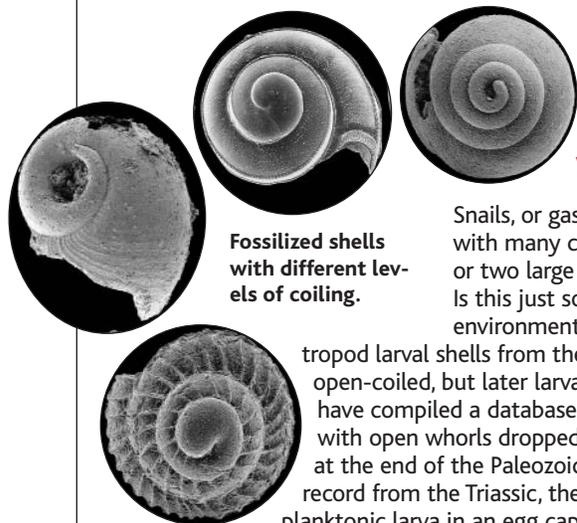


edited by Stella Hurlley



Fossilized shells with different levels of coiling.

PALEONTOLOGY

Why Whorl?

Snails, or gastropods, come in a wide variety of shapes, some with many coils of their tube-shaped shells, others with just one or two large coils, and some with irregular or straightened tubes. Is this just some random evolutionary experiment or are there environmental forces that drive the snails to curl? Fossilized gastropod larval shells from the Paleozoic (450 to 250 million years ago) are largely open-coiled, but later larval shells are mostly tightly coiled. Nützel and Fryda have compiled a database of larval shells showing that the number of species with open whorls dropped from 61% in the Ordovician to 2% in the Permian, at the end of the Paleozoic. There are no open-whorled larval shells in the fossil record from the Triassic, the beginning of the Mesozoic. A snail starts life as a planktonic larva in an egg capsule, and a tight coil would be stronger and better protected from predators. Thus gastropods may have evolved from an open coil to a tight coil because of predation. Unfortunately there is no evidence in the fossil record of predator-prey relationships for gastropods, and although healed cracks and other evidence of possible predation are found in extant larval shells, their planktonic predator remains unknown. — LR

Geology **31**, 829 (2003).

APPLIED OPTICS

Long-Distance Thermometry

From environmental issues, such as groundwater monitoring, to safety issues, such as fire detection in buildings, the one parameter that is most often measured is the temperature. Although individual temperature sensors can be installed throughout a system, for some applications this might prove prohibitively expensive or may just be unsuitable. What about a temperature sensor that could be unwound from a spindle and cover distances up to 50 km? Cho *et al.* show that optical fibers can be used for such applications. By detecting and analyzing the backscattered light arising from the interaction between pump and probe pulses launched into the fiber, they could measure temperature differences along the 50-km fiber, with 1°C sensitivity at the front end of the fiber to 13°C at the back end and with a spatial resolution of 15 m. For applications requiring fast continuous monitoring over long

periods of time and long distances, such a distributed temperature sensor should be particularly useful. — ISO

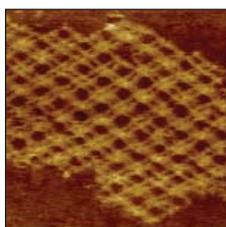
Opt. Lett. **28**, 1651 (2003).

MATERIALS SCIENCE

DNA Makes a Move

Because of the specificity of its base pairing, DNA is being tested as a central component in the design of nanomechanical devices. Yan *et al.* have designed a DNA nanoactuator that can reversibly expand and contract a two-dimensional (2D) array of DNA strands.

The authors first devised a nanoactuator that has two states. The first state consists of four DNA strands forming a bulged three-arm DNA branch junction with a loop sticking out in the center. Addition of



Nanoscale changes in DNA assemblies.

an appropriate "fuel strand" that is complementary to the loop sequence stretches the structure into the linear second state. The

nanoactuator is then incorporated into a 2D DNA lattice. The cavities in the 2D lattice can then be switched reversibly from 14 nm × 14 nm to 14 nm × 20 nm, without deterioration of the lattice.

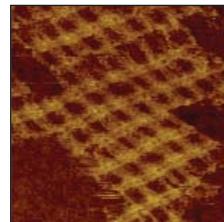
This nanoscale motion may be helpful in the assembly of future nanoelectronic devices. — JFU

Angew. Chem. Int. Ed. **42**, 4342 (2003).

