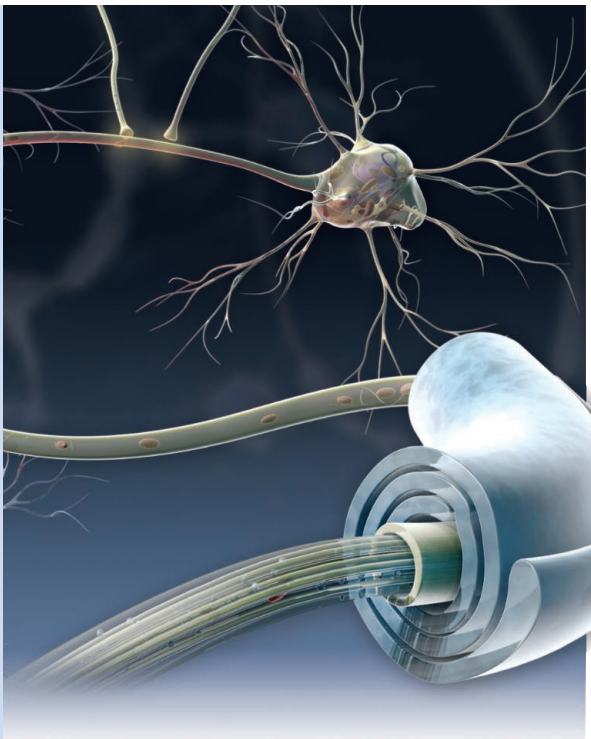
Patchy Insulation

Myelin insulates neuronal axons such that their electrical signals travel faster and more efficiently. However, not all axons are myelinated equally. **Tomassy *et al.*** (p. 319; see the Perspective by **Fields**) obtained detailed images from two snippets of the adult mouse brain and generated three-dimensional reconstructions of individual neurons and their myelination patterns. The images show that some axons have long, unmyelinated stretches, which might offer sites for building new connections. Thus, myelination is not an all-or-none phenomenon but rather is a characteristic of what may be a specific dialogue between the neuron and the surrounding myelin-producing cells.



Sleep Tight, Fly

Shortly after eclosion, young flies sleep a lot and are resistant to being woken. Several days later, the same flies sleep less and are more easily woken. **Kayser *et al.*** (p. 269) show that the different sleep pattern characteristic of youthful flies is critical to correct development of their brains. When sleep is disrupted in young flies, dopaminergic signaling is also disturbed and a glomerulus in the courtship behavior circuit does not develop properly, leading to inadequate courtship behavior and failure to reproduce.

Smoothing Graphene

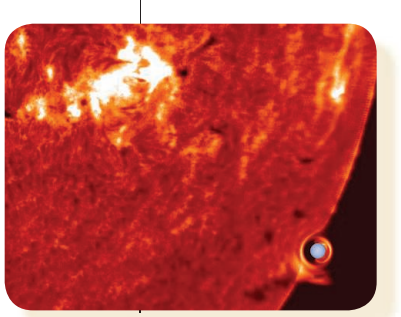
Several methods have been reported for the growth of monolayer graphene into areas large enough for integration into silicon electronics. However, the electronic properties of the graphene are often degraded by grain boundaries and wrinkles. **Lee *et al.*** (p. 286, published online 3 April) showed that flat, single crystals of monolayer graphene can be grown by chemical-vapor deposition on silicon wafers covered by a germanium layer that aligns the grains. The graphene can be dry-transferred to other substrates, and the germanium layer can be reused for further growth cycles.

On a Zeppelin

Nitrous acid (HONO) is an important atmospheric trace gas that acts as a precursor of tropospheric hydroxyl-radicals (OH), which is responsible for the self-cleansing capacity of the atmosphere and which also controls the concentrations of greenhouse gases, such as methane and ozone. How HONO is made is a mystery. Flying onboard a Zeppelin over the Po Valley in Northern Italy, **Li *et al.*** (p. 292) discovered HONO in the undisturbed morning troposphere, indicating that HONO must be produced there, rather than mixed from the surface. The high HONO concentrations are likely to have been formed by a light-dependent gas-phase source that probably consumed OH or HO_2 radicals, which hints that the impact of HONO on the abundance of OH in the entire troposphere may be substantially overestimated.

Starry Brightness

The high photometric precision of NASA's Kepler observatory has enabled the detection of many planets because they cause slight dimming of their host stars as they orbit in front of them. From these data, **Quintana *et al.*** (p. 277) have spotted a five-planet system around a small star. Here, the outermost planet is only 10% larger than Earth and completes its 130-day orbit entirely within the habitable zone, where liquid water could exist on its surface. Similarly, Kepler can detect faint periodic brightenings, as **Kruse and Agol** (p. 275) have reported for the binary system KOI-3278. In this system, a white dwarf acts as a gravitational microlens when it passes in front of its Sun-like G-star companion every 88 days. The lensing effect allows the mass of the white dwarf to be estimated, which helps us to understand how similar binary systems may have evolved.



Changing Assemblages

Although the rate of species extinction has increased markedly as a result of human activity across the biosphere, conservation has focused on endangered species rather than on shifts in assemblages. **Dornelas *et al.*** (p. 296; see the Perspective by **Pandolfi and Lovelock**), using an extensive set of biodiversity time series of species occurrences in both marine and terrestrial habitats from the past 150 years, find species turnover above expected but do not find evidence of systematic biodiversity loss. This result could be caused by homogenization of species assemblages by invasive species, shifting distributions induced by climate change, and asynchronous change across the planet. All of which indicates that it is time to review conservation priorities.

