

## GEOPHYSICS

## DON'T PANIC

The 2011 Tohoku-oki earthquake off the coast of Japan was the fifth earthquake since 2004 of magnitude 8.5 or greater (the others include the 2010 Maule earthquake off the coast of Chile and three off the island of Sumatra in Indonesia). This global recurrence rate is certainly higher than historical records indicate—the last major earthquake before these occurred in 1965 off the coast of Alaska, USA. In the past decade, several smaller-magnitude earthquakes with large numbers of fatalities in Haiti, China, Pakistan, and elsewhere have added fuel to the speculation that Earth is experiencing an era of increased seismicity, and therefore, global risk from future large earthquakes has increased. But could this simply be the result of a random variability of earthquakes across many unrelated faults and different types of plate boundaries? Michael ran three statistical tests using the record of magnitude 7.0 earthquakes since 1900 to resolve this dilemma. The tests rule out any statistically significant clustering and suggest that global triggering of large earthquakes by other earthquakes, except for aftershocks, is not occurring. Recent seismicity can be described by random and high variability of low-rate events within a Poisson process rather than clusters of related events. Global seismic hazard estimates should therefore not be adjusted to account only for the recent past; seismic risk should remain calculated based on the entire earthquake record, which, in some cases, stretches back thousands of years. — NW

*Geophys. Res. Lett.* **38**, L21301 (2011).

## CLIMATE SCIENCE

## Taking Greenland's Temperature

The climate warming that has occurred over the past century in Greenland has been much more pronounced than the concurrent hemispheric or global average temperature increases as a whole. Such a large and rapid local rise in temperature has raised considerable concern about effects on the Greenland ice sheet and sea level more broadly, and questions about how much of the temperature rise is natural and how much has been caused by humans. Kobashi *et al.* construct a proxy record for Greenland surface air temperature over the past 4000 years, using argon and nitrogen isotopic ratios from air bubbles occluded in the ice, in order to establish useful estimates of the natural variability of temperature there. They find that the current decadal mean temperature has not exceeded the highest values of the past 4 millennia, which occurred during the Holocene Thermal Maximum, but that the temperature can be expected to rise above those values before the year 2100 if the projections of climate models are correct. — HJS

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## NEUROSCIENCE

## Perfecting the Not Quite Perfect

Even the best musicians make slight errors when playing a rhythm. We find this frailty to be appealing, as evidenced by the fact that computer-generated perfect rhythms are often perceived as sterile or artificial. Having known this phenomenon for a long time, software engineers have added slight rhythmic fluctuations

to make computer-generated music sound more human. These fluctuations are usually produced by a random number generator. Hennig *et al.* have now analyzed the statistical properties of music produced by professional musicians. They found that there are long-range fluctuations



when humans produce all sorts of rhythms. A small rhythmic fluctuation at some point in time not only influenced fluctuations shortly thereafter, but even after tens of seconds. When given the choice, listeners clearly preferred music produced according to these criteria over the random number-generated fluctuations. The

authors conclude that these results may not only have practical implications such as improved techniques for audio editing and humanizing music, but they may also provide new insights into the neurophysiology of time perception and timing of actions. — PRS

*PLoS One* **6**, e26457 (2011).

## COMPUTATIONAL BIOLOGY

## Finding the Perfect Recipe

Computer games? What a waste of time. And online multiplayer ones? Even more so. But hold on ... you clearly haven't heard about "Foldit." This free online game allows players (singly or in teams) to use simple tools (for example something the gamers know as *shake*, but which is in fact an automated combinatorial side chain rotamer packing tool) to fold polypeptide chains into chemically realistic three-dimensional protein structures. It is more than a useful education tool, though, as has been previously shown through the solution of the structure of a retroviral protease, and as Khatib *et al.* now further demonstrate. Within the game, players were allowed to codify the strategies and tricks they used to create accurate models of proteins in the form of "macros" or "recipes." Furthermore, they could also edit and share recipes. Analyses of recipe use showed that recipes augmented—but did not substitute for—gamer strategizing, and that certain recipes spread widely through the gamer population, undergoing further modification ("evolution") as they were adopted by more and more gamers. One of the most highly

*Continued on page 1184*

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EDITORS' CHOICE

Continued from page 1183

popular gamer recipes, "Blue Fuse," not only turned out to be strikingly similar to an energy optimization algorithm developed independently by researchers but was able to outperform the researcher-developed algorithm within the context of the game, even given that the in-game scripting language was severely limited as compared to that used by the researchers. All of which hints at the power of gaming as a problem-solving tool. — GR

*Proc. Natl. Acad. Sci. U.S.A.* **108**, 10.1073/pnas.1115898108 (2011)

## EDUCATION

### Diagnosing Dyslexia

Dyslexia has often been diagnosed as an unexpectedly poor, or "discrepant" reading level as compared to the tested IQ of the student. This approach generates a bias that tends to attribute poor reading in students with lower IQs to factors other than dyslexia. Using functional MRI (fMRI), Tanaka *et al.* analyzed phonological processing in 8- to 17-year-old children with poor reading ability, with either normal or low IQ. The imaging for phonological processing in children with IQ discrepant with reading skills reflected the atypical brain function. Children with low IQ and poor reading skills—the nondiscrepant group—also showed brain function patterns similar to those characterizing dyslexia. Thus, the underlying brain function that leads to dyslexia can affect persons with low IQ just as it can those with higher IQ. The results suggest that diagnostic criteria for dyslexia should be revised and that interventions to improve reading skills may benefit a new group, children for whom every cognitive improvement could help. — PJH

*Psychol. Sci.* **22**, 1442 (2011).

## CELL BIOLOGY

### Actin Up

Microtubule-based transport of intracellular vesicles is important in a variety of cellular processes. The role of actin-based vesicular transport, however, is less well established. Schuh looked at the mechanisms of vesicular transport within mouse oocytes and describes how actin can promote long-distance multidimensional transport independent of microtubules in this large cell system. Vesicles were observed by live cell imaging to recruit actin nucleation factors, which, in turn, allowed vesicles to generate an extended actin network connected to the plasma membrane. Vesicles could then move through the network using the molecular motor myosin Vb. As vesicles were "consumed" by fusion with the plasma membrane at the cell periphery,

further vesicles were drawn outward along the actin network, leading to a net outward flux of vesicles. The extent to which similar mechanisms are used in other cell systems remains unclear, but the flexibility provided by this sort of self-generated network could potentially complement microtubule-based transport. — SMH

*Nat. Cell Biol.* **13**, 10.1038/ncb2353 (2011).



## MATERIALS SCIENCE

### Thinning the Switch

Even though the name might not mean much to you, a magnetic tunnel junction (MTJ) is probably closer to you than you think, given that it's a standard component of hard disk drive read heads. MTJs consist of an oxide material sandwiched between two ferromagnetic (FM) layers, and their function depends on reliably manipulating the magnetization of these FM layers, usually by applying an external magnetic field; the induced switching between low- and high-resistance states corresponds to 1 or 0 bits. Using electrical currents for manipulation would be preferable, but the high current density required cancels the benefits. Now, Wang *et al.* have used electrical voltage to reversibly alter the magnetic properties of the junction, enabling much smaller currents to control the switching. The key modification is the use of very thin layers of  $\text{Co}_{40}\text{Fe}_{40}\text{B}_{20}$  as the FM (with the standard MgO as the oxide), which makes it possible to control the magnetic anisotropy, and thus the coercivity, with electric fields. The results are expected to pave the way toward ultralow-energy switching in MTJs, a major goal in the field. — JS

*Nat. Mater.* 10.1038/nmat3171 (2011).