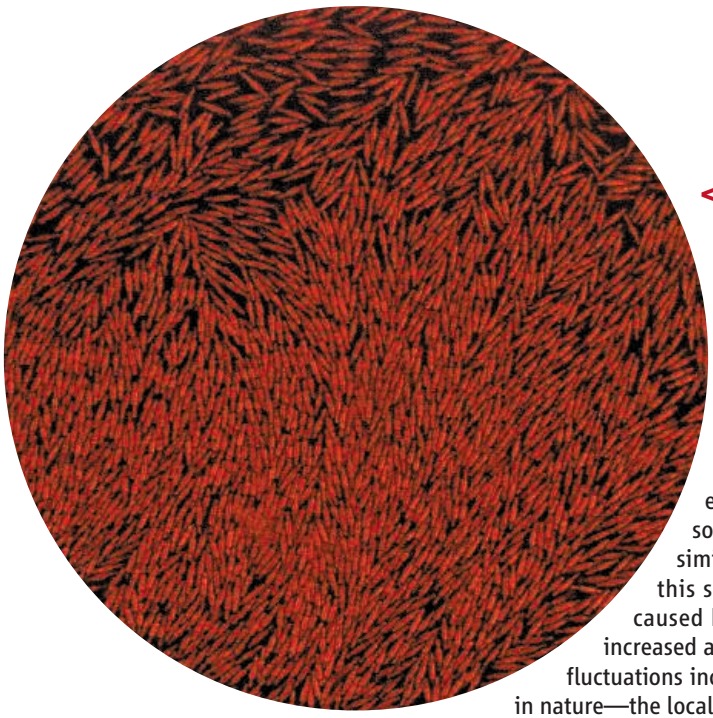
EDITED BY STELLA HURTLEY AND PHIL SZUROMI



<< Small Rods, Giant Fluctuations

In nature, large-scale ordering can occur that seems to be triggered by local motions or interactions, such as in the motion of flocks of birds. On a much smaller scale, long rod-shaped molecules in solution can form a nematic liquid crystalline phase, in which the rod orientations are not isotropic but tend to align parallel to one another. **Narayan *et al.*** (p. 105; see the Perspective by **Van Hecke**) studied copper rods (about 5 millimeters in length and 0.8 millimeters in diameter, and whose ends were thinned by etching) that were confined to two dimensions and agitated so that they behaved like a fluid. The ordering behavior was similar to that of nematic liquid crystals but occurred despite this system being far from equilibrium—density fluctuations caused by changes in ordering (swarming and flocking motions) increased as particle number N, unlike the equilibrium situation where fluctuations increase as $N^{1/2}$. These persistent fluctuations are thus "giant" in nature—the local density does not reflect the overall system density.

Wireless Power Transfer

Entanglement not only applies to quantum states but also to the myriad of cords and cables that help recharge our laptop, cell phones, and other portable devices. **Kurs *et al.*** (p. 83, published online 7 June; see the Perspective by **Stewart**) report a proof-of-principle demonstration of transferring electrical power wirelessly. Using near-field magnetic resonance between two strongly coupled induction coils, they can transfer 60 watts of electrical power with 40% efficiency across a distance of 2 meters. Because the external fields of this transmission process are mainly magnetic in character, the health risks should be less than that associated with systems that emit electrical fields.

Cold but Quick

Chemical reactions in solution generally accelerate with rising temperature, but recent studies have revealed a class of gas-phase reactions between small, neutral molecules that follow the opposite trend. This phenomenon of rapid reactivity at low temperature bears on our understanding of the chemical reactions that may occur in cold interstellar clouds, which are challenging to probe experimentally. **Sabbah *et al.*** (p. 102) have performed precise laboratory rate measurements of O atom reactions with gas-phase alkenes between ~20 to 300 kelvin. They then modeled the unusually rapid low temperature rates using a theoretical framework that includes two transition states, one of which involves low-energy rearrangement of a transiently stable pre-reaction complex. The results show promise for extensions of the method to other reaction systems of astrochemical interest.

Nailing the Myxozoa

The Myxozoa, which are primarily unicellular parasites, have defied phylogenetic placement for many years and have alternatively been classified as members of the protist or animal kingdoms. **Jiménez-Guri *et al.*** (p. 116) have performed a phylogenetic analysis of an amino-acid alignment and find that the myxozoan *Buddenbrockia plumatellae*—a strange worm discovered more than a century ago—is actually an active, muscular, writhing, worm-shaped cnidarian. The existence of a worm within the Cnidaria, which includes jellyfish and corals, challenges views on body-plan evolution.

Evidence from a Greener Greenland

At present, glaciers cover about 10% of Earth's terrestrial surface, but there is only limited knowledge about the biota that occupied these vast areas before the ice formed; most fossil evidence is either deeply hidden or has been scoured away during periods of glacial expansion. **Willerslev *et al.*** (p. 111; see the news story by **Curry**) were able to extract and amplify ancient DNA reproducibly from plants and insect remains from the silty sections of deep ice cores from just above the bedrock. At the time when this ice formed, southern Greenland was covered by a diverse boreal forest consisting of pine, spruce, alder, and yew and inhabited by insects such as butterflies and moths. These results could be indicative of either extensive deglaciation of southern Greenland during the last interglacial (Eemian) or DNA survival over longer time scales of up to 1 million years.

