Immunology

Who turned on the T cells?

Immunity **19,** 47–57 (2003)

Dendritic cells pick up, internalize and grind up any foreign matter (antigens) that they encounter in the body. Samples of the collected items are displayed at the cell surface for scrutiny by T cells, which then become active. Different tissues have distinct populations of dendritic cells, which generally travel to the lymph nodes to activate T cells there.

One might expect that if an antigen is injected into, for instance, the skin, the dendritic cells there would be the first to activate T cells. Surprisingly, however, Andrea A. Itano and colleagues show that T cells are first turned on by the dendritic cells that pick up the 'skin' antigen after it has been carried by lymph vessels into the lymph node.

Itano *et al.* created a model in which antigens, dendritic cells and antigen-specific T cells could all be monitored in mice. They showed that an initial *ménage à trois* in the lymph node results in proliferation of T cells and secretion of inflammatory proteins (cytokines). Only much later do dendritic cells from the skin arrive to present the antigen to the — by now active — T cells. But this encounter appears to be neither too little nor too late: it is essential for sustained cytokine production and for making T cells that can react swiftly to the same antigen in future. **Marie-Thérèse Heemels**

Astrophysics

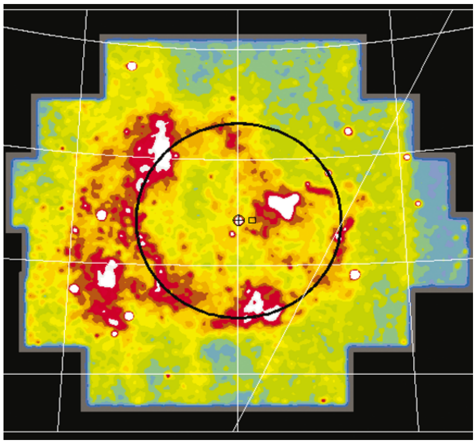
Pulsar pinpointed

Astrophys. J. **592,** L71–L73 (2003); *Astrophys. J.* **593,** L89–L92 (2003)

By settling a dispute over the distance to a pulsar, Walter F. Brisken and colleagues may have also solved the mystery of a bump in the cosmic-ray spectrum. The observed excess of cosmic rays at an energy of about 3×10^{15} eV might come from the remnant of a supernova explosion that occurred 100,000 years ago, 1,000 light years away. But there was no clear candidate for such a source. This, however, is precisely the place and time estimated by Brisken *et al.* for the supernova that created pulsar PSR B0656+14, in the constellation of Gemini.

This pulsar lies at the centre of an expanding circular shell of supernova debris that reaches between Gemini and the neighbouring constellation Monoceros, called the Monogem ring (pictured). Although the distance to the supernova remnant is measured to be about 1,000 light years, an indirect estimate of the pulsar's distance put it at 2,500 light years — suggesting that the superposition is coincidental.

But by making accurate measurements of the parallax of PSR B0656+14 using the Very Long Baseline Array, the researchers have redetermined the pulsar's distance directly. They find it to be 950 light years away. **Philip Ball**



The Monogem ring, seen through its X-ray emission. The cross marks the current location of the pulsar PSR B0656+14; its estimated position at birth is indicated by the black rectangle. Both are close to the centre of the expanding ring of gas that is the supernova remnant.

AAS

Sensory transduction

Not to be sneezed at

Proc. Natl Acad. Sci. USA **100,** 8981–8986 (2003)

Respiratory reflexes such as sneezing help to prevent potentially harmful airborne substances from entering the body. These protective reflexes are triggered by irritation of the trigeminal nerve, and lipid-soluble irritants can diffuse through the lining of the nasal cavity to reach the trigeminal nerve endings. But many compounds that induce respiratory reflexes are insoluble in lipids, so how do these substances tickle the trigeminal nerve?

Thomas E. Finger and colleagues propose an answer: they have identified a new type of receptor cell in the nasal cavity of rats and mice. This cell is similar to solitary chemosensory cells (SCCs), which occur in the skin of non-mammalian aquatic animals. The rodent SCC-like cells carry receptor proteins on their surface that detect bitter substances, such as the fungicide cycloheximide, which is known to irritate the respiratory tract. The chemosensory cells are innervated by the trigeminal nerve, so they probably communicate directly with the nervous system.

This is the first definitive description of an SCC-like chemoreceptor cell in adult mammals, and it will be interesting to see whether these cells are also present in the human nose. If so, it should help us to understand why so many different stimuli make us sneeze. **Heather Wood**

Materials chemistry

Diamonds from dry ice

J. Am. Chem. Soc. **125,** 9302–9303 (2003)

Diamonds up to a quarter of a millimetre across have been made by an entirely new route: chemical reduction of carbon dioxide. Zhengsong Lou *et al.* heated solid CO_2 to 440 °C at a pressure of 800 atmospheres in a sealed container with sodium metal. In the reaction products they found irregular but crystalline diamond particles of about 100 μm or so, along with octahedral crystallites about 10 μm in size.

As well as being produced industrially by high-temperature compression of carbon, diamond can be grown at low pressures by chemical-vapour deposition from a carbon-rich gas, typically a hydrocarbon. This generates polycrystalline films with typical crystal sizes of 0.1–10 μm. The reductive method of Lou *et al.* provides an alternative low-pressure route that is relatively cheap, uses quite mild conditions, and is apparently capable of making surprisingly large crystallites. Graphite (the stable form of carbon under these conditions) is the other major product, but the conversion ratio from CO_2 to diamond can be as high as 8.9 %. **Philip Ball**

Environmental biology

Metallic worms turn

Proc. Natl Acad. Sci. USA doi:10.1073/pnas.1731446100

Cadmium-tolerant worms rapidly lose their adaptation when the metal is removed from their environment. The result could lead to new tests for gauging the effectiveness of ecological restoration of contaminated sites.

Jeffrey S. Levinton and colleagues looked at the worm *Limnodrilus hoffmeisteri* living in the seabed of Foundry Cove, New York. Between 1953 and 1979, a battery factory released an estimated 53 tonnes of cadmium into the cove, making it one of the most metal-polluted sites on Earth.

The cove was cleaned up in 1994–95. By 2002, or in about 9–18 worm generations, the researchers found that the creatures were no more resistant to cadmium than those from an unpolluted site. Resistant worms grow slowly, probably because they need to make large quantities of metal-binding protein. In the absence of cadmium, non-resistant worms have an advantage.

This loss of resistance also decreases the potential for cadmium to move up the food-chain. Tracking resistant organisms could therefore be a good test of the health of polluted sites, Levinton and colleagues suggest. **John Whitfield**