EDITORS' CHOICE

edited by Gilbert Chin

GENETICS

A Genomic House of Mirrors

Certain inherited forms of human male infertility are associated with small deletions in the long arm of the Y chromosome, which result in defective sperm production. These deletions occur most often in a genomic region called *AZFc* (for azoospermia factor c). The putative fertility factors encoded within *AZFc* are of great interest, but this region of the Y chromosome has posed an enormous challenge to conventional sequencing efforts because it is unusually rich in repetitive DNA.

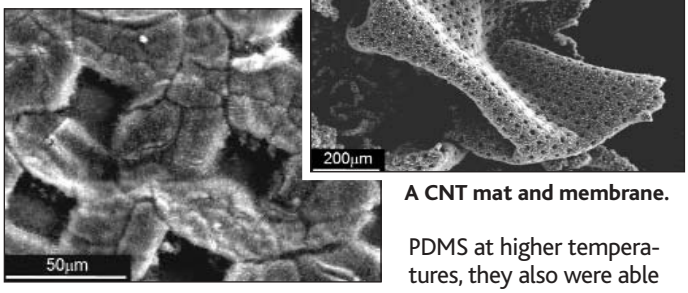
Kuroda-Kawaguchi *et al*. have accepted this challenge and now describe the complete nucleotide sequence and extraordinary structural features of *AZFc*. The region consists of six distinct families of amplicons (very large repeats), organized in three palindromes, including one that spans three megabases and shows almost perfect arm-to-arm identity. Encoded within these palindromes are 27 transcription units that are selectively expressed in the testis. Based on the sequence information, the authors speculate that the *AZFc* deletions found in infertile men arise by homologous recombination. The scale and precision of the symmetries within *AZFc* are unprecedented and raise intriguing questions about the evolutionary origin of this genomic region and the selective pressures that maintain it. — PAK

Nature Genet., 10.1038/ng757.

MATERIALS SCIENCE

Making Membranes of Nanotubes

In developing new applications for carbon nanotubes (CNTs), one goal is the assembly, or preferably the growth, of CNTs into complex three-dimensional geometries. Ng *et al*. take advantage of soft lithographic techniques to prepare poly(dimethylsiloxane) (PDMS) molds with patterned surfaces and relief features. The PDMS surface is highly hydrophobic, but treatment with an oxygen plasma improved the wetting properties of targeted areas. A nickel catalyst precursor, applied as an aqueous solution, could then be deposited specifically on the plasma-treated areas. The CNTs were grown onto the substrate with chemical vapor deposition techniques, producing localized "mats" of protruding nanotubes. A significant number of bridging nanotubes were observed between neighboring mats, which the authors attribute to surface undulations that formed on the PDMS, because similar bridging was not observed in mats grown on Si(001) surfaces. Taking advantage of the shrinkage of the PDMS at higher temperatures, they also were able to fabricate more complicated, intertwined "membrane" structures. — MSL



A CNT mat and membrane.

Langmuir, 10.1021/la108095.

GEOPHYSICS

Looking Beneath the Surface

The Chicxulub impact crater on the Yukutan Peninsula is thought to be the site where a large asteroid hit Earth 65 million years ago, at the end of the Cretaceous, causing widespread extinctions. The crater itself is buried beneath younger sediment, and discerning its size and thus some of the dynamics of the impact has required remote geophysical investigations and drilling. Christeson *et al*. report the results of a seismic and gravity study of the crater that provides further resolution of its structure and of several prominent features. A 1-kilometer-thick melt sheet, representing rocks that melted during the impact, extends about 50 km out from the crater center. Disruption is seen throughout the crust, which is about 35 km thick, and into the underlying mantle. — BH

J. Geophys. Res. **106**, 21751 (2001).

MICROBIOLOGY

Archaean Viruses

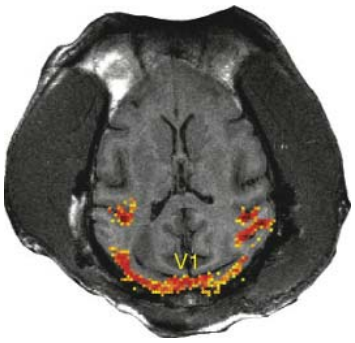
Organisms that survive in what humans would consider harsh environments are of interest because they are unusual and because their biochemistry and molecular biology function under regimes of high temperature or acidity or both. *Sulfolobus* are aerobic archaea that live at 80°C and pH 3 and

NEUROSCIENCE

More to Motion Processing

The detection and interpretation of movement in the environment can be crucial for the survival of the individual. It is thus no surprise that a large number of neurons in different areas of the visual system participate in motion analysis. Most studies have used electrophysiological techniques to characterize the response properties of single neurons. Less is known, however, about the behavior of large groups or networks of neurons involved in motion perception.

