In this issue . . .

Policy impacts on legal and illegal immigration

Restrictive immigration policies have been thought to redirect potential migrants toward illegal channels, but the hypothesis is difficult to test empirically. Miranda Simon et al. (pp. E7914–E7923) developed an agent-based computational model that simulated potential migrants' decisions about whether and how to migrate and their probability of success under the destination country's policy. The model parameters were calibrated based on an original survey conducted in Jamaica, a country with a high propensity for voluntary migration. Under a baseline policy in which anyone eligible for a visa could migrate, only 44% of aspiring migrants were able to move abroad through legal channels. Restricting student or high-skilled worker visas had a negligible effect on immigration. Restricting low-skilled worker or family reunification visas reduced immigration by 21% and 32% from baseline migration levels, respectively, but also increased unauthorized immigration by 14% and 24%, respectively. Furthermore, the restrictions increased unauthorized immigration even if unauthorized immigrants were apprehended at a rate of 80–90%. The results suggest that even minimal visa requirements significantly reduce immigration. Further restrictions can reduce total immigration but at the cost of increasing unauthorized immigration, which increased enforcement may not be able to offset, according to the authors. — B.D.

The Statue of Liberty. Image courtesy of Pixabay/Free-Photos.

Deep learning solves partial differential equations

Partial differential equations (PDEs) are a common tool for modeling systems in nature. However, high-dimensional PDEs are difficult to solve because the computational cost increases exponentially with the number of dimensions. Jiequn Han et al. (pp. 8505–8510) describe an algorithm that uses deep neural networks to solve PDEs with hundreds, and potentially thousands, of dimensions. Focusing on nonlinear parabolic PDEs, a large PDE class with numerous applications, the authors applied neural networks to approximate the unknown solution gradient—the mathematical path the algorithm follows to home in on the desired solution. The authors demonstrate the approach by solving the 100-dimension case for the nonlinear Black–Scholes, Hamilton–Jacobi–Bellman, and Allen–Cahn equations—three well-known problems from finance, game theory, and physics—along with numerical results suggesting that the algorithm is both accurate and computationally cost-effective. According to the authors, the approach might be directly applicable to systems with multiple variables and offer an alternative to simplified models. — T.J.

Climate change and desert bird collapse

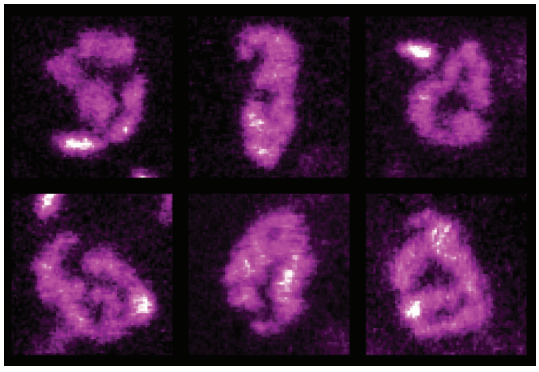
Over time, deserts have become warmer and drier more rapidly than other ecological regions in the contiguous United States, an effect linked to climate

Adult sage thrasher (*Oreoscoptes montanus*). Image courtesy of Chelsea Hofmeier (photographer).

change. In desert ecosystems, which are prone to climatic extremes, the effects of climate change could lead to the decline of desert birds, which tend to live at their physiological limits. Kelly Iknayan and Steven Beissinger (pp. 8597–8602) resurveyed historic research sites throughout the Mojave Desert in the southwestern United States to evaluate the effect of climate and habitat change on bird diversity in the region. The authors assessed 61 sites, the majority of which were originally surveyed in the early to mid-1900s. The surveys revealed evidence of community collapse in Mojave birds. On average, sites lost 43% of previously documented bird species; the common raven was the only bird to expand across survey sites. Climate change, particularly a decrease in precipitation, was associated with the decline in Mojave birds over the past century. Additionally, the presence of surface water was associated with species richness, such that sites with surface water lost fewer species than sites without surface water. According to the authors, the study carries implications for preventing future ecosystem disintegration in the Mojave Desert. — C.S.

Superresolution nanoscopy imaging in living mice

Morphological alterations in synapses have been linked to neurological and psychiatric disorders. Stimulated emission depletion (STED) is a minimally invasive, superresolution fluorescence microscopy method used to study the structure and molecular composition of synapses. Although superresolution imaging has been used in model cell and tissue systems, applying the approach in living animals is challenging due to factors such as optical aberrations and animal motion. Jennifer-Magdalena Masch et al. (pp. E8047–E8056) used a combination of STED nanoscopy and endogenous protein labeling to produce imaging in the far-red to near-infrared wavelength range and with high contrast and low background fluorescence. The approach enabled the in vivo analysis of postsynaptic density 95 (PSD95), a key scaffolding



Nanoscale distributions of the synaptic protein PSD95 in vivo revealed by superresolution STED imaging.

protein, at the postsynaptic membrane of excitatory synapses in the molecular layer of the visual cortex in living mice. The imaging revealed that PSD95 nanomorphologies exhibited a range of shapes and sizes such that many PSD95 assemblies were relatively compact, whereas larger PSD95 assemblies were complex, with irregular borders and internal perforations. According to the authors, the imaging approach might illuminate processes of synaptic transmission in living animals and aid brain pathophysiology. — C.S.