



## EVOLUTION

### Same But Different

Adaptation to local environments accompanied by reproductive isolation can result in ecological speciation among populations. One example of such adaptation is the color variation seen in several reptile species found in the gypsum sands of White Sands, New Mexico. Animals living within the white or dark sand environments are light- or dark-colored, respectively. By simultaneously comparing multiple genetic and phenotypic traits, Rosenblum and Harmon tested whether this divergence has led to ecological speciation in three replicate lizard species that display this pattern (*Aspidoscelis inornata*, *Sceloporus*

*undulatus*, and *Holbrookia maculata*). They detected signals of ecological speciation in all three species, including the clear divergence in color phenotype, but also in body shape and size. The degree to which speciation has progressed (as evidenced by genetic divergence), however, varied substantially. Phenotypical adaptations to local environmental variation were observed in all species, but thus far, only *H. maculata* showed evidence of true ecological speciation. Overall, these results provide insight into the variety of ways species can respond to apparently similar selective regimes. — SNV

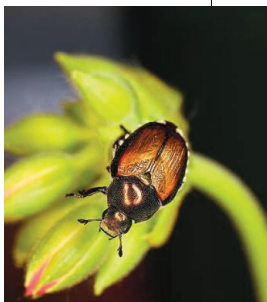
*Evolution* 10.1111/j.1558-5646.2010.01190.x (2010).

## ECOLOGY

### Floral Cure-All

A traditional Chinese medicine, Shih-chun-tze, used to treat infections with the large parasitic nematode *Ascaris* has as its active ingredient L-quisqualic acid, a known but rare agonist of excitatory amino acids.

Unexpectedly, when Ranger *et al.* were looking for explanations for the well-known phenomenon of Japanese beetle (*Popillia japonica*) paralysis, they found this agonist in the flowers of ornamental pelargoniums (zonal geraniums). Ingestion causes the



beetles to be paralyzed for several hours, increasing their vulnerability to predation, desiccation, and lost reproduction. The beetles find the petals irresistible, however, because after recovery they come back for more. Japanese beetle damage costs horticulture hundreds of millions of dollars

annually, but since the zonal geranium phenomenon was first described in the 1920s, the paralytic agent had not been identified. Silica gel flash chromatography was used to characterize the active ingredients in petals, and the active components were tested in agar plugs fed to beetles. Consumption of about 5 ng of L-quisqualic acid (thought to mimic the neurotransmitter L-glutamic acid), equivalent to one or two petals, is sufficient to paralyze the beetles. The work indicates that zonal geraniums may be a promising natural source of a novel pest control agent. — CA

*Proc. Natl. Acad. Sci. U.S.A.* **108**, 10.1073/pnas.1013497108 (2011).

## PLANETARY SCIENCE

### Crashing to the Core

Earth began to form through the accumulation and accretion of material in a disk of dust and gas that orbited the newly formed Sun. Once the so-called proto-Earth reached a certain size—through impacts with several other planetary bodies—gravity induced the differentiation of an

internal structure with a metallic core as the planet continued to grow. An evolving composition of the impactors may explain Earth's internal structure and composition, but inconsistencies exist between various isotope systems and compositional estimates that are typically used to explain Earth's earliest history. A new model by Rubie *et al.*, based on mass balances of average compositions of chondritic meteorites, attempts to reconcile Earth's accretion history with existing geochemical evidence. Among many simulations, the best-fit model predicts that the proto-Earth experienced a series of collisions with relatively large volatile-poor impactors of increasingly oxidized composition. This explanation requires minimal mixing between the metallic cores of the late impactors and silicate-rich magma on Earth before their heavier elements were incorporated into Earth's core as a consequence of equilibrium between metals and silicates at high pressures. According to this sequence of events, and a late addition of volatiles, the minor element composition of Earth's present-day iron-rich core is approximately 8% Si, 5% Ni, 2% S, and 0.5% O. — NW

*Earth Planet. Sci. Lett.* **301**, 31 (2011).

