neuronal proteins. For several, the method could pin-point the position of the added sugar. They also found that some proteins showed more *O*-GlcNAc modifications if they were taken from an intact brain shortly after its neurons had been stimulated than if they were taken from unstimulated brain tissue.

ASTRONOMY

Universal dust-up

Astrophys. J. **661,** L9–L12 (2007)

The most distant γ-ray burst ever seen has cast its light on dust in the early Universe.

Giulia Stratta of the ASI Science Data Center in Frascati, Italy, and her colleagues studied the radiation from a 12.8-billion-year-old burst over three days. The emission was fainter at certain wavelengths than expected from the burst's initial brightness, suggesting that dust in the early Universe is different to that found in the Universe today.

Dust is produced in the dying explosions of stars, so the amount of dust present at this early time and its composition could provide clues about how the first stars formed.

CHEMISTRY

The simplest link

Science **316,** 1172–1175 (2007)

It is now possible to join certain ring-shaped molecules together without resorting to chemical tinkering to make them more reactive. This provides a simple way to perform 'cross-coupling' reactions, a type of reaction widely used in the drug industry.

David Stuart and Keith Fagnou from the University of Ottawa, Canada, used a palladium and copper catalyst system to build carbon–carbon bonds between benzene and two-ringed molecules known as indoles.

Cross-coupling reactions have previously required several steps, with the starting materials first being converted into more reactive analogues. In the new scheme, the catalyst activates a carbon–hydrogen bond on the indole, making it reactive enough to form a bond with one of the benzene's carbon atoms. There are no unwanted side products.

CANCER BIOLOGY

Stem cells fished out

Genes Dev. doi:10.1101/gad.1545007 (2007)

A model of a common and often fatal childhood cancer — embryonal rhabdomyosarcoma (ERMS) — may have helped researchers to identify the stem cells that mediate the disease.

Leonard Zon of the Children's Hospital Boston in Massachusetts and his colleagues induced ERMS in zebrafish by activating a signalling pathway that is mediated by the Ras protein. This pathway is commonly activated in human ERMS, the researchers found.

They identified genetic pathways that drive progression of the disease in both zebrafish and humans, and found that tumour development in the zebrafish depends on a population of cancer stem cells. These cells triggered tumour development when transplanted into healthy animals. The human counterparts may be 'activated satellite cells', found in muscle. Gene-expression studies showed these to have similar self-renewal mechanisms to the zebrafish cancer stem cells.

T. BLACKALL

NITROGEN CYCLE

Seabirds add ammonia

Geophys. Res. Lett. **34,** L10801 (2007)

Seabird colonies are the world's largest point sources of atmospheric ammonia, according to new calculations.

Trevor Blackall, now at King's College London, and his colleagues travelled to two Scottish islands — the Isle of May, home to a colony of Atlantic puffins, and Bass Rock (pictured above), which houses thousands of Northern gannets — to measure how much of the gas is released by bird droppings.

Globally, birds' ammonia emissions are outstripped by those from livestock, synthetic fertilizers and oceans. But the researchers estimate that, in the relatively pristine Southern Ocean below 45° S, penguins account for almost 20% of ammonia emissions. The largest colonies may produce up to 6,000 tonnes of ammonia per year, more than even the biggest poultry farms.

JOURNAL CLUB

Iwao Ohmine
Nagoya University, Japan

A theoretical chemist compares love to hydrogen bonds.

Water molecules assemble into ice "palm to palm", like Romeo and Juliet on their first encounter. Each molecule reaches out to four neighbours, forming hydrogen bonds that lock the molecules into a tetrahedral network. And like the love of Shakespeare's pair, water's hydrogen bonds are resilient. Ice contrives to keep its network, even in the tightest of spaces.

Researchers recently predicted that ice constrained by a carbon nanotube's wall will form either tubular structures or intricate arrangements of double- and quadruple-stranded helices, depending on temperature, pressure and nanotube diameter (J. Bai *et al. Proc. Natl Acad. Sci. USA* **103,** 19664–19667; 2006).

I have spent many years studying the structure and dynamics of water, but am still amazed by these luxuriant ice structures. Had computer simulations not shown how strenuously ice's network can adapt for its molecules to keep their four hands touching, we could hardly have imagined such structures would be possible.

Simulations have also predicted that confined ice can have two symmetrically different phases, which become deformed and indistinguishable when put under pressure (K. Koga *et al. Nature* **412,** 802–805; 2001). So we expect that one type of ice will easily transform into the other through collective motion of its hydrogen bonds.

My prediction is that confined liquid water, which has a disordered network of hydrogen bonds, will undergo similar structural rearrangements. Molecular mechanisms may cause large changes to the network structure of water trapped in proteins or at membrane surfaces, for example. These studies could therefore help us begin to understand another intimate relationship — the relationship between water and life.

Discuss this paper at **http://blogs.nature.com/nature/journalclub**