

edited by Gilbert Chin



Dascyllus marginatus swimming among *Stylophora pistillata*.

ECOLOGY/EVOLUTION

Rapid Fin Movement Sleep

Coral and fish species often live in mutualistic associations, in which both partners benefit from the other's presence. For the fish, the association is usually obligatory, as they depend on the coral for both shelter and foraging (for zooplankton). The corals can survive on their own, but nevertheless show faster growth and greater reproductive output when fish are present; fish enhance nutrient input to corals via excretion and can protect them from predators and clear them of sediment.

Goldshmid *et al.* have documented another mechanism by which fish can benefit coral. In a reef of branching coral near the Red Sea port of Eilat, sleeping zooplanktivorous fish aerate their coral hosts at night. The fish, which were filmed by infrared video camera in their resting positions among the coral branches, spend the night sleep-swimming with their fins in vigorous motion.

In the absence of fish, measurements showed that oxygen availability to the corals was severely reduced, to less than 30% of ambient levels. These observations may explain how dominant branching corals (whose morphologies hinder the free flow of water) can inhabit zones of relatively calm water. — AMS

Limnol. Oceanogr. **49**, 1832 (2004).

typhoon (Toraji, July 2001) sequence. They found that at any given water discharge rate, the sediment load carried by a flood increased by a factor of 4 in the epicentral area: The earthquake, which produced 20,000 landslides, increased the rate of erosion, the amount of sediment delivered to the watershed, and the amount of sediment that is ultimately deposited in marine basins around the coast. Not only do these destructive events provide a natural laboratory to measure rates of erosion directly, but this particular sequence suggests that prehistoric large earthquakes and their rate of recurrence might be decipherable from the offshore sedimentary record. — LR

Geology **32**, 733 (2004).

IMMUNOLOGY

Inciting Local Reactions

Most immune responses kick off within the lymph nodes and spleen, which are distal to sites of infection. In these secondary lymphoid organs, naïve B and T lymphocytes are introduced to antigens that have been delivered from the infected tissue and, once activated, they then disperse to deal with the pathogen.

Moyron-Quiroz *et al.* show that a distinct lymphoid tissue that forms locally at the site of infection contributes to clearing a respiratory virus. In mice engineered to lack lymph nodes and spleen (SLP mice), the appearance of activated B and T lymphocytes in response to influenza virus infection was found to be delayed but not otherwise impaired. Histological examination of lungs from these infected mice revealed sites with induced bronchus-associated lymphoid tissue (iBALT). Although the pathways leading to iBALT formation appeared distinct from

those involved in the development of conventional lymphoid tissue, these sites possessed organized regions of proliferating T and B cells equivalent to those normally found in lymph nodes and spleen. Furthermore, SLP mice cleared virus efficiently and with reduced immune pathology, suggesting that iBALT may support locally efficient pathogen clearance while minimizing the global cost of a systemic immune reaction. — SJS

Nature Med. **10**, 1038/nm1091 (2004).

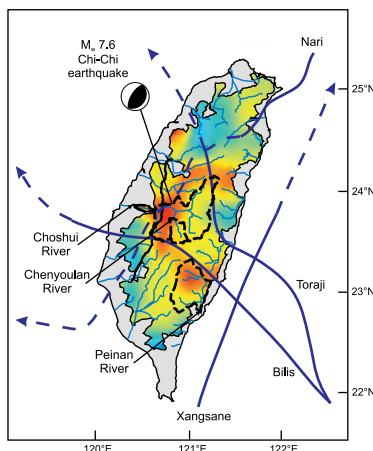
GEOLOGY

Mass Wasting

Taiwan consists of an active mountain belt, produced by the collision of the Eurasian and Philippine Sea plates, which forms the spine of the island. The mountains are being eroded by the many landslides caused by earthquakes and typhoons. Taiwan averages about four typhoons per

year, and on 25 August 2004, Typhoon Aere produced wind damage, landslides, and flooding on the northeastern coast.

Dadson *et al.* have measured the changes in sediment concentrations in rivers



Map showing the paths (blue) of four recent typhoons, the Chi Chi event, and the normalized change in suspended sediment load (color scale).