Using functional brain imaging, Tolias *et al*. studied the visual cortex of macaque monkeys with a visual adaptation paradigm designed to reveal the participation of neuronal populations. In agreement with earlier data, they found that a network of areas in the visual system is involved in the processing of information about stimulus movements. Their results concerning the relative participation of areas differed, however, from what one would have predicted from single neuron electrophysiology. To account for this difference, the authors suggest that neuronal selectivity may be a function of adaptation and that the change of neuronal specificity in early visual areas may reflect the adaptation of higher-level visual areas that project to the earlier areas via feedback connections. — PRS



Activity in the macaque primary visual cortex.

J. Neurosci. **21**, 8594 (2001).

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SOURCE: (TOP) NG *ET AL*., *LANGMUIR*, 10.1021/LA108095; (BOTTOM) TOLIAS *ET AL*., *J. NEUROSCI.* **21**, 8594 (2001)

can be cultured in the laboratory. Rice *et al.* have sampled hot springs and mud pots in Yellowstone National Park and discovered viruses with previously unobserved morphologies. Three of their isolates corresponded in appearance to known *Sulfolobus* virus families from Japan and Iceland: spindles (60 × 90 nm) and rigid and flexible rods about 1 mm in length. New morphologies seen were nonenveloped icosahedral particles about 40 nm in diameter and spindle-shaped particles with projections at both ends, arranged in rosettes. — GJC

Proc. Natl. Acad. Sci. U.S.A., 10.1073/pnas.231170198.

ENGINEERING

Survival of the Fittest Satellites

Constellations of satellites support communication worldwide and collect observations of Earth for commercial, military, and scientific purposes. Low-altitude satellites offer faster communication and reduced operating costs; unfortunately, the lower the altitude, the greater the problem of Earth's curvature, creating longer times during which the satellites are out of contact with ground stations.

To tackle this problem, Williams *et al.* have developed a genetic algorithm to determine the optimum spacing and orbital parameters for a constellation in order to maximize communications. A random set of initial designs was generated, and the best designs were allowed to interact and produce new designs (offspring). Their algorithm avoids local minima and can sample areas of design space that might not be considered otherwise. Surprisingly, the authors find that for three satellites, an optimum design would require asymmetric spacing, such that two satellites would be close together and far from the third—not a design that engineers would select intuitively. — LR

J. Astronaut. Sci., in press.

ATMOSPHERIC CHEMISTRY

Measuring Particle Composition

Earth's atmosphere contains many different types of particles, from natural substances such as sea salt to anthropogenic by-products such as soot. These particles play important roles in climate—for example, by seeding or suppressing rain or by consuming protective ozone. Atmospheric particles also contribute to health problems in densely populated areas. Detailed measurements of particle compositions, sizes, and distributions would be useful, but particle morphologies and compositions are complex and evolve with time.

Aerosol mass spectrometry has been used to monitor the composition of individual particles in real time, but the techniques have required careful calibration, and quantitative results have been difficult to obtain. Now, Reents and Schabel describe quantitative mass spectrometric determination of the atomic composition of individual particles, without the need for calibration. High laser power density converts the entire particle into atomic cations whose ion signals reflect the composition of the particle, and helium, instead of argon, is used as the carrier gas. This enables them to achieve an accuracy of 20% for the major components of multicomponent particles. — JU

Anal. Chem., 10.1021/ac010436c.

ECOLOGY

Leaves, Twigs, Roots

Mangrove forests fringe the shores of estuaries, islands, and reefs in many parts of the tropics. There is concern that the protective character of these intertidal ecosystems will be lost if they are unable to keep pace with the rise in sea level that is expected in the wake of climate warming. In many mangrove systems, the necessary vertical accretion would depend largely on peat accumulation, because inputs of sediment from outside the system are often negligible.

The red mangrove *Rhizophora mangle*.

In a study of litter production and decomposition in a Belizean mangrove ecosystem, Middleton and McKee show that peat formation is primarily the result of deposition of root material; litter from leaves and twigs tends to degrade more rapidly, and it is promptly recycled through the system via detritivores such as crabs. With these results in hand, it will be possible to generate more accurate models of how mangrove forests respond to climate change and to develop management strategies for their protection. — AMS

J. Ecol. **89**, 818 (2001).

CREDITS: FLORIDA KEYS NMS/NOAA

Survival of the Fittest Satellites

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