

## CLIMATE SCIENCE

### Wetter or Drier?

One expected result of global climate warming is an overall increase in precipitation. Not every place will receive more rain—some will receive less, even though the average should increase. Certain changes are already apparent in various regions, such as a greater frequency of extreme rainfall events and a higher number of rainy days. Another potential change that could have important effects is an increase in prolonged dry spells. Groisman and Knight have compiled rainfall data covering the last 40 years from more than 4000 carefully selected stations across the conterminous United States, in order to determine if this pattern already has begun there. They find that it has. More precisely, they show that the mean duration of prolonged dry spells in the warm season has increased significantly, and that the return period of 1-month-long dry episodes over the eastern United States has decreased from 15 years to between 6 and 7 years. This pattern could be hazardous for terrestrial ecosystems and agriculture. — HJS

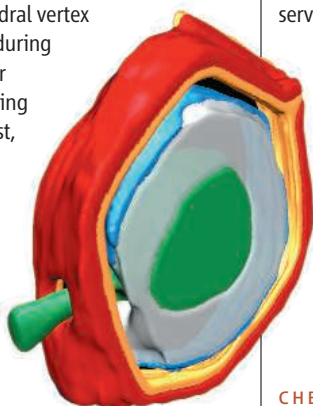
*J. Climate* **21**, 1850 (2008).

## VIROLOGY

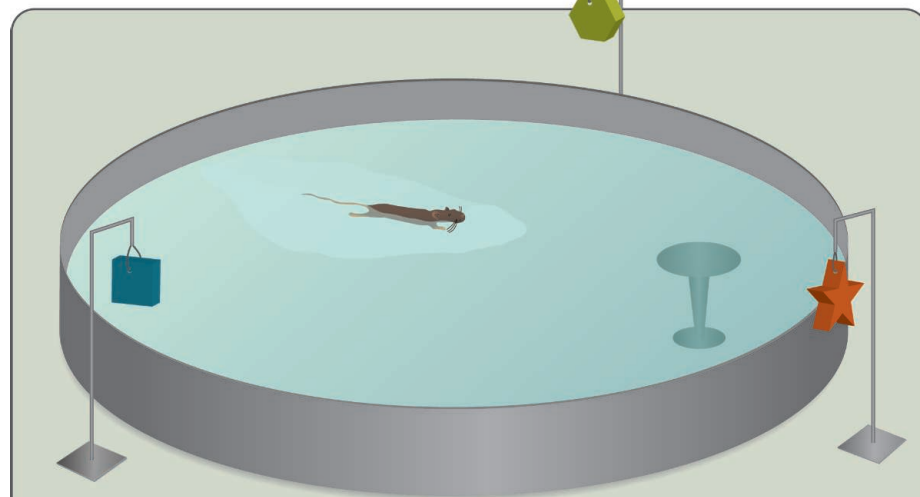
### Leave It to Mimi

*Acanthamoeba polyphaga mimivirus* is a very large double-stranded DNA virus (genome size of 1.2 megabase pairs). By examining images of infected amoebae with electron tomography and cryo-scanning electron microscopy, Zuberan *et al.* have deduced how the genome is released from and packaged into the icosahedral viral capsid. Other DNA viruses have been observed to use a single icosahedral vertex both for loading DNA during viral biogenesis and for releasing it upon entering the host cell. In contrast, mimivirus appears to use two distinct portals. When feeding its genome into newly

**DNA (green) entering through the viral capsid (red/orange) and membrane (blue).**



assembled viral capsids, a passageway at the center of an icosahedral face is used; when releasing its DNA, the mimivirus capsid undergoes a large conformational opening of five icosahedral faces



## NEUROSCIENCE

### Neurogenesis and Navigation

One of the old dogmas in neuroscience is that neurons in the adult mammalian brain do not divide and hence that their number cannot increase. Recent discoveries, however, show that in some areas of the adult mammalian brain, new neurons are being generated throughout the life span of the organism. This revisionist view has led to the speculation that some kinds of information encoding may require adult neurogenesis. Adult-born neurons have been hypothesized to play a role in spatial memory formation in the dentate gyrus of the hippocampus, but a causal relation between neurogenesis and spatial memory has not been unequivocally documented.

Dupret *et al.* generated transgenic mice that selectively overexpressed the pro-apoptotic protein Bax in neural precursor cells in an inducible manner. Overexpression of Bax removed newly born cells in the adult dentate gyrus and caused a strong deterioration in the relational processing of spatial information in the Morris water maze. Animals were unaffected when tested on simpler forms of spatial knowledge; nor were they affected in tasks where memory could be acquired without the hippocampus. — PRS

*PLoS One* **3**, e1959 (2008).

around a single vertex. This so-called stargate serves as a membrane-lined sleeve through which the whole viral genome can escape promptly after infection. These entry and exit strategies may also be used by other large DNA-containing viruses, especially those that, like mimivirus, contain an internal membrane and encode proteins related to the DNA-packaging ATPases that are involved in bacterial DNA segregation, another process during which a large amount of DNA passes through a membrane portal. — SMH

*PLOS Biol.* **6**, e114 (2008).

