin (about 10-nm) fibrils, which is qualitatively similar to the well-studied, spectrin-based cytoskeletal structure of the erythrocyte and also to the "active zone material" at the neuromuscular junction. Proteins were identified as loosely or tightly associated, and these assignments were consistent with their known or suspected functional roles. The interaction of this web with the presynaptic cytomatrix, the substructure that is thought to help guide and mobilize synaptic vesicles (as Koushika *et al.* show for the protein Rim), is reminiscent of the fibrillar basket that guides export cargoes to and through the nuclear pore. — GJC

Neuron **32**, 63 (2001); *Nature Neurosci.* **4**, 997 (2001).

CHEMISTRY

Gently Probing Bulk-like Clusters

Small clusters of atoms or molecules may differ in structure from the equivalent bulk material, with the size at which the transition to bulk structure occurs depending on the material. Theoretical predictions suggest that neutral weakly bound molecules may form the bulk structure at small cluster numbers, but experimental verification of this has been difficult. Molecular beam electron diffraction provides structural information about large clusters, but resolution deteriorates for clusters with fewer than several hundred molecules. Electron impact mass spectrometry can lead to extensive fragmentation, and the products tend to reflect the properties of ionic clusters and molecules more than those of neutral ones.



A nearly spherical 59-molecule SF_6 cluster.

To overcome these problems, Ingólfsson and Wodtke have studied SF_6 clusters with the gentle approach of electron attachment mass spectrometry. The authors conclude that bulk structures are indeed formed by clusters smaller than 50 molecules, confirming theoretical predictions. — JU

Phys. Rev. Lett. 10.1103/PhysRevLett.87.183401.

CREDITS: INGÓLFSSON AND WODTKE, PHYS. REV. LETT. 10.1103/PHYSREVLETT.87.183401

Science

An Uncompromised Carbonate Record

H. Jesse Smith

Science **294** (5543), 747.
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