



BIOMECHANICS

No Skimming Allowed

Pterosaurs were flying reptiles and the first air-borne vertebrates; they dominated the skies from the late Triassic to the end of the Cretaceous, during the epoch of their relatives, the dinosaurs. On the basis of similarities in jaw structure, it has been suggested that several pterosaurs, including *Thalassodromeus* and the giant *Quetzalcoatlus* (with a wingspan of up to 15 m), could have fed by skimming in a manner akin to that of extant ternlike shorebirds (*Rynchops* spp.). Skimmers fly low over calm shallow water with the tip of their lower beak dipping beneath the water surface. Humphries *et al.* have used full-sized models of mandibles from *Thalassodromeus* and the modern skimmer *R. niger* to demonstrate that the pterosaur bill would have generated an order of magnitude more drag in traveling through the water. Modeling indicated that the energetic cost to a shorebird of flying with its beak in the water is almost prohibitive (~20% of the total cost of flight), and the authors suggest this levy might explain the rarity of the skimming life-style. The substantially greater cost for a pterosaur larger than 2 kg appears to exclude outright skimming as a possible means for procuring food. Furthermore, many of the morphological specializations to the head and neck seen in *Rynchops* are not found in pterosaurs of any size, including the ability to regenerate broken or abraded bill tips and the presence of a reinforced lower jaw. — GR

PLoS Biol. 5, e204 (2007).

BIOMEDICINE

Timing is Everything

Cervical cancer is the second leading cause of cancer deaths in women, with more than 80% of these occurring in developing countries that have limited access to screening programs. Some strains of a sexually transmitted virus, human papillomavirus (HPV), play an essential role in the pathogenesis of this cancer. Newly developed vaccines directed against these oncogenic strains have shown promising results in clinical trials aimed at assessing their prophylactic activity—that is, their ability to prevent high-grade precancerous lesions or cervical cancer in women who had not been exposed to HPV before vaccination.

Hildesheim *et al.* have examined whether HPV vaccination can promote an immune response to HPV in women who are already infected with the virus. Such therapeutic activity had not been observed in animal studies of the HPV vaccines, but data addressing this question in humans are important for ongoing discussions of when and to whom the vaccines should be administered to maximize their benefits. In a

study involving about 2000 HPV-positive women in Costa Rica who were monitored for 12 months, the authors found that HPV clearance rates—measured as cell-mediated immunity to the virus—were comparable in subjects receiving the HPV vaccine (specifically, the bivalent HPV-16/18 cervical cancer candidate vaccine) and those who had received a control vaccine directed against an unrelated virus. Although the long-term effects of the current HPV vaccines are not yet known, the apparent absence of therapeutic efficacy noted in this study reinforces the view that the optimal time to vaccinate is before the onset of sexual activity. — PAK

J. Am. Med. Assoc. 298, 743 (2007).

IMMUNOLOGY

Wearing One's Own Coat

Autoimmunity conventionally falls within the realm of the adaptive immune system because it pertains to responses to self-constituents in humans and in a variety of animal models. Previous studies have shown that mice lacking the enzyme alpha-mannosidase-II (α M-II) exhibit a dearth of complex-type N-glycans and develop a

syndrome similar to the human autoimmune disease systemic lupus erythematosus. Green *et al.* provide evidence that α M-II deficiency in mice involves activation of the innate immune system. The first piece of evidence emerged from the observation that initiation of disease did not require cells of hematopoietic origin; rather, the mesangial cells of the kidney were stimulated to produce inflammatory proteins. Subsequently, other cells of the innate immune system participated in the development of glomerulonephritis, which unexpectedly could be attenuated by boosting the adaptive immune system via injection of immunoglobulin G. The absence of α M-II resulted in a surfeit of hybrid-type N-glycans that were recognized by innate immune lectins otherwise dedicated to sensing the structurally similar mannose linkages of foreign glycoproteins. Future work might determine if the maturation of branched glycans on self-proteins broadly helps avert harmful innate immune responses, and whether pathogens might cloak themselves in complex-type garb as a means of evading detection. — SJS

Immunity 27, 10.1016/j.immuni.2007.06.008 (2007).

