EDITORS' CHOICE

EDITED BY KRISTEN MUELLER AND JESSE SMITH

PALEONTOLOGY

Whales in the Desert

Mass strandings of whales have long puzzled observers, who wonder about the causes of such simultaneous and often large-scale mortality events. These events are not new, however, and recent road development in the Atacama region of Chile serendipitously revealed a large and unique collection of marine vertebrate fossils that may shed some light on the phenomenon. Pyenson *et al*. report that the site, Cerro Ballena, dates to the Late Miocene period and consists of over 40 skeletons of marine vertebrates, including rorqual and sperm whales, seals, predatory fishes, and fascinating, now completely extinct, species such as walrus-whales and aquatic sloths. Four distinct time horizons exist within the site, indicating that the mass strandings occurred repeatedly, and the relatively complete condition of the skeletons suggests that the death site was protected from scavengers and other forces that would distribute the bones. Based on the diverse array of species involved, and the repeated occurrence of the strandings, harmful algal blooms may have been to blame. The assemblage at Cerro Ballena provides both a vivid picture of a rich but now past marine environment and insight into a phenomenon that is often still a mystery. An associated open-access Web site allows readers to learn more about the site and fossils. — SNV

Proc. R. Soc. London Ser. B **281**, 20133316 (2014).

PSYCHOLOGY

Me Me Me

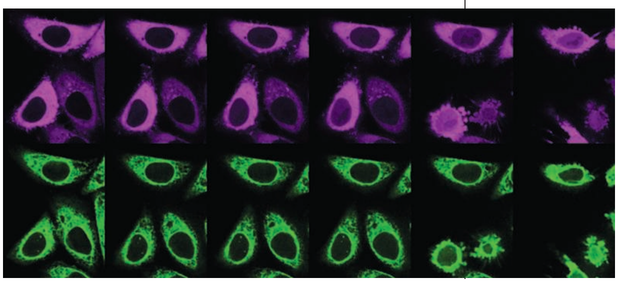
What makes me me, and not you? Is it my corpus of autobiographical memories? Is it my concordance of wants and desires, which may themselves have been birthed and shaped by my personality traits? Or is it my sense of right and wrong? Strohminger and Nichols opt for the last and demonstrate in a series of studies that morality constitutes the largest part of self. Capacities and traits were grouped into psychological categories representing lower-level functions, such as perception and sensation; everyday automatic cognitive functions, such as identifying objects and riding a bike; or distinctive individual preferences, such as liking broccoli and valuing honesty. Then, online Americans were asked which were associated most closely with personal identities or, alternatively, the extent to which a person would change if that particular capacity or trait were lost. Throughout, attributes closer to morality were deemed to be more essential to one's identity. In a futuristic scenario set in 2049, when asked what part of Jim the accountant's brain would need to be transplanted into a recipient body in order to resurrect Jim, the part supporting moral judgment was chosen most. — GJC

Cognition **131**, 159 (2014).

CELL BIOLOGY

A Complicated Death

Much is known about signaling mechanisms that cause cells to undergo cell death or apoptosis, but it can be hard to know how the many steps play out to determine whether a particular cell lives or dies. Kallenberger *et al*. therefore undertook a combination of mathematical modeling and experiments on single cells to elucidate how cultured human cells responded to activation of the Fas death receptor. The receptor causes activation of the protease caspase-8, which undergoes multiple cleavage events that control both its activity and substrate preference. Caspase activity in single cells was measured by monitoring fluorescently tagged substrates. This revealed the kinetics of caspase activation and the variability in cell responses. Unexpectedly, a slower rate of cell death in cells exposed to higher concentrations of CD95 ligand was observed. Such a complicated caspase cleavage scheme may enable important characteristics such as switch-like behavior that



CREDITS (TOP TO BOTTOM): ADAM METALLO/SMITHSONIAN INSTITUTION; S. KALLENBERGER *ET AL.*, *SCIENCE SIGNALING* **7**, 316 (11 MARCH 2014) does not cause cell death in response to low amounts of signal (but shows autoamplification when strongly activated) and a timer mechanism to shut the system down. — LBR

Sci. Signal. **7**, ra23 (2014).