Tools in the Toba Ash Tuff

The volcanic eruption at Toba, Indonesia, 77,000 years ago was one of the largest in Earth's recent past. This eruption likely caused dramatic cooling of Earth's climate and perhaps influenced human evolution—specifically early humans in eastern Asia—but evidence for evaluating these effects has been sparse. **Petraglia *et al.*** (p. 114) have identified the Toba ash in an archaeological sequence in India and found it to be rich with stone artifacts. The tools show a slight evolution across the ash layer but are fairly continuous. This record implies that local populations likely remained in the region and that the sophistication of the tools suggests that modern humans may have reached India by the time of the Toba eruption.

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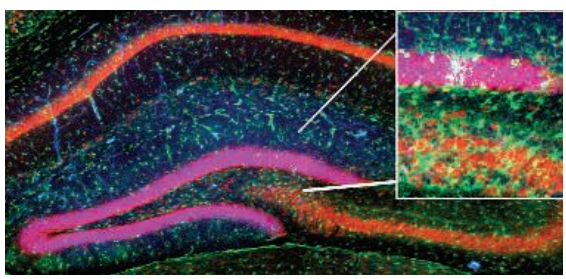
Diversity, Stability, and Controversy

The relation between diversity and stability is one of the most contentious issues in ecology: Different theories contradict each other, empirical results are inconsistent, and theoreticians and empiricists often disagree. **Ives and Carpenter** (p. 58) review this debate and point out the numerous types of stability that describe different properties of ecosystems and correspondingly numerous relations between diversity and stability. Empirical studies, however, have emphasized only a few of these relations, often ignoring those that are most important for pressing environmental concerns. Both the scope and focus of these studies should broaden to identify mechanisms that reveal generalities in diversity-stability relations.

Sea Anemone in the Spotlight

The starlet sea anemone *Nematostella vectensis* is an emerging cnidarian model. Despite the apparent morphological simplicity of sea anemones, jellyfish, corals, and other cnidarians, **Putnam *et al.*** (p. 86; see the news story by **Pennisi**) report considerable complexity in the genome of the sea anemone. The *Nematostella* genome establishes the antiquity of many genes that were previously thought to be unique to vertebrates and provides a different perspective on the origins of novel genes in animals.

Remembering the Fine Details



Pattern separation is the process by which two similar input representations are transformed into more dissimilar representations in order to reduce interference between the two patterns when they are subsequently stored in memory. A long-held but largely untested hypothesis is that the hippocampal dentate gyrus is involved in pattern separation. **McHugh *et al.*** (p. 94, published online 7 June; see the Perspective by **Bannermann and Sprengel**) generated a mouse line that specifically lacks *N*-methyl-D-aspartate receptors in dentate granule cells. Standard contextual fear conditioning was not affected, but the mice were unable to discriminate between two similar conditioning chambers.

Inflammation and Tumor Progression

Hepatocellular carcinoma, a common and deadly cancer of the liver, is 3 to 5 times more likely to occur in men than in women (see the Perspective by **Lawrence *et al.***). Working in a mouse model in which liver cancer is induced by exposure to a chemical carcinogen, **Naugler *et al.*** (p. 121) propose a molecular basis for this phenomenon explained by the action of the female hormone estrogen and its ability to inhibit inflammatory responses in the liver. Estrogen acts to inhibit secretion of interleukin-6 (IL-6) by liver macrophages known as Kupffer cells. Production of IL-6 was dependent on the signaling adaptor protein MyD88, which in turn may be activated by products of dying cells in the injured liver. **Rakoff-Nahoum and Medzhitov** (p. 124) implicate MyD88 in promoting another cancer, that of the intestine. Inflammation is known to be a risk factor for colorectal tumors. In a mouse model of intestinal tumorigenesis, mice lacking MyD88 showed inhibited growth and progression of tumors.

Bacterial Susceptibility: Whose Vault Is It?

The lung epithelia represent a major interface between the host and the outside microbial world and have evolved specific mechanisms to ensure the efficient clearance of pathogens. The importance of these processes is clearly evident in the lungs of cystic fibrosis patients, who are hypersusceptible to infection by *Pseudomonas aeruginosa* as a result of mutations in the cystic fibrosis transmembrane conductance regulator (CFTR) gene. **Kowalski *et al.*** (p. 130) provide evidence that a component of mysterious intracellular structures known as vaults also plays a primary role in the defense against this pathogen. After binding CFTR on epithelial cells, *P. aeruginosa* induced recruitment of major vault protein (MVP) to lipid rafts at the cell surface and the subsequent internalization of the bacteria. In mice, this MVP-dependent process was required for resistance to infection, which suggests that a similar process may be important in humans.

CREDIT: MCHUGH *ET AL.*