Resilient Hyperpolarization

Despite constant exposure to all sorts of stressors, most people are resilient and do not develop depression, but we do not understand the neurophysiological underpinnings of stress resilience. **Friedman *et al.*** (p. 313) studied this phenomenon in a mouse model of social-defeat stress depression. In the mice they found that, despite apparently pathological levels of hyperpolarization and elevated potassium channel currents in the ventral tegmental area (a structure known to be involved in depression), resilient mice showed normal activity in dopaminergic neurons. Thus, if "depressed" mice were experimentally provoked into hyperpolarization—unexpectedly, they completely reversed depression-related behaviors.

Additional summaries

Hope for SUSY?

Supersymmetry (SUSY), the symmetry between fermions, particles that form matter, and bosons, which mediate the interactions between them, has been proposed as one of the more likely extensions of the Standard Model of particle physics; however, it has so far received little experimental support. Condensed matter systems, such as the superfluid helium-3, may save the concept. In preparation for experimentation, **Grover *et al.*** (p. 280, published online 3 April) develop a theoretical approach that suggests SUSY describes the quantum phase transition on the boundary of a topological superconductor between a magnetic phase characterized by a bosonic order parameter and a neighboring phase hosting Majorana fermions.

Strained Superconductor

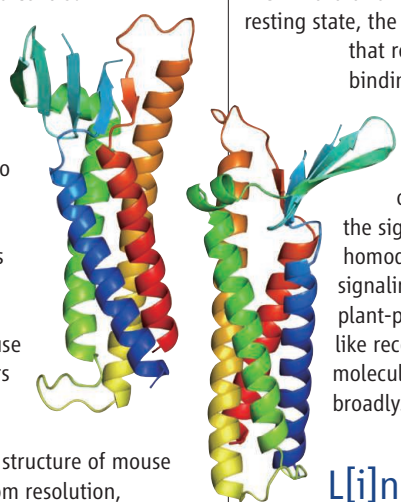
Distorting a material and observing its response can allow insight into its electronic properties. Thin films can be strained by placing them on a substrate with a different lattice constant; bulk samples present more of a challenge. **Hicks *et al.*** (p. 283) designed an apparatus to apply both tensile and compressive strain and used it to study the properties of the superconductor Sr_2RuO_4, which has long been hypothesized to host the unusual p-wave superconductivity. The response of the superconducting transition temperature T_c to the applied strain depended on the direction in which the strain was applied, and did not exhibit a cusp predicted to occur around zero strain. As the technique leaves a surface of the probe open to external probes, it could be adopted for a wide range of methods.

Thin and Selective Outpourings

When using a membrane to separate materials, the efficiency of the separation is limited by how fast the gas or liquid passes through the membrane and by how selective it is. Thinner membranes usually allow for faster flow rates but are usually less selective. Attempting to maintain selectivity, **Celebi *et al.*** (p. 289) developed a sophisticated way to drill holes of controlled diameter in a graphene sheet about two layers thick. For such a thin membrane, the primary barriers to separation come from entrance and exit from the holes and not from the motion through the membrane.

How Tight?

In metazoans, sheets of epithelial cells separate different tissue spaces and control their composition. Tight junctions are cell-cell adhesion structures in these cell sheets that form a seal between cells but also provide some selective permeability to ions and small molecules. Claudins are the main constituents of tight junctions, and mutations in claudins cause inherited human disorders involving the disruption of ionic balance. **Suzuki *et al.*** (p. 304) report the structure of mouse claudin-15 at 2.4 angstrom resolution, which shows an extracellular β-sheet domain anchored to a transmembrane four-helix bundle. The electrostatic distribution on the claudin surface reveals a negatively charged groove in the extracellular domain that may provide a pathway for positive ions.



CREDIT: SUZUKI *ET AL.*

Resisting the Chop

Dengue, West Nile, and Yellow Fever viruses are all flaviviruses that have single-stranded RNA genomes and form specific, short flaviviral RNAs (sfRNAs) during infection that cause viral pathogenicity. These sfRNAs are produced by the incomplete degradation of viral RNA by the host-cell exonuclease Xrn1. What stops the host enzyme from completely chopping up the viral RNA? **Chapman *et al.*** (p. 307) reveal a pseudoknot in the structure of the Xrn1-resistant segment of a sfRNA from Murray Valley Encephalitis Virus, which, perhaps, the host Xrn1 exonuclease cannot untangle.

Universal Immune Function

Certain pathogen effectors are detected in plants by cytoplasmic receptors. First solving the crystal structures of *Arabidopsis* receptors, **Williams *et al.*** (p. 299; see the Perspective by **Nishimura and Dangl**) discovered that in the resting state, the structures form a heterodimer that readies the complex for effector binding and keeps the signaling domains from firing too early. Once the pathogen effector binds, the structure of the complex shifts such that the signaling domains can form a homodimer to initiate downstream signaling. Similarities between these plant-pathogen receptors and Toll-like receptors in animals suggest the molecular mechanisms may translate broadly.

L[i]nc to Dendritic Cell Activation

Long noncoding RNAs (lncRNAs) are important regulators of gene expression, but whether they are important regulators of the immune system is poorly understood. **Wang *et al.*** (p. 310) identify a lncRNA expressed exclusively in human dendritic cells (DC), called lnc-DC, that is required for optimal DC differentiation from human monocytes and that regulates DC activation of T cells. Lnc-DC interacts with the transcription factor STAT3, which is also required for DC development and function, to prevent interaction with and to block dephosphorylation by tyrosine phosphatase SHP1.

Universal Immune Function

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