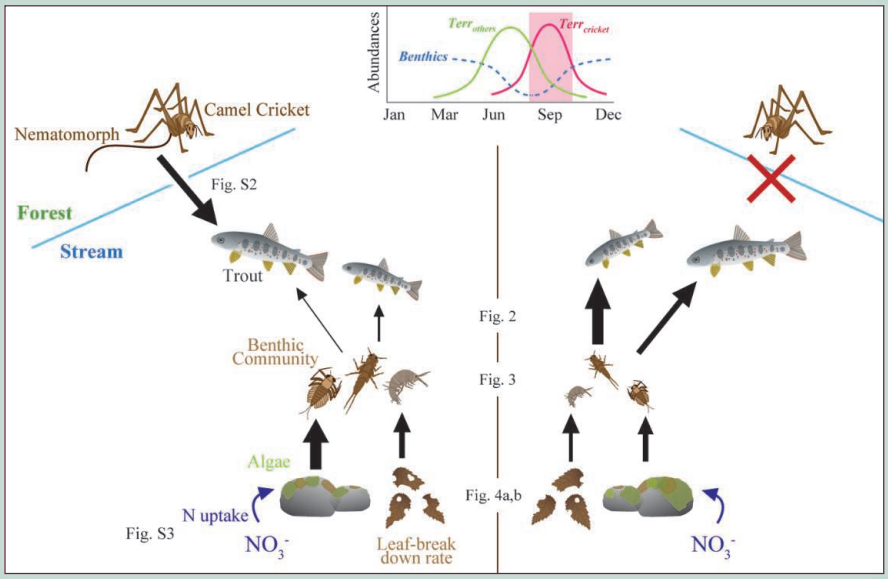
EDUCATION

The Cost of Improvement

With increased emphasis on the role of science and technology in economic prosperity come increased efforts to improve science education. In the United States, science-focused education efforts occur on a backdrop of broader efforts to improve public education by using standardized tests of student achievement, largely limited to literacy and math. Because low test scores often come with steep consequences, the pressure to "teach to the test" can corrupt the system and undermine the very educational processes that are being monitored. Indeed, research has shown that high-stakes standardized tests focused on literacy and math in primary school can lead to decreases in the instructional time dedicated to other topics such as science. Maltese and Hochbein studied U.S. high schools in Indiana and found that despite school-level improvement of some schools on measures of math and literacy as reflected on a statewide standardized test used for evaluating schools (ISTEP), student-level performance in those improving schools did not demonstrate improvement in literacy or math on a separate, widely used college-entrance examination (ACT). Furthermore, school-level improvement on ISTEP math and literacy was generally associated with lower individual student-level science achievement on ACT. — BW

J. Res. Sci. Teach. **49**, 804 (2012).



ECOLOGY

A Cascade of Consequences

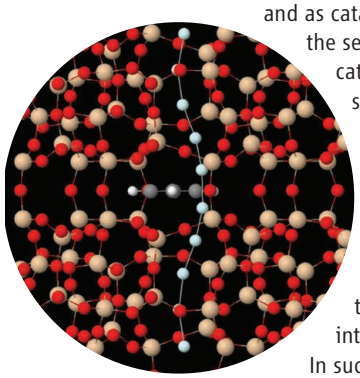
Specialized interactions between pairs of species can have wide and surprising consequences for the wider ecosystem they inhabit. Sato *et al*. investigated the case of the nematomorph parasitic worm, which has a life cycle involving a free-living adult stage and several parasitic larval stages, the last of which parasitizes cricket hosts. The relationship is manipulative, in that the worm induces the cricket to head for stream waters, where the adult worm will emerge to complete its free-living reproductive phase. The authors show experimentally that the addition of crickets to a Japanese stream ecosystem diverts predatory trout towards this attractive source of food and away from their normal diet of benthic invertebrates, in turn leading to a decrease in benthic algae and an increase in the rate of leaf-litter breakdown. Because of the ubiquity of nematomorphs at streams and streambanks globally, the cascading effects of their manipulative parasitism may be a common feature of these ecosystems. — AMS

Ecol. Lett. **15**, 786 (2012).

MATERIALS SCIENCE

Blocking Zeolite Transport

Zeolites are microporous aluminum silicates, and because their pore and channel sizes can be similar to those of small organic molecules, they are used as adsorbents, in separations, and as catalysts. In some of the separation applications of zeolites, such as removing hydrogen from hydrocarbon gas streams, both large and small molecules occupy the material's internal channels. In such processes, the larger molecules can partially block the channels and affect transport of the smaller molecules. Hedlund *et al*. measured the diffusion of helium in a ZSM-5 zeolite membrane in which they had adsorbed *n*-hexane or benzene. Loading with either hydrocarbon could decrease the transport by more than two orders of magnitude. Percolation models with parameters determined from density functional theory, rather than simply fitting the results with adjustable parameters, described the measured mass transport of helium through the defect-free zeolite. For *n*-hexane, the mass transport of helium initially decreased gradually with hydrocarbon loading but then decreased abruptly at about 50% loading. For benzene, the decrease was observed at a lower hydrocarbon loading (19%). This stronger effect was caused by benzene adsorbing at the intersections of channels in the zeolite. — PDS



J. Membrane Sci. **415-416**, 10.1016/j.memsci.2012.05.009 (2012).

MOLECULAR BIOLOGY

Blunt End Protection

One of the problems with having linear chromosomes, as most eukaryotes have, is their ends. Naked DNA ends are recognized by the cell as breaks in the continuity of the genome and are repaired with all haste. Trying to "repair" the ends of chromosomes, however, could have devastating consequences for the cell (the fusion of whole chromosomes, for example). Instead, special structures at chromosome ends, known as telomeres, whose general features have been conserved across evolution, protect them from the attentions of the cell's DNA repair machinery. Telomeres generally have a single-stranded (ss)DNA overhang that binds to proteins that help disguise the DNA end.

