HIGHLIGHTS OF THE RECENT LITERATURE

ECOLOGY/EVOLUTION

A Need for Specialists and Generalists

Raphanus raphanistrum **(above) and** ***Medicago sativa*****.**

No one disputes the agricultural importance of pollination, but what might happen if, under the current mass extinction, pollinator diversity were compromised? Fontaine *et al.* have measured the effect of pollinator diversity on plant yields in a 2-year experiment in caged plots at a site outside Paris. They created unmixed and mixed communities of plants with open or tubular flowers and pollinator insects with long (bumblebees) or short (syrphid hoverflies) proboscises, and they counted the number and species of fruits, seeds, and seedlings produced. As expected, the type of pollinator did have a significant effect: Bumblebees stimulated more fruit production overall, and the tubular flowers were unable to form fruits well if only syrphids were present. But there were unexpected effects: Although able to trigger fruit production, the bumblebees gave rise to fewer seeds per fruit for the open-flowered plants (possibly because they kept revisiting the same flowers, which is called geitonogamy), and when both types of pollinators were present, the overall recruitment of seedlings was enhanced, especially in the most complex of the communities. It appears that in mixed plots, the bumblebees show a preference for the tubular flowers and hence reduce their frequency of visits to the open flowers, which leaves the open flowers to the more efficient attentions of the syrphids. — CA

PLoS Biol. **4**, e1 (2006).

BIOCHEMISTRY

Filled with Lipids

The F- and V-type proton-pumping ATPases exhibit a common mechanical design in which the transmembrane passage of protons turns a membrane-embedded rotor that drives the nucleotide-binding components of the cytoplasmic turret through a cycle of conformational changes. This motor can run in forward or reverse directions, hydrolyzing ATP as it pumps protons uphill or making ATP as protons flow downhill. The precise structure of the entire membrane assembly has not yet been determined, but recent findings have offered views of the homo-oligomeric ring, which contains from 10 to 14 identical c subunits, depending on species. Using a photogenerated carbene, Oberfeld *et al.* fill in one of the gaps by demonstrating that in the *Escherichia coli* F-ATPase, the c subunits can be cross-linked to phospholipids at the inner surface of the ring, which is large enough (about 15 to 20 Å in diameter) to accommodate about 10 lipid molecules in the outer leaflet and 2 or 3 in the inner leaflet. — GJC

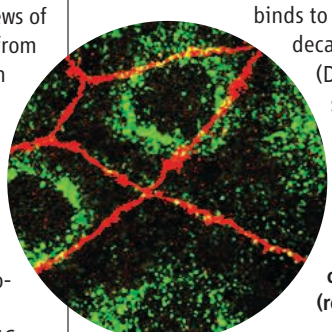
Biochemistry 10.1021/bi052304+ (2006).

VIROLOGY

Breaking and Entering

In order to establish a productive infection, group B coxsackie viruses (CVBs) (human pathogens that cause meningitis) need to cross an epithelial cell layer during transmission by fecal-oral or respiratory routes. Epithelial cells form a barrier to the passage of molecules and viruses by virtue of tight junctions that effectively seal off one side from the other. Protein components of the tight junction include the coxsackie and adenovirus receptor (CAR), whose virus-binding site is exposed only toward the basolateral surface; viruses approaching from the apical surface (the more likely arrival route) will not be able to access CAR.

Coyne and Bergelson describe how CVBs circumvent this problem of access. Invading virus binds to a protein known as decay-accelerating factor (DAF) on the apical surface of the epithelial cell layer. Binding to DAF triggers the intracellular activation of the Abl kinase, which promotes the rearrangement of the actin cytoskeleton via its effects on the small GTP-binding protein Rac. The actin rearrangements allow the virus to move to the tight junctions, where it can associate with CAR, which leads to virus entry and the eventual delivery of viral RNA into the cytoplasm. At the same time that DAF binding turns on Abl kinase, a kinase called Fyn is activated; this promotes viral recruitment to and internalization via caveolar membranes during the entry process. — SMH



Virus (green) in caveolae and CAR (red) at tight junctions.

Cell **124**, 119 (2006).

MATERIALS SCIENCE

Small and Sensitive

Fiber optic systems offer significant bandwidth and efficiency advantages as compared with traditional current-bearing wires. However, shifting the carrier from electrons to photons requires the development of alternative switch and detector technologies. Recently, indium phosphide nanowires were investigated for potential use as integrated detectors in photonic devices and optical switches.

