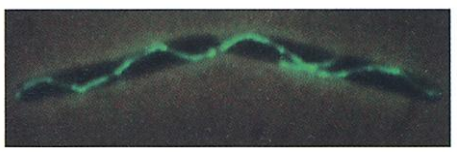
EDITORS' CHOICE

edited by Gilbert Chin

MICROBIOLOGY

Forcing Partition

The description by Jones *et al.* of actinlike proteins forming a meshwork in *Bacillus subtilis* has contributed to a discussion of how bacteria might generate forces that, in eukaryotic cells, require a cytoskeletal framework. One such process for which force is needed is the allocation of replicated bacterial DNA (chromosome and plasmids) to the daughter cells. Møller-Jensen *et al.* have studied the actinlike filament composed of the ParM ATPase, which is encoded on the R1 plasmid in *Escherichia coli*. They find that ParM polymerization required ATP (like actin) and appeared to utilize a nucleation site established by two other regions of the *par* locus: the DNA binding protein ParR and the centromerelike DNA region *parC*. Together, these components segregate plasmids to opposite ends of the cell, in a fashion analogous to how the mitotic spindle functions in eukaryotic cells. — SMH



ParM (green) can form helical filaments.

Cell **104**, 913 (2001); *EMBO J.* **21**, 3119 (2002).

APPLIED PHYSICS

Tunable Nanocrystalline Lasers

The discrete energy levels of quantum dots, or nanocrystals, provide a potential advantage for their use in laser sources requiring thermal stability and low threshold. Moreover, as the energy spacing is dependent on the size of the nanocrystal, the emitted wavelength can be tuned by size selection. However, although optical gain has been observed in colloidal nanocrystalline thin films, the intrinsic disorder of the colloids and the dominance of nonradiative recombination mechanisms have prevented lasing from occurring and have limited operation to cryogenic temperatures.

Eisler *et al.* show that by spin coating a layer of CdSe nanocrystals dispersed in titania onto a patterned diffraction grating, and selecting the layer thickness to match the Bragg condition of the grating, lasing can be achieved at room temperature. The ease of processing and the ready availability of other semiconductors in nanocrystalline format may allow the development of laser sources over a wide range of wavelengths and on a variety of substrates. — ISO

Appl. Phys. Lett. **80**, 4614 (2002).

NEUROSCIENCE

Of RNA, Rhythms, and Arborization

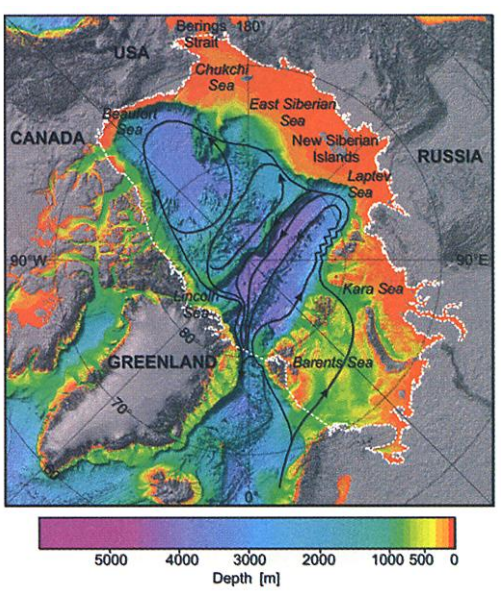
Fragile X syndrome is an inherited disorder that causes mental retardation in humans. Effects of mutation in the *fmr1* gene range from abnormal neurite morphology to alterations in the sleep-wake cycle. The FMR1 protein binds RNA selectively, and it has been suggested to participate in messenger RNA processing. Morales *et al.* and Dockendorff *et al.* have examined the function of the homologous protein dFMR1 (or dFXR) in *Drosophila*. These authors show that, as in mammals, dFMR1 is expressed in brain neurons, where it affects neurite morphology and axonal guidance; the dorsal cluster and lateral neurons show more abnormalities than do photoreceptor neurons, which correlates with alterations in eclosion and circadian rhythms. It appears that dFMR1 activity is required downstream of the molecular pacemaker, but the central questions of which RNA molecules are targeted and how these regulate neuronal development remain. — PJH

Neuron **34**, 961; 973 (2002).

GEOLOGY

The Smallest Ocean

The geometry of the Arctic Ocean (depth, seafloor area, volume) has been difficult to determine accurately. Large parts of the Arctic are covered by ice for much of the year, and it has not been nearly as well mapped by satellites and ships as the other oceans. Despite its small size, the circulation and dynamics of the Arctic Ocean have played important roles in Earth's recent climate.



Relief map of the Arctic Ocean (white border) and inferred circulation (black lines).

Jakobsson has combined newly declassified submarine data with satellite and sounding data in a new analysis, revealing that the Arctic Ocean and its adjoining seas have extensive continental shelves whose extent is half of the entire basin. This makes the Arctic the shallowest of all of the oceans with a mean depth of only 1201 meters. The extensive shelves indicate that the circulation in the Arctic Ocean is particularly sensitive to worldwide changes in sea level, as have occurred repeatedly during glaciations in the past two to three million years. — BH

Geochem. Geophys. Geosys. **3**, 10.1029/2001GC000302 (2002).