CHEMISTRY

Process of Elimination

Transition metals such as rhodium and palladium (Pd) often catalyze reactions through a pair of processes termed oxidative addition and reductive elimination. Effectively, the metal inserts itself between two bonded atoms, and then after some rearrangements or substitutions in the coordination sphere, a different bond forms via the reverse process. Pérez-Temprano *et al.* explored the factors underlying which bonds form most readily by reductive elimination from Pd(IV). They prepared a complex with fluoride, tosyl-substituted nitrogen (NHTs), and aryl as well as alkyl carbon ligands, and then measured a ratio of alkyl C-F, C-C, and alkyl C-N bonded products of roughly 5:3:1. By adding an $(NHTs)^{-}$ salt to the reaction mixture, the authors could shift the ratio almost completely in favor of the C-N elimination pathway. Kinetic studies implicated a mechanism in which dissociation of $(NHTs)^{-}$ from Pd leads to a transient five-coordinate intermediate common to all three product channels, with the C-N pathway proceeding stepwise via subsequent attack by the nitrogen anion at carbon. The results could help to optimize synthetic protocols for C-N bond formation. — JSY

J. Am. Chem. Soc. **136**, 10.1021/ja411433f (2014).

MICROFLUIDICS

Paper Power

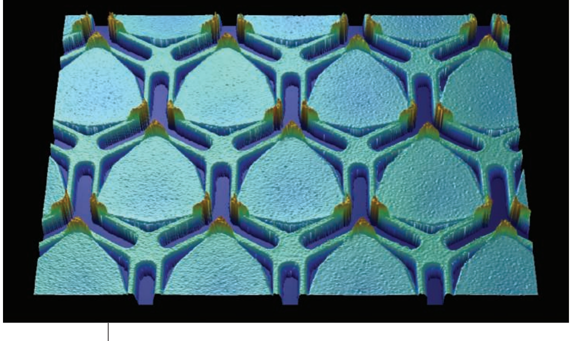
Paper-based microfluidic devices offer much promise for instrument-free medical diagnostics that can perform complex analytical functions while being easy to manipulate and use. Such devices require miniaturized power sources that are compatible with the paper technology and can be disposed of with minimum environmental impact. Esquivel *et al.* explore the use of fuel cells for powering such devices. They have developed a microfluidic fuel cell that exploits the capillary flow in the paper test strip without requiring external pumps. Both the KOH electrolyte and the methanol fuel are stored within the paper strip; when water is added, the fuel cell starts to generate power. The proof-of-concept prototypes reported by the authors meet the power needs of commercially available rapid tests that are powered by button-cell batteries. Integrated with a lateral flow test, the fuel cells can use the sample under analysis (e.g., blood) to generate the power needed for the analysis itself (e.g., glucose levels in the blood). The test strips are similar in construction to the lateral flow strips used in medical diagnostics and should thus be comparatively easy to incorporate into the manufacturing process. — JFU

Energy Environ. Sci. 10.1039/C3EE44044C (2014).

MATERIALS SCIENCE

Thermally Stable Reflections

A simple thermostat exploits the difference in the thermal expansion of two metal films to sense temperature changes and trigger the heating or cooling system on or off as needed. In some cases, though, the change in dimension with temperature is a problem; for example, a satellite built on Earth has to be engineered to allow for the shrinking of the parts that will occur when it reaches the low temperatures found in outer space. A few materials exist that show either limited or negative thermal expansion, including complex metal oxides, silica glasses, and an iron-



CREDIT: NAMIKO YAMAMOTO

nickel alloy, but these materials may be brittle or operate only over a narrow temperature range. One route to creating a material with a tailorable coefficient of thermal expansion (CTE) is to create an engineered structure. Yamamoto *et al.* created a periodic lattice composed of hexagonal plates of aluminum combined with a frame of titanium, which has a lower CTE, to make a thin-film material. When heated, the expansion of the aluminum is accommodated by stretching and bending of the titanium, in such a way that the connection points stay stationary. The samples were tested from room temperature to 185°C and showed a very low and slightly negative CTE. The authors envision using this architecture for making an array of mirrors, and demonstrate this capability by showing that the reflected image quality remained constant over the test temperature range. — MSL

Adv. Mater. 10.1002/adma.201304997 (2014).

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