EDITORS' CHOICE

edited by Gilbert Chin

MICROBIOLOGY

Chemical Crosstalk in a Biofilm

The bacterial pathogens *Burkholderia cepacia* and *Pseudomonas aeruginosa* contribute to the death of cystic fibrosis patients. This association is no accident. *P. aeruginosa* produces volumes of slimy polysaccharides and lipopeptides that form the structural components of a biofilm and help to shield the bacteria from antibiotics. Biofilm production is regulated by a density-dependent mechanism called quorum sensing, which is mediated by hormone-like *N*-acyl homoserine lactones. These molecules control the production not only of biofilm matrix material but also of virulence factors such as proteases, flagellae, and fimbriae.

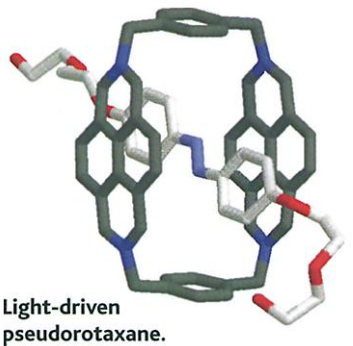
Huber *et al.* have found that *B. cepacia* shares the same quorum-sensing molecules as *P. aeruginosa*; thus, these organisms potentially enhance each other's virulence. Mutations in the *cep* quorum-sensing system of *B. cepacia* resulted in an immature biofilm and an absence of swarming behavior, although the latter deficit could be reversed by adding biosurfactants. — CA

Microbiology **147**, 2517 (2001).

CHEMISTRY

Light Machinery Powered by Light

Like macroscopic machines, molecular machines need energy to run. If energy is supplied in the form of chemical fuel, then not only must it be delivered, but waste products that form must be removed. Balzani *et al.* show that light can be used to power the dethreading and rethreading of a pseudorotaxane, in which a cyclic component moves back and forth over a linear backbone (true rotaxanes have bulky groups at both ends that usually prevent complete dethreading). There are two isomers, *E* and *Z*, of the "thread." Initially, the *E* isomer forms a pseudorotaxane with its partner cyclophane; irradiation at 365 nanometers then photoisomerizes the *E* to the *Z* isomer, which dethreads. Irradiation at 436 nanometers reverses the photoisomerization, and the *E* isomer rethreads to form the original construct. Such light-powered nanomachine components have the added advantage that they can be switched on and off easily and rapidly. — JU



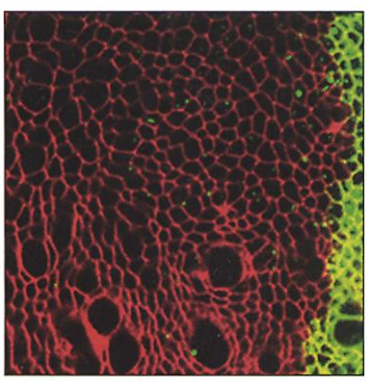
Light-driven pseudorotaxane.

Chem. Commun. 10.1039/b105160c.

DEVELOPMENT

Woolly Sailors

Gradients of morphogens are important in development and in tissue patterning. Although diffusion might suffice for the dispersal of soluble molecules, some morphogens adhere to membranes and to the extracellular matrix.



Argosomes (green dots) leaving the posterior compartment (green) and entering the anterior region (red).

Greco *et al.* have used *Drosophila* embryos to examine how the gradient of one such membrane-associated morphogen, Wingless, might be established. This protein appears to be released from cells that are located in the imaginal disc epithelium, via the budding of membrane vesicles, called argosomes. These vesicles, which contain Wingless and other membrane constituents (labeled with green fluorescent protein), appear to be derived from the basolateral regions, and can be observed to depart from one cell and to travel into surrounding areas, possibly by means of transendocytosis. How these tiny membrane carriers navigate the extracellular and intracellular byways before arriving at their destinations will be of interest. — SMH

Cell **106**, 633 (2001).

CLIMATOLOGY

Going Away with the Flow?

The West Antarctic Ice Sheet (WAIS) contains enough ice that sea level would rise by approximately 5 meters if it were to melt completely in response to global warming. Even in the absence of large catastrophic collapse, the factors that control the transition from slow inland ice flow, dominated by internal deformation, to streaming flow, dominated by basal sliding, are important to understand in order to predict how the ice sheet will evolve and how much the sea level might rise. It has been suggested that a soft sedimentary bed may provide material to form a lubricating layer that allows ice streams to develop.

Studinger *et al.* tested this proposal by using aerogeophysical data to estimate the distribution of marine subglacial sediments and fault-bounded sedimentary basins beneath the WAIS. They find that significant ice flow occurs exclusively in regions covered by subglacial sediments. The distribution of subglacial sediments therefore can provide a template for ice flow and has the potential to modulate the evolution of ice streams and the WAIS. — HJS

Geophys. Res. Lett. **28**, 3493 (2001).

GENETICS

Second Sightings

The inherited disorder retinitis pigmentosa (RP) affects 1 in 4000 individuals and is characterized by progressive degeneration of the photoreceptor cells in the retina. Patients with this disorder commonly develop tunnel vision and night blindness, which can then progress to complete blindness. Although RP is genetically heterogeneous, several of the loci have been identified as genes involved in the phototransduction pathway.

