Jon Lundberg of the Karolinska Institute in Stockholm and his colleagues had set out to study the importance of natural gut bacteria in nitrate metabolism using mice bred to harbour no microorganisms. But when these germ-free mice were fed sodium nitrate, and nitrite ions then showed up in their blood, the team began hunting for enzymes to explain the result.

They recorded nitrate-reducing activity from xanthine oxidoreductase in the liver tissue of both rodents and humans, and found that NO_2^- can be further reduced to NO. The pathway ramped up during an experiment in which the researchers clamped the abdominal aorta of rats — perhaps unsurprisingly, given that NO dilates blood vessels.

NANOTECHNOLOGY

Sheet change

Nanoletters doi:10.1021/nl0808132 (2008)

Researchers have worked out how to detect trace amounts of amyloid-β protein that has undergone the conformational change seen in people with Alzheimer's disease.

Gerard Coté of Texas A&M University in College Station and his co-workers built a nanofluidic device able to concentrate amyloid-β proteins and gold nanoparticles at the entrance of a tiny channel by exploiting capillary flow. They then performed surface-enhanced Raman spectroscopy on the concentrated amyloid-β proteins, searching out any with a structure predominantly composed of β-sheets, a common folding arrangement.

This may allow doctors to test the cerebrospinal fluid of patients with cognitive decline and identify those who will go on to develop Alzheimer's disease, the authors say.

CHEMICAL SENSING

Molecular mapping

Angew. Chem. Int. Edn doi:10.1002/anie.200801516 (2008)

A family of molecular proton sensors that can be programmed to sit at specific distances from the surface of a membrane has been devised by Seiichi Uchiyama and Prasanna de Silva at Queen's University in Belfast, UK, and Kaoru Iwai at Nara Women's University in Japan.

These molecules have position-tuning groups that 'seek out' a local environment that matches their own compatibility with water. They thus distribute themselves at various distances along a radial coordinate of a membranous sphere called a micelle. The local proton concentration determines the intensity of emission from a fluorescent 'reporter' group on the sensor, whereas the asymmetry of local electronic-charge polarity determines the emission wavelength.

All of these details can be mapped. This technique might one day provide clues about how biological surfaces and structures function.

ZOOLOGY

Mid-ocean wanderer

Biol. Lett. doi:10.1098/rsbl.2008.0147 (2008)

Basking sharks (*Cetorhinus maximus*; pictured below) thought to exist in discrete populations thousands of kilometres apart may in fact mix by migration, say scientists who tracked a female across the Atlantic.

Previous tagging experiments have shown apparently distinct populations of basking sharks migrating south for winter at shallow depths along the continental shelf of Europe and the east coast of North America.

D. BURTON/NATUREPL.COM

But a basking shark tagged by Mauvis Gore of Marine Conservation International in Newton, UK, and her colleagues travelled 9,589 kilometres from the Isle of Man, UK, to a region east of the Newfoundland shelf. The shark's nights were generally spent at depths of 200–300 metres and her days at 400–800 metres, once reaching 1,264 metres.

Correction

The Research Highlight 'Growing up bigger' (*Nature* **453,** 567; 2008) said that deuterium atoms in deuterated benzene can occupy more space than hydrogen atoms in benzene owing to vibrations of the carbon–deuterium and carbon–hydrogen bonds. In fact, the effect is caused by vibrations of the entire molecules about their equilibrium positions.

JOURNAL CLUB

Uri Alon
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A biophysicist learns the art of hugging.

If there are two things I love, they are warm hugs and simple answers to long-standing questions. Why must proteins bend in order to bind to their partners? This bending, known as induced fit, is puzzling, because it costs elastic energy and makes the binding less tight. But all sorts of proteins show induced fit — such as antibodies that recognize viruses and regulatory proteins that embrace DNA — despite the fact that such processes would be more efficient if the protein and target fitted together like pieces of a jigsaw puzzle.

Enter two Israeli physicists, Tsvi Tlusty and Yonatan Savir. They used statistical mechanics to show that bending is a good idea if the goal is not to bind tightly but to avoid binding the wrong partner (Y. Savir and T. Tlusty *PLoS ONE* **2,** e468; 2007).

Suppose that a protein needs to bind its target molecule 'A', and to avoid binding molecule 'B', which is a bit smaller than A but otherwise similar in shape. The protein would do well to make its binding pocket a little larger than A; it would then have to bend a little to embrace A, at a small energy cost, but bend a lot to bind B. Crucially, the elastic energy required for a protein to flex rises ever more steeply with the extent of bending, just as that needed for a spring to bend rises with the square of bending. So the energy difference between binding A and binding B is greater with induced fit than it is when A is a perfect fit.

Like all fruitful theories, this one makes testable predictions. It allows researchers to hypothesize what sort of imperfect fit might best serve a particular protein so that binding to non-target molecules is minimized. An antibody that attaches to virus proteins should be able to avoid similarly shaped human proteins, for instance. So perhaps, as with people, if you really want to know whether proteins are made for each other, it's in the hug.

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