EDITORS' CHOICE

edited by Gilbert Chin

GEOCHEMISTRY

Hydrocarbons in the Solar Nebula

Recent studies of interplanetary dust particles and primitive meteorites have identified hydrocarbons in the samples; sometimes these phases were associated with iron and nickel metal. These organic materials must have formed in the solar nebula, but how they did has been unclear. The solar nebula (the flattened disk of debris left over from the formation of the sun) contained abundant gases—carbon monoxide and hydrogen—and dust grains—iron metal and refractory oxide phases—which swirled around the sun and either aggregated into planetesimals or were removed from the disk.

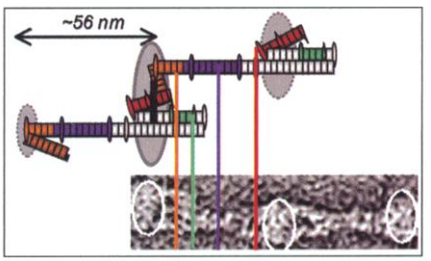
Fischer-Tropsch catalysis is the conversion of CO and H_2 into simple hydrocarbons by an iron or nickel metal catalyst, and Kress and Tielens have modeled this known surface chemical reaction to try to determine the origin of simple hydrocarbons in the solar nebula. They found that Fischer-Tropsch catalysis could have served to convert CO into CH_4 at the time of planetesimal formation. At earlier times, the temperatures would have been too high, and at later times the temperatures too low, for catalysis to be efficient. Thus, their kinetic model offers a plausible route for hydrocarbon formation in the solar nebula and may help provide clues to organic material origins in other astrophysical environments. — LR

Meteorit. Planet. Sci. **36**, 75 (2001).

STRUCTURAL BIOLOGY

The Heart of the Fiber

Fibrillin is a large, multi-domain protein that contributes to the integrity of connective tissue components; skeletal and cardiovascular abnormalities in Marfan syndrome have been linked to mutations in this protein. Baldock *et al.* have collected data from automated electron tomography, localization of antibodies and colloidal gold, and an examination of stretched and untensioned samples. They



Schematic of two head-to-tail monomers (red-orange) packing into beaded and intrabead regions (electron micrograph).

now present a detailed proposal for how eight fibrillin monomers are packed, as dimers, into a microfibril that has been characterized as "beads-on-a-string" with a bead periodicity of 56 nanometers. Each monomer folds back on itself into segments joined by noncovalent and covalent (transglutaminase) interactions that are thought to underlie reversible extension and retraction of the extracellular matrix. — GJC

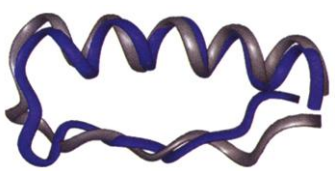
J. Cell Biol. **152**, 1045 (2001).

CHEMISTRY

Small is Functional

The synthesis of small, fully folded proteins has been advanced by an improved understanding of the factors driving secondary and tertiary structure formation and by combinatorial methods. The current challenge is making small proteins that function.

Chin and Schepartz have devised a method based on protein grafting to synthesize DNA-binding proteins just 35 residues in length. Protein grafting means that the functional residues are introduced into a scaffold with the dual goals of maintaining conformational stability and optimizing substrate binding. The scaffold was based on the solvent-exposed α-helix of avian pancreatic polypeptide, and the authors identified a miniature protein with high affinity for the target ATGAC sequence. The fold of the grafted protein resembles that of avian pancreatic polypeptide and suggests that this method also may be used to derive reduced versions of other proteins that utilize an α-helix for recognition. — JU



Backbone structure of the protein (blue) and avian pancreatic polypeptide (grey).

J. Am. Chem. Soc., in press.

GEOPHYSICS

Shaking Southern California

The Southern California Earthquake Center (SCEC) was initiated in 1991 to try to understand the physical processes of earthquakes in southern California. In its third phase, the SCEC was to study the effects of different rock sites on the amplitude of ground shaking to help improve probabilistic seismic hazard analysis. Field *et al.* summarize these results, which are described in fourteen papers in a special issue.

Site effects may be influenced primarily by nonlinear responses of the sediments to seismic waves, or by the scattering or focusing of seismic waves by basins and other structures, or both. Refined models of the subsurface geology, the velocity structure of the crust, and the paths of seismic waves through these structures form the basis for a detailed analysis of the amplitude of ground shaking at different sites. The depth of the Los Angeles basin has the largest effect on the amplitude of the ground shaking; sites located beneath the deepest part of the basin show the strongest ground motions (highest amplitude shaking) in simulations of medium- to large-magnitude earthquakes from a range of possible sources. These data and models provide a useful synthesis of the complex site effects in southern California and what is known of the physics behind earthquakes. — LR

Bull. Seism. Soc. Am. **90**, S1-S244 (2000).

