

edited by Gilbert Chin

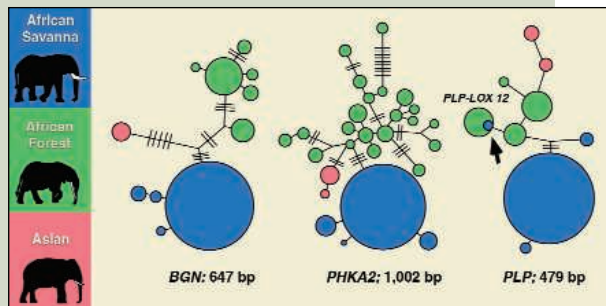
GENETICS

Parental Contributions in Elephants

African forest elephants and their much larger savanna cousins are now recognized as two distinct species that underwent an evolutionary split some 2.6 million years ago. Still, the two species coexist in narrow transition zones between forest and savanna and can produce forest-savanna hybrids.

In order to study this mixing, Roca *et al.* have analyzed the nuclear and mitochondrial (mt) DNA of the two species across sub-Saharan Africa. The distribution of nuclear alleles is, as expected, distinct between the two elephant species; however, several of the savanna populations have mtDNA typical of their forest counterparts, even though their nuclear DNA is clearly of the savanna. This striking dichotomy between nuclear and maternally inherited mtDNA can best be explained by repeated hybridization

between forest/hybrid females and the more aggressive savanna bulls, who presumably out-compete the forest/hybrid males, with each backcross further diluting the forest females' nuclear DNA. The high degree of similarity of the mtDNA in the savanna populations with that of the forest elephants suggests that the mixing is the result of a recent event, and the location of some of these savanna populations provides a clue: Although they are relatively distant from extant forests, they are within the range of the extended forests of the Holocene or, in the case of the Southern African populations, in the region of a large paleo-lake. — GR



Distinct haplotypes of three nuclear genes.

Nature Genet. 37, 96 (2005).

ods were used to analyze the nearly circular symmetric diffusion patterns, one based on Q space and the other on direct space, and both depend on the shift in the position of the first peak (relative to the uncompressing reading) for determining the strain in the sample. The experiments showed that the macroscopic stiffness of the material was less than one might expect from the nearest-neighbor bonding, due to rearrangement of the atoms on the scale of 4 to 10 Å. For the Q-space method, it is possible that

this technique can be applied to polymer glasses using laboratory x-ray sources, where absorption is not an issue. — MSL

Nature Mater. 4, 33 (2005).

EVOLUTION

A Minimal Set of Folds

The application of technologies that allow the collection of large amounts of data (genomic and proteomic, expression and structure) has generated a demand for methods that can be used to interrogate and systematize these data sets—hence large-scale biology has marched arm in arm with sophisticated (and sometimes bordering on the abstruse) computational analysis. In a refreshing departure from this complexity, Yang *et al.* have used a simple nearest-neighbor kind of approach to overlay a catalog of 174 sequenced genomes with the three-dimensional structures of 1294 protein fold superfamilies.

Surprisingly, they can resurrect the phylogenies of Archaea, Bacteria, and Eukarya quite accurately within each kingdom and pretty well across them. They also find 50 fold superfamilies that are

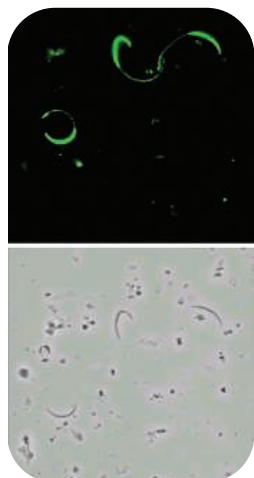
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MICROBIOLOGY

Breaking and Entering

Malaria begins when an infected Anopheline mosquito injects parasites into a potential host's bloodstream while feeding. The infective stage of the malaria parasite, the sporozoite, then travels to the liver through the bloodstream, where it invades hepatocytes. One of the major sporozoite surface proteins, the circumsporozoite protein (CSP), has been studied as a potential vaccine candidate, but its physiological role for the parasite within the mammalian host is unclear. Coppi *et al.* observed that during the invasion

process, when the parasites came into contact with target cells, CSP was proteolytically cleaved by a parasite-derived papain-like cysteine protease. In the presence of inhibitors of CSP processing, invasion was blocked in vitro. Furthermore,



CSP (top, green) on the surface of live sporozoites (bottom).

when mice were treated with a protease inhibitor specific for papain-like proteases, sporozoite infectivity was also completely inhibited. Thus, a specific proteolytic cleavage event is important in promoting the invasion process, and interfering with this process can prevent malaria infection. — SMH

J. Exp. Med. 201, 27 (2005).

MATERIALS SCIENCE

Disordered Strain

Many methods exist for the nondestructive measurement of strain in crystalline materials, where the regular ordering of atoms generates a sharp signal when probed with x-rays or neutrons. In amorphous materials, localized strain information can be obtained by using techniques that probe the surface, such as optical or electron microscopy, but behavior at the surface does not typically mimic that in bulk material. Further, the strain fields are usually governed by the behavior around inhomogeneities such as inclusions, voids, and cracks.

