

<< Assessing Earth's Inorganic Hydrocarbons

A long-standing question, important not just for petroleum resources but possibly in the origin of life, is the degree that a series of inorganic reactions that lengthen carbon chains (known as Fischer-Tropsch type reactions) might yield hydrocarbons from mantle methane. Although several examples of such hydrocarbons have been inferred, it has been difficult to demonstrate a purely mantle, abiogenic origin in the face of abundant biogenic hydrocarbons. **Proskurowski *et al.*** (p. 604) now show that the abundance of hydrocarbons in the Lost City vent field, an off-axis system in the Atlantic Ocean, decreases systematically with chain length in a manner predicted by Fischer-Tropsch type reactions. Analysis of carbon isotopes further support an inorganic origin. Because this system is likely representative of many similar systems in the oceans, an abundant source of mantle-derived hydrocarbons may be present on Earth, as well as during Earth's early history.



Water as Glass and Liquids

When molecular liquids form glassy phases, the energetic change is often of the same magnitude as when they form crystals—in both cases, large amounts of translational and rotational energy must be lost. In that regard, the glass transition for pure water that occurs at between 120 and 160 kelvin is puzzling in that it occurs with a very modest change in heat capacity. **Angell** (p. 582) reviews the many studies of water's glass transition, including those of aqueous solutions and of water confined to nanoscopic environments. He concludes that ~ 225 kelvin, a temperature often associated with water's "second critical point," an order-disorder transition occurs that accounts for most of the energetic changes. Hence, liquid water appears to exist in two forms—a "fragile" liquid (a poor glass-former) above this temperature, and a "strong" liquid (a good glass-former) below.

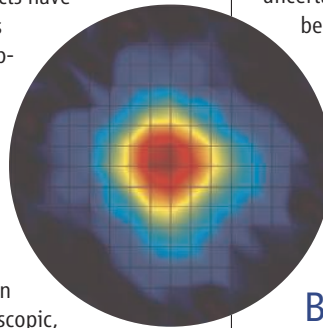
More Relaxed on the Surface

The glassy state of materials, in which a liquid-like structure is frozen in place below a specific temperature, may manifest differently in the bulk of the materials versus the surface region. **Fakhraai and Forrest** (p. 600; see the Perspective by **Dutcher and Ediger**) probed the glass transition in an amorphous polymer by embedding gold nanoparticles onto the surface of a polystyrene film and allowing them to sink into the film, where they make small indentations. They then removed the gold, using mercury, and were able

to watch the surface relaxation at various temperatures. They observed enhanced surface relaxation, that is, greater mobility of the polymer chains, at the surface relative to the bulk.

Cuprate Liquid Crystal

Recent experimental work has revealed exotic electronically ordered phases in correlated electron systems akin to those seen in conventional liquid crystals. These effects have manifested themselves as anisotropic transport properties, in which conductivity depends upon direction within the sample. **Hinkov *et al.*** (p. 597, published online 10 January) used neutron scattering to investigate the role of spin fluctuations in the macroscopic, nematic liquid-crystalline electronic behavior of the high-temperature superconductor $\text{YBa}_2\text{Cu}_3\text{O}_{6.45}$. They find that an anisotropic ordering of the spins begins at 150 kelvin, well above the temperature where static magnetism occurs, and appears to develop in parallel to the previous reported transport properties. They argue that these fluctuating spins are at the core of the electronic liquid-crystalline behavior in correlated electron systems.



Food for Thought

One of the most potentially harmful effects of climate change may be its impact on agriculture

in food-insecure regions. **Lobell *et al.*** (p. 607; see the Perspective by **Brown and Funk**) analyze the climate change-related risk for agriculture in 12 regions worldwide that collectively represent a population of nearly 1 billion people in order to identify which general approaches to adaptation will be most effective in different areas. They find that South Asia and Southern Africa are two regions particularly at risk from negative impacts on several crops, and that uncertainties vary widely by crop. Also,

because the reasons underlying a region's vulnerability differ, the adaptation priorities that ultimately need to be followed will depend on how investment institutions perceive uncertainty and risk.

Getting the Balance Right

Balancing selection, the maintenance of multiple alleles within a population, is a means by which genetic diversity may be maintained within a species. **Seidel *et al.*** (p. 589, published online 10 January) have discovered a globally distributed genetic incompatibility that causes embryonic death among natural isolates of the nematode worm, *Caenorhabditis elegans*. The incompatibility persists despite its negative consequences for fitness, which contradicts the prediction that natural selection should eliminate genetic incompatibilities from interbreeding populations.