ASTROPHYSICS

The First Bursts

Theoretical work and recent observations have suggested a scenario in which many of the first stars that formed (called population III stars) were supermassive (greater than 260 solar masses) and collapsed into supermassive black holes that swallowed all of the heavy elements (metals) created by the nucleosynthetic processes. If correct, then the early universe may have had a different environment and structure, with a higher rate of electron-positron pair instability supernovae and a larger number of supermassive black holes.

Schneider *et al.* adopt an ingenious approach to determine whether the initial mass function (IMF) is skewed toward very massive stars; it is based on the calculated flux of diffuse neutrino emission from gamma-ray bursts (GRBs) from supermassive population III stars. If the IMF is top-

CONTINUED ON PAGE 2301

heavy, then high-energy neutrino emission will dominate two energy bands that current (AMANDA-I) and forthcoming (AMANDA-II and IceCube) neutrino telescopes can measure. Thus, detecting the properties of the elusive neutrino at high energies and, possibly, a new type of GRB (the first GRBs, with peak energies in the x-ray regime and longer durations) will open a window into the evolution and structure of the earliest stages of star formation and metal enrichment of the universe. — LR

Mon. Not. R. Astron. Soc. **334**, 173 (2002).

CHEMISTRY

Copper Route to (*E*)-Alkenes

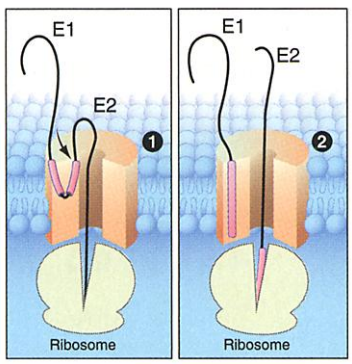
Mild methods exist for reducing alkynes to cis alkenes while leaving other functional groups on the molecule intact. This is more difficult when the trans isomers are desired, because the existing routes are harsher and often require activating functional groups near the triple bond. Trost *et al.* have modified a synthetic route in which the triple bond is hydrosilylated with a ruthenium complex and then converted to the trans alkene by treatment with tetrabutylammonium fluoride (TBAF). Elevated temperatures (~80°C) in this last step have limited its general use, but the authors have found that addition of cuprous ion (as CuI) allows the C-Si bond to be cleaved catalytically at much lower temperatures (~35°C) in high yields. Because CuI buffers the reactivity of TBAF toward other functional groups, in cases where more reactive functional groups are present, the copper complex is used in stoichiometric amounts. — PDS

J. Am. Chem. Soc. 10.1021/ja026457l (2002).

BIOCHEMISTRY

Doing Double Duty

For a membrane protein, achieving the proper topological arrangement generally relies on two encoded domains. An NH_2-terminal signal sequence helps to attach the protein synthesis machinery to the translocation pore in the target membrane; in many cases, this leader sequence of about 10 residues is later cleaved and discarded. Second, a transmembrane region of about 20 to 25 residues contains hydrophobic amino acids that fix the protein within the lipid bilayer. Cocquerel *et al.* describe how hepatitis C virus has combined these domains into one segment for its envelope proteins E1 and E2, which are made as a single unit. The signal sequence of E2 overlaps almost completely with the last half of the transmembrane region of E1. Thus, after the E2 signal sequence passes into the pore, pulling the remainder of the E2 protein with it, a protease cuts them apart. Acting then as the transmembrane anchor, the former signal sequence triggers a conformational change in the pore that results in release of the COOH-terminal portion of E1 sideways into the lipid bilayer. How this release occurs awaits structural characterization of the intermediates. — GJC



Model for postcleavage rearrangement of E1 and E2; pore, blue; transmembrane segment, pink.

EMBO J. **21**, 2893 (2002).

CREDITS: (SOURCE) COCQUEREL *ET AL., EMBO J.* 12, 2893 (2002); (ILLUSTRATION) PRESTON MORRIGHAN/*SCIENCE*

HIGHLIGHTED IN *SCIENCE*'S SIGNAL TRANSDUCTION KNOWLEDGE ENVIRONMENT

Science's stke www.stke.org

Restraining Degeneration

Huntington's disease (HD) is characterized by progressive neurodegeneration of striatal neurons in the brain, often leading to dementia. A mutation in the gene encoding huntingtin and nuclear accumulation of the mutant protein are associated with the pathology of HD, but it is not yet clear why these neurons die. Growth factors that promote cell survival are attractive therapeutic agents for neurodegenerative diseases, and Humbert *et al.* report that insulinlike growth factor 1 (IGF-1), which activates the protein kinase Akt, shows neuroprotective potential. The IGF-1–induced phosphorylation of huntingtin in vitro and in cultured neurons blocked the formation of nuclear inclusions and cell death (apoptosis). Furthermore, postmortem brain samples from HD patients showed decreased amounts of Akt, consistent with the proposal that the phosphorylation status of huntingtin may alter its interactions with apoptotic effectors. — LDC

Dev. Cell **2**, 831 (2002).