

RESEARCH HIGHLIGHTS

Selections from the scientific literature

ASTROPHYSICS

Mind the black-hole gap

What's the smallest a black hole can be? About 4.5 times the mass of the Sun, according to Will Farr of Northwestern University in Evanston, Illinois, and his colleagues.

Farr's team obtained data on the masses of 20 known black holes that are sucking gases away from their partners in binary star systems. Using these data, the researchers created an expected mass distribution for all stellar-mass black holes and found that 99% would have a mass greater than 4.5 solar masses.

This presents a problem for theories predicting a smooth distribution between black holes and neutron stars, which have a theoretical limit of three times the mass of the Sun.

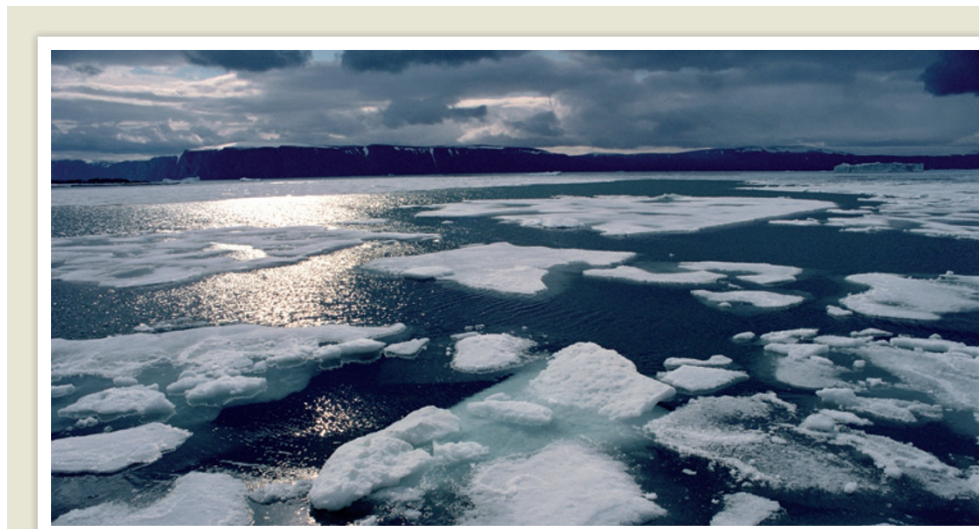
Astrophys. J. 741, 103–122 (2011)

MEDICINE

Safety switch for cell therapy

Cell therapies often induce harmful reactions in patients, so researchers have devised a 'safety switch' and tested it in a common procedure — the infusion of T cells in patients with blood cancers. Malcolm Brenner at Baylor College of Medicine in Houston, Texas, and his colleagues worked with T cells that are frequently given to reduce the risk of relapse and boost immune recovery after stem-cell transplantation. They modified the cells to include a gene that encodes an inducible protein crucial to cell death.

When the T cells provoked the dangerous graft-versus-host disease (GVHD) in four children with acute leukaemia, an otherwise inert drug was infused to activate the protein.



B&C ALEXANDER/ARCTICPHOTO

ARCTIC SCIENCE

More light under ice

In summer, Arctic waters become an ever-evolving mosaic of bare ice, meltwater ponds and open water. In June and July 2010, Bonnie Light of the University of Washington in Seattle and her colleagues measured the optical properties of ice floes formed during the previous winter in the Chukchi Sea to see how changes in ice cover affect the amount of solar radiation that reaches the ocean.

The transmission of sunlight through ice covered by meltwater ponds was generally an order of magnitude greater than that through

thicker bare ice. But horizontal propagation of light in the vicinity of melt ponds, caused by scattering in the ice, led to unexpectedly high rates of light transmittance under the surface of bare ice.

Increased summer melting and thinning may substantially raise the amount of sunlight reaching the upper ocean, so this complexity could have profound effects on biological production and ocean chemistry.

Geophys. Res. Lett. <http://dx.doi.org/10.1029/2011GL049421> (2011)

Within 30 minutes, more than 90% of the T cells had been eliminated. The GVHD resolved within 24–48 hours and had not returned one year later.

N. Engl. J. Med. 365, 1673–1683 (2011)

CHEMISTRY

Solar-cell progress

Dye-sensitized solar cells could offer a cheap alternative to conventional silicon devices, but are often hamstrung by the price of ruthenium, a component in their dye, and

problems with the electron carriers used to complete the electrical circuit.

Michael Grätzel at the Swiss Federal Institute of Technology Lausanne (EPFL) and his colleagues report improvements in both these areas. They used a zinc-porphyrin dye called YD2-o-C8 to avoid the need for ruthenium. And, to overcome the voltage limit inherent in traditional electron carriers, they paired this dye with a cobalt polypyridyl electrolyte. The authors' system can generate about 1 volt and has an impressive efficiency of 12.3%. *Science* 334, 629–634 (2011)

BIOLOGY

Giant webs catch river insects

Darwin's bark spiders spin immensely tough silk into enormous webs across rivers and small lakes in Madagascar. Matjaž Gregorič at the Slovenian Academy of Sciences and Arts in Ljubljana and his colleagues report that the webs of this spider (*Caerostris darwini*) are the largest ever seen, with orbs spanning up to 2.76 square metres, and silk bridges as long as 25.5 metres. However, they might not be designed to