Keeping the Guests Apart

Many proteins form remarkably intricate pocket structures to orient and direct molecular reagents. Simpler nanometer-scale enclosures can also be formed by self-assembly from molecules in solution through hydrogen bonding or coordination to metal centers. **Dalgarno *et al.*** (p. 2037) show that one such structure can encapsulate two polyaromatic dye molecules but keep them rigidly apart, as evidenced by x-ray diffraction in the solid state and fluorescence-quenching studies in solution. The rigidity seems to arise from π-stacking and CH···π interactions between the guest molecules and the capsule walls.

Calling in the Bodyguards

Plants attacked by herbivorous insect pests can bring out their own chemical defenses, but can also call in "bodyguards," predators that prey on the first round of pests. Volatile compounds are important in this signaling triangle. **Kappers *et al.*** (p. 2070; see the news story by **Pennisi**) have now engineered *Arabidopsis* to produce the volatile compounds necessary to call in such bodyguards by targeting terpenoid metabolism.

Roomy Solids

Metal-organic framework compounds, which can have high surface area and useful gas storage capabilities, are normally held together by coordination to single metal centers. Recently, it was shown that hydrothermal synthesis of Cr ions, organic dicarboxylates, and fluorhydric acid produced porous frameworks anchored by inorganic trimers that are linked into large supertetrahedrons. **Férey *et al.*** (p. 2040; see the Perspective by **Hupp and Poeppelmeier**) now report the computational design and synthesis of a related compound based on Cr ions and terephthalate that is stable up to 275°C and adopts a zeotype cubic structure with a giant cell volume (~702,000 cubic angstroms), as determined from an analysis of x-ray powder diffraction data. The network of extra-large pore sizes (diameters of 30 to 34 angstroms) leads to a very high nitrogen sorption capacity of nearly 6000 square meters per gram, and allows even large Keggin polyanions to be incorporated into the cages.

A Very Long Wave

The recent Sumatra tsunami that produced devastation around the Indian Ocean traveled several times around the globe before dissipating. This history is recorded in a global tide-gauge network, and **Titov *et al.*** (p. 2045, published online 25 August 2005) have used an ocean model to understand the global propagation of this tsunami. Large waves were recorded in places such as the coast of Peru, locally in Antarctica, and at Halifax, Nova Scotia, far from the earthquake, and with a very indirect path. The modeling suggests that the waves were in part guided by Earth's mid-ocean ridge system.

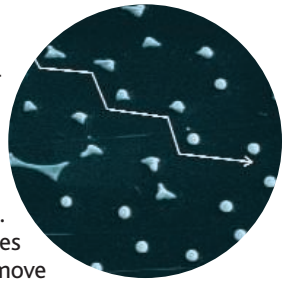
Out of a Wetter Africa

Between 3 million and 1 million years ago, the modern human genus *Homo* arose, *Homo erectus* appeared, and our ancestors migrated out of Africa. During this sequence of events, the general trend of African climate has been thought to be one of increasing aridity. **Trauth *et al.*** (p. 2051, published online 18 August 2005) now present a record of lake development and disappearance in rift basins from East Africa, the region from which most of the human fossils from that time comes. Three separate periods, each roughly 200,000 years in duration, were apparently wetter and caused the rift lakes to be deep and extensive.

Carry-on Chromosome

One approach to dissecting human diseases with multiple interacting loci has been to try and express large numbers of genes on human transchromosomal fragments or constructed artificial chromosomes in mice. Down syndrome (DS) depends on trisomy in chromosome 21, and several attempts have been made at recapitulating the disease through a transchromosomal approach. **O'Doherty *et al.*** (p. 2033; see the news story by **Miller**) report the germline transmission of a transchromosomal fragment carrying 91% of chromosome 21 genes. At least 58 of these were transcriptionally active and, although the fragment was not expressed uniformly in all somatic cells, the transchromosomal animals displayed a phenotype sharing similarities with DS, including behavioral and physiological abnormalities. The ability to transmit such a large human chromosomal fragment in mice should also allow the exploration of other complex genetic diseases.

Ready to Jump



Many studies have followed the rebound of droplets hitting a solid surface, but **Habenicht *et al.*** (p. 2043) have isolated just the second half of this process. They used a laser to melt irregularly shaped gold nanoparticles. Formation of the melted droplet causes the center of mass of the particle to move away from the surface, and for sufficiently high fluences, the process is rapid enough to desorb the droplet with speeds on the order of 10 meters per second.

