PSYCHOLOGY

State of Reference

Students in elementary physics classes are introduced to the concept of frame of reference—the spatial coordinate system used by an observer to describe events—for instance, in the context of the perceived motion of trees by a passenger in a moving automobile. Adding in the dimension of time leads into nonintuitive territory, as in the example of a traveling astronaut who returns to Earth younger than her stay-at-home twin.

Building on previous work that demonstrated that internal physiological states can influence one's perception of physical quantities (such as thirsty people being more likely to characterize objects as transparent; that is, resembling water), Balcetis and Dunning show that internal psychological states are also capable of altering our perception of the external world. They induced states of high or low cognitive dissonance (a mismatch between thought and action) by asking or telling two groups of students to walk across campus wearing various fruit- and vegetable-themed adornments. In order to render a freely chosen yet somewhat embarrassing task less unpleasant to fulfill, the first set of students mentally shortened the distance they had to cover by estimating it to be fully 40% less than the average estimate made by the second group. Intriguingly, the route to ameliorating the state of dissonance appeared to be purely perceptual, as the free-choice students did not shorten their time of exposure by walking faster; in fact, they took about 10% longer. — GJC

Psychol. Sci. **18**, 917 (2007).

MATERIALS SCIENCE

Thin and Fast

Temperature changes in gas-phase chemical processes such as combustion and explosions can evolve on the submicrosecond time scale, but commercial thermocouples (TCs) are limited to millisecond response times. Thin-film TCs can achieve submicrosecond responses, but extreme film thinness (less than 100 nm) affects sensitivity through decreases in the thermopower. In principle, TCs made from submicrometer-diameter wires (SMTCs) would have a more favorable change in thermal mass and could be thicker (1.0 to 0.5 μm). Bourg *et al*. fabricated SMTCs by first electrodepositing silver wires 1.0 to 0.5 μm in diameter onto half of a stepped graphite surface. A mask covering the other half of the substrate was removed, the silver wires were coated with a self-assembled alkanethiol monolayer, and nickel wires were deposited. The arrays were then pressed into a cyanoacrylate adhesive, and after hardening, the graphite was removed. Scanning electron microscopy revealed a robust weld at the silver/nickel interface. The success rate for SMTCs ranged up to 80%, and these junctions were functional after months of air exposure. In laser-heating tests, response times varied from tenths of microseconds to several microseconds, with outputs of 20 μV/°C. — PDS

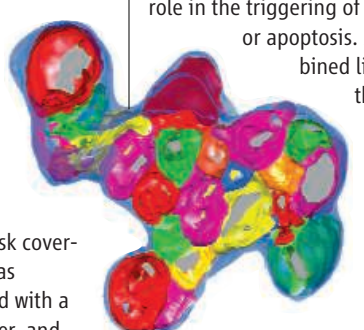
Nano Lett. **7**, 10.1021/nl071990q (2007).

CREDITS (TOP TO BOTTOM): ERICH LESSING / ART RESOURCE, NY; SUN *ET AL.*, *NAT. CELL BIOL.* **9**, 1057 (2007)

CELL BIOLOGY

Death Throes in Living Color

Mitochondria—the tiny double-membrane–bounded organelles that provide healthy cells with a ready supply of energy—also play a key role in the triggering of programmed cell death or apoptosis. Sun *et al*. have combined light microscopy and three-dimensional electron microscopic tomography to record in detail the structural changes in mitochondria in cells that have been stimulated to undergo apoptosis. One of the first events observed after stimulation was a rearrangement of submitochondrial morphology: The inner mitochondrial membrane changed from an organized arrangement of folded membrane cristae into a vesicular patchwork, which was accompanied by the release of several mitochondrial proteins into the cytosol. However, one key mitochondrial protein involved in the apoptosis pathway, cytochrome c, was released efficiently independently of and before this remodeling. Swelling of the mitochondria occurred after the collapse of the membrane potential and was accompanied by a dissolution of the intramitochondrial structure. This generation of a composite time-course overview of morphological changes within single cells should help to dissect a variety of nonsynchronous cellular events. — SMH



Vesiculated reconstructed mitochondria.

Nat. Cell Biol. **9**, 1057 (2007).

