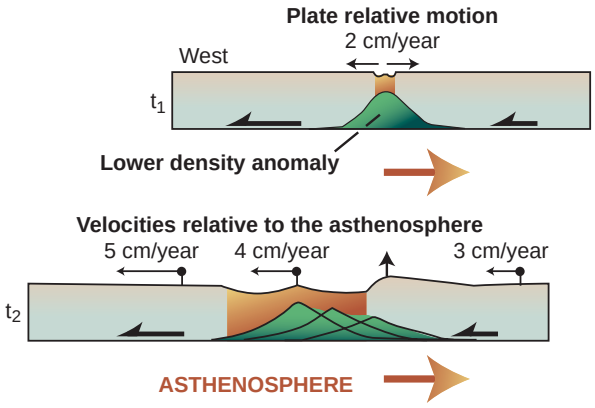
EDITORS' CHOICE

edited by Gilbert Chin

GEOPHYSICS

The Rise of the East



Model of preferential lifting of the eastern sides of ridges.

An early confirmation of plate tectonics theory was the finding of symmetrical magnetic anomalies on both sides of mid-ocean ridges. More recent studies, however, have suggested that rift zones can sport substantial asymmetry. Examining bathymetric profiles for 20 representative rift sections, Doglioni *et al*. have found that the eastern sides of the East Pacific Rise, the Mid-Atlantic Ridge, and the northwest Indian Ridge are all 100 to 300 m higher than the western sides. Moreover, the eastern flanks of continental rift zones, such as the Red Sea and Lake Baikal, are likewise uplifted relative to the western flanks. The asymmetry may stem from a global "westward drift" of the strong lithosphere relative to the underlying, more plastic mantle. Such drift would cause the depleted, buoyant asthenosphere (generated by partial melting below mid-ocean ridges) to be shifted relatively eastward beneath the lithosphere, which would then lift the eastern flanks. The same mechanism may have contributed to the anomalous uplift of the tectonically stable African continent since the Mesozoic. — SW

Tectonics 10.1029/2002TC001459 (2003).

GENETICS

Taking a Third Strike

Sickle cell anemia is the classic example of a monogenic disease, in which a mutation in the gene encoding the β chain of hemoglobin produces an altered protein that is directly responsible for the loss of red cells. At the other end of the spectrum are multifactorial diseases, such as diabetes and asthma, which are caused by mutations in several genes in combination with environmental factors.

Draper *et al*. document a rare instance of a triallelic digenic condition resulting in cortisone reductase deficiency (CRD). Within the lumen of the endoplasmic reticulum, two enzymes, hexose-6-phosphate dehydrogenase (H6PDH) and 11β-hydroxysteroid dehydrogenase type 1 (11β-HSD1), cooperate to drive the reduction of cortisone to cortisol. Of three CRD patients, two were homozygous for a mutation in H6PDH and heterozygous for a mutation in 11β-HSD1, whereas the third exhibited the converse genotype. In contrast, individuals bearing the same mutation in both copies of the gene encoding either enzyme (but without the third mutation) were unaffected. The interaction of these loci can be described as summed reductions in pathway flux that cross the threshold from health into disease. — GJC

Nature Genet. 10.1038/ng1214 (2003).

ECOLOGY/EVOLUTION

Brief Encounter

When humans disturb habitats, the range and distribution of plants can be altered, creating opportunities for hybridization between species heretofore isolated in place or time. *Banksia hookeriana* and *B. prionotes* are sister species living in the Australian sandplains and are pollinated by nectar-feeding birds. Under natural conditions they do not cross-fertilize because their flowering seasons do not coincide.

Lamont *et al*. have discovered that, owing to the greater availability of resources in disturbed vegetation, their flowering seasons expand and overlap; this gives rise to opportunities for cross-pollination. Hybrids between the two species were found in 10% of the disturbed sites investigated, but in none of the undisturbed sites. The hybrids are fully fertile and may prove to have a different range of environmental tolerances than their parent species. Because the disturbances are relatively recent, the aftermath for the genetics and evolution of these species is still uncertain. Nevertheless, this study points to a potentially new consequence of human activity for the biology of species. — AMS


Flowering *Banksia*.

J. Evol. Biol. **16**, 551 (2003).

CLIMATE SCIENCE

Thermal Blanket

One of the crucial factors limiting the predictability of global climate and surface temperature changes is a large uncertainty about the precise effects of aerosols on Earth's radiation balance. All large-scale global climate models include the direct radiative effects of aerosols at higher wavelengths, but few consider aerosol radiative properties in the infrared (IR) region. Vogelmann *et al*. report interferometric measurements of clear-sky IR spectra, performed during a cruise across the western Pacific Ocean. These data reveal large aerosol forcings of up to 10 W/m^2, values that are large compared to the estimated 1 to 2 W/m^2 forcing produced by greenhouse gas accumulation since the beginning of the industrial revolution. The response of climate to radiative perturbations can vary with altitude, and the aerosol IR effects are so large that the thermal radiative properties of aerosols will be important to include in climate models. — HJS

Geophys. Res. Lett. 10.1029/2002GL016829 (2003).

