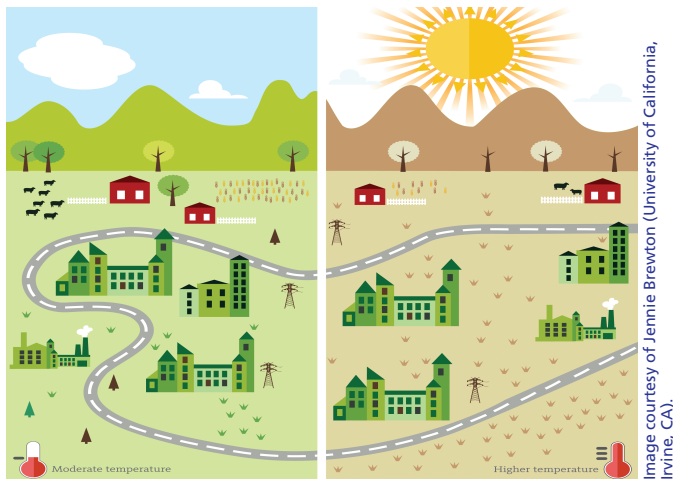


In This Issue

Heatwaves and droughts under climate change

Heatwaves and droughts can cause significant damage to human health, air quality, vegetation, and food production. The damage is exacerbated when heatwaves and droughts occur simultaneously. Omid Mazdiyasn and Amir AghaKouchak (pp. 11484–11489)



Heatwaves place substantial stress on natural and man-made environments.

examined changes in the frequency of concurrent droughts and heatwaves in the contiguous United States over time. While no significant trends were observed in the occurrence of droughts, simultaneous heatwaves and droughts were more frequent during the period from 1990–2010 relative to 1960–1980, especially in the southern and western United States. The greatest change was observed for the longest and most severe heatwaves. Overall, a larger percentage of the contiguous United States experienced concurrent droughts and heatwaves at any given time during 1990–2010, compared with 1960–1980. Common statistical methods do not show this trend as being significant, but the authors used a statistical approach that reveals a significant divergence between the patterns of concurrent heatwaves and droughts before and after the period from 1998–1999. The authors suggest that the results may help anticipate and mitigate the effects of future climate change, and that the statistical approach may help monitor other climate trends. — B.D.

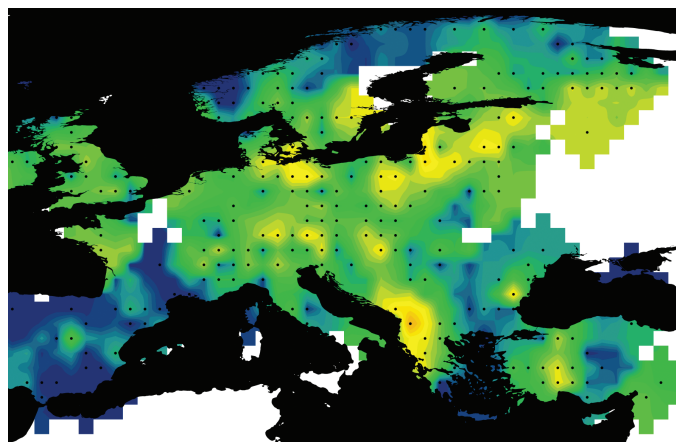
Challenging the paradigm of HIV-1 vaccine design

An effective HIV-1 vaccine has proven elusive, partly due to the difficulty of eliciting an immune response that can neutralize diverse viral strains circulating in the human population. Harnessing the

power of broadly neutralizing antibodies, which can emerge years after HIV infection, could help overcome this challenge, but these antibodies are difficult to elicit via vaccination. Shishi Luo and Alan Perelson (pp. 11654–11659) used a mathematical model to examine how broadly neutralizing antibodies coevolve with HIV. By simulating the coevolution of multiple viral strains and antibody populations, the authors demonstrate that broadly neutralizing antibodies emerge late in infection due to competition from the autologous antibody response. In the model, broadly neutralizing antibodies emerged earlier and faced less competition in infections elicited by multiple distinct strains of HIV, compared with single strains. The findings suggest that a vaccine containing a mixture of diverse viral strains might reduce this competition, reduce the number of antibody mutations, and elicit broadly neutralizing antibodies early in infection. Traditional vaccine design is based on the premise that infection is protective and that a vaccine should mimic a natural infection. According to the authors, these results suggest that vaccines that present the host with high levels of multiple diverse strains might have improved efficacy. — A.G.

