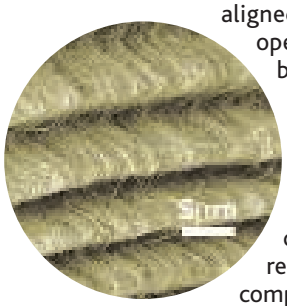
edited by Stella Hurtley and Phil Szuromi

Hard Nanowired

In transistor fabrication, regions with different types of semiconductor doping can be created through ion implantation and lithographic patterning. **Yang *et al.*** (p. 1304) now report on the gold-nanocluster–catalyzed synthesis of silicon nanowires that are both highly uniform in diameter with lengths exceeding 10 micrometers and whose pattern of doping can be altered anywhere along the nanowire. Regions of light or heavy n-type doping were created by changing the amount of phosphine introduced during growth and were imaged by scanning gate microscopy. Nanowires with different patterns of doping regions were used to create an address decoder, and at low temperatures, the different doping regions defined quantum dots that exhibited Coulomb oscillations.

Springing Back

Many materials can recover their shape after compressive stress, but they can pass a limit after which they either fail completely or fail to reexpand. **Cao *et al.*** (p. 1307) have fabricated freestanding films consisting of aligned carbon nanotubes that behave as open-cell flexible foams. The films can be reversibly squeezed to only 15% of their original thickness without structural failure, despite the significant zigzag bucking of the nanotubes. The nanotubes act as elastic compression springs; they are highly compressible along their axis but regain most of their free length after a compressive load is released.



A Single Spiral Around Saturn

The braided structure of Saturn's delicate F ring, with its wispy interweaving strands, has long puzzled astronomers. From sequences of detailed images taken by the Cassini spacecraft, **Charnoz *et al.*** (p. 1300; see the Perspective by **Showalter**) show that the F ring is not so complex and takes the form of a loose single-arm spiral that wraps around the planet three times. After using simulations to explore the spiral's origin, the authors propose that the passage of one of Saturn's tiny moonlets close to the main F-ring band may have expelled material which, after many orbits, has been strung out into a spiral pattern.

Airing Out Older Glacial Cycles

Air trapped in glacial ice contains the only reliable direct record of atmospheric composition before scientific sampling began in the 18th century. Since 1997, the oldest ice available for analysis was that from the Vostok, Antarctica, ice core, which extends back to 420,000 years ago and covers four complete glacial cycles. A new ice core from the EPICA Dome C site in Antarctica now extends back to an age of 740,000 years or more. Two reports present data on the composition of the atmosphere between 400,000 and 650,000 years ago, an interval soon after glacial cycles switched from a dominantly 41,000-year period to the dominantly 100,000-year period that occurs today (see the Perspective by **Brook**). **Siegenthaler *et al.*** (p. 1313) present measurements of the atmospheric concentration of CO_2, the most important trace greenhouse gas, and show how its concentration varied during a much more narrow range than it did during the past 400,000 years. **Spahni *et al.*** (p. 1317; see the cover) present parallel measurements for two other important trace greenhouse gases, CH_4 and N_2O. As is the case for CO_2, CH_4 varied between much more narrow bounds during that time, although N_2O varied just as much as it did in the nearly half-million years since then. These data will be keys to understanding how the carbon cycle has operated since the middle of the Pleistocene epoch.

Hanging On to Introns

Evolution has increased the complexity of organisms, especially bacteria and single-celled eukaryotes that are contrasted with vertebrates, but it does not necessarily follow that the genes and genomes of organisms that arose early in evolution should be less complex than those of newer species. **Raible *et al.*** (p. 1325) analyzed the genome of the marine ragworm, *Platynereis dumerilii*, a possible "living fossil," and show that the structure of its genes is remarkably complex, and that its genome has an intron richness which resembles that of human genome. These two very different organisms have retained this genetic complexity, which has been lost in the other insects and nematodes whose genomes have been studied.

Promoting Lipid Processing for Presentation

A subpopulation of T cells recognizes antigens derived from lipids, rather than from proteins, and these lipid antigens are presented by members of the CD1 family of cell surface proteins. However, one CD1 family member, CD1e, does not seem to present lipids directly. **De la Salle *et al.*** (p. 1321) observed that a lipid antigen that depends on processing to stimulate T cells via another member of the CD1 family (CD1b) could not do so in the absence of CD1e. CD1e was required to assist in modifying a lipid precursor within the lysosome, which allowed intracellular association with CD1b and subsequent presentation to T cells. Thus, the role of this remaining CD1 family member appears to involve processing, rather than direct presentation of, antigenic lipids to T cells.

