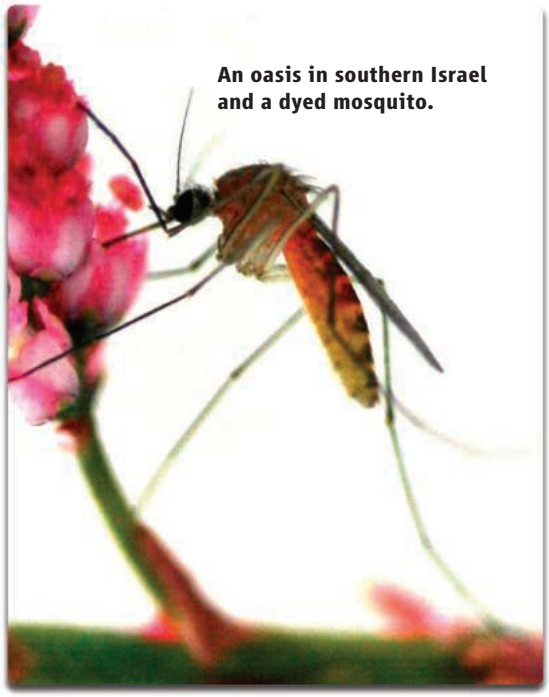
EDITED BY GILBERT CHIN AND JAKE YESTON



An oasis in southern Israel and a dyed mosquito.

ECOLOGY

The Sweet Taste of Death

Notoriously, female mosquitoes need a meal of blood before laying their eggs. Less well known is that their in-between meals involve snacks of nectar. Müller and Schlein show that in desert areas when there are no other flowering plants available, mosquitoes are attracted to flowering trees. They measured this allure using insect traps baited with flowering and nonflowering branches of various local trees; more than twice as many mosquitoes were caught with flowering branches than with leafy branches or with flowering annual plants. The authors were able to exploit the mosquitoes' thirst for sweets to bring about their demise by spraying acacia trees with a sugar solution that had been spiked with a food dye and the oral insecticide Spinosad, thus almost eliminating them from one oasis. It is possible that this method of localized mosquito control could be used in other types of "nectar deserts," such as rice paddies. — CA

Int. J. Parasitol. **36**, 10.1016/j.ipara.2006.06.008 (2006).

GEOLOGY

Shaking Clues from the Mississippi

The seismic hazards associated with fault zones removed from plate boundaries are particularly difficult to assess. The New Madrid fault zone in the central United States produced a series of large earthquakes around the year 1812, and trenching has identified an episode of activity starting approximately 1000 years ago (900 C.E.), extending to the 1812 quakes. However, the earlier activity of the fault zone has been enigmatic, posing a problem in assessing risks.

One major fault in this seismic zone—the Reelfoot thrust fault—straddles the Mississippi River, and Holbrook *et al.* have therefore looked for past changes in the course of the river as an indicator of prehistoric quakes. Large quakes on the fault would have produced uplift to the south, thereby reducing the gradient of the river north of the fault. A lower gradient would then cause the river to straighten its course rather than meander. The river straightened approximately 1000 years ago, coincident with the known seismic activity. The authors also identify a second episode, between 3600 and 4200 years ago, when the river cut off many meandering channels. Thus, two episodes of faulting spanning roughly 1000 years seem to be separated by a several-thousand-year interval of fewer large quakes. The results suggest that another period of more frequent earthquakes could arise after long quiescence. — BH

Mississippi River at New Madrid.

Tectonophysics **420**, 431 (2006).

ECOLOGY/EVOLUTION

Leaving Out the Details

The species-area relationship (SAR) is a well-studied concept in ecology and biogeography, relating area to the total number of species found within it. The relationship takes the form of a power law $S = cA^z$, where S is the number of species, A is the area, and c is a constant. The exponent z varies from as little as 0.5 to as much as 1.0, according to the group of organism, the scale in question, and the habitat type, but is most commonly found to lie in the range of 0.2 to 0.3. However, the factors underlying this relationship, and the reasons for the variation in z, have remained enigmatic.

In a new theoretical treatment of the question, García Martín and Goldenfeld show that the observed relationship and the value of z flow from the statistical properties of spatial and abundance distributions, such as clustering and mean distance between individuals, rather than directly from any ecological property of organisms and ecosystems (competition, dispersal, etc.) They validate the theory using data from a grassland site in California. — AMS

Proc. Natl. Acad. Sci. U.S.A. **103**, 10310 (2006).