ECOLOGY/EVOLUTION

Something Fishy in Speciation

Adaptation to environmental conditions is believed to drive population divergence and hence demonstrates the predictability of evolutionary change. By investigating the morphology, genetic divergence, and mate choice of Bahamas mosquitofish, which live in isolated pools, Langerhans *et al.* demonstrate parallel speciation events among pools, in which the presence or absence of a fish predator appears to be driving speciation. In pools with strong predation, mosquitofish have evolved a morphology conducive to high-speed escape swim-

Continued on page 21

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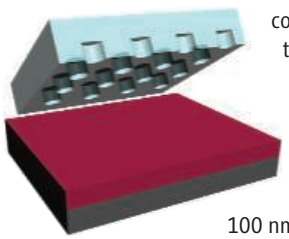
ming. Haplotype and allozyme analyses show that these morphological changes in response to predation have occurred multiple times. As these fish prefer to mate with similar individuals, the presence or absence of a predator drives speciation through mate selection. Taken all together, this set of results shows a direct link between natural selection and speciation: The traits under divergent selection between environments are the same traits used in mate choice, resulting in reproductive isolation between populations inhabiting different environments. — LMZ

Evolution **61**, 2056 (2007).

APPLIED PHYSICS

A Bigger Photonic Playground

In metallic nanostructures, surface plasmons, the collective oscillations of free electrons, can induce such phenomena as enhanced optical transmission and collimation of light through a subwavelength aperture. Though the structures are patterned on length scales of 100 nm, surface plasmons can interact over much longer distances. Henzie *et al.* cleverly combined a series of standard lithographic techniques to make larger photonic structures. Using interference lithography, they patterned high-quality silicon masters from which hundreds of photomasks could be made for patterning over centimeter length scales. Patterns of holes were created in both Si and Au films, either as infinite arrays or as a set of islands or patches. The patterned Au arrays exhibited an order-of-magnitude enhancement of optical transmission, a feature comparable to the optical quality seen in nanohole films produced by ion milling. When patches were not too far apart, plasmon interactions between them also led to much higher sensitivity in refractive index sensing. — MSL



CREDIT: HENZIE *ET AL.*, *NAT. NANOTECHNOL.* **2**, 549 (2007)

Nat. Nanotechnol. **2**, 549 (2007).

ECOLOGY

Millennium Bugs

One thousand years ago, the Emperor of China ordered that locust abundance be recorded so as to predict swarms. Although wetland management techniques reduced locust outbreaks in the second half of the 20th century, they have recently become troublesome again in the Yangtze and Yellow River basins, perhaps as a consequence of global climate change. Locust numbers peak during drought years and in years after floods, reflecting differential effects of moisture and warmth on different life cycle stages. This discrepancy has made it difficult to predict how the warmer and wetter conditions that are projected to prevail in East Asia will affect locust numbers.

Stige *et al.* combined the millennial time-series data with recent temperature and precipitation reconstructions of historical weather and discovered that locust abundance is highest during periods with a high frequency of floods and droughts. The records reveal that these more variable climates actually tended to occur during the coldest and wettest decades. So, warmer conditions will not necessarily favor locust breeding. — CA

Proc. Natl. Acad. Sci. U.S.A. **104**, 10.1073/pnas0706813104 (2007).

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<< Gut Sensations

Recent studies have helped to define the proteins that transform the arrival of sugars on the tongue into a sensation of sweetness. Two studies suggest that the same pathway functions in the intestinal tract. Jang *et al*. found that the sugar-sensitive G protein–coupled receptor (T1R2/T1R3) and the G protein subunit gustducin could be detected in enteroendocrine cells—specifically, the L cells, which secrete the appetite-regulating glucagon-like peptide (GLP-1) of the human duodenum. Application of glucose to human L cells resulted in GLP-1 release, which was blocked by an antagonist of T1R3. In mice, gustducin was also present in L cells, and delivering glucose directly into the duodenums (to bypass the tongue) of normal mice and of gustducin-deficient mice showed that GLP-1 secretion was absent in the latter group of animals and that the temporal pattern of insulin secretion was altered. Margolskee *et al*. connect glucose absorption to glucose sensing via the T1R2/T1R3 pathway. Normal mice, unlike those deficient in gustducin or T1R3, showed an increase in sodium-glucose cotransporter 1 (SGLT1) mRNA and protein and in glucose uptake when fed a high-carbohydrate diet or a low-carb diet containing artificial sweeteners. — NRG

Proc. Natl. Acad. Sci. U.S.A. **104**, 15069; 15075 (2007).

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