EVOLUTION

Rarely Jumping Genes

Horizontal gene transfer (HGT), the movement of genes between distinct lineages, has been proposed as a means by which foreign genetic material can be incorporated and utilized within a species and its descendants. It is believed that most such transfer has occurred either via the engulfment of one organism by another, which generally is restricted to single-celled species, or during the course of host-parasite interactions. Richards *et al.* have identified suspected HGT events by comparing the genomes of six plant species with those of 150 prokaryotes and eukaryotes. Through stringent phylogenetic analyses, they found five fungus-to-plant and four plant-to-fungus transfers, including three cases in which transfer had been presaged by a jump from a prokaryote to a eukaryote. On the basis of these results, they suggest that HGT between eukaryotes does occur and can provide new genes that are useful enough to hang on to. — LMZ

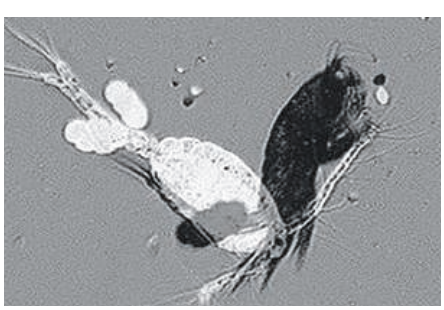
Plant Cell **21**, 10.1105/tpc.109.065805 (2009).

BIOPHYSICS

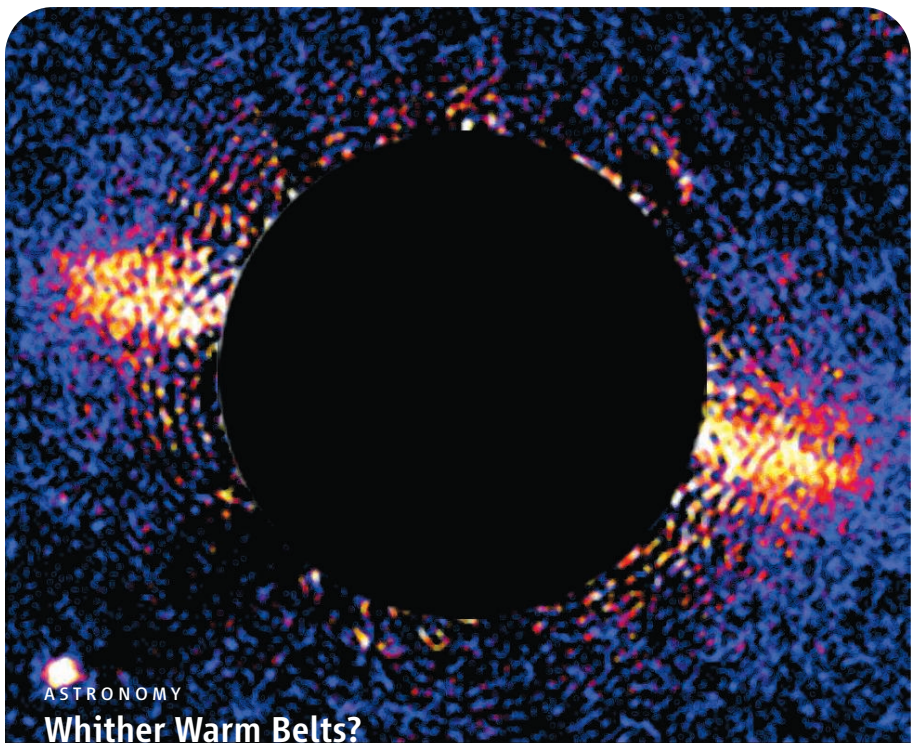
In the Blink of an Eye

The advent of high-speed video microscopy is helping to resolve many of the hitherto unseen mysteries of animal biomechanics. Copepods—crustaceans that typically are smaller than 1 mm and are a vital component of marine foodwebs—feed on even smaller prey that they capture in swift, surprise lunges. What has been a puzzle is how this is achieved without alerting the target or displacing it by fluid flow caused by the leaping copepod. Capturing 2000 images per second, Kiørboe *et al.* show that the attack is so fast (about 100 mm s^{-1}) that the viscous boundary layer ahead of the predator remains thin, thus preserving the element of surprise, as well as maneuverability. In terms of evolutionary feasibility, this strategy appears to be restricted to zooplankton in a limited size range (0.3 to 1 mm), which also possess a powerful musculature. — AMS

Proc. Natl. Acad. Sci. U.S.A. **106,** 12394 (2009).



Ambush of a dinoflagellate by *Oithona davisae*.



ASTRONOMY

Whither Warm Belts?

Is our solar system's architecture—four terrestrial planets, an asteroid belt, four Jovian planets and a Kuiper belt—common across the universe? Space-based infrared observations of circumstellar disks around nearby, Sun-like stars have suggested that cold disks of dust and debris analogous to our Kuiper belt are common, whereas warmer, asteroid belt analogs appear to be much rarer. Chen *et al.* reanalyzed spectra acquired with the Spitzer infrared telescope of three debris disks around nearby stars, and found that the thermal emission from all three is consistent with the presence of two dust populations, one warm and one cold. For one of the stars, HR 8799, the warmer dust lies within the orbits of the three known local planets, whereas the cold dust lies outside—a structure very much resembling that of the solar system. Eleven stars are now known to have multiple dust belts around them, in potentially similar fashion to the solar system's asteroid belt and Kuiper belt; the arrangement could prove even more common. — MJC

Astrophys. J. **701**, 1367 (2009).

