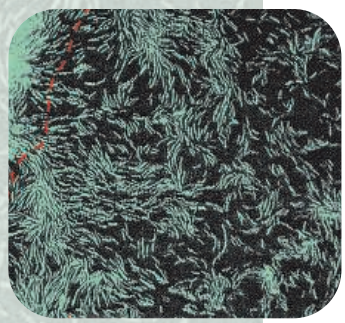
Pulsar Pumped

Stimulated emission, in which a photon interacts with an excited molecule and causes a second identical photon to be emitted, forms the basis for coherent light generation and amplification in lasers. The same effect was discovered in interstellar molecular clouds in the 1960s in the form of unusually bright and narrow microwave spectral lines. **Weisberg *et al.*** (p. 106; see the Perspective by **Elitzur**) report their observation of stimulated microwave emission in an OH cloud caused by photons from a distant pulsar. These results not only yield insights into maser action in interstellar clouds, but also into molecular-cloud density and distribution.

Get a Move On

Soil-dwelling myxobacteria move by a process termed gliding motility, which requires the surface expression of cellular protrusions, the type IV pili. More than 25 years ago, *Myxococcus xanthus* motility mutants lacking pili were shown to be phenotypically complemented by direct contact with motile neighbors. **Nudleman *et al.*** (p. 125) now identify the mechanism of the contact-mediated, nongenetic complementation of this type of motility. Complementation appears to be effected by the transfer from one cell membrane to another of the TGL protein, which is required for the construction of secretin pores, which in turn allow for the synthesis and retraction of the pili required for motility.

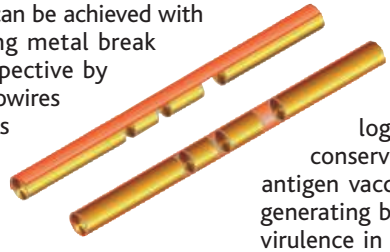


Pressure-Treated Curium

Pressure-induced delocalization of *f* electrons in rare earths and actinides involves an intimate relation between electronic configuration, structural degrees of freedom, anomalous lattice dynamics, and magnetism. A high-pressure x-ray diffraction study of curium by **Heathman *et al.*** (p. 110) revealed a sequence of structural phase transitions as its *f* electrons delocalize with increasing pressure. They identify an unusual lattice structure previously unobserved in other actinides, and on the basis of band-structure calculations, they argue that this phase is stabilized by antiferromagnetic ordering. Thus, curium joins cobalt and iron as metals that have lattice structures stabilized by magnetism.

Metals with Many Gaps

The fabrication of nanostructures is facilitated not only by making small regular structures, but also by forming void spaces that can capture nanomaterials or molecules. For example, in molecular electronics, the formation of metallic gaps can be achieved with scanning probes at surfaces or by drawing metal break junctions. **Qin *et al.*** (p. 113; see the Perspective by **Martin and Baker**) created bimetallic nanowires with repeating gap structures as small as 5 nanometers by first growing bimetallic wires in porous membrane templates with thin layers of etchable metals (such as nickel within gold). After removing the templates, the wires were captured on a substrate and coated on one side with silica. After release, etching proceeded on only one side, allowing the remaining wire to stabilize the resulting gaps.



CREDITS (TOP TO BOTTOM): NUDLEMAN *ET AL.*; QIN *ET AL.*

Sea-Driven Weather

Better prediction of devastating climate events, like the 2003 European heat wave, is a high priority of long-range weather forecasters. **Sutton and Hodson** (p. 115; see the news story by **Kerr**) have explored how weather depends on slowly varying environmental properties, such as basin-wide sea surface temperatures. Focusing on North America and Europe, they used a global climate model that incorporated historical records of Atlantic Ocean sea surface temperature and land-based data for pressure, precipitation, and air temperature. Ocean temperature distributions, possibly related to thermohaline circulation, have had an important influence on summertime climates on both continents and may have also influenced rainfall and drought frequency there.

The Value of Excess

The surface air temperature record of Greenland has been reconstructed mostly from analyses of the isotopic composition of H and O of the water in ice cores. A number of other factors besides average temperature can influence those proxies, however, such as the seasonality and origin of precipitation. **Masson-Delmotte *et al.*** (p. 118) measured the deuterium excess of ice from Greenland Ice Core Project (GRIP) samples in order to constrain the source and seasonality of the precipitation for the last full glacial cycle. Earth's orbital obliquity is an important control on the latitudinal temperature gradient between the source and site of precipitation, and moisture sources shifted to the south during cold periods.

