**SUSTAINABILITY**

**Weighing Water**

In comparing competing sources of energy, many recent analyses have focused on relative conversion efficiencies and associated greenhouse gas emissions. However, other potentially limiting factors also contribute to the value of a given approach. Based on the prediction that fresh water will become one of the most limited resources in the future, Mulder et al. estimated the energy return on fresh water input (for production and processing) across a range of energy technologies. One of the more striking outcomes of the analysis is that the most efficient petroleum-based energy source (diesel fuel) yields over two orders of magnitude more energy per volume of fresh water used than does biomass. Such a vast difference in return on water invested suggests that policies striving to replace fossil fuels with biomass resources—their many other appealing characteristics notwithstanding—may exacerbate the increased burden on a global fresh water supply already stressed from the higher agricultural demands of a more populated world (though feedstock shifts may relieve some of this pressure). Solar and wind technologies show potential advantages in this context. — NW

**APPLIED PHYSICS**

**Spinning into View**

The efficiency of electrical devices is compromised considerably by Joule heating. In an attempt to thwart this effect, spintronics seeks to manipulate the electron’s spin rather than its charge. This manipulation is perhaps best exemplified by the spin-transfer torque effect, in which passing a spin current from one ferromagnetic layer into another through an intervening nonmagnetic film (the so-called magnetic tunnel junction) causes the relative polarization of the two ferromagnetic layers to switch from parallel to antiparallel, or vice versa. This switching process has been challenging to characterize on a single-shot basis as the signal (change in conductance) is quite weak. Now, in a single-event experiment, Cui et al. resolve not just the switch itself but the smaller oscillations of the conductance leading to a switch (reflecting the increasingly intense precession of the spins). As the measurements are performed at room temperature and thermal effects are important in assisting the switching process, the observed dynamics may be more generally applicable to nonlinear systems in warm environments. — JS


**EVOLUTION**

**Splitting on the Edges**

Explanations of the species richness on coral reefs have often inferred diversification processes from large-scale patterns. In contrast, quantitative phylogenetic studies, based on thorough taxonomic and spatial sampling, can document the speciation events responsible for regional diversity patterns. Applying this approach to the abundant and colorful *Calcinus* hermit crabs, Malay and Paulay have constructed mitochondrial and nuclear gene phylogenies for 56 species (9 undescribed) and mapped their distributions. Differences in color patterns follow species boundaries and evolve rapidly, indicating a likely role in species recognition. Most speciation in the genus has occurred peripherally, in remote areas. All of the younger species pairs are narrowly allopatric, and molecular clock analyses imply that sister species require at least 2 million years (and usually much longer) to develop secondary sympatry. There are a few major ecological shifts between sister species, but environmental preferences are conserved across most speciation events (niche conservatism). These hermit crabs’ strong preference for oceanic areas and substantial ability for dispersal have led to diversity peaks in the Mariana Islands and in southeast Polynesia rather than in the Indo-Malayan triangle (the locus of maximum marine biodiversity). The example of *Calcinus* serves as a reminder that different groups, having their individual histories and ecologies, should not be expected to show identical biogeographic patterns. — SJS

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**PLANT BIOLOGY**

**Partners in Reproduction**

Production of the next generation in plants follows a more tortuous path than the corresponding process in animals. In *Arabidopsis*, the next generation is made up of both embryo and endosperm, which are produced in two separate fertilization events by separate sperm (albeit from the same meiotic generation). Pillot et al. have analyzed how the transition from an initial reliance on maternal RNAs to subsequent zygotic transcription occurs for both next-generation tissues. Although the zygote can coast by separate sperm (albeit from the same meiotic generation). Pillot et al. have analyzed how the transition from an initial reliance on maternal RNAs to subsequent zygotic transcription occurs for both next-generation tissues. Although the zygote can coast on maternally supplied transcripts for a while, the endosperm cannot and becomes self-reliant from the moment of fertilization. These differences can be attributed to the epigenetic status of the chromatin. Analyses of DNA methylation and histone modifications show that the differences in the female gametes—the egg and central cells—are established late in gametogenesis. — PJH

Weighing Water
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