Surprisingly, Kazda *et al*. find that a substantial fraction of the telomeres in the plant *Arabidopsis thaliana* do not have canonical overhanging ssDNA ends. Rather, the chromosomes have blunt ends, which are probably a consequence of the replication of DNA. These blunt ends, which would be unable to bind the protective protein complex found on the other *Arabidopsis* telomeres, are bound by

the Ku70/80 heterodimer, which is normally required for DNA repair but can also act to protect free DNA ends. — GR

Genes Dev. **26**, 1703 (2012).

GENETICS

Commensal Complexity

Strains of the Pseudomonas fluorescens group of commensal bacteria offer plants protection against pathogens through the production of antibiotics or the stimulation of plant resistance. The specific protections offered vary between strains, suggesting that genetic variation may underlie these differences. In order to investigate this, Loper *et al*. sequenced seven plant-associated strains that differed with respect to species, location on the plant, and mechanism of protection. A comparison of these genomes to three previously sequenced strains showed that whereas approximately 50% of the genes overlapped among all sequenced *P. fluorescens* strains, forming a core genome, the remaining genomic properties were highly variable and could be used to distinguish three pan-genomic complexes, with a high number of strain-specific elements and genes. Within the clades, specific genes and genetic elements tended to be found only within a select subset or single strains, some of which underlie phenotypic characteristics and may be involved in multitrophic interactions such as the production of secondary metabolites and components of the type III secretion system. The tremendous genetic diversity observed among these strains highlights how such investigations can help us better understand the complexities of species interactions. — LMZ

PLoS Genet. **8**, e1002784 (2012).

CHEMISTRY

Angle of Attack

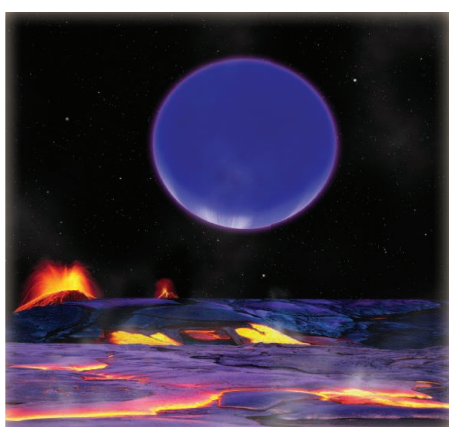
In qualitative terms, chemists have become adept at predicting how reaction probabilities depend on the relative dispositions of two colliding reagents. For instance, if a reactive site is bounded by a large fragment and a small one, the collision partner is more likely to make it past the small one. This steric effect is the basis for much of asymmetric catalysis. A more detailed, quantitative picture of what happens at any particular collision angle is rather harder to capture. Wang *et al*. have now mapped out the precise three-dimensional steric constraints guiding an elementary chemical reaction: chlorine's abstraction of a hydrogen atom in the vibrationally excited C-H bond of CHD_3 to produce HCl. By varying the polarization of the vibrational excitation laser, the authors could effectively choose the alignment of the (partially deuterated) methane reagent relative to the incoming Cl atom beam, after which they used ion imaging to map out the product trajectories and their associated quantum states. The results for the production of vibrationally relaxed HCl are largely in keeping with expectations from the longstanding line-of-centers model in collision theory, whereas pathways leading to vibrationally excited HCl manifest more complex dynamics. — JSY

Nat. Chem. **4**, 636 (2012).

ASTROPHYSICS

Chaotic Planets

It may not seem so, but the orbits of the planets in our solar system are chaotic, meaning that they are unpredictable beyond a characteristic time scale, known as the Lyapunov time, which in the case of the solar system's inner planets is about 5 million years. Deck *et al*. now show that the orbits of the two planets in the Kepler-36 system are chaotic, with a Lyapunov time of less



than 10 years. The orbits of Saturn's moons Prometheus and Pandora are the only other ones known to show chaos on such a humanly observable time scale.

The two planets orbit a distant star, which has a mass similar to that of the Sun and is among the 156,000 stars regularly monitored by NASA's Kepler space telescope. The planets have masses around 4 and 8 times that of Earth and orbit so close to one another that the angular size of the heavier planet as seen from the lighter planet would be 2.5 times as large as the full Moon viewed from Earth (see Carter *et al*., Reports, 3 August 2012, p. 556; published online 21 June 2012). The authors suggest that the orbital chaos is a consequence of mutual gravitational interactions between the two planets. — MJC

Astrophys. J. **755**, L21 (2012).

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A Cascade of Consequences

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