**VIROLOGY**

**Assembling HIV**

Most enveloped animal viruses produce their surface spike proteins via the host secretory pathway; these meet up with the cytoplasmically generated capsid at the cell surface before budding infectious virions directly into the extracellular space. Pelchen-Matthews et al. examined the budding process of the AIDS virus, HIV-1, in human monocye-derived macrophages. Cryoelectron microscopy revealed virions budding into an intracellular space that displayed the immunological hallmarks of late endosomes—a compartment involved in the endocytosis and recycling of material from the cell surface. Consistent with the idea that these intracellular compartments are the bona fide source of secreted virions, it was possible to precipitate virions from the extracellular medium with antibodies against endosomal markers, but not with those recognizing cell surface markers. Thus, in macrophages, which are a major reservoir of HIV, most infectious HIV appears to bud into an intracellular compartment, where it is likely to be protected from immunological attack during assembly, and which may facilitate cell-to-cell transmission. — SMH


**ECOLOGY/EVOLUTION**

**Something New to Chew On**

The introduction of exotic species to existing habitats has become a worldwide problem, with serious ecological and economic effects. The release from their familiar enemies—pathogens and herbivores—is one mechanism by which exotic plant species may establish themselves in fresh habitats, sometimes at the cost of indigenous flora. Nevertheless, new work shows this to be an oversimplification. In a field experiment in Canada in which locally occurring species were compared with closely related exotics from Europe or Asia, Agrawal and Kotanen show that, within their introduced range, non-native plants may actually suffer greater levels of attack by herbivores than related species native to the territory. This result suggests that invading plants may be more likely to prosper in a new area if their close relatives are absent. — AMS


**MATERIALS SCIENCE**

**Tough Gels**

Hydrogels are made of swollen, cross-linked polymer networks and can contain in excess of 90% water by volume. When functionalized with free chains on their surfaces, these gels exhibit low surface friction and thus have been attractive candidates as artificial replacements for damaged cartilage. Unfortunately, many hydrogels aren’t very strong.

Using a variety of cross-linkable hydrophilic polymers, Gong et al. have overcome this problem by synthesizing hydrogels with a double network structure. They found that the resistance to stress could be improved considerably by controlling two key parameters. The first was the molar ratio of the two polymers, and the second was the cross-linking density of the two polymers. The highest strength hydrogels were obtained when the first network was highly cross-linked, and the second only lightly so. The highly cross-linked network has a high Young’s modulus but is quite brittle on its own, and the authors speculate that the fluidity of the second network provides for the efficient transfer and dissipation of applied stress that enhances strength overall. — MSL


**EARTH SCIENCE**

**Sedimentary History**

Understanding changes in the delivery of eroded material to the oceans is of fundamental importance for determining the relation between climate and continental weathering. Typically, the record of tephra in input is reconstructed by analyzing the isotopic composition of seawater on the basis of proxies such as the calcium carbonate skeletons of foraminifera or the ferromanganese crusts of deep-sea nodules. There hasn’t been much work carried out directly on material transferred from land to ocean.

Using marine sediments recovered from the tropical Atlantic Ocean, Abouchami and Zabel have measured the isotopic composition of continental sedimentary Pb for the past 200,000 years in order to determine its provenance and whether Pb isotopes respond to variations in Earth’s orbit. They find a clear signal of climate in the isotopic compositions of these sediments, regardless of whether they were transported by wind or rivers, and they also find systematic glacial-interglacial variations in the relative contributions of their sources. The probable cause of these covariations, they suggest, is changes in large-scale atmospheric circulation patterns in general, and in the position of the intertropical convergence zone in particular. — HJS


**APPLIED PHYSICS**

**Fast Optical Switching**

Communication networks that are based on optics must be able to guide light without appreciable losses and to switch the light on and off, ideally at a rapid rate. Although each function can be performed well by...
individual components, there is a drive for further improvement by seeking an integrated approach where both functions can be achieved by a single component. One path has been to develop semiconductor photonic crystals, where the exceptional light-guiding properties of the photonic crystal are combined with the nonlinear optical properties of the growth material. Bristow et al. use a pump-probe technique to excite a transient nonequilibrium carrier distribution in a two-dimensional photonic crystal made from AlGaAs, and they demonstrate ultrafast photoinduced changes in the reflectivity at a wavelength of 882 nm. The measured response time of less than 10 ps reveals the potential such semiconductor photonic crystals hold for optical communication. — ISO


ATMOSPHERIC SCIENCE
Regional Climate Change
Global studies of temperature trends in climate models and in observations have shown that natural climate variability (caused by changes in solar irradiance and by volcanic emissions) cannot explain the warming of the atmosphere over the past 100 years. Anthropogenic emissions of greenhouse gases and aerosols must be included in climate models to reproduce the observed warming, especially for the second half of the 20th century. But can regional climate change also be attributed to human activities?

Using the Hadley Centre climate model HadCM3, Stott has compared three ensembles of four simulations each with a record of near-surface air temperatures over land in six continental-scale regions. Each region is composed of subregions that capture local patterns of climate change but avoid the very small spatial scales that are not well represented in the model. Even though many uncertainties remain, the comparison indicates that for the past century, greenhouse gas emissions have caused increased warming in all six regions, whereas aerosol emissions have partly counteracted this trend. — JFU


Thinking Inside in the Box
In attacking diseases whose molecular mechanisms are not known, devising an assay for a high-throughput screen in drug development is particularly challenging. Gunther et al. describe a screen that uses microarray analysis of gene expression to classify drugs that are currently used to treat depression or psychosis and those that interact with opioid receptors, which are important in the treatment of pain. They used two supervised classification methods—the classification tree (CT) and random forest (RF) algorithms—that were trained on the microarray data. Primary cultures of human neuronal cells were treated with antidepressants belonging to one of four subclasses [atypical, tricyclic, monoamine oxidase inhibitors, and serotonin selective reuptake inhibitors (SSRIs)]; classical or atypical antipsychotic agents; or opioid receptor agonists for the δ, κ, or μ opioid receptors. Thirty-two of the 36 drugs were correctly classified by CT and 30 by RF. Furthermore, RF analysis categorized SSRIs and tricyclic antidepressants into their subclasses when these were handled as unknowns. The marker genes identified as predictive for each drug class may provide insights into the molecular mechanism underlying the disease. Delta opioid receptor agonists were misclassified as antidepressants by both CT and RF, suggesting that this receptor might be a target for the treatment of depression. This approach may increase the efficiency of screening for new types of drug leads, especially for complex phenotypes where multiple pathways may converge to the disease state. — NG