## CHEMISTRY

### Start Smart

Palladium(0) complexes are widely used as homogeneous catalysts for formation of carbon-carbon, carbon-oxygen, and carbon-nitrogen

bonds. In general, the active catalysts are too unstable to store, and so precursors [often in the Pd(II) oxidation state] are prepared with stabilizing ligands that dissociate under the reaction conditions. However, the mechanisms and efficiency whereby these precursors transform into active catalysts have largely gone unaddressed, as has the potentially inhibitory effect of the stabilizing ligands left behind in the reaction solution. Biscoe *et al.* undertook a more careful approach by synthesizing a stable Pd(II) precursor complex resembling a reaction intermediate along the catalytic cycle. In three efficient steps, they appended a cyclometalated phenyl ring with a tethered chelating amine group to the Pd center. Exposure of this precatalyst to basic reaction conditions in the presence of aryl chlorides and amines led to rapid liberation of the protective ligand as an inert dihydroindole, leaving the resultant Pd(0)

complex free to proceed with a similar C-N coupling cycle of the bulk reagents. In comparison with traditional precatalysts, these complexes dramatically accelerated coupling reactions (in one case from 4 days to 4 hours), allowing loadings below 1 mol % and reaction temperatures at or below 25°C for sensitive substrates. The absence of interfering precatalyst ligands also facilitated clear mechanistic studies. — JSY

*J. Am. Chem. Soc.* **130**, 10.1021/ja801137k (2008).

## ECOLOGY

**Deterministic Competition**

The neutral theory of ecological community composition, which holds that species are interchangeable, has in recent years become a benchmark against which to test ecological data for signs of more niche-based mechanisms of species coexistence. Using data on tree species abundance in a Mexican tropical deciduous forest, Kelly *et al.* show that closely related pairs of species are more similar in abundance to each other than would be expected by chance, and also more similar in abundance than more distantly related species. This analysis suggests that closely related species interact with each other in different ways than do more distantly related or unrelated pairs—and hence argues against an important tenet of neutral theory. — AMS

*Ecology* **89**, 962 (2008).

## BIOMATERIALS

**Bridging the Gap**

Peripheral nerves can be severed by injury or surgical procedures. For large gaps, the only clinical route to repair is through the use of autografts. However, this option requires a second surgical procedure with potential complica-



tions at the donor site and there is a limit on the number of suitable donor sites, as only motor or mixed nerves make suitable donors, whereas purely sensory nerves do not. Kim *et al.* fabricated films of an electrospun polymer, with either aligned or randomly distributed fibers that were stacked into thicker constructs. Studies were conducted on rats with 17-mm nerve gaps using both constructs, as well as autografts and

saline injections as controls. The polymer films with randomly oriented fibers showed poor axon growth. In contrast, the aligned fibers helped facilitate nerve regeneration with the propagation of Schwann cells from both nerve stumps. Axons were found to grow from the proximal stump, but only in places where the Schwann cells had migrated. The aligned constructs were almost as effective as the autografts in restoring muscle functionality, but the pattern of nerve regeneration differed between those grown on the polymer and the autografts or normal nerves, and there was greater electrical signal latency. Overall, the work shows that topography of a graft, without the addition of neurotrophic factors or cell transplants, may be enough to induce nerve regeneration. — MSL

*Biomaterials* **29**, 10.1016/j.biomaterials.2008.03.042 (2008).

## IMMUNOLOGY

**Another Twist in the Extrathymic Tale**

$\alpha\beta$  T cells are descended from progenitors within the thymus, yet additional sites of lymphogenesis may also exist, most notably the mucosa of the gut. A decade ago, compelling evidence for intestinal extrathymic  $\alpha\beta$  T cell development appeared with the report of small gut lymphoid aggregates called cryptopatches (CPs) that contained progenitors able to repopulate the T cell compartments of a mouse. Then, a few years ago, controversy was ignited by an elaborate fate-mapping study that concluded that all intestinal  $\alpha\beta$  T cells are thymus-derived after all. In that study, the transcription factor retinoic acid-related orphan receptor  $\gamma$  (ROR $\gamma$ t) was required for both gut and thymic T cell development, but this could be uncoupled from CP development and function. Thus, it was concluded that CPs are not genuine sites of lymphocyte development, but rather are lymphoid aggregates, induced by lymphoid tissue-inducing (LTI) cells and required for intestinal immune responses.

Naito *et al.* have performed further detailed analyses of the same engineered mouse strains used in the second study and find that CPs harbor a more complex mix of cells than was originally apparent, of which only a minority are actually LTI-like. Indeed, many CP cells with absent or minimal ROR $\gamma$ t expression displayed the telltale signs of differentiating T cells, even in animals that did not possess a thymus. The case for extrathymic  $\alpha\beta$  T cell development may now be re-reinforced, but we still remain some way from understanding the function of these unusual T cells. — SJS

*Mucosal Immunol.* **1**, 198 (2008).

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## Bridging the Gap

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