Tripeptide Maternal Support

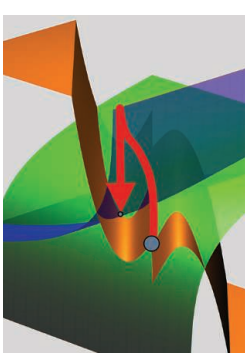
In flowering plants, fertilization involves multiple gametes. The diploid zygote, which will form the embryonic plant, is surrounded by the often triploid endosperm, which provides a supportive and nourishing function. Working in *Arabidopsis*, **Costa *et al.*** (p. 168; see the Perspective by **Bayer**) identified a trio of small signaling peptides that derive from the endosperm but that regulate growth of the embryo. RNA interference was used to down-regulate expression of all three peptides. Fertilization was not affected, but seed growth was. The peptides were critical for normal development of the suspensor, which tethers and nourishes the growing embryo.

Taking Flight

Anyone who has tried to swat a fly knows that their powers of avoidance are impressive. Executing such rapid avoidance requires that the sensory recognition of an approaching threat be translated into evasive movement almost instantaneously. **Muijres *et al.*** (p. 172) used high-speed videos and winged robots to show that flies respond to approaching threats by making rapid banked turns initiated through subtle wing changes over just a few wing beats. The rapid nature of the turns suggests the existence of dedicated sensory-motor circuits that allow the flies to respond within a fraction of a second.

Exposing a Hidden State

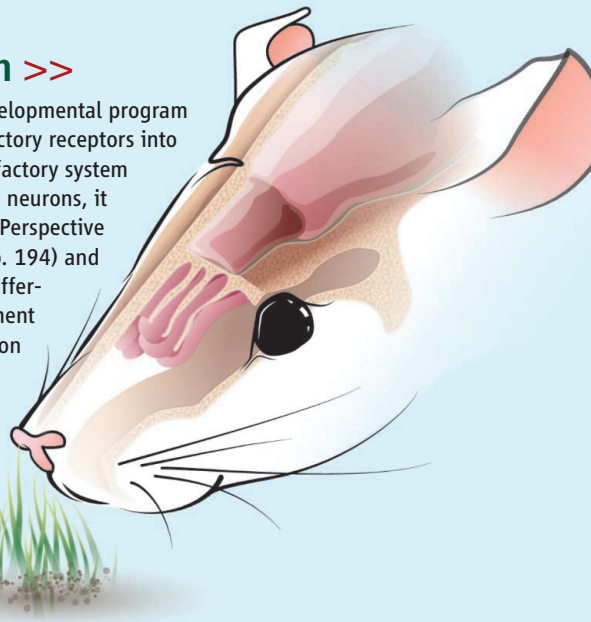
Shining intense laser light on a material can temporarily alter its properties. The effect usually subsides after a few picoseconds, unless the system is trapped in a metastable state, in which case the transient period may last as long as microseconds. **Stojchevska *et al.*** (p. 177) observed that, following exposure to a 35-femtosecond laser pulse, the layered dichalcogenide *1T*-TaS_2 entered a stable "hidden" state not present in the equilibrium phase diagram and stayed there indefinitely. The switch to the hidden state could be reversed by heat or a train of laser pulses. Because the switch alters the sample's conducting properties, the phenomenon might also lead to practical applications.



CREDITS: (TOP TO BOTTOM) V. ALTOUNIAN/*SCIENCE*; DRAGAN MIHAILOVIC

Axon Routing in the Olfactory System >>

The olfactory system of mice entails a developmental program that wires neurons expressing similar olfactory receptors into glomeruli together. Although the adult olfactory system continues to produce and incorporate new neurons, it cannot withstand severe damage (see the Perspective by **Cheetham and Belluscio**). **Ma *et al.*** (p. 194) and **Tsai and Barnea** (p. 197) examined the difference in responses between early development and adulthood. Manipulating the expression of an odorant receptor or the activity of the olfactory neurons altered olfactory neuron axonal pathfinding. The results suggest that the guidance systems used differ between early development and adulthood: Early axons find their own way, but later-in-life axons can only follow existing pathways.



Yeasty HIPHOP

In order to identify how chemical compounds target genes and affect the physiology of the cell, tests of the perturbations that occur when treated with a range of pharmacological chemicals are required. By examining the haploinsufficiency profiling (HIP) and homozygous profiling (HOP) chemogenomic platforms, **Lee *et al.*** (p. 208) analyzed the response of yeast to thousands of different small molecules, with genetic, proteomic, and bioinformatic analyses. Over 300 compounds were identified that targeted 121 genes within 45 cellular response signature networks. These networks were used to extrapolate the likely effects of related chemicals, their impact upon genetic pathways, and to identify putative gene functions.

Shutting Down Repair to Protect

Cells repair DNA double-strand breaks (DSBs) by halting the cell cycle and activating the machinery involved in mending the breaks. However, during mitosis neither the DNA damage checkpoint nor DSB repair occur, apparently leaving the cell extremely vulnerable to DSBs. **Orthwein *et al.*** (p. 189, published online 20 March) found that the DSB response was blocked by the phosphorylation of two crucial repair factors, RNF8 and PB531, preventing their recruitment to the site of damage. Restoring DSB repair during mitosis caused end-to-end chromosome fusions, which are catastrophic for chromosome segregation and normal cell division, explaining why the repair machinery is shut down during cell division.

