EDITORS' CHOICE

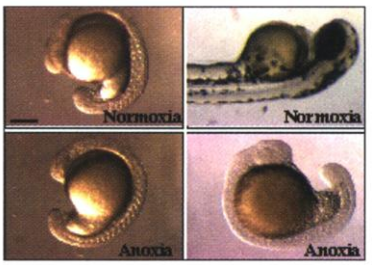
edited by Gilbert Chin

DEVELOPMENT

Conserving Energy

Removal of oxygen from growing embryos usually would translate into certain death. Invertebrates such as *Caenorhabditis* and *Drosophila* can withstand deprivation for a day, but vertebrate embryos, due to their larger size and complexity and their reliance on a circulatory system for supplying oxygen to tissues, would not be expected to tolerate anoxia for long.

Padilla and Roth have observed that zebrafish embryos can survive for 24 hours in the absence of oxygen. They enter a state of suspended animation: Cell division is arrested, and hearts stop beating. This cessation of energy-intensive processes enables the embryos to reduce their energy requirements to levels that can be sustained in the absence of oxygen. Figuring out how the embryos control the shutdown process and how the embryos recover upon reoxygenation may lead to advances in our understanding of a variety of pathological states. — SMH



Zebrafish development in 24 hours

Proc. Natl. Acad. Sci. U.S.A. **98**, 7331 (2001).

CLIMATOLOGY

Different Answers Blowing in the Wind

Winds blowing over the surface of the ocean are responsible for most large-scale surface ocean currents. Knowing the wind stress (the transfer of momentum from the air to the water) is a necessary part of understanding air-sea coupling during important climatological events such as El Niño–Southern Oscillation (ENSO). Conventional determinations of wind stress rely on wind measurements made with anenometers, which are located in fixed positions, so surface water motion is not included. Sea surface winds also can be measured remotely with satellite-mounted radar scatterometers that provide nearly global coverage on an almost daily basis. This method measures the relative motion between air and water, so the wind stress calculated from these measurements reflects the physical interaction between the atmosphere and the ocean. By comparing measurements from scatterometers with concurrent measurements from an array of buoy-mounted anemometers distributed throughout the tropical Pacific Ocean, Kelly *et al.* show that there can be large discrepencies, or even reversals, between estimates of wind stress made by the two methods. — HJS

Geophys. Res. Lett. **28**, 2469 (2001).

ANTHROPOLOGY

Indonesian Chronology

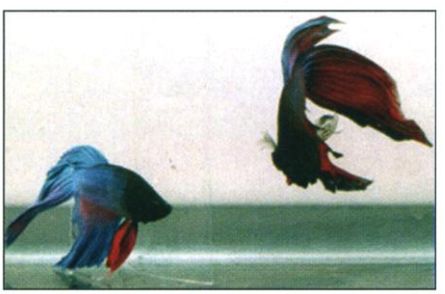
The precise date of migration of early humans into Indonesia bears on questions of when and which humans migrated from Africa and also relates to the development of technology and perhaps language. Recent dating from Java in western Indonesia indicates that humans may have arrived there considerably more than 1 million years ago; periodically, Java has been connected by land to the Asian mainland when sea level has dropped.

O'Sullivan *et al.* provide an extensive series of fission track dates of sites containing stone artifacts. These dates show that early humans migrated to Flores, in eastern Indonesia, by at least 840,000 years ago. Colonization of Flores would have required an open-water journey of at least several tens of kilometers, implying that seafaring technology had arisen by then. — BH

Geology **29**, 607 (2001).

ANIMAL COMMUNICATION

Fighting Fish and Biting Wasps



Animal signaling is usually studied in terms of just two parties—sender and receiver. Doutrelant *et al.* show that the nature of one-to-one communication can be altered by the presence of an onlooker. Male Siamese fighting fish, *Betta splendens*, display vigorously to each other, and their displays often are witnessed by other individuals—"eavesdropping" males or females who may glean information about the quality of potential mates or competitors. The displays are unchanged in the presence of an eavesdropping male, but in the presence of females the displays become less overtly aggressive (biting) and more showy (tail beating and prolonged gill cover erection). The effect of an audience might explain why conspicuous signals are ingredients in both intersexual and intrasexual communication, their proportions reflecting a tradeoff between the two functions.

Communication with a quite different function is found in social insect colonies, where much of the interaction between individual nestmates concerns benefits to the colony, such as exchange of information and division of labor. O'Donnell documents the curious behavior of the wasp *Polybia occidentalis*, whereby the workers engage in "social biting." Biting of one worker by one or more others, sometimes lasting for up to 10 minutes, has the effect of encouraging the bitten to leave the nest on foraging excursions. — AMS

Behav. Ecol. **12**, 283; 353 (2001).

