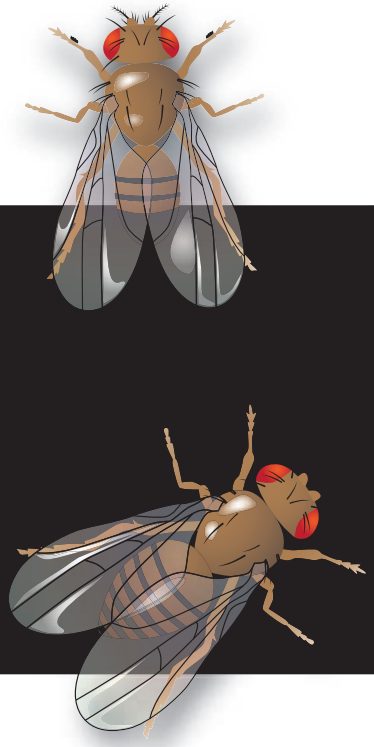


Battle of the Sexes

In many species, males compete with one another to propagate their own DNA, often to the detriment of females (see the Perspective by **Promislow and Kaeberlein**). **Shi and Murphy** (p. 536, published online 19 December) discovered that mating in *Caenorhabditis* species causes mothers to shrink and die soon after they have ceased producing progeny. Males appear to hijack the longevity and stress resistance pathways normally employed by the mothers to slow reproduction and somatic aging in times of stress. **Maures *et al.*** (p. 541, published online 29 November) explored why the presence of abundant mating-competent males causes a decrease in the life span of nematodes of the opposite sex and found that a secreted substance, possibly a pheromone, reproduced the effect of the males when transferred in the culture medium. Detection of pheromones from a female fruit fly is enough to cause changes in metabolism, reduce resistance to starvation, and shorten the life span of male flies. **Gendron *et al.*** (p. 544, published online 29 November) report that the signals from the female appear to be recognized by sensory receptors on the legs of male flies.

Neurodegenerative Genetics

The underlying genetics of neurodegenerative disorders tend not to be well understood. **Novarino *et al.*** (p. 506; see the Perspective by **Singleton**) investigated the underlying genetics of hereditary spastic paraplegia (HSP), a human neurodegenerative disease, by sequencing the exomes of individuals with recessive neurological disorders. Loss-of-function gene mutations in both novel genes and genes previously implicated for this condition were identified, and several were functionally validated.

Early Separation

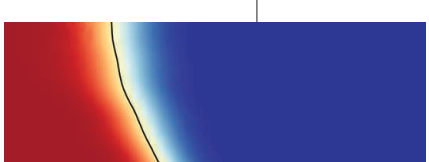
In photovoltaic devices, electrons excited by the absorption of light must travel across a junction, while the positively charged "holes" they leave behind effectively migrate in the opposite direction. If the electrons and holes do not separate efficiently, they can recombine and fail to produce any appreciable current. **Gélinas *et al.*** (p. 512, published online 12 December; see the Perspective by **Bredas**) studied this separation process by ultrafast optical absorption spectroscopy in thiophene-derived donor-fullerene acceptor systems common in organic photovoltaics and report a rate significantly faster than simple charge diffusion would suggest. The results implicate a coherent charge delocalization process, likely to involve fullerene π-electron states.

Acoustically Isolated

The control of sound transmission is desirable in a number of circumstances from noise suppression to imaging technologies. **Fleury *et al.*** (p. 516; see the cover; see the Perspective by **Cummer**) studied a subwavelength acoustic meta-atom consisting of a resonant ring cavity biased by an internally circulating fluid. The direction of rotational flow of the fluid (air) changed the resonant properties of the ring cavity, allowing the propagation of sound waves within the cavity to be controlled. With several ports connected to the cavity, sound could be directed to a certain port while isolating transmission in another.

Disorderly Flow

Lithium batteries are becoming ever more important in society. While their application used to be confined to portable electronics, they are now becoming the enabling technology for electric vehicles and grid storage for renewables. Generally, the flow of lithium ions into and out of battery electrodes is thought to require ordered materials. **Lee *et al.*** (p. 519, published online 9 January) used a combination of experimental work and computations to identify disordered electrode materials with high Li diffusion. The improved energy density properties could be attributed to compositions with excess lithium beyond the stoichiometric limit, leading to intermixing between the lithium and transition metal sublattices and the formation of a percolation network providing specific lithium transport pathways.



Big MACs

Tubeworms are important marine benthic species that encrust rocks and contribute to fouling of man-made objects, such as ships' hulls and drilling well heads. Like most marine invertebrates, the larval stages of tubeworms are free-swimming, but the cues for larval settlement and the triggers for metamorphosis are mysterious. **Shikuma *et al.*** (p. 529, published online 9 January) experimented on larval settlement by the tubeworm, *Hydroides elegans*, which needs to associate with a biofilm-forming bacterium, *Pseudoalteromonas luteoviolacea*, before settlement can occur. The bacterium was found to express metamorphosis-associated contractile structures (MACs) in large and structurally elaborate arrays that allow the tubeworm larvae to develop.