In an appealing convergence of concept, researchers now report that two of the genes responsible for autosomal dominant RP encode putative pre-messenger RNA (mRNA) splicing factors: proteins that are needed to make mature mRNA. McKie *et al.* show that the culprit gene on chromosome 17p13.3 (*RP13*) encodes an ortholog of yeast splicing factor PRP8, and Vithana *et al.* show that the culprit gene on chromosome 19q13.4 (*RP11*) encodes an ortholog of yeast splicing factor PRP31. Why de-

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SOURCE: (LEFT) GRECO *ET AL.*, *CELL* **106**, 633 (2001); (RIGHT) BALZANI *ET AL.*, *CHEM. COMMUN.* 10.1039/B105160C

fects in a fundamental housekeeping function such as splicing would affect only the retina and not other tissues is unclear, but the authors note that the retina is one of the fastest metabolizing tissues in the body and may be particularly vulnerable when splicing is disrupted. — PAK

Hum. Mol. Genet. **10**, 1555 (2001); *Mol. Cell* **8**, 375 (2001).

MATERIALS SCIENCE

Photosensitive Magnetic Switches

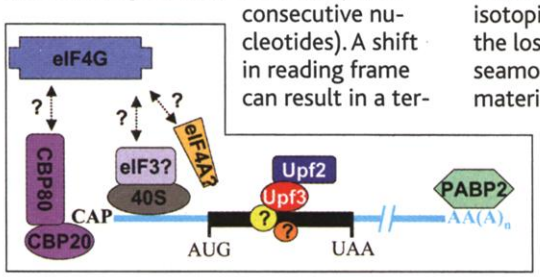
Some photosensitive molecules can undergo reversible structural transitions that result in significant changes in the optical properties; this class of molecules can be used as optical switches. There is evidence that suggests that careful design of the bonding arrangement within a molecule could produce magnetic behavior as well. Exploiting both the photostructural sensitivity and the magnetic properties of molecular materials would create the potential to develop a large breadth of applications, but the successful union of these characteristics has been hard to attain. Nakatani and Yu present a short status report on this developing field and find that the incorporation of organic photochromes (cationic spiropyrans) into molecular magnetic systems yields light-induced switching of the magnetic properties. Although the switching proceeds only at cryogenic temperatures, the demonstration of the principle is encouraging. — ISO

Adv. Mater. **13**, 1411 (2001).

MOLECULAR BIOLOGY

Remembering the First Time

Translation, or the making of proteins from messenger RNA (mRNA), relies on the exact registration of codons (three consecutive nucleotides). A shift in reading frame can result in a termination codon being created from the joining of parts of two codons. Such a deleterious junction can also result from inexact splicing, which is the process that removes intervening sequences from the pre-mRNA. Recent work suggests that when the ribosome transits the mRNA for the first time, a quality control mechanism checks to see if the termination codon lies downstream of all of the exon-exon junctions. If not, then components of the nonsense-mediated decay (NMD) machinery may be recruited by the junctional complexes (as described by Le Hir *et al.* and by Kim *et al.* and Lykke-Andersen *et al.*, 7 Sept., Reports, pp. 1832 and 1836).



Model of the first round of translation.

Ishigaki *et al.* show that two cap-binding proteins, CBP80 and CBP20, bind to the 5′ end of the mRNA in the nucleus and are then replaced by the mainly cytoplasmic eukaryotic initiation factor 4E. This swap may provide the signal (perhaps one of many) that no premature termination codons are present and that the likelihood of synthesizing a truncated protein (which may have a dominant negative function) is small. — GJC

EMBO J. **20**, 4987 (2001); *Cell* **106**, 607 (2001).

GEOCHEMISTRY

Lost Superocean

The largest mass extinction occurred about 250 million years ago at the boundary between the Permian and the Triassic. At that time, almost all of the continents were part of one supercontinent called Pangea, which was surrounded by a superocean called Panthalassa. Carbon isotopic records from marine deposits near the continental shelf of Pangea show an extreme excursion, signifying that a major climatic change, quite possibly related to the mass extinction, occurred at about the same time.

Musashi *et al.* have analyzed the carbon isotopic record of Permo-Triassic marine deposits from two ancient volcanic seamounts in southwest Japan. These seamounts were located in the Panthalassa superocean, far away from the continental shelf of Pangea, and their carbon isotopic record represents a sampling of the lost superocean's environment. The seamount carbonate minerals and organic materials show a sharp increase in the light isotope, carbon-12, consistent with major changes seen in organic and inorganic carbon from other records. Thus, this signature of the lost superocean provides further evidence for a dramatic and global alteration of the carbon cycle (affecting organisms and sedimentary rocks). Additional modeling of the carbon record may help to determine whether the global climate change and mass extinctions may both have been related to a large impact event. — LR

Earth Planet. Sci. Lett. **191**, 9 (2001).

CREDITS: ISHIGAKI *ET AL.*, *CELL* **106**, 607 (2001)