GENETICS

Complex Rhythms

One of the hopes of the Human Genome Project has been to unearth the genetic basis of complex traits and diseases. This will be an arduous task indeed if a new paper by Shimomura *et al.* is any indication. They have studied circadian rhythms by examining five aspects of a wheel-running behavior (period, phase, amplitude, activity level, and dissociation) in two strains of mice (BALB/c and C57BL/6) and in the first- and second-generation progeny of matings between the strains. Quantitative trait locus analysis uncovered 14 loci with significant ef-

CONTINUED ON PAGE 2401

SOURCE: (TOP) PADILLA & ROTH, *PROC. NATL. ACAD. SCI. U.S.A.* **98**, 7331 (2001); (BOTTOM LEFT) SEAN O'DONNELL/UNIVERSITY OF WASHINGTON; (BOTTOM RIGHT) R.F. OLIVEIRA AND P.K. MCGREGOR

fects. A subsequent genome-wide analysis for epistatic genetic interactions identified two locus pairs, differing from any of the 14 loci, that affect two of the parameters when occurring together but not when occurring alone. All but two of these loci were clearly different from the mammalian clock genes. Thus, the variation in circadian behavior is determined by the accumulated effects of and interactions between many genes, most of which do not encode the central role players of the behavior. — KK

Genome Res. **11**, 959 (2001).

APPLIED PHYSICS

Giving Ferroelectrics a Push

Ferroelectrics, materials in which the electric polarization can be switched by an applied electric field, are attractive for the development of fast, bistable, nonvolatile memories. For materials in which the change in the electric dipole results in a local structural modification, switching could be detected with a scanning force microscope (SFM). Alternatively, it may be expected that application of an external stress also should affect the electric dipole.

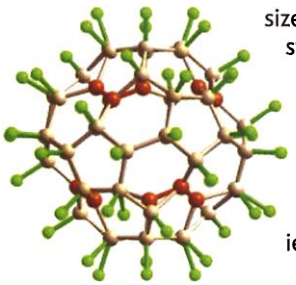
Abplanalp *et al.* show that combining electric and mechanical stress can lead to a novel switching effect in such materials. They used an SFM to apply mechanical stress and an electric field to a local region of a thin layer of barium titanate. At low mechanical stress, a voltage pulse poles the ferroelectric in the direction of the applied field, as expected. However, simultaneous application of a large mechanical force (0.9 micronewton) during the voltage pulse created a region that was poled in the direction opposite to the applied field. This ferroelastoelectric response may prove useful for developing new ferroelectric devices. — ISO

Phys. Rev. Lett. **86**, 5799 (2001).

CHEMISTRY

Unconventional Clusters

Atoms in small clusters often have different structures than they do in bulk, because their much greater surface energy must be minimized to reduce the overall energy. Different elements solve this problem in different ways, sometimes with spectacular results. For example, fullerenes such as C_{60} form the robust "football" structure of hexagons and pentagons. Troyanov *et al.* show, using x-ray crystallography, that C_{60} literally caves in when enough fluorine atoms (48 of them) are attached. The resulting molecule has very low reactivity because of shielding by the fluorine atoms.



The indented $C_{60}F_{48}$ fullerene.

For many other elements, especially metals, cluster sizes often follow "magic numbers"—certain cluster sizes are particularly stable. A well-known example is the Mackay icosahedra, which are complete at sizes of 13, 55, 147, . . . atoms. Recent studies indicate that cobalt may form polytetrahedral clusters, which can be assembled entirely from tetrahedra with atoms at their vertices. However, regular tetrahedra cannot fill the entire space, and the resulting strain must be reduced through local icosahedral coordination. Doye and Wales have discovered a series of magic numbers for polytetrahedral clusters. This series allows large polytetrahedral clusters to be built without serious strain. The structures are based on internal networks of linelike defects called disclinations. — JU

Angew. Chem. Int. Ed. **40**, 2285 (2001); *Phys. Rev. Lett.* **86**, 5719 (2001).

HIGHLIGHTED IN *SCIENCE*'S SIGNAL TRANSDUCTION KNOWLEDGE ENVIRONMENT

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Insider Versus Outsider

Strains of *Saccharomyces cerevisiae* infected with a small RNA virus secrete a toxin that kills uninfected yeast. The toxin activates TOK1, a potassium channel in the plasma membrane, and promotes unchecked K^+ efflux, which causes cell death. How infected yeast remain immune has remained a mystery, although some evidence has pointed to an intracellular mechanism that protects infected yeast cells. Sesti *et al.* show that even in the presence of extracellular toxin, TOK1 channels of infected cells remain inactive due to an interaction of intracellular toxin with the channel. Experiments with a mutant toxin that did not kill yeast but could still confer resistance to externally applied wild-type toxin suggests a role for the mutant protein in large-scale pharmaceutical productions, where killer strains of yeast are a concern. — JN *Cell* **105**, 637 (2001).

CREDITS: TROYANOV *ET AL.*, *ANGEW. CHEM. INT. ED.* **40**, 2285 (2001).