

Physics

Cool gas, hotter superconductors

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J. Kinast *et al.* have obtained strong evidence that an extremely cold gas of lithium-6 atoms can become a unique type of superfluid.

Lithium-6 atoms are fermions, which cannot share the same quantum state and hence do not readily become a superfluid, a medium that flows without friction. But they can form strongly bound non-molecular pairs — analogues of the Cooper pairs of electrons responsible for superconductivity, where current flows without resistance.

Previously, the researchers had seen this 'Fermi gas' of tightly bound atom pairs vibrating in a way that suggested it could become a superfluid at sufficiently low temperatures. Now, they have studied the thermodynamics of a Fermi gas of lithium-6 atoms. They noted a clear jump in the heat capacity after precisely reducing the energy of the gas, consistent with a phase change signalling the creation of a superfluid. The findings also coincide with the predictions of a theory the authors initially created for high-temperature superconductors.

Kinast *et al.* say that understanding this superfluid state could help to develop superconductors that operate well above room temperature.

Mark Peplow

Evolutionary biology

Reinvention of a nose

Curr. Biol. **15**, 116–121 (2005)

Despite being descended from marine ancestors, the robber crab *Birgus latro* would drown in water. But it has no fear of heights, and can easily climb to the tops of palm trees to break open coconuts with its massive claws. Life on land has required other adaptations as well, and Marcus C. Stensmyr *et al.* have cracked the question of how the olfactory system of these giant crabs has become so well suited to terrestrial living.

Stensmyr *et al.* first verified the reputed ability of robber crabs to track down any smelly food in their immediate environment. The authors then looked at the crab's olfactory adaptations. They found that the robber crab has sensitive carbon dioxide detectors, which, together with other odour sensors, help it to locate food sources. Moreover, the bristle hairs on the animals' antennules have characteristics that enable odours to be sensed while minimizing water evaporation.

Strikingly, recordings of the output from the crab's olfactory neurons show strong similarities to those from insects. This, the



Phylogeny

Hippo relations

Proc. Natl Acad. Sci. USA **102**, 1537–1541 (2005)

A morphological analysis has helped to fill a large gap in the evolutionary story of the hippopotamus. The discovery also brings researchers a step nearer to closing the book on a debate that has lasted more than 150 years.

Taxonomists had suggested that the nearest living relatives of hippos are pigs. But genetic analyses indicated that hippos are more closely related to cetaceans (whales, dolphins and the like).

Jean-Renaud Boisserie *et al.* now report that hippos are the only surviving members of a group of animals known as anthracotheres — and that the anthracotheres are the sister group of the cetaceans. They base this conclusion on studies of a range of animal species, including *Libycosaurus*, a semi-aquatic anthracothere that lived in Africa between 12 million and 6 million years ago.

The link between hippos and anthracotheres, which are well represented in the fossil record, also enables the evolutionary history of hippos to be traced back through what was a frustrating 40-million-year hole in their story. **Michael Hopkin**

researchers explain, makes the crab and insect smelling systems a striking example of convergent adaptation.

Roxanne Khamisi

Developmental biology

Four-square specialist

Development **132**, 479–490 (2005)

Biologists have thought that each cell in a four-cell mammalian embryo has exactly the same ability to give rise to tissues as its neighbour. Karolina Piotrowska-Nitsche *et al.* challenge this idea, showing that each cell tends to behave differently.

The authors have found before that, in most two-cell mouse embryos, one of the cells divides along a vertical line that runs from top to bottom (meridionally). The other divides roughly along a horizontal line that spans its equator (equatorially).

Piotrowska-Nitsche *et al.* have now made 'chimaeric' embryos by sandwiching together cells of the same type. When all the cells were derived from equatorial divisions, the embryos suffered developmental problems and some did not survive to birth. When all the cells were derived from meridional divisions, the embryos developed normally.

The researchers went on to show that a single cell derived from an equatorial division, when added to four randomly selected cells, does have the ability to give rise to all tissue types. But the results suggest that, during normal embryo development, cells start specializing from an earlier stage than was thought.

Helen Pearson

Atmospheric physics

TIGER burning bright

Geophys. Res. Lett. **32**, L02801 (2005)

During thunderstorms, the air is full of sprites and elves. These are the evocative names of flashes of light in the upper atmosphere, known as 'transient luminous events' (TLEs). The cause is excitation of gas molecules following a lightning discharge: elves are triggered by the electromagnetic pulse from cloud-to-ground lightning; sprites and other types of TLE may follow within a fraction of a second, typically as red or blue flashes arising well above the thundercloud.

In January 2003, the crew of the space shuttle Columbia recorded a decidedly odd TLE, as Yoav Yair *et al.* now report. The observation was made by astronaut Ilan Ramon — one of the crew killed in the shuttle's ill-fated final flight just days later — as Columbia passed just south of Madagascar.

A lightning discharge occurred near the Earth's limb — the visible edge of its atmosphere. It was immediately followed by a TLE to the east, more than 1,000 km from the thunderstorm. The shape of this flash was unlike that of known TLEs, and its separation in time and space from the lightning also made it unusual. The researchers call it a 'transient ionospheric glow emission in red' (TIGER), and it seems that these ghostly apparitions may not require a nearby thunderstorm.

Philip Ball