Surveying Savannas

Savannas are structurally similar across the three major continents where they occur, leading to the assumption that the factors controlling vegetation structure and function are broadly similar, too. **Lehmann *et al.*** (p. 548) report the results of an extensive analysis of ground-based tree abundance in savannas, sampled at more than 2000 sites in Africa, Australia, and South America. All savannas, independent of region, shared a common functional property in the way that moisture and fire regulated tree abundance. However, despite qualitative similarity in the moisture–fire–tree-biomass relationships among continents, key quantitative differences exist among the three regions, presumably as a result of unique evolutionary histories and climatic domains.

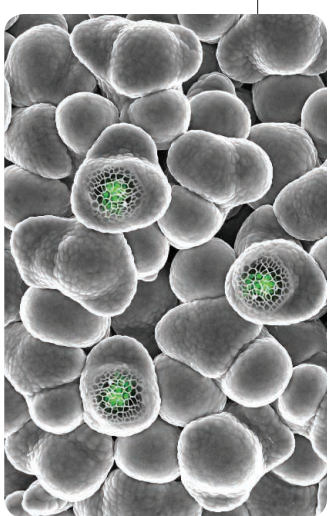
CREDITS (TOP TO BOTTOM): H. MCDONALD/*SCIENCE*; LEE *ET AL.*

Additional summaries

Repairing the Brain

Research with stem cells and reprogramming of cellular fates is leading to improved understanding of neurodevelopmental events, as well as opening doors to possible cellular replacement therapies. **Amamoto and Arlotta** (p. 504) review recent progress in this field and highlight the discoveries made and the remaining challenges as stem-cell technologies are applied to cells of the central nervous system.

A Matter of Timing



Plants flower only when their developmental programs give the go-ahead; otherwise floral genes remain repressed. **Sun *et al.*** (p. 505; see the Perspective by **Zhang**) analyzed the regulatory program that controls expression of the transcription factor KNUCKLES (KNU), which is required in the control of floral genes. KNU expression was silenced by the presence of Polycomb group (PcG) proteins. The floral homeotic protein AGAMOUS competed for control of KNU and activated its expression, but with a 2-day lag time. Thus, eviction of PcG by activating DNA binding proteins can insert a lag time before a switch in gene expression takes place.

CREDIT: SUN *ET AL.*

Melting Moments

The boundary between Earth's core and mantle defines where the iron-rich liquid outer core meets the more chemically heterogeneous solid lower mantle and is marked by a sharp thermal gradient of nearly 1500 kelvin. The precise relationship between temperature and melting of the lowermost mantle constrains the structure and heat flow across the core-mantle boundary. In order to identify trace amounts of liquid as melting initiates, **Nomura *et al.*** (p. 522, published online 16 January) performed x-ray microtomographic imaging of rocks of a primitive mantle composition that had been subjected to high pressures and temperatures in a diamond anvil cell. The experimentally determined maximum melting point of 3570 kelvin suggests that some phases typically thought to lose stability in the lowermost mantle, such as $MgSiO_3$-rich post-perovskite, may be more widely distributed than expected.

Coordinating the Clock

In flies, the mechanosensory chordotonal organs help to coordinate the effects of temperature on circadian cycles. **Simoni *et al.*** (p. 525) provide a mechanism by which mechanosensory input is processed to help to synchronize the biological clock in *Drosophila melanogaster*. The chordotonal organs, which have similarities to the mammalian ear, were also required for sensation of a vibration stimulus and its effects on the endogenous brain clock. The chordotonal organs, present in the joints of the limbs, provide neuronal signals that allow the animal to sense its position or posture—and thus might mediate feedback of a range of behaviors onto the endogenous biological clock.

The Makings of a Choosy Pathogen

The oomycete *Phytophthora infestans* is responsible for potato blight. A closely related pathogen afflicts the 4 o'clock flower. To assess why such similar pathogens are restricted to one host or the other, **Dong *et al.*** (p. 552; see the Perspective by **Coaker**) analyzed similar effectors from both pathogens. The results suggest that the host specialization that led to evolutionary divergence depends on reciprocal single–amino acid changes that tailor the pathogen effector to a specific host protease that is being disabled. Thus, small changes can open the door for a pathogen to jump to another species of host and, itself, diversify into another species of pathogen.

Eggs Well Done

Germ cells can endure extensive DNA damage during their development. Programmed meiotic double-strand breaks (DSBs) are essential for proper segregation of chromosomes to oocytes and sperm. However, incomplete DSB repair by recombination activates a checkpoint that triggers cell death. Exogenous DNA damage is also lethal to oocytes via a highly sensitive checkpoint. **Bolcun-Filas *et al.*** (p. 533) show that the CHK2 kinase is a key component of both checkpoints in mouse oocytes. Deletion of *Chk2* restored fertility to females that would otherwise be sterile because of a meiotic recombination mutation or radiation exposure.