(normalized to the water discharge rate) for a typhoon (Herb, August 1996), earthquake (moment magnitude 7.6 Chi-Chi, September 1999),

CHEMISTRY

A Mercury Bridge

Environmental contamination by mercury and other heavy metal ions is a growing problem, and detection requires sensors that are both highly selective and sensitive. Ono and Togashi have developed a DNA-based sensor that meets these requirements. Their 22-nt oligo contains two 9-nt mercury-binding sequences and a 4-nt linker, and is capped by a fluorophore at one end and a fluorescence quencher at the other. When Hg^{2+} ions bridge apposing thymines, the fluorophore and quencher are brought together in a hairpin configuration, and fluorescence drops. The sensor is more sensitive (40 nM) than previously reported small-molecule sensors and can detect Hg^{2+} ions even in the presence of a 10-fold excess of other heavy metals. — JFU

Angew. Chem. Int. Ed. **43**, 4300 (2004).

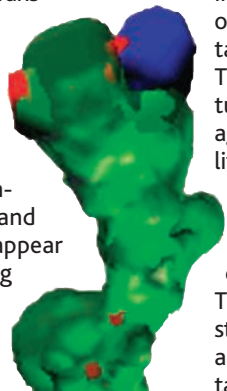
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CELL BIOLOGY

Putting Supplies to Use

The fragile X mental retardation protein (FMRP) is an RNA-binding protein that is highly expressed in neurons. Absence of the protein results in fragile X syndrome, the most common form of inherited mental retardation, and, in a mouse knockout, the abnormal development of dendritic spines, which may result in deficits in long-term synaptic plasticity. Previous work has suggested that FMRP regulates the neuronal trafficking messenger RNAs (mRNAs) and represses translation of these mRNAs.

Two groups, Stefani *et al.* and Khandjian *et al.*, describe the association of FMRP with polyribosomes—large, rapidly sedimenting granules containing mRNAs and ribosomes—and these appear to be actively translating conglomerates because Stefani *et al.* show that the ribosomes



Reconstruction of a dendritic spine (green) showing FMRP granules (red) in the neck and head, and the presynaptic marker synapsin (blue).

can be released by the translational inhibitor puromycin. A clue to how FMRP might be involved in delivery, repression, and use of its mRNA cargo comes from results reported earlier by Antar *et al.* Using high-resolution fluorescence microscopy, they show that FMRP-containing granules are localized to dendritic spines and that stimulation, either through KCl depolarization or via metabotropic glutamate receptors, dynamically regulates FMRP localization in dendrites and at synapses. Thus, the apparently contradictory functions of FMRP may simply reflect where in the supply line one looks. — GJC

J. Neurosci. **24**, 7272 (2004); *Proc. Natl. Acad. Sci. U.S.A.* **101**, 13357 (2004); *J. Neurosci.* **24**, 2648 (2004).

BIOCHEMISTRY

A Neatly Pleated Sheet

Amyloid diseases such as Alzheimer's disease are characterized by a buildup of insoluble protein aggregates in tissues. These aggregates are formed by the conversion of normal soluble proteins into

insoluble self-assembling fibrils via a soluble oligomeric intermediate that may be toxic to cells. An antibody that binds specifically to the oligomeric intermediates of several different amyloid proteins blocks toxicity, suggesting that the intermediates may share a common structure.

To identify what this structure might be, Armen *et al.* have modeled the conformational changes of four amyloid proteins under the low pH conditions that favor amyloid fibril formation. From their molecular dynamics simulations, they conclude that a key step in oligomeric intermediate formation is the acquisition of an α -pleated sheet that could be the target of the toxicity-blocking antibody. The α -pleated sheet, a secondary structural motif proposed more than 50 years ago by Pauling and Corey, has garnered little attention because it is rarely found in proteins. The α -pleated sheet has a residue length of 3.0 Å compared to 3.3 Å for the more common β -sheet conformation found in many proteins. The hunt is on to find this α -pleated sheet structure in the test tube; if it exists, such an unusual structure would be a valuable target for designing therapeutics. — OMS

Proc. Natl. Acad. Sci. U.S.A. **101**, 11622 (2004).

PALEOECOLOGY

Turning Over a New Leaf

Plants form the basis of most ecosystems, and understanding their turnover at the Cretaceous-Tertiary boundary is critical for determining the environmental effects of the large asteroid impact that seems to have triggered the mass extinction. Wilf and Johnson have studied in painstaking detail a section in North Dakota that spans the boundary and, when combined with other sections in North America that seemed to bear much of the brunt of the impact, helps document the effects of the extinction and earlier climate changes during the Cretaceous. Analysis of both leaf fossils and pollen shows that in all, about one-third to three-fifths of plant species in North America became extinct at the boundary, a bit lower than most previous estimates. Additional extinction occurred as a result of gradual global cooling during the latest Cretaceous. Most of the survivors were minor contributors to the Cretaceous ecosystem, yet they dominated the subsequent ecosystems in the Tertiary. — BH

Paleobiology **30**, 347 (2004).