Cell Fate Specification in the Worm

Early in the development of the nematode worm *Caenorhabditis elegans*, the vulva is composed of six precursor cells that have the potential to develop into one of three vulval cell fates, termed 1°, 2°, and 3°. The 1° and 2° fates are patterned through the cross-talk between two signaling pathways, the EGFR-MAPK pathway and the LIN-12/Notch pathway. **Yoo and Greenwald**

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CREDITS (TOP TO BOTTOM): SHOWALTER *ET AL.*; CAO *ET AL.*

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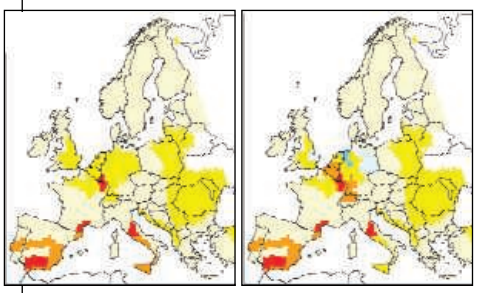
(p. 1330, published online 20 October; see the Perspective by **Karp and Ambros**) now show that a specific microRNA (miRNA), identified by a computational prediction analysis, is involved in specifying the 2° vulval cell fate. The miRNA *mir-60* is a direct transcriptional target of LIN-12/Notch, and, in turn, an ortholog of the oncogene Vav is the target of *mir-60*. The regulatory circle is completed by the regulation of LIN-12 activity by Vav.

Greenhouse Europe

Assessing the likely affects of global climate change remains a high priority for all nations. **Schröter *et al*.** (p. 1333, published online 27 October) show how the pattern of Europe's vulnerability to global changes is likely to change in the 21st century caused by the decreased supply of ecosystem services such as plant growth, carbon sequestration, biodiversity, water, and soil fertility. They apply four climate models to Europe and combine them with socioeconomic scenarios to project the evolution of a range of ecosystem services for the coming century, ranging from carbon sequestration to freshwater provisioning and biodiversity. The loss of these services is likely to be accentuated particularly in the Mediterranean and in mountainous regions.



CREDIT: SCHRÖTER *ET AL.*

Action, Choice, and Reward

To attain specific goals, humans and animals choose actions based on current behavioral contexts and on past experiences. **Samejima *et al*.** (p. 1337) examined single unit activity within the basal ganglia in monkeys performing a simple motor decision task in which rewarded action and the relative reward value were independently manipulated. Cells were identified that showed activity associated with a preferred direction, amount of reward, or some combination of both. About one-third of neurons in the dorsal striatum coded for action value. A reinforcement learning algorithm, trained on the same sequence of trials presented to the animal, could predict trial-by-trial neural activity. The dorsal striatum may be the site of reinforcement learning of action values that are then used to select actions further downstream in the basal ganglia.

Getting to the Bottom of Drug Cravings

Behavioral sensitization, an animal model for drug craving, involves neural adaptations in the mesocorticolimbic regions of the brain, including the nucleus accumbens. Synaptic plasticity in the nucleus accumbens, especially long-term depression (LTD), plays an important role in behavioral sensitization. Using new synthetic peptide inhibitors, **Brebner *et al*.** (p. 1340) showed that LTD in nucleus accumbens is mediated by clathrin-dependent, regulated endocytosis of AMPA receptors. An AMPA-specific inhibitor delivered to neurons in the nucleus accumbens blocked behavioral sensitization. Thus, LTD in the nucleus accumbens is mediated by facilitated endocytosis of postsynaptic AMPA receptors and may be involved in the pathogenesis of drug craving.

Signaling from Wingless

Despite the extensive study of the Wingless (Wg) or Wnt signaling pathway in regulating development and cancer, a previously unrecognized mechanism has been uncovered for Wg signaling at developing synapses in the *Drosophila* nervous system. **Mathew *et al*.** (p. 1344; see the Perspective by **Arias**) found that the Wg receptor DFrizzled2 (DFz2) can be cleaved and translocated from the plasma membrane to the area of the cell just outside the nucleus. In response to Wg signals, the C terminal portion of the receptor then enters the nucleus, where it might act to regulate gene expression. Expression of a DFz2 mutant that could not be cleaved failed to rescue synapse formation in flies that expressed a mutant of DFz2 with defective signaling.

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