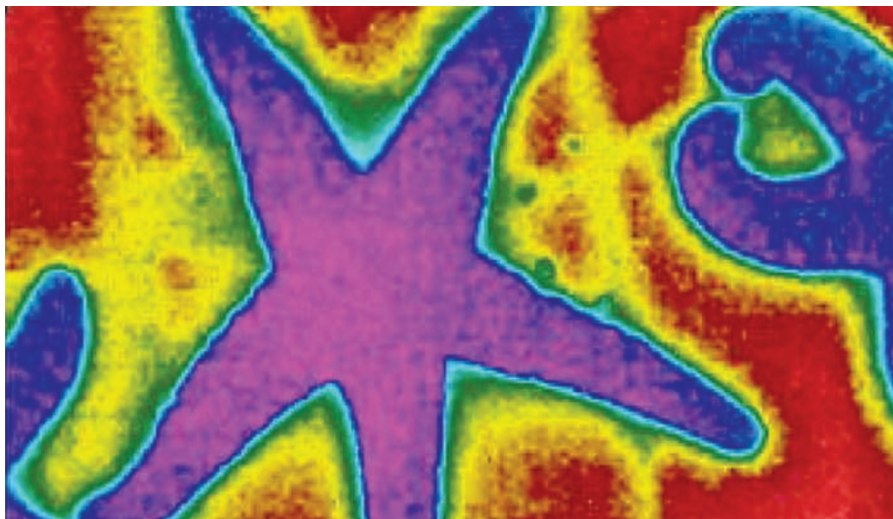


RESEARCH HIGHLIGHTS

Chill out

Am. Nat. doi:10.1086/648065 (2009)

Sea stars know how to keep their cool when the weather heats up. By sucking up cold water while submerged at high tide, they can avoid overheating after the waves roll out. Sylvain Pincebourde, now at the University of François Rabelais in Tours, France, and his colleagues exposed ochre sea stars (*Pisaster ochraceus*) to simulated tidal cycles and various water and ambient temperatures in laboratory aquaria. They found that the intertidal predators increase the amount of colder-than-air fluid in their internal cavity after exposure to elevated aerial temperatures during low tide. This substantially reduces the sea stars' body temperatures, as shown in the infrared image, during subsequent low tides.



B. HELMUTH/S. PINCEBOURDE

PHYSICS**Quantum speed limit**

Phys. Rev. Lett. **103**, 160502 (2009)

The processing speed of computer chips has doubled almost every two years for the past 40, as engineers have crammed ever more transistors into smaller circuits. But according to Lev Levitin and Tommaso Toffoli of Boston University in Massachusetts, chips will ultimately hit a roadblock, limited by the minimum time it takes for a particle to flip from one quantum state to another — a fundamental step in any information system.

There are two independent bounds on this minimum time — one based on the average energy of the quantum system, the other based on the uncertainty in the system's energy. In their calculations, Levitin and Toffoli unify the bounds and show there is an absolute limit to the number of operations that can be achieved per second by a computer system of a given energy. Levitin says that, at the current doubling pace, computing speed will reach this limit in about 80 years.

BIOLOGY**How cockroaches steer**

J. Exp. Biol. **212**, 3473–3477 (2009)

Many animals can sense Earth's magnetic field, but for some species, it remains uncertain whether this ability depends on embedded magnetic particles or magnetically sensitive 'radical pair' chemical reactions of light-sensitive molecules.

Martin Vácha and his colleagues at Masaryk University in the Czech Republic exposed American cockroaches to a magnetic field in which the position of magnetic north changed by 60° every 5 minutes. This

normally makes cockroaches restless. The team also applied a radio-frequency field at only a fraction of Earth's field intensity to jam the creature's magnetic sensing system. At a certain frequency, the cockroaches stayed calm. Other radio frequencies had the same effect, but at higher field strengths.

Because the radio-frequency field should not affect a magnetic-particle-based sensor, the result suggests that insects use a radical-pair-based method of sensing magnetic fields.

NANOTOXICOLOGY**Lung penetration**

Nature Nanotechnol. doi:10.1038/nnano.2009.305 (2009)

When inhaled by mice, multiwalled carbon nanotubes (CNTs) can embed themselves in the lining of the lung (pictured below).

James Bonner at North Carolina State University in Raleigh and his colleagues exposed mice to nanoparticle aerosols of either 30 milligrams per cubic metre or 1 milligram per cubic metre for six hours. In the mice exposed to the higher level, immune cells called macrophages (pictured) engulfed the nanotubes and carried them to the lung lining.

Within weeks of exposure, those mice also developed a condition called subpleural

fibrosis, which causes localized fibrous lesions. This work does not confirm the suggestion made by other studies that nanotubes may cause lung tumours, but the authors say they urge caution be taken when people are exposed to nanotubes in the air.

CLIMATE CHANGE**Stormy warming weather**

Geophys. Res. Lett. doi:10.1029/2009GL039810 (2009)

Arctic residents have complained that their weather is changing, and a study by researchers in Australia backs this up.

Ian Simmonds and Kevin Keay of the University of Melbourne examined the relationship between the number and strength of cyclones each year in the Arctic basin and the extent of Arctic sea ice during the month of September for the past 30 years. They found that years with the least amount of ice had significantly stronger storms, although there was no correlation with the number of storms.

The findings support previous forecasts that the decline in sea ice, and particularly the record lows of recent years, is raising the risk of stronger storms in the Arctic.

CANCER BIOLOGY**Double protection**

Sci. Trans. Med. **1**, 3ra7 (2009)

Blocking a key cell-signalling pathway increases certain tumours' sensitivity to high doses of ionizing radiation while protecting healthy tissue from the harmful rays.

David Roberts of the National Cancer Institute in Bethesda, Maryland, and his colleagues inhibited the cell-surface receptor

