EDITORS' CHOICE

edited by Gilbert Chin

BIOCHEMISTRY

All for One and One for All

Chlorophyll (and bacteriochlorophyll) and heme biosynthesis diverge at the point where a metal atom is inserted into the middle of the porphyrin skeleton. Ferrochelatase inserts an iron atom into the nascent heme, whereas magnesium chelatase introduces magnesium. Hansson *et al.* have examined the activity of BchI, one of three proteins (BchD and BchH being the other two) that support the synthesis of bacteriochlorophyll. BchI is a member of a family of ATPases associated with various cellular activities (termed AAA^+) and has been shown to form a hexameric structure as have other AAA ATPases involved in protein degradation and DNA replication. Binding ATP is sufficient to promote formation of the hexamer and the interaction between BchI and BchD, but for BchI to catalyze the insertion of magnesium into protoporphyrin IX, which is bound by BchH, ATP must be hydrolyzed. Mixing wild-type and ATPase-deficient monomers did not yield active hexamers, suggesting that the conformational changes attendant on ATP hydrolysis must occur across all six monomer-monomer interfaces before metal atom insertion can take place. — GJC

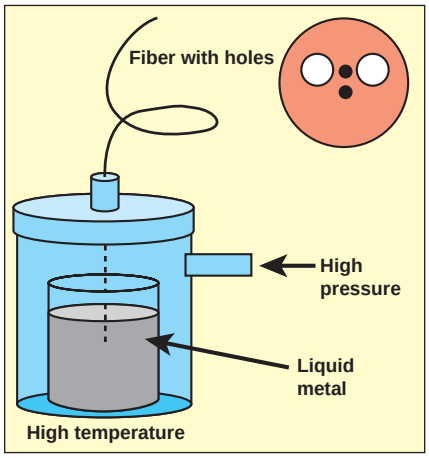
Proc. Natl. Acad. Sci. U.S.A. **99**, 13944 (2002).

APPLIED PHYSICS

Making Modulators from the Outside In

In communications, electro-optic fiber modulators are used to imprint electrical data onto the optical carrier or to change the output signal from phase to amplitude modulation. Such devices usually work as interferometers: A beam of light is split between two paths, and a change in the refractive index of one path is induced by an electrical bias, which introduces a phase difference between the two beams that results in constructive or destructive interference. This type of device requires the electrodes to run inside the length of the fiber, and current methods for inserting these electrodes are costly. Fokine *et al.* describe a simplified method for electrode insertion in which one end of a glass fiber with a twin-core and twin-hole design is placed in molten metal within a pressurized chamber. The melt is injected into the fiber holes and then allowed to solidify. For electrodes made of a Bi/Sn alloy, the bias required to induce a phase difference of π radians was ~1.3 kilovolts. This approach may ultimately lead to lower cost electro-optic devices. — ISO

Opt. Lett. **27**, 1643 (2002).



Pressure injection of a liquid alloy at 170°C.

CHEMISTRY

Thin Films from Thin Solutions

Surfactants can be used during the growth of oxide materials to create micelles that pattern the material at nanometer scale. Often the concentration of surfactant needed to create micelles is high and leads to difficulties in removing these organic molecules from the final product. Choi *et al.* show that thin films of nanostructured ZnO can be formed at low surfactant concentrations (as low as 0.1 weight %) on electrode interfaces. They take advantage of the electrostatic potential at the surface to induce micelle formation as well as the electrochemical formation of OH^- (via the reduction of nitrate ions), which raises the pH and helps to deposit ZnO from solution at the interface. The ZnO particles formed have wall thicknesses and interlayer spacings of about 1.5 nm. — PDS

J. Am. Chem. Soc. 10.1021/ja0275562 (2002).

GEOPHYSICS

A Steady Buildup

When the Tibetan Plateau (the highest topography on Earth) originated and how it evolved have been widely debated. Has all of Tibet been high for many millions of years, or has it been built gradually over time, from the south to the north? It is currently bordered on the north by the Altyn Tagh fault, one of Earth's longest strike-slip faults. As a result of the left-lateral slip on this fault, Tibet seems to be extruding eastward. Understanding the origin of the fault and the history of its motion are fundamental to deciphering the origin and evolution of the plateau, as well as its effects on the Asian monsoon, the dynamics of the Himalayan orogeny, and the tectonic evolution of Asia.

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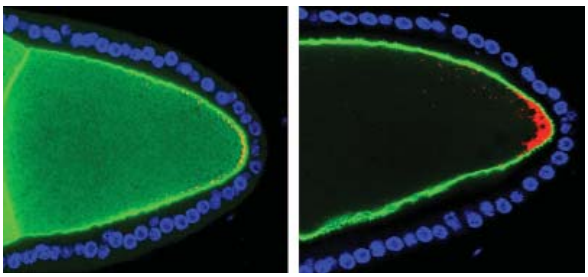

Unphosphorylatable (left) and phosphomimetic (right) forms of Dmoesin (green) affect posterior localization of Oskar (red).

