EDITORS' CHOICE

edited by Gilbert Chin

EVOLUTION

Affiliative Felids

Humans have domesticated fewer than 10 animal species. It remains uncertain whether this small number reflects the rarity of susceptibility or "preadaptation" to domestication on the part of animals, or simply satiation on the part of humans. Cameron-Beaumont *et al.* investigated the degree of preadaptation among the smaller members of the cat family (Felidae), using tactile behavior (rubbing and licking) toward humans by zoo-bred animals as an indicator. Some lineages (lynx and Asian leopard groups) evinced a disinclination to affiliative behavior, whereas cats in the ocelot lineage were affectionate toward humans—more so, in fact, than domestic cats. It appears that the potential for tameness among felids is not evolutionarily restricted to the domestic cat, but that this relationship with humans was so successful that other human-felid alliances have never been contemplated, or perhaps have been stillborn because of behavioral incompatibilities. — AMS

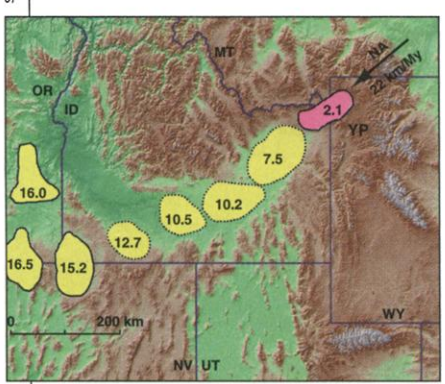
The domesticated cat.

Biol. J. Linn. Soc. **75**, 361 (2002).

GEOLOGY

Breaking Through the Crust

The largest known volcanic eruptions in North America during the past several million years have come from the Yellowstone Plateau (YP) system. Activity began about 16 million years ago in eastern Oregon (yellow, solid borders) and progressed east northeastward, to the current location in western Wyoming (magenta), in a series of major eruptions thought to mark the trace of a hot spot in the mantle beneath North America. These eruptions have spread ash over most of the western United States.



History of the Yellowstone hot spot.

Perkins and Nash used samples of this ash record from numerous localities to analyze the eruption history. In all, 142 major eruptions are recorded that can be separated into three broad sequences. Overall, the magma temperature and frequency of eruption (both of which may be driven primarily by the input of mantle-derived basalt) and migration rate (currently 22 kilometers per million years) all have declined over time, and these factors taken together with mantle-crust interactions could explain the history of eruption volumes. — BH

Geol. Soc. Am. Bull. **114**, 367 (2002).

CELL BIOLOGY

Capital Investment

During differentiation of professional secretory cells such as those in the pancreas or the liver, synthesis of the machinery of the secretory pathway—and in particular the rough endoplasmic reticulum (ER), which is the site of secretory protein synthesis—is dramatically increased. One of the machine parts is the mammalian ER protein p180, which serves as a receptor that binds the ribosome (the core of the protein synthesis machinery).

Heterologous expression of p180 in yeast induces proliferation of ER membranes and increases the capacity of the secretory pathway. Hyde *et al.* find that, contrary to expectations, these effects did not involve an induction of the unfolded protein response pathway or an increase in transcription of secretory machinery genes. Instead, it appeared that the lifetimes of messenger RNAs (mRNAs) encoding secretory pathway parts were extended, and this stabilization of mRNAs depended on their association with the ER. Whether this longevity is due to sequestration of the mRNAs from exonucleases or to interference with programmed RNA degradation will be of interest. — SMH

J. Cell Biol. **156**, 993 (2002).

CHEMISTRY

Smoking Catalysts

Catalyzing reactions in physiological solvents has seemed to be reserved for protein and RNA enzymes, but Dickerson and Janda show that a metabolite—in this case, a nicotine derivative that can persist in the blood of heavy smokers—can do so, too. Nornicotine can accelerate the aldol condensation reaction for a variety of substrates in phosphate buffer solutions near physiological pH. In the authors' proposed mechanism, which is similar to that for a type I aldolase, condensation products will form so long as carbon-carbon bond formation can compete with the rapid hydrolysis of an enamine intermediate. Although the overall rates are still low, the action of such compounds could affect glycolysis and the metabolism of drugs containing ketone groups. — PDS

J. Am. Chem. Soc. 10.1021/ja017774f (2002).

BEHAVIOR

Estrogen and Learning

Whether and how the hormone estrogen affects cognitive functions has not been clear but has important implications for hormone replacement therapy in women. Current therapy involves the administration of a complex equine estrogen mixture, and its effects appear to include providing some protection against Alzheimer's disease. Estrogen receptors are expressed in the mammalian brain, but estrogen has been reported both to enhance and to impair memory. Mice lacking the estrogen receptor α (ER-α) isoform display some types of behavioral alteration, though not as severely as mice lacking the ER-β isoform.

