When ions flow through the TRPA1 channel, pain neurons fire. Ardem Patapoutian at the Genomics Institute of the Novartis Research Foundation in San Diego, California, and his colleagues report that 15% of mouse sensory neurons show increased activity when exposed to zinc, and that mouse neurons lacking TRPA1 are unaffected by the element. Mice without a working version of the gene that encodes TRPA1 displayed fewer signs of discomfort when injected with zinc acetate.

'Inside out' cell membranes were highly sensitive to zinc, suggesting that it activates TRPA1 from inside neurons.

ASTROPHYSICS

Where are the dwarfs?

Astron. J. **137,** 3009–3037 (2009)

A leading theory for the evolution of the Universe's structure explains how lumpy galaxies formed after matter was evenly distributed by a relatively smooth Big Bang. 'Cold dark matter' models predict that there should be many more small dwarf galaxies surrounding the Milky Way than have been identified. Kristin Chiboucas of the University of Hawaii in Honolulu and her colleagues think that the 'missing galaxy' problem is not just local; they report a paucity of dwarfs around Messier 81 (M81), a spiral galaxy in the constellation Ursa Major (the Great Bear).

A dozen of the 22 new dwarfs the team found lie within M81's gravitational influence. Theory predicted hundreds more. This finding adds weight to the evidence that missing dwarfs are a real problem and not one of imperfect observation.

CHEMISTRY

Bangs in the dark

Angew. Chem. Int. Edn doi:10.1002/anie.200804853 (2009)

Chemical hallmarks of certain explosives can be quickly identified by the loss of a characteristic glow in a very porous material.

The metal–organic framework (MOF) developed by Jing Li at Rutgers University in New Jersey and her colleagues is luminescent under ultraviolet light. But when its plentiful pores fill up with either 2,4-dinitrotoluene, a by-product of TNT manufacture, or 2,3-dimethyl-2,3-dinitrobutane (DMNB), a tracer molecule for plastic explosives, that luminescence fades.

This happens because the explosive molecules can quickly bind to the inside of the MOF, owing to its porosity, and once there they interfere with the electronic processes that otherwise cause luminescence.

ZOOLOGY

Horny?

Science **323,** 773–776 (2009)

Among many insects there are two male types, dominant and subordinate. But researchers studying the horns of dung beetles have found that some species have three types.

Mark Rowland at the University of New Mexico in Albuquerque and Douglas Emlen at the University of Montana in Missoula trapped and studied closely related dung beetles, the phanaeine. They noticed that males could have big horns, little horns or no horns at all. Some species had a developmental mechanism that entirely halted horn growth in subordinates, and others had one that merely attenuated horn growth. Five species had both — resulting in alpha, beta and gamma males (pictured below, clockwise from top right: female, gamma, beta and alpha).

SCIENCE/AAAS

NEUROSCIENCE

Precision memories

Nature Neurosci. doi:10.1038/nn.2263 (2009)

Why do some memories fade, whereas others retain their original clarity? Experiments on mice suggest that details of precise, long-term memories are stored outside the area of the brain involved in initial memory formation, the hippocampus.

Paul Frankland and his colleagues at the Hospital for Sick Children in Toronto, Canada, trained mice to expect an electric shock to their feet when placed in one type of chamber, but not when housed in a different-looking one. When returned to these chambers, the mice were more likely to freeze in the type associated with the foot shocks.

This behaviour persisted if the rodents' hippocampi were surgically damaged 42 days after training, but not if this was done just one day afterwards. So although longer-term memories may be stored outside the hippocampus, the storage process seems to be prolonged and hippocampus-dependent.

JOURNAL CLUB

Susan E. Hough
US Geological Survey, Pasadena, California

A seismologist considers a new method of earthquake prediction.

I am acutely aware that numerous methods of earthquake prediction at one time held great promise, but fell apart under proper scrutiny. In recent years, I have heard about many studies purporting to uncover evidence of electromagnetic precursors, almost all of which involved weak or non-existent statistical analysis.

But occasionally I come across research that is not so easy to dismiss. For example, data from the French micro-satellite DEMETER, which was launched in 2003 to investigate electromagnetic perturbations in the ionosphere, have been analysed by a team of French and Czech researchers (F. Němec *et al. Geophys. Res. Lett.* doi:10.1029/2007GRL032517; 2008). These authors find that there are very-low-frequency electromagnetic fluctuations in the ionosphere above the epicentres of moderate and large earthquakes that occur a day or two before the ground starts to shake.

Němec and colleagues' results could be fatally flawed. If electromagnetic disturbances are generated when earthquakes occur, what are apparently true signals of one earthquake could actually be signals related to a preceding shock. Or the analysis might go awry because of subtle data-selection biases. But if there are fatal flaws, they are not obvious.

In any case, as the authors themselves emphasize, the significance of the DEMETER results can be demonstrated only when data from many earthquakes are averaged. This highlights a key point: it is entirely possible for precursors to be real but of no use for prediction. If earthquake scientists can separate consideration of earthquake precursors from the highly charged debates about earthquake prediction, the research community might just learn something about earthquake processes.

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