MATERIALS SCIENCE

Hardening Hydrogels

In recent years, preparation methods for biocompatible bonelike materials have grown increasingly sophisticated. One approach has been to mineralize polymeric hydrogels by the addition of calcium salts; however, the chemical functionality of such systems is not easily tuned, nor is the polymer template easily disassembled after mineralization. Schnepp *et al.* replace the polymer with a supramolecular network that self-assembles from water-soluble small-molecule building blocks. They start with an aqueous solution of tyrosine phosphate, N-substituted by an aromatic fluorenylmethyloxycarbonyl (FMOC) group. Enzymatic dephosphorylation induces the assembly of gels composed of nanofilaments held together by tyrosine H-bonding and fluorenyl π-stacking interactions. By exposing the gels to different calcium ion concentrations for different periods of time, the authors achieve controlled degrees of calcium phosphate mineralization.

Nucleation of calcium phosphate along the fibers produced viscoelastic hybrid gels with enhanced thermal stability and stiffness. Furthermore, the shear threshold for a nonlinear response increased by two orders of magnitude relative to the unmineralized sample. Week-long exposure to moderately concentrated

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$CaCl_2$ led to extensively mineralized composites without disrupting the viscoelastic properties of the supramolecular structure; the organic material could then be removed by washing to produce macroporous networks. — MSL

Adv. Mater. **18**, 1869 (2006).

BIOMEDICINE

Batteries Not Required

Electronic cardiac pacemakers are small battery-operated devices that are implanted into damaged hearts to correct defects in electrical conduction between the atria and the ventricles. Although these devices are remarkably successful in restoring regular heart rhythm in adults, they can produce complications in children. Thus, new forms of pacemaker therapy are actively being explored.

Choi *et al*. used a tissue engineering approach to create a biologically based artificial pacemaker consisting of skeletal muscle precursor cells from fetal rats cultured in a three-dimensional collagen-based tissue construct. After documenting that the cells within the engineered tissue were coupled through gap junctions and were capable of propagating an applied electric current, the authors implanted the tissue into the heart of adult rats. The implanted tissue became vascularized and persisted for the entire lifetime of the recipient animals. Importantly, in about one-third of the rats, it produced a permanent alternative conduction pathway between the right atrium and right ventricle. Whether these tissue constructs would provide adequate pacing support in rats whose native heart rhythm has been blocked remains to be tested. — PAK

Time course of atrioventricular conduction from site of stimulation (*).

CREDIT: CHOI *ET AL.*, *AM. J. PATHOL.* **169**, 72 (2006)

Am. J. Pathol. **169**, 72 (2006).

BIOTECHNOLOGY

Labor Relations

Superficially, biosynthetic pathways for natural products might be likened to factory assembly lines where having more workers would mean being able to make more product. When the costs of factory buildings, workers, and excess inventory of parts are factored in, a just-in-time process is a more efficient solution, so that workers are neither overburdened nor idle and no partially assembled products accumulate. Add in the biological complications of multiple assembly teams using some of the same parts along with feedback, feed-forward, and inter-pathway interactions, and calculating the optimal numbers of workers seems out of reach.

Pfleger *et al.* have instead developed an approach for constructing a library of artificial operons, which in this instance code for a three-enzyme segment of the isoprenoid pathway. By inserting into the intergenic regions variations of posttranscriptional regulatory elements, such as hairpin-forming sequences and ribonuclease sites (and perhaps riboswitches, too), they generate lots of combinations and find that increasing the hairpin-forming propensity of the ribosome binding site in front of the second gene is sufficient to reduce the mRNA levels of the second and third genes, which keeps acetyl CoA concentrations high enough to support vigorous growth and isoprenoid production simultaneously. — GJC

Nat. Biotechnol. **24**, 10.1038/nbt1226 (2006).

CHEMISTRY

Small Yet Selective

Structural diversification of complex molecular frameworks, for example to combat antibiotic resistance, would benefit from an often elusive catalytic combination of specificity (to leave intact biochemically critical functional groups) and versatility (to offer as wide a range of functionality as possible in the components varied for screening). Enzymes have evolved to achieve remarkable selectivity in modifying the structures of intricate organic molecules. The price of this function, however, is a comparatively narrow substrate scope and range of transformations relative to inherently less selective small-molecule catalysts.

Regioselective acylation is a common example of a reaction traditionally left to enzymes. In the absence of a chiral catalyst, acylation of the antibiotic erythromycin A is known to occur preferentially at the 2′ and 4″ hydroxyl sites. Lewis and Miller show that a pentapeptide catalyst overcomes this kinetic selectivity to acetylate a third site, the 11-OH, with 5:1 selectivity; the same site preference is also observed for the catalyzed addition of longer-chain acyl groups, with selectivities ranging from 3.5 to >10:1. Moreover, an accompanying tautomerization further modifies the adjacent molecular framework. The results suggest that small-molecule catalysts may have unexpected promise for direct functionalization of complex molecules with high regio- and stereoselectivity. — JSY

Angew. Chem. Int. Ed. **45**, 10.1002/anie.200601490 (2006).

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Labor Relations

Gilbert J. Chin

Science **313** (5787), 593.
DOI: 10.1126/science.313.5787.593b