Rissman *et al.* report that ER-β knockout female mice learned to escape in a water maze just as well as wild-type females; however, when treated with physiological doses of estrogen, learning was impaired or blocked in the knockout mice. In addition, the knockout mice displayed decreased expression of ER-α in response to estrogen treatment. The authors propose that ER-β may facilitate the

CONTINUED ON PAGE 17

SOURCE: (TOP) PHILLIP SZUROMI; (BOTTOM) MIKE PERKINS

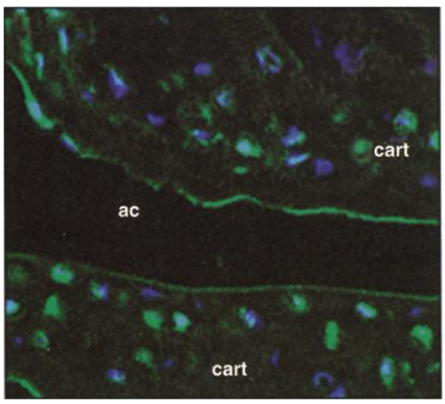
positive effects of estrogen on spatial learning and that its absence may increase the negative consequences of estrogen by removing a suppressive effect on ER-α–mediated activities. — LDC

Proc. Natl. Acad. Sci. U.S.A. **99**, 3996 (2002).

BIOMEDICINE

All Over the Joint

Rheumatoid arthritis is a debilitating and costly disease that affects over 2 million people in the United States; it is characterized by chronic inflammation of the synovial lining of the joints, which can ultimately lead to destruction of the joint and surrounding tissue. This inflammation is thought to be an autoimmune reaction, and the glycolytic enzyme glucose-6-phosphate isomerase (GPI) has been fingered as a likely target antigen. However, GPI is expressed in all tissues, so it has been difficult to explain why the immune attack is directed specifically to the joints.



GPI (green) on the cartilage surface (cart) lining the articular cavity (ac).

New insight into this puzzle emerges from Matsumoto *et al.*, who show that in healthy mice, GPI from the bloodstream selectively accumulates on the cartilage surface lining the joints. These joint-specific deposits of GPI were greatly amplified in a mouse model of rheumatoid arthritis. In complementary work, also with mice, Wipke *et al.* found that systemically injected antibodies against GPI localize within minutes to the peripheral joints and that this localization persists for at least 24 hours. These results support a model in which GPI (or other target antigens) exposed on the cartilage surface serves as a target for pathogenic autoantibodies, which in turn trigger an inflammatory cascade that proceeds unimpeded because cartilage lacks the normal cellular inhibitors of antibody-triggered immune attacks. — PAK

Nature Immunol. **3**, 360; 366 (2002).

APPLIED PHYSICS

Powering Up in Single Mode

Rare earth–doped optical fibers are compact and rugged light sources used in the telecommunication industry as lasers and optical amplifiers. For higher powered pulsed applications, their utility is somewhat hampered by the limited power they can carry and emit. One obvious alternative, increasing the diameter of the fiber, has the disadvantage of allowing light to propagate via many transverse modes. Di Teodoro *et al.* provide a simple solution by introducing a bend in the fiber of just the right geometry that suppresses propagation of the higher order modes. An ytterbium-doped multimode fiber 17 micrometers in diameter can operate in single mode when coiled around a 1.67-micrometer diameter spool and can achieve peak power in excess of 300 kilowatts. — ISO

Opt. Lett. **27**, 518 (2002).

HIGHLIGHTED IN *SCIENCE*'S SIGNAL TRANSDUCTION KNOWLEDGE ENVIRONMENT

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Fatty Acids and Synaptic Strength

Changes at synapses in the brain are thought to provide the cellular basis for learning and memory. The AMPA-type (α-amino-3-hydroxy-5-methylisoxazole-4-propionic acid) receptors for the excitatory transmitter glutamate are anchored in place at synapses through interactions with a scaffolding protein known as postsynaptic density protein–95 (PSD-95), which is known to be posttranslationally modified by addition of the fatty acid palmitate. El-Husseini *et al.* report that synaptic activity (corresponding to release of glutamate by the presynaptic neuron) enhances palmitate cycling on PSD-95 in cultured hippocampal neurons. Pharmacological inhibition of palmitoylation breaks up PSD-95 clusters and reduced AMPA receptor–mediated signaling. Thus, activity-dependent depalmitoylation of PSD-95 provides a new mechanism for the regulation of synaptic function. — LBR

Cell **108**, 849 (2002).

CREDITS: MATSUMOTO *ET AL.*, *NATURE IMMUNOL.* 3, 360 (2002)