BIOMEDICINE

Feverish Fallout

Temperature-sensitive mutations have been an invaluable research tool in genetic studies of organisms such as bacteria, yeast, and fruit flies. Following up on some unusual features of patients afflicted with a rare genetic disorder, Vermeulen *et al.* show that temperature-sensitive mutations occur in humans as well and can affect fundamental mechanisms of gene regulation.

Patients with trichothiodystrophy (TDD) display a wide spectrum of medical problems, including mild mental retardation, brittle hair and nails, and scaling of the skin. This condition is caused by mutations in the *XPD* gene, which encodes a component of the transcription and DNA repair complex TFIIH. Vermeulen *et al.* studied four TTD patients who had under-

CONTINUED ON PAGE 2051

SOURCE: (LEFT) CHIN AND SCHEPARTZ, *J. AM. CHEM. SOC.*, IN PRESS; (RIGHT) BALDOCK *ET AL.*, *J. CELL BIOL.* 152, 1045

gone transient hair loss while they were suffering from a fever. Cell culture analyses revealed that the XPD mutations in these patients destabilized TFIIH and disrupted its transcriptional and DNA repair activity at 41°C. The authors postulate that the fever-induced hair loss was induced by a transient suppression of the synthesis of proteins that cross-link keratin filaments, which caused the base of the hair fiber to become very fragile.—PAK

Nature Genet. **27**, 299 (2001).

VIROLOGY

Reconstructing Influenza Pathogenicity

The 1918 pandemic of influenza A was extraordinarily virulent and killed tens of millions of people. The first genetic characterization of the 1918 virus from wax-embedded tissue samples showed it to be a novel H1N1 influenza A virus. In an effort to identify the basis for this virulence and to prepare for future epidemics, Basler *et al.* sequenced the H1N1 nonstructural segment (NS), which encodes NS1 and nuclear export protein. The NS1 protein is a type I interferon antagonist in the mouse and is responsible for immunosuppression during infection by influenza A.

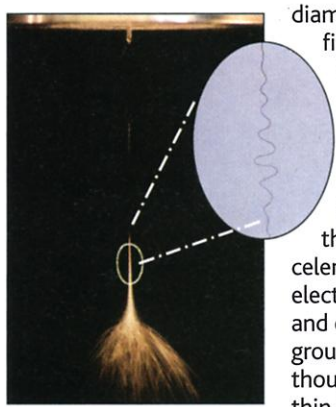
Basler *et al.* regenerated influenza viruses from cloned DNA and, following stringent containment protocols, tested in mice the pathogenicity of NS1 derived from the 1918 strain. Unfortunately, their results are inconclusive, as their engineered virus containing the 1918 NS1 sequence did not behave more virulently in mice than control strains, quite probably because the 1918 virus is a human strain. Nevertheless, as Lederburg points out, this was no mean feat because sequencing the original, fragmented RNA remains arduous and virulence may well depend on a specific constellation of varying genetic elements. — CA

Proc. Natl. Acad. Sci. **98**, 2746 (2001); *Proc. Natl. Acad. Sci.* **98**, 2115 (2001).

POLYMER SCIENCE

Whipped, not Splayed

Polymer fibers formed by extrusion or gel spinning, in which the polymer is deformed by mechanical processes, usually are larger than 1 micrometer in diameter, but thinner fibers can be made by using electrical fields. A fluid reservoir containing polymer melt or solution is charged, and then a fluid jet is accelerated through an electric field gradient and collected on a grounded plate. It was thought that the very thin fibers were produced when the primary fluid jet split into multiple filaments in a process called splaying.



Apparent splaying (1 ms exposure), and rapid whipping (18 ns, inset).

Shin *et al.* use high-speed photography to show that a whipping instability rapidly bends and stretches the fluid jet. What had appeared to be splaying was instead multiple images of the single strand as it whipped back and forth. It is envisioned that the non-woven meshes that are formed by the process will be used as membranes, filters, composite reinforcements, and tissue engineering scaffolds. — MSL

Appl. Phys. Lett. **78**, 1149 (2001).

HIGHLIGHTED IN *SCIENCE*'S SIGNAL TRANSDUCTION KNOWLEDGE ENVIRONMENT

Science's stke www.stke.org

A Chemokine Signal for Metastasis

Chemokines are peptide ligands known for their ability to direct the movement of cells of the immune system. Müller *et al.* show that breast cancer cells express more chemokine receptor CXCR4 than normal breast epithelial tissue. Neutralizing antibodies against the receptor CXCR4 or its chemokine ligand CXCL12 inhibited the stimulation of migratory behavior of breast cancer cells by purified CXCL12 or by protein extracts from tissues that are known breast cancer secondary sites. Furthermore, in a mouse model of metastatic breast cancer, treatment of the animals with antibodies against CXCR4 decreased metastasis to the lung and the lymph nodes, two tissues with high levels of CXCL12. These data suggest that the choice of metastatic sites for breast cancer cells is mediated in part by the interaction of tissue-derived CXCL12 and tumor-expressed CXCR4. — NG

Nature **410**, 50 (2001).

CREDITS: SHIN *ET AL.*, *APPL. PHYS. LETT.* **78**, 1149 (2001).