DEVELOPMENT

Polar Coordinates

During oocyte development in *Drosophila*, intricate and orchestrated cellular rearrangements set up a functionally and physically polarized mature egg. Polesello *et al.* examined the role of the protein Dmoesin, whose homologs (ezrin, radixin, and moesin) in other organisms mediate interactions between the actin cytoskeleton and plasma membrane proteins. In oocytes, Dmoesin and actin coordinate to bring about the positioning of the posterior polarity determinant Oskar. Mutation of a conserved threonine residue suggests that phosphorylation of Dmoesin is important in organizing the cytoskeleton and in promoting the correct localization of posterior determinants. In *Drosophila* expressing mutant Dmoesin, anchorage of filamentous actin to the oocyte cortex was disrupted, resulting in aberrant anterior-posterior polarity in the future embryos. — SMH

Nature Cell Biol. **4**, 782 (2002).

CREDITS: (RIGHT) (SOURCE) FOKINE *ET AL., OPT. LETT.* **27**, 1643 (2002); (ILLUSTRATION) DEBRA J. MORGENEGG/*SCIENCE*; (LEFT) POLESELLO *ET AL., NATURE CELL BIOL.* **4**, 782 (2002)

Yin *et al.* examined rocks deposited along or adjacent to the fault, including those in a large nearby basin that were deposited during the past 65 million years. The nature of the deposits over time, and correlation along the fault with time allow the movement history to be inferred. Their data imply that uplift in at least this part of northern Tibet began about 50 million years ago, shortly after India collided with Asia. They conclude that the fault has been active since then, has accommodated nearly 800 km of slip, and has moved at about 9 mm per year, which remains its present rate of activity. — BH

Geol. Soc. Am. Bull. **114**, 1257 (2002).

ECOLOGY/EVOLUTION

Where the Birds Are

The selection of areas for species conservation has generally been conducted in the absence of detailed knowledge of the population dynamics of the endangered organisms. Thus, it has not been possible to predict with confidence the likelihood of the persistence or extinction of species in nature reserves. Araújo *et al.* present a potentially simple solution. Their rationale is that the probability of occurrence of a species in a particular locality at a particular time is likely to predict its likelihood of persistence. The probability of occurrence reflects factors such as the suitability of the habitat and the ability of the species to disperse into it. Using long-term

Two passerines—the woodlark (top) and the hawfinch (bottom).

data (two 4-year periods, 20 years apart) on the distribution of passerine birds in Britain, they find that the probability of absence in 10 km x 10 km tracts during the second period was negatively correlated to the probability of occurrence in the first period. Thus, greater success in conservation, in terms of minimizing extinction risk, may be achieved by selecting areas where the probability of occurrence is maximized. — AMS

Proc. R. Soc. London B **269**, 1971 (2002).

OCEANOGRAPHY

Fixed Locally

Water leaving the Mediterranean Sea through the Strait of Gibraltar is richer in nitrogen than the water entering from the Atlantic. What is the source of the budget-balancing nitrogen of the Mediterranean? Two possibilities are nitrogen input from rivers and fixation of atmospheric N_2. Pantoja *et al.* used analyses of the stable isotopic composition of nitrogen in particles and in chlorins (derivatives of chlorophyll) to evaluate the importance of biological N_2 fixation as well as past changes in the nitrogen cycle. They calculate that up to 20% of nitrogen in the western basin and up to 90% in the eastern basin may derive from biological N_2 fixation. These data add to a growing body of evidence that N_2 fixation supplies a significant fraction of the bioavailable nitrogen in subtropical surface waters and that a large percentage of subsurface nitrate is generated from the oxidation of newly fixed nitrogen. — HJS

Deep-Sea Res. I **49**, 1609 (2002).

IMMUNOLOGY

Complex Explanation

Every so often vaccines don't quite work as planned, as occurred in the 1960s when a vaccination program against respiratory syncytial virus (RSV) led to worse, rather than better, responses in children who subsequently were exposed to the virus. The primary cause of enhanced RSV disease was traced to the use of formalin as a means of inactivating the virus in vaccine preparations, although why this should adversely affect immunity to RSV remained unclear.

Polack *et al.* report that enhanced RSV disease in mice is characterized by deposition of antibody-containing immune complexes and by activation of components of the complement system; signs also detected in lung tissue preserved from affected children. Mice lacking either the complement component C3 or B cells did not develop enhanced RSV disease when immunized with formalin-inactivated RSV vaccine. The requirement for both antibodies and complement agrees with the interpretation that vaccination might stimulate excessive production of antibodies that, while failing to neutralize the virus itself, could nevertheless form immune complexes and activate complement-mediated damage in the lungs. Potentially, this could result from disruption of critical viral epitopes by formalin treatment or from diminished maturation of B cells that produce high-affinity antibodies. — SJS

J. Exp. Med. **196**, 859 (2002).

PHOTOS: GRAHAM CATLEY/LINCOLNSHIRE BIRD CLUB