Poulsen *et al.* have developed a technique for measuring strain distributions in amorphous materials. They exposed a bulk metallic glass based on magnesium, copper, and yttrium to high-energy x-rays, and then compressed it in situ. Two meth-

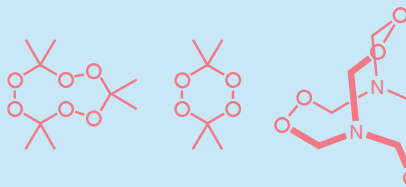
common to all three kingdoms—many, but not all, of these proteins are involved in translation—which, in the authors' view, represents the fossilized metabolic machinery of the last common ancestor of the three major lineages. — GJC

Proc. Natl. Acad. Sci. U.S.A. **102**, 373 (2005).

CHEMISTRY

Explosive Entropy

Explosive compounds, such as nitroglycerin or trinitrotoluene (TNT), tend to decompose via highly exothermic pathways. The explosion is sustained by the enthalpy released as strong bonds (in the products) form. In contrast, Dubnikova *et al.* suggest that triacetone triperoxide (TATP), which explodes with power comparable to that of TNT, undergoes a



A trio of peroxide-based explosives.

nearly thermoneutral decomposition and derives explosive force entirely from the increase in entropy. As its name suggests, this compound incorporates three acetone equivalents: It is a nine-membered ring with three O atom pairs separated by isopropylidene (>C(CH₃)₂) groups. The authors used density functional theory to calculate decomposition rates

along several pathways, beginning with the structure determined by x-ray diffraction. Comparison with experimental data suggests that exothermic oxidation of the hydrocarbon groups does not play a significant role. Instead, they conclude that the explosion is initiated by cleavage of an O-O bond and is driven by the liberation of four gaseous molecules (one ozone and three acetones) from the harmless-looking solid TATP. — JSY

J. Am. Chem. Soc. **10.1021/ja0464903** (2004).

APPLIED PHYSICS

Seeing Through Fog

Light is scattered and absorbed as it travels through turbid media such as fog, cloud, and dirty water, making it difficult to image objects that may be hidden within. Some light, however, passes through ballistically—that is, without loss—and capturing that ballistic light offers the potential for imaging otherwise hard-to-see objects. Zevallos *et al.* show that combining ultrashort pulses (130 fs) of light with a pulsed detection system (80-ps window) can improve the contrast between the buried object and the noisy background that arises from the diffuse light scattered from the surrounding turbid material; the brief window lets in most of the ballistic light and only a little of the noise, thereby providing a clearer snapshot. The ability to improve the imaging of objects normally hidden from view has a whole host of applications, from the medical imaging of biological tissue to remote sensing and underwater surveillance. — ISO

Appl. Phys. Lett. **86**, 011115 (2005).

HIGHLIGHTED IN SCIENCE'S SIGNAL TRANSDUCTION KNOWLEDGE ENVIRONMENT



Reactivating an Actin Regulator

Control of the actin cytoskeleton is critical for many cellular processes, particularly cell motility, and the actin-depolymerizing factor cofilin is inhibited by phosphorylation. Gohla *et al.* have identified a protein, named chronophin, with phosphatase activity toward phosphorylated cofilin. This enzyme is a member of the haloacid dehalogenase superfamily of phosphotransferases, which have a well-described catalytic mechanism as exemplified by the Ca²⁺-ATPase of sarco(endo)plasmic reticulum (see Olesen *et al.*, Reports, 24 December 04, p. 2251) but have not previously been implicated in serine dephosphorylation in mammals. Overexpression of chronophin decreased the amount of phosphorylated cofilin in HeLa cells, whereas depletion by RNA interference increased the amounts of phosphorylated cofilin and F-actin, stabilized membrane protrusions and stress fibers, and induced abnormalities in cell division. These findings suggest that chronophin could be a therapeutic target in cases (for instance, chronophin is overexpressed in neuroblastomas) where control of the actin cytoskeleton is disrupted. — LBR

Nature Cell Biol. **7**, 21 (2005).

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