CHEMISTRY

A Race for the Gold

The adsorption of DNA molecules on gold surfaces is a convenient platform for emerging methods in bioanalysis and nanotechnology. Results from Kimura-Suda *et al*. indicate that caution is needed when interpreting such experiments, especially when oligo(dA) strands are involved. A combined x-ray photoemission and infrared spectroscopy study of competitive adsorption of homo-oligomers from solution onto gold surfaces shows that, whereas oligo(dC) and (dG) strands have similar adsorption affinity, oligo(dA) strands have

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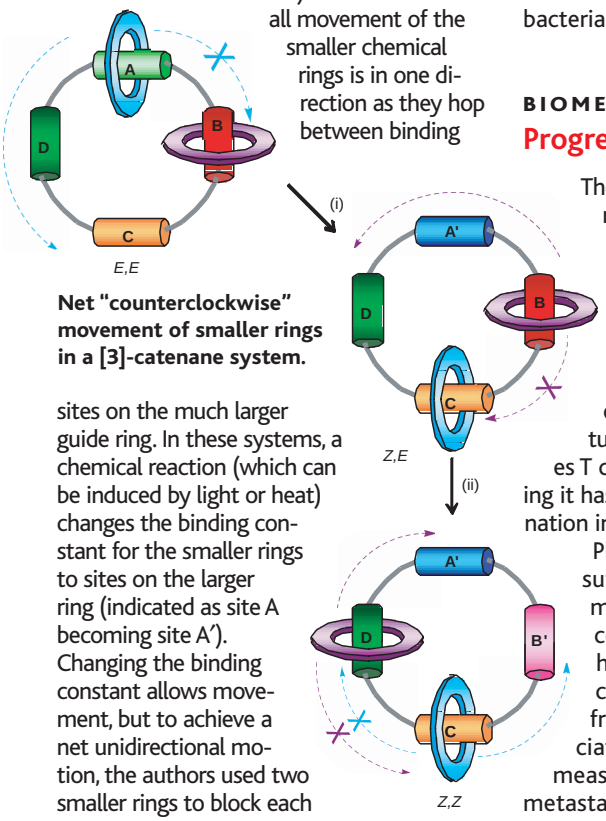
much greater affinity than oligo(dT)—so much so that a solution of dA•dT 25-mers leads to deposition of only the dA strands. Although the affinity of the bicyclic G and A would be expected to be greater than that for the pyrimidines C and T, the adsorption preference actually does not follow the thermodynamic preference of G > A > C > T. This finding may explain some previously puzzling results where AT hybridization would have been expected to dominate over adsorption. — PDS

J. Am. Chem. Soc. 10.1021/ja035756n (2003).

CHEMISTRY

Chemical Turnstiles

Entrance gates in subways and stadiums work, in part, because they are designed to rotate in only one direction. Leigh *et al*. have designed interwoven ring molecules (catenanes) in which the overall movement of the smaller chemical rings is in one direction as they hop between binding sites on the much larger guide ring. In these systems, a chemical reaction (which can be induced by light or heat) changes the binding constant for the smaller rings to sites on the larger ring (indicated as site A becoming site A′). Changing the binding constant allows movement, but to achieve a net unidirectional motion, the authors used two smaller rings to block each other from completely reversing direction. Like some biological motors, some individual steps are backtracks (such as the "clockwise" movement of the purple ring in step on the right-hand side). — PDS



Net "counterclockwise" movement of smaller rings in a [3]-catenane system.

Nature **424**, 174 (2003).

MICROBIOLOGY

Invasion Strategy

Bacillary dysentery occurs when the bacterium *Shigella flexneri* invades the cells lining the colon. The bacteria divide within the host cells and go on to invade neighboring cells. Contact with host cells activates the type III secretion of *Shigella* proteins, which insert into the host cell membrane and enable the cytosolic access of bacterial effectors that reorganize the host cell cytoskeleton, which, in turn, promotes successful invasion and further bacterial dissemination. Tran Van Nhieu *et al*. examined the role of the gap junction protein connexin in the processes of invasion and dissemination by *Shigella*. Cells lacking connexins were refractory to bacterial dissemination; in cells possessing connexin 26, transient peaks of intracellular calcium were induced during invasion. These peaks depended on the invading bacteria expressing a functional type III secretion system. The effectors then induced the opening of connexin 26 hemichannels, causing the release of ATP into the medium, stimulating further bacterial invasion. — SMH

Nature Cell Biol. 10.1038/ncb1021 (2003).

BIOMEDICINE

Progress on Cancer Regression

The tolerance displayed by the immune system toward self tissues represents a major obstacle in the treatment of cancer by immunotherapy. The surface protein cytotoxic T lymphocyte-associated antigen 4 (CTLA-4) has emerged as a primary target for overcoming unresponsiveness to tumors because it potently represses T cell activation and because inhibiting it has helped to improve tumor vaccination in animal models.

Phan *et al*. treated 14 patients suffering from progressive metastatic melanoma with a combination of antibody against human CTLA-4 and a vaccine incorporating two peptides derived from the gp100 melanoma-associated antigen. In three patients, measurable or complete regression of metastatic tumors was observed, as compared with no regression in patients treated with the vaccine alone in a previous trial. Autoimmune responses in tissues, including the skin and intestine, were also detected in six of the patients. Specific increase of reactivity to the vaccinating peptides was not detected in peripheral blood T cells, but an increased expression of activation markers was observed. Thus, these results hold promise for refining immunotherapy approaches in treating cancer. — SJS.

Proc. Natl. Acad. Sci. U.S.A. **100**, 8372 (2003).

CREDITS: LEIGH *ET AL.*, *NATURE* **424**, 174 (2003)