

Developmental biology

Protein destruction from egg to embryo

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As a fertilized egg develops into an embryo, protein levels change dramatically. Yet gene transcription — the initial step in protein synthesis that makes an RNA copy of a DNA-based gene — is not needed. So how does the embryo manage to develop correctly?

Jason Pellettieri *et al.* offer a suggestion. They show that, in the nematode worm *Caenorhabditis elegans*, the MBK-2 protein coordinates the breakdown of several maternal proteins. When the process is impaired, fertilized eggs fail to undergo division by mitosis (which ordinarily generates cells that have two copies of each chromosome). The eggs also lack polarity — a sense of orientation — and so fail to lay down the beginnings of a head-to-tail body axis.

The distribution of MBK-2 changes radically after fertilization, so the authors conclude that the protein may control several events around this time. They suggest that it may help to transform a symmetrical, single-celled egg into an asymmetric, patterned embryo. **Helen R. Pilcher**

Environmental science

Lead, leaching and landfill

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The mountains of electronic waste, or e-waste — televisions, computers, cell phones, and so forth — that are accumulating in industrialized societies pose a potential hazard. They contain toxic heavy metals, such as lead in batteries and solder, which may be leached into groundwater when e-waste is dumped in landfills. But Yong-Chul Jang and Timothy G. Townsend claim that the release of heavy metals may not be as great as suggested by the standard US assessment protocol.

In the United States, lead leaching from

solid wastes is determined using the Environmental Protection Agency's Toxicity Characteristic Leaching Procedure (TCLP). Tested in this way, lead leaching from cathode-ray tubes in televisions and computer monitors exceeds the specified limit for non-hazardous waste. Nevertheless, cathode-ray tubes can still be dumped in municipal landfills in some US states. Jang and Townsend show that when cathode-ray tubes and printed circuit boards in Florida landfill sites were leached using the actual runoff fluid from these sites, rather than the leachate (acetic acid) specified in the TCLP, the amount of lead released was about two orders of magnitude lower. For lead at least, TCLP therefore seems to be not merely a conservative test but potentially a misleading one.

Philip Ball

Biophysics

Cell mail delivered by light

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At present, the usual way to transfer material into a specific living cell is to inject it through a micropipette. This is how genetic material is transmitted during cloning. Kenich Yoshikawa and colleagues demonstrate an alternative method. They use optical tweezers — laser beams that create an optical trap — to pull micrometre-sized particles through the cell walls of plant (ginkgo and cabbage) cells. This is less disruptive than puncturing the membranes with a micropipette.

Optical tweezers can be used to pick up individual DNA molecules if the strands are compacted by complexation agents such as certain polymers. But the grip is too loose for reliable transfer. So the researchers encapsulated the DNA in the nanoscale pores of aluminosilicate zeolite particles, which can be trapped about 40 times more efficiently. They also inserted a calcium-sensitive fluorescent dye into cells using a zeolite vehicle. Ideally, they say, one should find a vehicle that dissolves after delivery.

Philip Ball

Astrophysics

Dark interactions

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Invisible dark matter, of unknown origin, dominates the mass of galaxies and clusters of galaxies. It cannot be imaged directly. But M. Markevitch and colleagues have measured how strongly dark-matter particles interact with one another — an issue that greatly exercises astrophysicists — by combining data on a one-off event.

The gravity shadow of a dark-matter bullet, speeding through galaxy cluster 1E0657-56, was spotted by other observers in the distortion pattern of faint galaxies lying beyond cluster 1E0657-56. Earlier X-ray observations by Markevitch *et al.* had revealed that hot gas trails in the bullet's wake. The blob of dark matter is fast-moving and sweeps galaxies along with it, but the hot gas travels more slowly. The disparity in velocity can be explained if the probability of dark-matter particles colliding with one another is extremely low, much lower than for gas particles.

Markevitch *et al.* calculate that two 1-gram particles of dark matter must come within an area of 1 cm² of each other to interact. This would rule out stronger interactions, which have been invoked to explain why dark matter in galaxy cores is less concentrated than computer simulations predict.

Joanne Baker

Ecology

Oxygen needs in the corals

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Coral reef fish can tolerate low levels of oxygen, Göran E. Nilsson and Sara Östlund-Nilsson have discovered. Reef fish were not previously known for their ability to survive in such hypoxic conditions — nor are reefs usually thought of as being low in oxygen.

The researchers looked at 31 species of fish living in the corals of a lagoon on the Great Barrier Reef. All of the fish showed a critical oxygen concentration of around 30% or lower of air saturation. In other words, the fish can maintain a high rate of oxygen consumption, and respire aerobically, until oxygen concentrations drop to these severely hypoxic levels.

Nilsson and Östlund-Nilsson suggest that hypoxia tolerance might help fish to live alongside oxygen-consuming coral. In a lagoon cut off from the sea at low tide — or deep within the reef, where many fish seem to spend the night — respiring coral might create a nocturnal oxygen shortage. The authors also propose that, given the high biodiversity of coral reefs, there may be many unusual adaptations to hypoxia waiting to be discovered.

John Whitfield



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