Continued on page 547

Continued from page 545

Regulating Ovulation

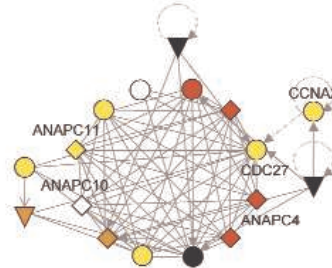
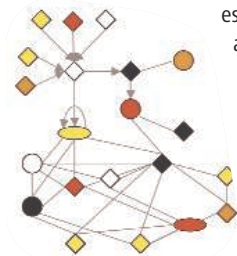
In mammals, the ability of a female to remain fertile for an extended period depends on the continuous awakening of primordial follicles from their dormant state in the ovary. Menopause, or the natural end of female reproductive life, occurs when the pool of primordial follicles has been depleted. The mechanisms controlling follicular activation have remained a mystery. **Reddy et al.** (p. 611; see the news story by **Marx**) now reveal that follicle activation is controlled by the oocyte PTEN (phosphatase and tensin homolog deleted in chromosome 10)–phosphatidylinositol 3-kinase pathway. In a mouse model where Pten is deleted specifically in oocytes, the entire pool of primordial follicles is prematurely activated and subsequently depleted in early adulthood, which results in premature ovarian failure.

Maternal Influences

Fertilization is a dynamic process of the transition from two highly specialized cells—the oocyte and spermatozoon—into the totipotent zygote. Maternal and paternal contributions to the zygote are not equal. In addition to nuclear DNA, oocytes and spermatozoa are equipped with complementary arsenals of structures such as mitochondria and centrioles for the creation of developmentally competent embryos. By using the microsurgical manipulation of mammalian oocyte nucleolus, **Ogushi et al.** (p. 613) demonstrate that the nucleolus, a subnuclear organelle important in ribosome assembly, is exclusively of maternal origin. The oocyte nucleolus is essential for nucleolus assembly in zygotes, and is thus also essential for normal embryonic development.

Growth and Survival, the Complete Toolkit

As tumors progress to a more aggressive state, they acquire multiple genetic alterations, some of which have little functional impact and others that are essential for the continued growth and survival of the tumor cells.



Schlabach et al. (p. 620) and **Silva et al.** (p. 617) have developed a functional genomics strategy that will allow, at a genome-wide level, systematic identification of genes required for cell growth and survival. Cell lines derived from human mammary and colorectal cancers and normal mammary tissue showed a similar pattern of so-called “essential” genes, with many residing within functional pathways known to be critical for fundamental cellular processes such as cell cycle and translational control. Importantly, however, additional genes were

identified as being essential for the growth of specific cell lines. This functional genomics strategy complements the cancer genome sequencing approaches that have shown recent success and could set the stage for high-throughput discovery of cancer drugs.

Interfering with Inflammation

The efficient and selective targeting of small interfering RNA (siRNA) molecules to cells could help to harness this technology for treating disease. **Peer et al.** (p. 627; see the Perspective by **Szoka**) combine nanoscale liposomal packaging of siRNAs with antibody targeting to immune cells. The targeted siRNA cargo was able to find and efficiently inactivate its target, a key cell-cycle regulating molecule called Cyclin D1. Furthermore, the systemic injection of the packaged siRNA particles reversed pathology in a mouse model of inflammatory bowel disease.

T Cell Role for Cathepsin K

Cathepsins are cysteine proteases that degrade proteins in the lysosome and some cathepsins assist with the processing of antigens for the immune system. **Asagiri et al.** (p. 624; see the Perspective by **Krieg and Lipford**) uncover a further but distinct immunological role for another cathepsin, cathepsin K, which is known to be involved in osteoclast function in the bone. Cathepsin K is expressed in immunological dendritic cells and is needed for the complete induction of the inflammatory T helper 17 T cells. In animal models for two autoimmune conditions, pathology was ameliorated by cathepsin K deficiency because of its unexpected involvement in signaling through the innate immune receptor TLR9.

See the Total Solar Eclipse 2008!

Siberia & Lake Baikal

July 26–August 10, 2008

Visit **Moscow** and discover the enchantment of the Kremlin. Have a special visit to **Star City**, where Russia's cosmonauts and astronauts from many countries train. Fly to **Novosibirsk** to see the Total Solar Eclipse on August 1, 2008! Then fly to **Irkutsk**, the “Paris of Siberia,” with striking gold-domed churches and wooden homes. Visit the Lake Baikal Solar Observatory and board our ship for 6 days on Lake Baikal. \$4,995 + air.



Warming Island, GREENLAND

September 16-27, 2008

Join explorer **Dennis Schmitt** as he returns to East Greenland and his discovery—a three-finger-shaped island in East Greenland now named **Warming Island**—a compelling indicator of the rapid speed of global warming.

We will visit **Scoresby Sund**, the longest fjord in the world, and at **Cape Hofmann Halvo** we will look for musk oxen. Remains of remote Inuit villages will be of interest, as will seals and other wildlife—all against the stunning glaciers and peaks of coastal Greenland. This is an ideal time to see the **Aurora Borealis**. From \$5,745 + air.

For a detailed brochure, please call (800) 252-4910

AAAS Travels

17050 Montebello Road
Cupertino, California 95014
Email: AAASInfo@earthexpeditions.com