

designed the rotaxanes so that ultraviolet light would push the shuttle group to one end, hiding a fluoroalkane segment of the chain in the process. This makes the rotaxane layer more wettable where the light is shining. So, illuminating the front edge of a droplet drags it forward.

MATERIALS

Diamond geezers

Appl. Phys. Lett. **87**, 083106 (2005)
A diamond material that has been assembled from spherical carbon molecules (C_{60}) is denser and harder than the real thing (pictured), report Natalia

Dubrovinskaia from the University of Bayreuth in Germany and her colleagues.

The researchers squashed the fullerene molecules together at 2,200 °C using 20 gigapascals of pressure, which is equivalent to the weight of the Titanic pressing down on an area the size of a CD.

This left them with a translucent cylinder made from a jumble of diamond nanorods, each of which was less than 20 nanometres across. The material is 0.2–0.4% more dense than natural diamond, and tests suggest it could form longer-lasting coatings for precision drill bits.

ECOLOGY

Richer soil

Science **309**, 1387–1390 (2005)

The average gram of unpolluted soil contains a million different bacterial species, according to a reanalysis of existing data.

IMAGE
UNAVAILABLE
FOR COPYRIGHT
REASONS

Previous estimates put the figure at 10,000.

The number of species is estimated by jumbling DNA from a sample and seeing how quickly matching sequences group together. Past calculations assumed that all species were equally common. To reach the higher figure, the team from Los Alamos National Laboratory in New Mexico allowed for variation. It also calculates that pollution with toxic metals wipes out 99.9% of bacterial species, despite an unchanged cell count.

EVOLUTION

Margin for error

Nature Genet. doi:10.1038/ng1621 (2005)

A classic problem in biology, concerning the origin of life, may benefit from a relaxed view.

Eigen's paradox points out that long genomes need complex enzymes to replicate themselves reliably — and questions whether the code for such enzymes could fit within

these genomes. Now Eörs Szathmáry of the Collegium Budapest in Hungary and his colleagues redefine what constitutes a 'reliable' copy by mapping the effect of mutations — or mistakes — in RNA molecules called ribozymes.

They show that a ribozyme's function, which is defined by its shape (or phenotype), can survive a relatively large number of mutations to its sequence (or genotype).

This suggests that long genomes could survive much higher error rates in copying than researchers had previously thought.

CELL BIOLOGY

Bubble wrap

Cell **122**, 605–617 (2005)

Within cells, many proteins are transported inside bubble-like lipid sacs called vesicles. These bud off the membrane layers of the endoplasmic reticulum, where such proteins are made. But how are the vesicles sculpted?

Researchers led by Randy Schekman at the University of California, Berkeley, have revealed that a protein called Sar1p initiates membrane curving by poking a helical arm into the membrane. If the arm is removed from the protein, budding never begins. Sar1p then interacts with other proteins that stabilize the budding vesicle and capture its cargo. And it seems that Sar1p is involved from start to finish, because buds formed in the presence of mutant Sar1p are unable to pinch off, remaining attached to the membrane layer.

JOURNAL CLUB

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A geophysicist revises his heat-flow notes by the light of a deep blue crystal.

In September 1999, after a long day at a conference, I was sharing a bottle of wine with Joe Smyth on the shore of Lake Maggiore in northern Italy.

He was rhapsodizing about the translucent, blue crystals he had

formed by squeezing olivine — a major constituent of Earth's mantle — to the pressures found deep beneath the surface.

A few weeks later I was back in the United States, teaching an undergraduate geophysics class. As I filled the blackboard with equations for heat transport in Earth's interior, I dutifully crossed out the radiative terms as negligible.

We have all known since the 1970s that rocks are opaque to radiation at the high pressures and temperatures of the mantle, so its

contribution to heat flow is deemed unimportant.

There matters rested, until I picked up the July issue of the *American Mineralogist*, and was reminded of Joe and those crossed-out terms.

Joe had measured the absorption spectra of his beautiful blue crystal — a hydrous ringwoodite — as it was squeezed between two diamonds to the pressure found 645 km down (H. Keppler and J. R. Smyth *Am. Mineral.* 1209–1212; 2005).

The surprising result? The

absorption of red and infrared wavelengths decreased as the pressure intensified. Thus, for realistic ringwoodite, radiative heat transfer is important.

This means that plates heat up more quickly than we thought as they subduct into the mantle, and it affects our modelling of mantle plumes such as those that produced the volcanic islands of Hawaii.

Not all the consequences are clear, but one thing is certain: I'm revising my lecture notes before classes begin.