Pettersson *et al.* have prepared more complex heterostructures and analyzed their response across a range of infrared wavelengths. The authors grew indium arsenide (InAs) wires with a core region including either 15 or 35% phosphorus, and then incorporated them into photodetection devices. The energy gap between the InAs and InAsP conduction bands strongly reduced the dark current (that is, the current measured when the wires are not exposed to light), and the spectral response could be modulated by the extent of phosphorus doping. Moreover,

Continued on page 745

CREDITS (TOP TO BOTTOM): JEAN EVERETT/COLLEGE OF CHARLESTON; HUGH WILSON/DIGITAL FLORA OF TEXAS; COYNE AND BERGELSON, *CELL* **124**, 119 (2006)

Published by AAAS

Continued from page 743

light that was polarized parallel to the wire induced 10 times more current than orthogonally polarized light, a property attributed to the large dielectric contrast between the nanowires and surrounding medium. The results suggest considerable promise for these structures as efficient infrared polarization-sensitive detectors in the 0.65- to 1.4-eV energy range. — MSL

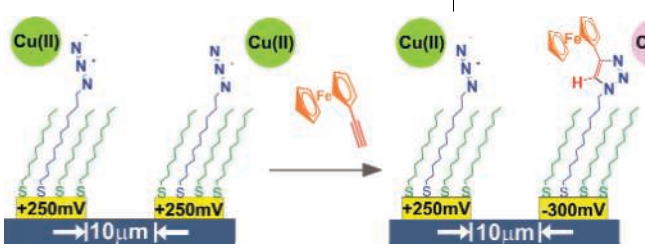
Nano Lett. 10.1021/nl052170l (2006).

CHEMISTRY

Stick, Switch, Click

Microelectrode arrays can be useful in sensor devices, but the application of such arrays depends on being able to modify their surfaces in a controlled fashion. Devaraj *et al.* have adapted a "click" reaction—the high-yield coupling of an azide to an alkyne—so that microelectrodes that are only 10 μm apart can be derivatized sequentially using the same ligation chemistry.

Azide-terminated alkane thiols were self-assembled onto gold microelectrodes on a silicon substrate, and then placed in contact with an electrolyte solution containing a Cu(II) bis(bathophenanthroline)disulfonic acid complex and ethynylferrocene (the alkyne). Switching on a negative bias (0.3 V) at one microelectrode reduced the copper complexes in the immediate vicinity to the active Cu(I) state, which enabled them to catalyze the click



Localized coupling of alkyne (orange) and azide (blue).

reaction between the azide and the alkyne. Nearby, positively biased microelectrodes were not functionalized and remained available for subsequent priming and reaction with other alkynes. — PDS

J. Am. Chem. Soc. 10.1021/ja058380h (2006).

ASTROPHYSICS

A Bright Window into the Very Distant Past

Gamma-ray bursts are extremely energetic flashes that are related to the deaths of stars. Their afterglows have been traced as x-rays and in the optical spectrum, which puts constraints on the physical mechanisms responsible for the energetic emission. Their brightness means that they are visible at great distances and hence carry information from long ago.

Using the Swift x-ray telescope, Watson *et al.* have detected the afterglow from the most distant gamma-ray burst yet: GRB 050904, with a redshift of 6.295. Its x-ray emission is highly variable, brightening and dimming on a time scale ranging from a few minutes to half a day. At its height, GRB 050904 was a luminous x-ray source, outshining the brightest quasars at that redshift by a factor of 100,000. Evidence of absorption in its spectrum suggests that oxygen and other elements formed in stars were already widespread in the young universe. This observation indicates that bright and distant gamma-ray bursts, rather than quasars, may be the best background sources for absorption studies of the intergalactic medium within a billion years of the Big Bang. — JB

Astrophys. J. **637**, L69 (2006).

ECOLOGY/EVOLUTION

Making Space for All Types and Sizes

Tree species in tropical rain forests vary widely in their maximum height at adulthood and thus occupy many levels in the forest. In contrast, trees in temperate forests tend to concentrate in the upper canopy, and there is a relative scarcity of understory or subcanopy species.

King *et al.* tested a recent forest dynamics model indicating that greater diversity in adult stature in tropical forests as compared to temperate forests reflects the reduced exclusion of smaller species by canopy species. Measurements of the relative abundances of adult subcanopy species and saplings of canopy species in temperate, subtropical, and tropical forests indicate that there are greater rates of recruitment and establishment of subcanopy species in low-latitude habitats. The underlying mechanism that allows the greater diversity in tree stature in tropical forests may be a combination of varying crown geometries, the length of the growing season, and the extent of light penetration to lower levels in the forest through gaps in the upper canopy. — AMS

J. Trop. Ecol. **22**, 11 (2006).

CREDIT: DEVARAJ *ET AL., J. AM. CHEM. SOC.* 10.1021/JA058380H (2006)