EARTH MONITORING

Tsunamis from space

Nat. Hazards Earth Syst. Sci. **9,** 1135–1147 (2009)

A team in Colorado has linked surface roughness in the open ocean to a tsunami, offering potential for reliable early warning systems.

Oleg Godin of the Earth System Research Laboratory in Boulder and his colleagues studied radar data from satellite-based altimeters to identify the surface roughness associated with the deadly 2004 Sumatra–Andaman tsunami. Analysis of radar backscattering strength separated surface roughness caused by the tsunami — sometimes referred to as tsunami shadows — from other factors churning the sea. The authors say the report is a starting point for developing algorithms to use satellite-based and airborne radar and microwave radiometers to detect tsunami intensity and direction from surface roughness.

CHEMISTRY

A one-pot shot

Angew. Chem. Int. Edn **121,** 5970–5973 (2009)

Making a complex organic molecule generally involves a long series of reactions and purification steps to build it piece by piece. Much more efficient would be to simply throw all of the components into a flask at the same time, combining them at a stroke.

Romano Orru and his colleagues at the Free University Amsterdam in the Netherlands have now united an unprecedented eight molecular fragments — without intermediate purification steps — to create a complex 'druglike' compound.

Their synthesis has three stages — each designed not to interfere with chemical groups incorporated in previous steps — and lasts for almost three days. But the end product comes out of the flask with an overall yield of 24%, impressive for a synthesis that involves forming nine new chemical bonds.

BEHAVIOUR

Why 'there's never just one'

Behav. Process. **82,** 81–84 (2009)

Even cockroaches develop psychological problems if they are denied a normal social life. Animals reared in solitude are less likely to explore new environments or search for food, are more timid when approaching other cockroaches and are less able to spot the signs of a good mate.

NIGEL CATTLIN/FLPA

Mathieu Lihoreau and his colleagues at the University of Rennes 1 in France reared nymphs of the gregarious German cockroach (*Blattella germanica*; pictured above) either in isolation or in a group of ten siblings. The effects of solitary confinement parallel those of 'isolation syndrome', the authors say. This behavioural syndrome has been described in a variety of vertebrates, but Lihoreau and colleagues suggest that it may develop when any group-living species is denied company.

PHYSICS

A cold shake

Phys. Rev. Lett. **103,** 045301 (2009)

Scientists have observed turbulence in a Bose–Einstein condensate (BEC), a state of matter that can form when atoms are trapped and cooled almost to absolute zero.

Emanuel Henn at the University of São Paulo in Brazil and his colleagues used an oscillating magnetic field to shake a BEC of rubidium atoms. When the oscillation amplitude passed a certain threshold, vortices distributed in random directions emerged.

A cloud of atoms released from the trap maintained an oval shape while expanding, possibly because vortices kept it from deforming. Further study of the system might help researchers understand turbulence in ordinary fluids, the authors say.

DEVELOPMENT

Starting from scratch

Development **136,** 2695–2703 (2009)

Transplanting a nucleus from a specialized adult cell into an enucleated egg overhauls gene expression in the nucleus, allowing it to direct development into any one of many tissue types. Yet no one is quite sure how.

John Gurdon and his colleagues at the Gurdon Institute in Cambridge, UK, transplanted various nuclei into developing eggs of the frog *Xenopus laevis* and looked at the expression of muscle genes. The transplanted nuclei expressed many muscle genes, but surprisingly their expression did not rely on the activity of proteins such as MyoD that are normally required for muscle-gene expression. This suggests that the egg cell uses special methods to reprogram nuclei.

JOURNAL CLUB

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A chemist realizes that popularity is no measure of strength.

Urea, the water-soluble organic compound found in mammalian urine, has been known for its ability to denature — or unfold — proteins for more than 100 years. To this day, it is among the most widely used protein denaturants. So one could be forgiven for taking it for granted that we know in gory detail what happens when we pour urea into a protein solution. But, alas, nailing down the individual molecular interactions between urea and the chemical groups at a protein's surface is exceedingly difficult.

Experiments and simulations suggest that urea interacts primarily with amide groups in the protein backbone, but every such group in a given protein has its own local environment, leading to fuzzy signals in spectroscopic studies. Paul Cremer's group at Texas A&M University came up with a good means by which to address the problem. They employed a popular protein proxy, poly(*N*-isopropylacrylamide), in which all of the amide groups are chemically equivalent (L. B. Sagle *et al. J. Am. Chem. Soc.* **131,** 9304–9310; 2009). Using infrared spectroscopy combined with measurements of hydrophobic collapse, they showed that urea interacts only weakly with this polymer.

Essentially, Cremer and colleagues' measurements suggest that one needs buckets of urea to see any effect. This is exactly the same situation as that observed for proteins, in which high concentrations of urea are necessary for denaturation. Thus one of the most common denaturants is actually a shockingly weak one. In fact, the strength of its interactions with the protein is little greater than those of harmless water molecules.

In the end, the key to the denaturating mechanism may be the fact that urea is a larger molecule than water — which has subtle entropic consequences — rather than that the two have different hydrogen-binding abilities.

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