Carotenoid and Retinal United

Carotenoids provide antenna molecules that increase the spectral range over which light energy can be absorbed and subsequently transferred to chlorophylls for use in photosynthesis. Retinal is the light-absorbing chromophore in a family of proton pumps—the archaeal and bacterial rhodopsins. **Balashov *et al.*** (p. 2061) describe the intermingling of these two phototransduction pathways within the bacterium *Salinibacter ruber*. They find a 1:1 complex of the carotenoid salinixanthin and the retinal-containing

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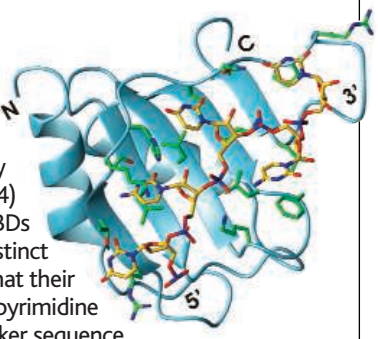
protein xanthorhodopsin and show that light absorbed via the carotenoid is transferred to the retinal and used as an energy source for pumping protons across the cell membrane.

Understanding Noise in Gene Expression

Extensive variation among populations can be largely attributed to genetic differences. However, even when genetics are the same (as with identical twins or clonal populations of cells), variability still exists. **Raser and O'Shea** (p. 2010) review the level of variation in gene expression among cells measured as "noise" in gene expression and summarize the current understanding of the sources and consequences of noise as well as its regulation.

Polypyrimidine-Tract Binding Protein Structures Revealed



Polypyrimidine-tract binding protein (PTB) is a eukaryotic protein that binds to UC-rich RNA substrates through four RNA binding domains (RBDs) and plays a key role in messenger RNA splicing. **Oberstrass *et al.*** (p. 2054) have determined the solution structures of the four RBDs each bound to a pyrimidine tract. Each domain has a distinct specificity, and the third and fourth domains interact so that their bound RNAs are antiparallel. Thus, RBD34 can bind two pyrimidine tracts in the same RNA only if they are separated by a linker sequence and can induce RNA looping to regulate alternative splicing.

Manipulating Muscle Satellite Cells

Satellite cells of muscle are thought to provide progenitors for muscle repair and regeneration, but are rare and difficult to isolate. **Montarras *et al.*** (p. 2064, published online 1 September 2005) successfully isolated muscle satellite cells from a mouse line that expresses green fluorescent protein using flow cytometry. When satellite cells isolated from the diaphragm were grafted into muscles of the *mdx* mouse, a model for muscular dystrophy, the cells effectively supported repair of the muscle and establishment of resident satellite cells. However, in vitro culture of the satellite cells to expand their numbers did not improve efficiency of engraftment.

A Toothy Problem

In mammalian tooth development, epithelial enamel knots appear where cusps will develop in a species-specific manner, but the question remains whether enamel knots really exert a causal effect on cusp patterns. **Kassai *et al.*** (p. 2067) show how regulation of enamel knots has dramatic effects on cusp patterning. Ectodin, a recently identified bone morphogenic protein antagonist in tooth development, appears to provide a "negative" image of genes expressed in the enamel knots that give rise to cusps and integrates the induction and inhibition of enamel knots. The enamel knots of ectodin null-mutant mice were enlarged and altered cusp patterns so extensively that they resembled the teeth of the black rhinoceros.

Ancient Linguistics

Studying the relationship of languages has traditionally depended on recognizing "cognate sets" of word pairs matched across languages and reconstructing the changes in their sounds and meaning. However, because of linguistic erosion, this method is limited to a time depth of only 8000 to 10,000 years, but much human migration occurred before then. **Dunn *et al.*** (p. 2072; see the Perspective by **Gray**) develop a method that uses the language structure, rather than vocabulary, to construct language phylogenies, and allows a much deeper sampling of linguistic time. Using features such as the ordering of sentence elements or the grammatical elements of gender or tense, they constructed phylogenies of Papuan languages in Island Melanesia that may have been separated since the late Pleistocene.

CREDIT: OBERSTRASS *ET AL.*

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