Glaciation and Europe's inland aquatic species

The Caspian Sea and Lake Ohrid on the Balkan Peninsula are currently Europe's only inland aquatic biodiversity hotspots. However, the fossil record reveals high species richness in the ancient past that was associated with a series of long-lived lakes. Thomas Neubauer et al. (pp. 11478–11483) examined whether species



Pattern of reduced overall biodiversity in modern European lake faunas.

richness in inland water systems is linked to tectonic processes that reconfigure the landscape and drive climate change on geologic time and spatial scales. The authors constructed an extensive history of continental aquatic gastropod species from the Miocene to pres-

ent day and demonstrate that the geodynamic history of the European continent has kept pace with the emergence and evolution of inland aquatic biodiversity. In hotspots that flourished in longstanding lake systems, warm climates experienced periods of strong faunal evolution. In contrast, the deepening cold and glaciations of the Quaternary icehouse sharply curtailed inland water biodiversity, signaling the demise of most preexisting hotspots across the continent. Together, the findings suggest that the current pattern of species richness in Europe's inland waterways is a relatively young configuration that began when the most recent glaciation ended. — T.J.

Mapping early American caffeine trade

In the years since archaeologists discovered cacao residues in ceramics from Chaco Canyon, New Mexico, researchers have questioned the time depth and geographic extent of cacao exchange between populations in the pre-Hispanic US Southwest/Mexican Northwest and Mesoamerica. Patricia Crown et al. (pp. 11436–11442) used a combination of liquid chromatography and mass spectrometry to analyze organic residues present in 177 ceramic samples recovered from 18 sites in Arizona, Chihuahua, Colorado, and New Mexico. The findings reveal that villagers residing in a swath of land stretching from southern Colorado to northern Chihuahua consumed caffeinated drinks beginning as early as A.D. 750 and extending to at least A.D. 1400. The analysis identified traces of caffeine, theobromine, and theophylline, which are components of stimulant drinks that were most likely concocted



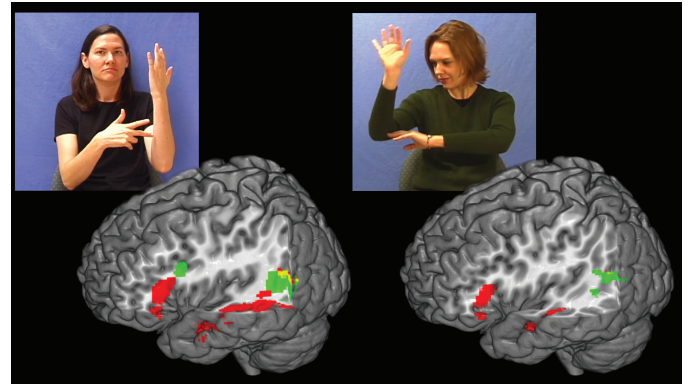
Fourmile Polychrome flowerpot-shaped vessel from Grasshopper Pueblo.

from either cacao or holly leaves and twigs. The stimulant drinks were likely consumed during ceremonial occasions rather than on an everyday basis, similar to practices by other North and South

American populations during that time. According to the authors, the findings may shed light on relations and trade between geographically distant North American populations. — A.G

Neural processing of gestures and sign language

Though sign language and gestures both convey symbolic meaning, they are thought to be fundamentally distinct. Aaron Newman et al. (pp. 11684–11689) recruited 19 congenitally deaf American Sign Language (ASL) users and 19 hearing, nonsigning, native



Brain activation for ASL vs. control (Left) and gesture vs. control (Right). Signers' (red) and nonsigners' (green) brain activity.

English speakers in a test aimed at comparing the neural systems involved in processing sign language and gestures. As the participants viewed videotaped sequences of nonlinguistic gestures, ASL verbs of movement, and gestured descriptions of the movements, the authors monitored their brain activity through functional MRI. In the deaf participants, ASL verbs of movement triggered greater activity, compared with gestures, in left hemisphere brain regions previously tied to language processing in hearing people. In contrast, in hearing participants, both ASL verbs and gestures activated brain regions in both hemispheres that are associated with processing human movement rather than language. The findings suggest that signers may process ASL verbs of movement not as imagery but as units with underlying linguistic structures. Knowledge of sign language also appeared to sensitize language-associated brain regions to gestures in signers. According to the authors, sign language, including the gesture-like ASL verbs of movement, may be processed similarly to spoken languages in specialized regions of the brain's left hemisphere. — P.N.