CLIMATE

Antarctic and Greenland Climate Changes

To investigate the temporal relationship between climate changes in the Northern and Southern Hemispheres, the ages of climate events recorded in ice cores from near the two poles are often compared. However, there is a large inher-



wetlands expanded because of Northern Hemispheric warming. Thus, by comparing the two signals, a robust estimate of the relative timing of warming in the Northern and Southern Hemispheres can be made. This technique, applied to 108,000-year-old ice from Vostok in Antarctica, indicates that the South warmed approximately 2000 years before the North, consistent with the popular idea of a climatological "bipolar seesaw." — HJS

Geophys. Res. Lett. **30**, 1899 (2003).

MICROBIOLOGY

Genomic Recipe

It is a lot harder to characterize an organism if you can't get it to grow in culture. The microorganism *Tropheryma whipplei*, which causes gastrointestinal Whipple's disease, has not been able to be grown outside of fibroblast cells. However, with the availability of the complete genome sequence of two strains of *T. whipplei*, Renesto *et al.* discovered how to please this fastidious bacterium.

CONTINUED ON PAGE 21

The <1-megabase genome contains a great deal of functional information, but computer modeling studies revealed that it lacks the machinery to make several amino acids. With this knowledge, the investigators were able to design a cell-free culture medium that supported the growth of three different strains of *T. whipplei* as well as a new strain isolated from a heart valve. This type of approach should lead to other successes in growing previously unculturable intracellular pathogens. — BJ

Lancet 362, 447 (2003).

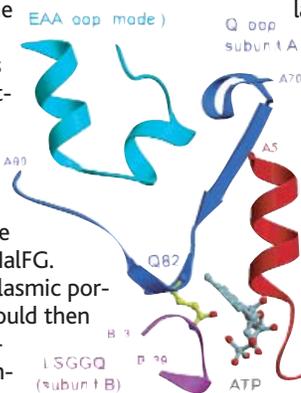
BIOCHEMISTRY

Loops and Gates

One of the critical concerns applicable to all membrane transport proteins is how to move the target molecule across the cell membrane without creating a non-specific, potentially lethal, leak. The usual solution is to keep the transporter closed with a gate and to design a binding site to recognize the desired substrate; opening of the gate is then regulated, for example, by changing the transmembrane voltage, in the case of KvAP, or by binding of a proton, in the case of lacY.

Chen *et al.* have examined the mechanism for the maltose transporter, which consists of two ATP-binding subunits—the MalK dimer—and two integral membrane subunits—MalF and MalG. Crystal structures of the MalK dimer in open, semi-open, and closed conformations (which are governed by ATP hydrolysis) reveal a tweezers-like movement of the monomers. The reorientation of MalK₂ with respect to the cytoplasmic surface of MalFG has the effect of exerting force at the point of contact, which is formed by the Q loops from MalK and the EAA loops from MalFG. Closing the cytoplasmic portions of MalFG would then lever open the external portions, enabling maltose to enter the transport cavity. Finally, hydrolysis of ATP would reverse the tweezers motion and allow maltose access to the cytoplasm. — GJC

A model of the contact between the Q and EAA loops.



Mol. Cell 12, 651 (2003).

ECOLOGY/EVOLUTION

Meltdown in an Island Forest

Examples of the harmful effects of alien species introductions continue to flood into the ecological literature, but few introduced species are as destructive as ants.



Uninvaded forest with open understory (top); ant-invaded forest 1 to 2 years later (bottom).



O'Dowd *et al.* report a particularly devastating instance of an invasive ant whose effects cascade through an entire tropical island ecosystem, ultimately leading to the death of rainforest canopy trees. The yellow crazy ant, *Anoplolepis gracilipes*, was first introduced to Christmas Island in the Indian Ocean about 70 years ago. The ants persisted for decades at low density before their population began to explode in the late 1980s, forming supercolonies infesting one-fifth of the island. The ants eliminate the red land crab, a keystone consumer in the forest floor ecosystem. The elimination of the crab results in vastly increased tree seedling density and decreased litter decomposition on the forest floor. Meanwhile, in the forest canopy, the presence of ants promotes mutualistic population growth of honeydew-secreting scale insects, in turn resulting in increased growth of honeydew-dependent fungi that cause dieback and death of canopy trees. This invasional "meltdown" over a 2-year period shows how an invader can alter the trophic dynamics of an entire ecosystem through direct effects at multiple levels in the food web. — AMS

Ecol. Lett. 6, 812 (2003).

Science

Long-Distance Thermometry

TWIL

Science **302** (5642), 19.
DOI: 10.1126/science.302.5642.19b

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