Toughening Up Elastomers

Elastomers are soft polymer materials widely used in industry and daily life. Inspired by recent work on double-network hydrogels, **Ducrot *et al.*** (p. 186; see the Perspective by **Gong**) designed interpenetrated network elastomers that contained isotropically prestretched chains as the first network. Double- and triple-network structures yielded elastomers with very high strength and toughness in comparison with the corresponding single networks.

Mapping Stardust

A galaxy's structure throughout time depends largely on its ability to convert the raw material of molecular clouds into stars. One of the most influential properties in determining star formation rates is the distribution of densities among individual molecular clouds, which can be described by a probability density function of volume densities. **Kainulainen *et al.*** (p. 183) devised a method to quantify these distributions from empirical dust extinction maps of nearby clouds. The threshold for star formation in these observationally based calculations was significantly lower than theoretical predictions.

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Additional summaries

Interneurons Reach Far and Wide

Interneurons in the brain have been garnering increasing attention. **Southwell *et al.*** (p. 167) review the development of this unique class of neurons. The cells migrate long distances during brain development. Transplantation of interneurons derived from embryonic stem cells is yielding insight into disease processes and may have therapeutic potential. For example, Parkinson's disease, epilepsy, certain psychiatric disorders, and even some sorts of chronic pain either involve interneurons or may respond to transplanted interneurons.

All Together Now

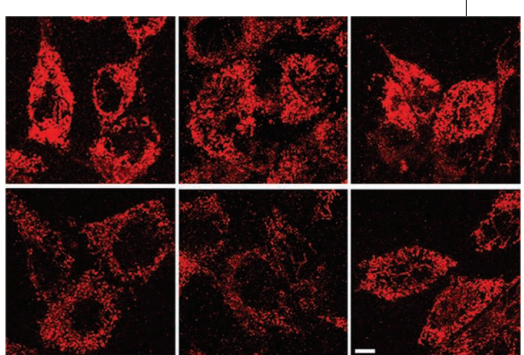
In quantum entanglement, correlations between particles mean that the measurement of one determines the outcome of the other(s). Generally, when trying to exploit quantum entanglement, the larger the number of entangled particles, the better. However, the size of entangled systems has been limited. **Haas *et al.*** (p. 180, published online 27 March; see the Perspective by **Widera**) prepared a small ensemble of ultracold atoms into a collective entangled state. Starting from one internal quantum state, the system of cold atoms was excited with a weak microwave pulse leading to a small excitation probability. Because it is not known which atom is promoted into the excited state, the detection of one quantum of excitation projects the system into an entangled quantum state, called a W-state. A fast repeat-until-success scheme produced such W-states quasi-deterministically. Using such a technique was able to yield entangled states of more than 40 particles. The relatively large ensemble-entangled states could potentially in the future find use in quantum sensing or enhanced quantum metrology applications.

Tangling Evolutionary Trees

Evolutionary rates tend to vary among taxa and may result in phylogenetic trees that do not reflect the true relationships among taxa, depending on the sequences input into the analysis. Examining vertebrate trees, **Evans *et al.*** (p. 200) demonstrate that differences in evolutionary rates, leading to phylogenetic distortions, are correlated with the mechanisms underlying germ cell formation. Evolutionary rate is faster in cases where germ cells are established by maternal molecules ("preformed") relative to those that are induced during embryogenesis ("epigenesis") in slowly evolving and, presumably, ancestral lineages. For example, frogs evolve more rapidly than salamanders, and teleosts more rapidly than ascipenseriform fishes. Thus, epigenesis constrains the ability of gene regulatory networks to change, with the repeated and convergent evolution of preformation eliminating this constraint.

In the PINK1

Pathogenic mutations in the kinase PINK1 are causally related to Parkinson's disease (PD). One hypothesis proposes that PINK1 regulates mitophagy—the clearance of dysfunctional mitochondria. A second hypothesis suggests that PINK1 has a direct effect on mitochondrial complex I, affecting the maintenance of the electron transport chain (ETC) resulting in decreased mitochondrial membrane potential and dysfunctional mitochondria. In support of the second hypothesis, **Morais *et al.*** (p. 203, published online 20 March) observed a complex I deficit in fibroblasts and neurons derived from induced pluripotent stem cells from PINK1 patients before any mitophagy was induced. The phosphoproteome of complex I in liver and brain from mice deficient for Pink1, compared



to wild-type animals, revealed that Ser^{250} in complex I subunit NdufA10 was differentially phosphorylated. Ser^{250} is critically involved in the reduction of ubiquinone by complex I, explaining why *Pink1* knockout mice, flies, and patient cell lines show decreased mitochondrial membrane potential. Synaptic defects in *pink1* null mutant *Drosophila* could be rescued using phosphomimetic NdufA10.

CREDIT: MORAIS *ET AL.*