Cancer

Germ-cell suspect in the male

Cancer Cell **4**, 361–370 (2003)

Testicular tumours, the most common form of cancer in young men, usually develop when the reproductive germ cells begin dividing uncontrollably. The cellular events that trigger the process are largely unknown.

Sharon Gidekel and colleagues have implicated a protein, called Oct-3/4 and known to help regulate sperm production, in tumour formation. Gidekel *et al.* found that it was present in all human testicular germ-cell tumours that they tested, and occurred even in early-stage tumours that had not yet become malignant.

Protein levels influenced malignancy in a dose-dependent manner. Mice injected with cells expressing high levels of Oct-3/4 developed highly malignant tumours; those receiving cells with Oct-3/4 at low levels developed less aggressive tumours.

When Oct-3/4 concentrations were directly reduced in mouse tumours, the growths went into remission. Gene-directed therapies that eliminate the protein may prove useful against human testicular cancers, the authors speculate. In adults, Oct-3/4 is expressed only in germ cells, so Gidekel *et al.* suspect that treatments that target it directly should not affect other tissue types. **Helen R. Pilcher**

Optics

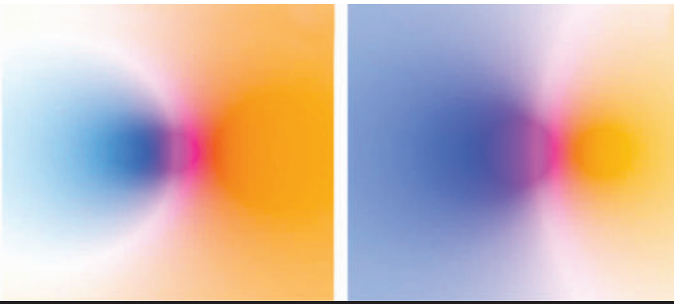
Colourful 'black holes'

New J. Phys. **5**, 154.1–154.7 (2003)

What is the colour of darkness? Proving that this is not some Zen koan, Jonathan Leach and Miles J. Padgett have teased out the chromatic patterns around an 'optical vortex', where a white-light beam has zero intensity and indefinite phase.

Such vortices are examples of phase singularities, 'dark' spots caused by wave interference. They also occur, for example, in ocean tidal patterns. In 2002, Michael Berry predicted that singularities in white light are surrounded by distinctive patterns of colour: a blue and an orange-yellow region separated by a purplish circular boundary, with green notably absent (see picture). Leach and Padgett have now confirmed that this chromatic structure appears around optical vortices, created by passing light from a tungsten halogen bulb through a liquid-crystal diffraction grating with a Y-shaped slit pattern.

Because of the very low intensity close to the singularity, it is no simple matter to convert the observed colour pattern to a chromatic image that corresponds to what a sufficiently sensitive human eye would register: the researchers used a CCD camera with a trichromatic response matched to the colour response of the eye. **Philip Ball**



Out of the darkness: white light, here from black-body radiators at 3,300 K (left) and 6,000 K (right), is still colourful around 'dark' vortices.

IOPP/DPG

Climate

Warmth, wind and water

J. Clim. **16**, 3793–3802 (2003)

Why is there an evaporation minimum at the Equator? Richard Seager and colleagues ask themselves this question, and tackle it with computer models of atmospheric and oceanic behaviour.

At all points on the Equator there is less evaporation than in neighbouring tropical regions both north and south. In some places this can be largely explained by the consequences of a cold tongue of upwelling water. But this mechanism cannot apply to the Indo-Pacific warm pool, the site of the warmest waters in the world.

Proposed explanations are put in terms of exchanges of latent heat, and two in particular are accepted. One is that cloud cover over the warm pool reduces the amount of solar radiation reaching the surface, thereby reducing the balancing flux of latent heat required. The other is that less vigorous winds, compared with the trade winds to the north and south, have the same effect.

Seager and colleagues' modelling work brings in another consideration: they find that the wind factor can be accounted for only when heat transport in the ocean itself is included in the picture, through divergence of the heat flux away from the warm pool. But the authors candidly admit that the extent of atmosphere–ocean coupling requires further study. **Tim Lincoln**

Ecology

Eaten history

Mol. Ecol. **12**, 3467–3475 (2003)

In arable fields, spiders help in pest control by consuming large numbers of aphids. But aphids have poor nutritional value, and are sometimes toxic. By investigating the contents of spiders' stomachs using DNA-based techniques, N. Agustí and colleagues provide a new angle on the importance of springtails (Collembola) in the spider diet.

The researchers developed genetic markers that allowed them to amplify and identify the mitochondrial DNA of three species of Collembola in the gut contents of money spiders. They say that this is the first time such techniques have been used to identify prey species from the guts of wild-living arthropods.

The spiders preferred to eat the largest collembolan, *Isotoma anglicana* — this springtail was heavily represented in their stomachs, even though it is relatively rare in the wild. Agustí and colleagues point out that farming methods that increase the population density of this species could boost spider numbers, and so have a beneficial knock-on effect on pest control. **John Whitfield**

Developmental biology

Serpin takes its Toll

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Curr. Biol. doi:10.1016/S0960982203008303 (2003)

The back of most creatures, the dorsal side, is different to the belly, or ventral side. In the fruitfly *Drosophila*, such lopsided development stems in part from local activation of the Toll signalling pathway. Two groups — Carl Hashimoto *et al.* and Petros Ligoxygakis *et al.* — have now identified a serine protease inhibitor, a serpin, that is essential to blunt Toll signalling and confine it to ventral areas.

The Toll pathway is turned on by a cascade of proteases, enzymes that cut up other proteins. The fluid surrounding the *Drosophila* embryo contains proteases with names such as Gastrulation defective, Snake and Easter, which cut and activate one another consecutively at the ventral side of the embryo. Finally, active Easter slices the protein Spätzle and a piece of the latter activates the Toll receptor protein. But activating Easter locally is not enough to confine Toll signalling ventrally.

Activation of the Toll pathway bears a striking resemblance to the blood-clotting cascade, in which proteases are turned on at the site of tissue damage and serpins inactivate the ones that diffuse away. Both groups followed up this connection in *Drosophila*. A serpin-like gene indeed emerged that seems necessary and sufficient to keep Easter activity in check in developing flies. These findings suggest that inhibition of proteases by serpins may be a general mechanism for spatially controlling biological processes. **Marie-Thérèse Heemels**