SCIENCE & TECHNOLOGY CONCENTRATES

ATOMIC INSIGHTS ON SHARK TEETH

Considering that neither brushing nor flossing is a part of a shark’s daily dental regime, the animals get remarkably few cavities. To get an idea of what makes shark teeth so resistant to decay, researchers in Japan aimed to transmission electron microscope at the enamel on the creatures’ teeth. Normally, the micrometer-thick electron beam can damage biological material, but by using low-dose imaging techniques, Yoshiharu Ohtsubo and Zhongdong Wang of Hokkaido University and colleagues were able to minimize such damage and digitally image every individual atom in the enamel. (Angew. Chem. Int. Ed. 2013, DOI: 10.1002/anie.201207805). The enamel is made of fluorapatite, Ca₁₀(PO₄)₆F₂, which appears to the researchers as a mixture of calcium, phosphorus, and oxygen atoms with fluorine atoms at their corners. Making

This TEM image of shark’s teeth enshrouds reveals its atomic structure. The image shows the arrangement of calcium, phosphorus, and oxygen atomic columns. The spot at the center of each hexagon represents a fluorine atom.

calculations based on these images, they determined that fluorite is partially bound to calcium in the enamel. The results suggest that fluorite is critical to stabilizing the hexagonal frame. Loss of fluorite would leave atom-atoms holes and weaken the teeth—BAD

NANOPORES FIND PHOSPHATES

Traditional phosphates embedded into lipid membranes known as nanopores are already invaluable in genomics research. However, the discovery of DNA has led to a new technique that could further improve its applications. A research team is now able to detect phosphoinositides phosphorylation patterns that regulate protein activity. (Nat. Biotechnol. 2014, DOI: 10.1038/nbt.2999). To remove a protein "caused" through the "eye" of a nanopore, Christian B. Rosen, David H. Williams, Laurens, and Hagan Bayley’s group at the University of Oxford added a short DNA sequence to the C terminus of the protein. The technique distinguished whether fluorescent was phosphorylated in one or two positions, in both positions, or in neither position. The nanopores can determine phosphorylation patterns in hundreds of individual copies of proteins, which is useful information in cancer research, although the method currently detects phosphorylation only near the ends of proteins. Other groups have used nanopores to feed an entire protein through a nanopore, a method Bayley’s group hopes to adapt to overcome the detection limitation. The technology has been patented and licensed to Oxford Nanopore Technologies, a company Bayley founded.—KD

FAIRY RINGS SHARE MAGICAL CHEMISTRY

For centuries, people around the world have been mystified by the formation of circular areas of decaying plant growth in woodlands and grassy fields. The rings sometimes emerge with mushrooms, adding to the intrigue. Myths and superstition led to the geometric patterns of plant growth to be called fairy rings. In 2010, a research team led by Hiroshi Kogai of Shizuoka University, Japan, discovered that the "fairy" is the plant growth-regulating auxin produced by fungi. The team has found that auxin is produced from another amino acid, leucine. It is reported that the auxin is produced from amino acids in the phylum. The auxin has been shown to alter the composition of the plants. The auxin is synthesized in the plants and is transported to the other parts of the plant. The auxin has a role in regulating the movement of the plants. The auxin is synthesized in the plants and is transported to the other parts of the plant.

ENZYME CATALYSIS ILLUSTRATED

A term of enzymatic catalysis is that the catalysis should bind the transition state more strongly than the ground state. Although the principle is widely applied, particularly with catalytic antibodies and boronate have lacked a simple, well-characterized model to illustrate this seminal system. Ray A. Schlegel at China’s Tsinghua University, J. Fraser Stoddart at Northwestern University, and colleagues report in Nature Chemistry that they’ve designed a representative reaction that depicts a catalytic conformational change (2014, DOI: 10.1038/nchem.1893). The team studied the inversion of camphoric acid, a bowl-shaped hexacyclic aromatic hydrocarbon that has an energy barrier to inversion of 12 kcal/mol. Their energy barrier can be lowered to about 7 kcal/mol by a catalyst that stabilizes the planar intermediate state. The catalyst, known as "Blok", is a cyclic trisnorlactone made from two extruded pyridylamine that selectively binds planar polyether acetate. When complexed inside Blok", the energy barrier for head-to-head inversion process—like an umbrella flipping inside–occurs twice as fast with Blok" than without it.