PROTEIN CHEMISTRY

The Rag-and-Bone Trade

Sequencing ancient DNA can establish genetic differences among species and can document population changes over long periods, yet a major challenge is to avoid extensive sampling of rare and ancient specimens. One technique used to probe for the presence of well-preserved DNA in such specimens is to measure the extent of racemization of aspartic acid. Shapiro *et al.* have performed replicate amino acid analysis in three laboratories of 91 samples of human and animal bones that had been recovered from a range of burial environments and ages. They found no correlation between racemization and the successful amplification of ancient DNA. Collagen, which constitutes up to 95% of bone protein, contributes most of the aspartic acid in bone, but racemization is slowed by its triple helical structure; after denaturation into soluble gelatin, racemization proceeds readily, but gelatin is more easily lost in the burial environment. — LDC

Proc. R. Soc. B **276**, 2971 (2009).

CREDITS (TOP TO BOTTOM): PAUL KALAS, UC BERKELEY; KIØRBOE *ET AL., PROC. NATL. ACAD. SCI. U.S.A.* **106**, 12394 (2009)

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PHYSICS

Up for Hours

The natural lifetime of an atomic or molecular excited state is typically measured in millionths, billionths, or trillionths of a second. Traditionally, the challenge in achieving precision has therefore been developing a laser source and detection system with sufficiently fine time resolution. Hodgman *et al.* tackle a challenge at the opposite extreme: precise measurement of the longest atomic excited state lifetime. Promotion of one of the two electrons in helium from the 1s to the 2s orbital, concomitant with a spin flip, produces the 2^3S_1 state, which persists for more than 2 hours before relaxing by emission of a photon in the extreme ultraviolet regime. The lifetime is especially long in this case because both orbital angular momentum and spin considerations render direct relaxation highly improbable in quantum mechanical terms. In measuring the comparatively long duration of such a state, the challenges are twofold: collisional interference by other atoms in the system must be compensated for, and the rare photon-emission events must be detected with great efficiency and matched to a well-determined number of excited atoms. The authors addressed the first of these challenges by isolating the excited helium atoms in a magnetically confined trap. To accurately quantify emission events, they switched from a previously implemented absolute detection scheme to a relative detection mode, comparing the number of photons emerging from atoms in the 2^3S_1 state to those emerging from atoms prepared in a shorter-lived (and thus more easily calibrated) state at somewhat higher energy. The extracted lifetime of 7870 s compares well with theoretical predictions. — JSY

Phys. Rev. Lett. **103**, 53002 (2009).

CANCER

Becoming Homesick

One mechanism by which organisms battle the spread of cancer cells is the process of anoikis—cell death that occurs when a cell's adhesion molecules lose touch with their cognate substrata that line the cell's normal home within the body. A deficit in anoikis, which is mediated in part by the tumor suppressor protein p53, may contribute to cancer metastasis. Cheng *et al.* used RNA interference to identify SIK1 (salt-inducible kinase 1) as necessary for p53-mediated anoikis in a transformed mammary epithelial cell line. Losing SIK1 was associated with an increase in micrometastases formed by transformed cells upon injection into mice. Losing the protein kinase LKB1 is also associated with cancer; LKB1 phosphorylates and activates SIK1, and in a lung tumor cell line that lacked LKB1, a constitutively activated from of SIK1 inhibited invasion and metastasis. An enhanced understanding of cancer metastasis may lead to strategies to prevent this deadly aspect of the disease's progression. – LBR

Sci. Signal. **2**, ra35 (2009).

APPLIED PHYSICS

Focusing Gem

Diamond is a hard, chemically stable, and wear-resistant material, and so constitutes an ideal coating for apparatus used under harsh conditions. At the same time, it is not particularly pliable and therefore would not seem to be the first material of choice for tunable optics. However, Kriele *et al.* show that a thin membrane of nanocrystalline diamond—deposited initially as a thin film on a sacrificial substrate that is subsequently etched away—can be used as a flexible lens. By simply varying the applied pressure, the authors show that the membrane can bend and bow, with the focal length of the diamond lens varying accordingly from infinity to just 3.5 mm. Diamond should thus find use in remote-sensing applications and imaging in harsh environments: no longer just a material to be seen with, but now a material to see with as well. — ISO

Appl. Phys. Lett. **95**, 31905 (2009).

MEDICINE

A Gut Feeling

Crohn's disease is a chronic inflammatory disease of the gastrointestinal tract. The exact cause is unknown, but environmental and host genetic factors are known to be important. Jansson *et al.* have carried out a large-scale study of the gut microbiota and detected thousands of metabolites in fecal samples from sets of identical twins that were discordant for Crohn's disease using high-resolution ion cyclotron resonance–Fourier transform mass spectrometry. They identified metabolites that could differentiate between diseased and nondiseased individuals, including some from pathways involved in tyrosine metabolism, which is consistent with genetic polymorphisms that have been associated with Crohn's disease. The data from this metabolomic study could lead to the identification of biomarkers for disease diagnosis. — HP

PLoS ONE **4**, e6386 (2009).

CREDIT: JUPITERIMAGES