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CHEMISTRY

Networked Polyhedra

One approach to engineering porous solids has focused on combining metallic and organic building blocks. Linking multiple organic ligands to metal-ion nodes can produce microporous three-dimensional networks. In an extension of this method, small bidentate ligands such as

1,3-benzenedicarboxylate (bdc)

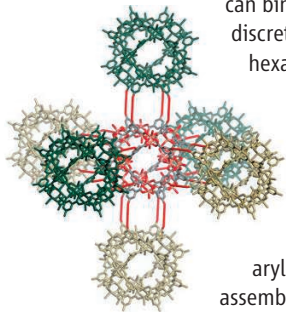
can bind to Cu^{2+} ions to form discrete polyhedra (rhombi-hexahedra) that in turn act

as larger nodes for assembling expanded networks. Perry *et al.* now show that when

two bdc units are bridged with a flexible aryloxy spacer group, self-assembly with Cu^{2+} ions leads to a covalently linked set of the poly-

hedral units, arranged together in an interpenetrating tetragonal net. Crystallography reveals that the ligands adopt two independent conformations, one syn and one anti, in different directions within the lattice. — PDS

J. Am. Chem. Soc. **129**, 10076 (2007).



NEUROSCIENCE

Playing with Mirrors

Since the initial characterization of mirror neurons in the monkey—visuomotor neurons that fire during both execution and observation of movements—more than a decade ago, there has been much speculation about whether similar neurons in the human brain are involved in a wide range of social cognitive processes, such as understanding the emotions and intentions of others. Dinstein *et al.* point out that many of the human brain areas thus implicated were characterized as being active during imitation and have not always been shown to encode movements in a selective manner. Using brain imaging of subjects playing the rock-paper-scissors game, they describe a set of six cortical areas that were active during the observation and the execution of the three types of hand configurations, where selectivity was defined as a suppressed response to a repeated configuration (for instance, playing rock followed by rock). The same regions, in addition to a host of others, were active during imitation trials (simultaneous observation and execution) and also were active, albeit only weakly, during instructed movement trials—these two kinds of tasks having been used in most prior studies of human mirror neuron-like responses. One intriguing question raised by these findings is whether there might exist dis-

tinct, interspersed populations of visual and motor neurons within these regions. — GJC

J. Neurophysiol. **98**, 10.1152/jn.00238.2007 (2007).

CLIMATE SCIENCE

Change in the Water

The rapid, millennial-scale cooling episodes (called Dansgaard-Oeschger events) that occurred repeatedly throughout the last glacial period are normally associated with climate change in the North Atlantic region. However, research over the past decade has also implicated their expression in the Pacific and Indian Oceans, leading to two competing explanations for the connection: atmospheric or oceanic transmission of the signal. Schmittner *et al.* used an ocean-atmosphere climate model to show that changes in buoyancy-forced ocean circulation can cause large variations in subsurface oxygen levels by changing oxygen demand. This result suggests that the climate signal of Dansgaard-Oeschger events originating in the North Atlantic was transmitted by oceanic, rather than atmospheric, teleconnections; further, it is consistent with the association of Dansgaard-Oeschger events with changes in the Meridional Overturning Circulation of the Atlantic Ocean. The influence of changes in wind stress and North Pacific Intermediate Water formation was also notable, though somewhat weaker than that of thermohaline circulation. Thus, ocean ecosystems and biogeochemical cycles appear to respond sensitively to ocean circulation changes. — HJS

Paleoceanography **22**, 10.1029/2006PA001384 (2007).

PHYSICS

Harmonizing High Harmonics

Intense infrared laser pulses can ionize the atoms of an inert gas and give rise to x-ray emission at high multiples (or harmonics) of the driving field frequency when the liberated electrons recombine with their parent ions. Selecting the output wavelength and boosting its intensity, however, have been experimentally challenging and have in large part been approached by trial-and-error. One severe problem is that the phase of emitted x-rays is out of kilter with the driving infrared laser field. Cohen *et al.* propose to address this issue by using a weak counter-propagating, quasi-continuous laser field to modulate the phase of the emitted harmonics. They show by simulation that tuning the wavelength of the counter-propagating laser field, and thus modulating the refractive index experienced by the driving field, could efficiently correct the phase mismatch. — ISO

Phys. Rev. Lett. **99**, 53902 (2007).