



ASTRONOMY

Unproductive Mergers

How do you make a massive galaxy that does not form new stars anymore? According to van der Wel *et al.* the answer is by merging galaxies of similar size. They selected 17,480 galaxies with low star-formation rates from the millions of galaxies mapped in the Sloan Digital Sky Survey and analyzed their shape distribution. Whereas the projected axial ratios of the less massive galaxies were consistent with a mix of shapes, from bulge- to disk-dominated galaxies, the most massive galaxies in their sample all turned out to be spheroidal. Because the only known mechanism capable of forming round galaxies is the merging of galaxies with mass ratios up to about 3, the authors concluded that such merging is the dominant mechanism for the production of massive, non-star-forming galaxies. — MJC

Astrophys. J. **706**, L120 (2009).

CHEMISTRY

Fluorine Diverted

The advent of frequency tunable laser sources briefly enticed chemists with the prospect of performing a sort of molecular surgery, whereby energy input at the precise resonance frequency of a bond could be used to break that bond, while leaving the rest of the molecule undisturbed. It quickly became clear, though, that most molecules wouldn't cooperate; the energy tended to spread across the whole molecular framework, despite being introduced at a specific site. Still, selective vibrational excitation would at worst have no impact. Surely it wouldn't hinder subsequent reactivity, would it? Very recently, precisely such a baffling outcome was observed in the reaction of fluorine atoms with trideuterated methane (CHD_3): Exciting the C-H bond actually reduced the likelihood of fluorine's breaking it, instead leading to an increased proportion of D-F product (see Zhang *et al.*, Reports, 17 July 2009, p. 303). Czakó and Bowman have now analyzed this reaction system theoretically. Preliminary examination of the potential energy surface suggested that vibration should lower the barrier toward breaking the excited bond, in keeping with intuition. Yet in quasiclassical trajectory simulations of low-energy collisions,

inducing C-H bond vibration appeared instead to steer the F atom toward the deuterium centers, thus bolstering the experimental findings. — JSY
J. Am. Chem. Soc. **131**, 10.1021/ja906886z (2009).

ECOLOGY

Intrinsic Rhythms

Many plant species reproduce irregularly, flowering synchronously only every few years. Famous examples are the giant dipterocarp trees of Southeast Asian rainforests and the beech trees of temperate forests. Despite much research on the ecological and evolutionary aspects of this phenomenon, little is known about the proximate mechanisms by which the individual plants in a population achieve reliable synchrony in their flowering. Crone *et al.* addressed this question in an experimental study with a North American plant species, *Astragalus scaphoides*, which flowers in alternate years. By manipulating the

resource budgets of individual plants (by reducing fruit set through flower removal), they showed that the levels of mobile carbohydrate control the frequency of flowering: Plants prevented from setting fruit maintained higher levels of resources and hence flowered again the next year; this resulted in pollen-limited reproduction, reducing seed set and leading to the reestablishment of synchrony the following year. — AMS

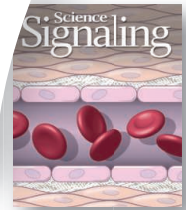
Ecol. Lett. **12**, 1119 (2009).



CELL BIOLOGY

The Scenic Route

The plasma membrane contains a large number of proteins and lipids, many of which are organized spatially into regions that mediate processes such as motility, adhesion, and signal transduction. Cilia are hairlike extensions that protrude from the plasma membrane and are found on the surface of most cells. They mediate mechanical and sensory interactions between the cell and its environment, as well as act as signaling centers for the Hedgehog and Wingless developmental pathways. In order to support these functions, proteins must be targeted to the ciliary membrane. For the transmembrane receptor pro-



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tein Smoothened, which is part of the Hedgehog pathway and localizes to the cilium upon activation, current models have focused on its delivery by membrane vesicles moving from the Golgi apparatus to the cell surface. Milenkovic *et al.* have identified an alternative route: lateral transport within the plasma membrane. They found that Smoothened could move to the ciliary membrane from the bulk plasma membrane when the Hedgehog pathway was activated. Increasing the levels of the second-messenger molecule cAMP, which is involved in lateral transport in algae, could also induce lateral transport of Smoothened, suggesting a conserved mechanism of regulation. Perhaps to improve efficiency and accuracy, Smoothened is transported to the ciliary membrane along two different routes. — HP

J. Cell Biol. **187**, 365 (2009).

MICROBIOLOGY

Journeys of a Pathogen

Leprosy is caused by *Mycobacterium leprae*, which infects the neurons and mucosa of humans. Strikingly, its genome has decayed extensively, which probably accounts for its slow rate of growth; global variation between strains is limited to four SNP clusters, each having a distinctive geographical prevalence that reflects past human migrations. Monot *et al.* have sequenced *M. leprae* strains from Brazil, Thailand, and the United States, and made comparisons with archaeological samples. Genotyping the pathogen can be used to pinpoint a person's origins quite precisely. For example, samples from an Egyptian burial revealed that the corpse had been infected with a European strain of leprosy and was more probably a Roman legionary than an African. Their updated map of leprosy strains supports the out-of-Africa theory for modern humans and indicates that leprosy crossed to Asia twice: once via a southern route into India and through Indonesia to the Philippines, and also via a northern route along the Silk Road in countercurrent fashion to the Black Death. Subsequently, leprosy arrived in South America via European immigrants rather than by pre-Columbian colonization via the Bering Strait. — CA

Nat. Genet. **41**, 10.1038/ng.477 (2009).

GEOLOGY

Fresh from the Ocean

Freshwater springs have been found along the Atlantic coastal shelves of North America and Europe even at depths of several hundred meters below sea level, and several hundred

kilometers offshore. In some areas (for example, the southern United States), springs are emanating from coherent aquifers that are recharged high enough above sea level to provide the gravitational potential to push the fresh water out into the denser saltwater. Elsewhere though, the fresh water seems to have been trapped during glacial cycles when sea level was considerably lower. Cohen *et al.* provide an overview of these settings and explore their formation and resource potential through a series of numerical models. Their models suggest that extensive recharging occurred beneath Pleistocene ice sheets, which extended out onto the shelves or along submarine canyons. They estimate that some submarine aquifers off New England may contain as much as 10,000 km³ of fresh water. Globally, there may be as much as 300,000 km³ of fresh water, though it is nonrenewable. — BH

Groundwater 10.1111/

j.1745-6584.2009.00627.x (2009).

PSYCHOLOGY

Short-Circuiting the Path to Violence

Self-esteem and narcissism are sometimes invoked as explanations for outbreaks of classroom aggression, whether physical or verbal. That is, too little of one or too much of the other putatively contribute to the tendency to lash out when threatened, and hence there have been efforts to boost students' self-esteem as a means of reducing the frequency of confrontations. Thomaes *et al.* argue instead that the critical need is to buffer self-esteem—whether a student has a lot or a little of it—and they conducted a randomized field trial in the Netherlands to assess the efficacy of a brief



affirmation exercise designed to buttress self-esteem. Before the intervention, aggressive behavior was prevalent among the individuals who scored high on the narcissism scale and low on self-esteem. Afterward, acts of aggression decreased even though the individual levels of self-esteem (both high and low) were unchanged, supporting the conclusion that firming up one's sense of worth reduces the vulnerability to threat and thus diminishes the motivation to launch defensive counterattacks. — GJC

Psychol. Sci. **20**, 10.1111/

j.1467-9280.2009.02478.x (2009).