Physiology

Salty secrets of the Sumatran stingray

J. Exp. Biol. **206,** 2931–2940 (2003)

The stingray *Himantura signifer* spends most of its life in the fresh waters of the Batang Hari river in Sumatra, but every now and then it is thought to venture into brackish delta waters. In the lab, it can survive such salty conditions for at least two weeks. How does it cope with the shift to salt water? Wai L. Tam *et al.* provide some answers.

The authors find that, in fresh water, the stingray has higher levels of the soluble nitrogenous compound urea in its blood, compared with other freshwater species. If the external salt concentration is gradually raised, urea levels increase still further. The animals achieve this by adopting a 'waste not, want not' policy as regards ammonia: they excrete less of this waste product as salt levels increase, using it instead to synthesize more urea.

Tam *et al.* speculate that this ability may help *Himantura* to maintain its osmotic balance with the outside world and to survive in brackish waters. Its better-known cousin, *Potamotrygon motoro*, is not so versatile, and is consigned to a freshwater life in the Amazon. **Helen R. Pilcher**

Physical chemistry

Stronger hydrogen bonds

J. Am. Chem. Soc. **125,** 8992–8993 (2003)

Quantum-mechanical effects strengthen hydrogen bonds, say Simone Raugei and Michael L. Klein. Their computer simulations of the simplest hydrogen-bonded liquid, hydrogen fluoride (HF), show that the intermolecular hydrogen bonds are about 4% shorter when quantum nuclear effects — the zero-point energy of the nuclei — are included, relative to 'classical' molecular-dynamics simulations.

Zero-point energy arises because quantum particles cannot sit right at the bottom of the potential well that holds them together. Intuitively, one might expect this quantum effect to make the atoms more delocalized. But the quantum simulations of Raugei and Klein show the opposite: the two fluorine atoms in a pair of hydrogen-bonded HF molecules are closer together and more localized, owing to a shortening and strengthening of the hydrogen bond.

There are as yet no experimental structural measurements on liquid HF with which to compare these simulations. They do exist for deuterated HF, but the predicted differences between quantum and classical cases lie at the limits of experimental resolution. The researchers think that the quantum strengthening of hydrogen bonds should also apply in biological molecules such as proteins and DNA. **Philip Ball**

Biomaterials

Zinc hardens worm jaws

Proc. Natl Acad. Sci. USA **100,** 9144–9149 (2003)

Hardness in nature usually comes from either calcium or silicon: think of the calcium minerals in bone and mollusc shell, or the silica exoskeletons of radiolarians. But an increasingly complex chemistry is now coming to light in nature's hard materials. Following their report of the presence of the copper mineral atacamite in the jaws of the polychaete worm *Glycera*,

MARK & CAROL ARCHAMBAULT

Helga C. Lichtenegger and colleagues have now found zinc in the jaws of the closely related species *Nereis limbata* (pictured).

But surprisingly, whereas a definite mineral phase is seen in *Glycera* jaws, there is no sign of an inorganic zinc compound in *Nereis*. The zinc is concentrated towards the tapering tip of the jaw, and is correlated with both chlorine content and hardness. But the primary components of the jaw are glycine- and histidine-rich proteins. The researchers think that the zinc is probably bound to histidine residues in an environment like that in zinc insulin. The metal ions may serve to crosslink the protein matrix. **Philip Ball**

Cell biology

Channel taps magnesium

Cell **114,** 191–200 (2003)

According to Carsten Schmitz and colleagues, a mystery mammalian ion channel called TRPM7 — which seems to be active in almost every tissue — controls the entry of magnesium ions into cells.

The channel is interesting because it is one of only two known to incorporate a kinase domain, a structural region that modifies the activity of other proteins by adding phosphate groups to them. TRMP7's brother, TRMP6, regulates the absorption of magnesium by the kidney; people with defective TRMP6 suffer from a rare disease called primary hypomagnesaemia that is treated with mineral supplements.

Schmitz *et al.* now show that altering the structure of TRMP7, by mutating the kinase domain, increases its tendency to open in response to magnesium. This contradicts previous suggestions that the channel needs a fully functional kinase domain in order to unbolt. Moreover, TRMP7 is apparently important for letting magnesium in. Mammalian cells without a working TRMP7 stop dividing or die. But boosting the outside concentration of magnesium rescues the cells.

The authors suggest that while TRMP6 regulates the body's overall level of magnesium, TRMP7 controls the concentration in individual cells. The rush of magnesium into the cell may alter the activity of TRMP7's kinase domain, which then influences other cellular proteins. **Helen Pearson**

Oceanography

Bloom in cyclone

Geophys. Res. Lett. doi: 10.1029/2003GL017141 (2003)

For three days in July 2000, cyclone Kai-Tak whipped across the South China Sea. I. Lin and colleagues have made the most of a combination of satellite views of this tropical storm and its effects, and in their latest paper have documented the resulting bloom of phytoplankton. They calculate that the bloom constituted a 10-fold increase in growth, or primary production, over normal conditions.

This is not unexpected, as storms are known to stir marine waters from depth and bring nutrients to the sunlit upper zone where phytoplankton can use them in photosynthesis. But tropical cyclones are especially unpredictable beasts, and making measurements from ships or moored arrays would be an ineffective and hazardous business. Hence the virtue of satellite data — in this case from three different sensors, which the authors have used to inform models of physical ocean mixing and primary production.

The further calculations of Lin *et al.* produce a bigger picture. Kai-Tak was of only moderate force, but they estimate that this storm alone was responsible for 2–4% of new annual production in the South China Sea. Given cyclone incidence, they believe that the overall figure could amount to 20–30%. **Tim Lincoln**