Genomics and Vaccine Development

The prominent bacterial pathogen group B *Streptococcus* (GBS) is responsible for the majority of sepsis and meningitis cases between birth and 2 months of age. Based on evidence that effective maternally derived antibody protection can be transferred to newborns, different conjugate vaccines against the prevalent western serotypes are currently being assessed in clinical trials, but a rationally designed, multiunit vaccine that could broadly protect against global serotypes would be highly desirable. To identify potential antigens suitable for use in a universal GBS vaccine, **Maione *et al.*** (p. 148) scanned the genome sequences of eight GBS strains that represent the most important disease-causing serotypes. On the basis of immunological tests, GBS proteins were identified that were conserved between all strains globally. From these, a four-antigen vaccine combination emerged as the most effective at generating broad serotype immunity. Pili are often important in virulence in Gram-negative bacteria through their role in adhesion, but are usually not usually associated with Gram-positive strains such as *Streptococcus*. **Lauer *et al.*** (p. 105) nonetheless

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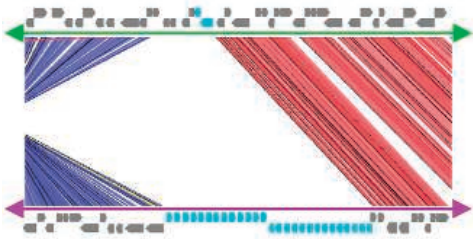
have identified pilus-like structures in GBS through immunogold electron microscopy which are composed of antigens that confer protective immunity in mouse models of maternal immunization.

The Nuclear Ins and Outs of tRNA

Transfer RNA (tRNA) is part of the machinery that converts the nucleic acid genetic code into protein. In the nucleus, tRNAs are transcribed, trimmed, and modified, and after being checked by an intranuclear quality-control system, are exported to the cytosol, ready to promote protein translation. **Takano *et al.*** (p. 140, published online 19 May 2005) now find that mature, cytosolic tRNAs are actively transported back into the nucleus by a mechanism that is independent of the usual nuclear protein import machinery that relies upon the small guanosine triphosphatase Ran. It is not clear why tRNA needs to return to the nucleus—perhaps to be subjected to further quality control, or perhaps even to promote hypothetical nuclear translation.

Theileria Genomes Work with Less

Apicomplexans are a diverse group of parasitic protozoa that cause diseases in humans and animals. *Theileria parva* is a tick-borne apicomplexan responsible for the death of 1 million cattle a year in Africa (see the Perspective by **Roos**). **Gardner *et al.*** (p. 134) present the sequence of *T. parva*, and **Pain *et al.*** (p. 131) present a comparison with the newly generated sequence of *T. annulata*. In several ways, these organisms represent stripped-down versions of more complex apicomplexans in that they have 20% fewer genes than malaria parasites; they resemble yeasts more than higher eukaryotes in the complexity of their cell cycle regulation. *Theileria* species induce transformation of lymphocytes but lack homologs of cellular protooncogenes. Other candidates that may explain the mechanism for transformation may provide drug or vaccine candidates.



Phosphorylation Rheostat

The modulation of the activity of proteins by phosphorylation has often been described as a binary switch, but **Pufall *et al.*** (p. 142) show that finer rheostat-like control can also be achieved. The transcription factor Ets-1 exhibits a graded DNA binding affinity that depends on the number of sites that are phosphorylated. Ets-1 exists in conformational equilibrium between a dynamic conformation that binds DNA and a well-folded inhibited state. Increasing phosphorylation progressively shifts the equilibrium toward the inhibited state and thus fine-tunes the level of activity. The phosphorylated region, which serves as the allosteric effector, is predominantly unstructured and flexible, and probably acts through transient interactions.

Habitat Corridors Promote Conservation

As wildlife habitats become more fragmented by human land use, wild plants and animals encounter increasing difficulties in dispersal between patches of suitable habitat. If the patches are small, then local extinctions may ensue. To mitigate this problem, conservationists favor networks of corridors to provide links between patches, but how effective is this approach? In a replicated, landscape-scale study of the role of habitat corridors in the southern United States, **Levey *et al.*** (p. 146; see the news story by **Stokstad**) followed Eastern Bluebirds as they carried native wax myrtle seeds from bushes in a central source patch to one of four surrounding receiver patches in a matrix of mature pine forest. The birds carried substantially more seeds to the corridor-connected patches than they did to the others. The authors were able to build a predictive seed-dispersal model at the landscape scale from individual-based observations on the movements of birds.

CREDIT: PAIN *ET AL.*

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The Nuclear Ins and Outs of tRNA

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