## PSYCHOLOGY

**I'm Free, You're Not**

A seemingly universal belief is that people consider that their capacity to act freely is greater than that of others. Pronin and Kugler supply a set of experiments in support of this proposition. Ivy League undergraduates reported that their own past (choice of college to attend and choice of field of concentration) and futures (place to live and profession) were less predictable than those of a roommate, and a similarly broader scope of futures was claimed by restaurant waiters for themselves in comparison to a co-worker. These asymmetries could not be explained simply as self-optimism, because the larger set of future scenarios comprised both positive and negative outcomes. Finally, and in contrast to the tendency to attribute one's own actions to situational influences and another's actions to dispositional traits, they found that where the undergraduates differed from their roommates was in the apportionment of causal motivations to intentions versus personality; that is, we see our actions as the product of changeable desires, and the sense that we could have acted otherwise had we so desired is what underpins our belief in free will. — GJC

*Proc. Natl. Acad. Sci. U.S.A.* **107**, 22469 (2010).

## GEOCHEMISTRY

**Caves in 2D**

Vast expansive underground caves start out meagerly as small fractures in carbonate-rich bedrock such as limestones or dolostones. As slightly acidic water, which is undersaturated in carbonate, slowly percolates through the rock, carbonate dissolves according to the direction of flow. Geochemical models, however, predict this scenario to break down at depth because undersaturated solutions have very low penetration depths. Models designed to overcome this discrepancy are successful at explaining cave formation but treat fractures as simplified one-dimensional (1D) objects from which dissolution uniformly propagates, and rely on complicated chemical kinetics. By performing simulations of dissolution using a 2D model, Szymczak and Ladd observed that uniform dissolution fronts generated in just one dimension are mathematically unstable as soon as the fracture has any width. Instead, the model predicts that dissolution along fractures



occurs at smaller, highly localized hot spots spaced out along a semi-regular wavelength. These hot spots can eventually develop into channels according to the size and orientation of the fracture relative to the flow direction. Over time, a single channel can eventually grow into a large cave or system of caves. — NW

*Earth Planet. Sci. Lett.* **301**, 424 (2011).

## CLIMATE SCIENCE

**First Warm, Then Wet**

Data derived from Asian loess sequences and stalagmites from caves in China have provided a valuable record of changes in the East Asian monsoon since the Last Glacial Maximum but have not been equally informative about the relationship between the timing of monsoon precipitation and warming in that region. Knowing the relative timing of those changes is an important part of understanding how climate changed during the last deglaciation. Peterse *et al.* present a record of temperature in central China for the past 34,000 years, in an effort to better define its relation to monsoon activity there. They find that the intensification of east Asian summer monsoon precipitation lagged deglacial warming and the increase of Northern

Hemisphere summer insolation by about 3000 years. Intense soil formation, which depends on both higher temperatures and available moisture, lagged deglacial warming by even longer, around 7000 years. — HJS

*Earth Planet. Sci. Lett.*

**301**, 256 (2011).

## DEVELOPMENT

**Enucleation Regulation**

Mammalian mature red blood cells lack nuclei. Enucleation results from asymmetric cell division in which the condensed nucleus, surrounded by a plasma membrane, buds off from the immature erythroblast. Micro- (mi) RNAs are important regulators of erythroid cell development and homeostasis; thus Zhang *et al.* used RNA-seq technology to examine whether they also regulate erythroid maturation. Their analysis revealed that the majority of miRNAs are down-regulated during this process. In particular, expression of miR-191 decreased sharply. Overexpression of miR-191 resulted in defective cell enucleation, but differentiation was unaffected. Reduction of miR-191 expression allowed for the expression of target erythroid genes *Riok3* and *Mxi1*, which are required for chromatin condensation and enucleation. — BAP

*Genes Dev.* 10.1101/gad.1998711 (2010).

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