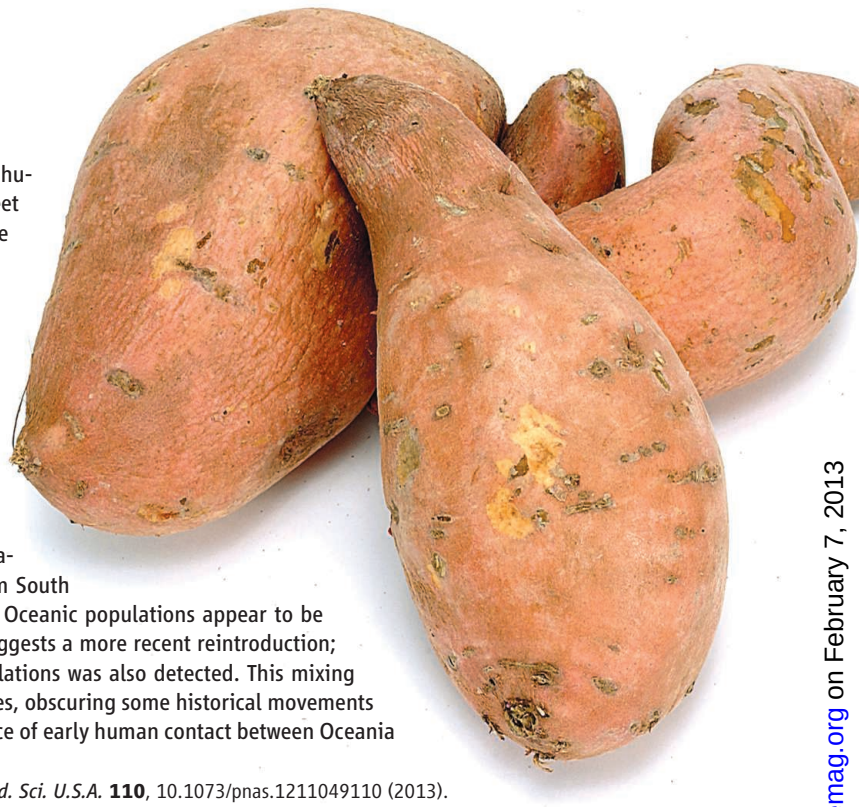
EDITED BY KRISTEN MUELLER AND MARIA CRUZ



EVOLUTION

Sweet Potatoes Get Around

The origins of the sweet potato and its movement with humans have long been debated. This is because the sweet potato originated in South and Central America, but some evidence suggests that it was found in Polynesia during pre-Columbian times, indicative of contact between these human populations at this early time. Roullier *et al*. have used genetic markers in modern and herbarium specimens to infer the movements of this crop across the world. Two distinct gene pools were discovered in the northern and southern regions of the neotropics; in addition, recent interbreeding and movement between these two distinct gene pools could be detected. On the basis of herbarium specimens collected across the globe, there was evidence that the majority of lineages in Polynesia were initially derived from South America during pre-Columbian times. However, modern Oceanic populations appear to be primarily from the northern region population, which suggests a more recent reintroduction; although evidence of mixing with South American populations was also detected. This mixing has led to the generation of local varieties and phenotypes, obscuring some historical movements of plant germplasm, and provides more definitive evidence of early human contact between Oceania and South America. — LMZ

Proc. Natl. Acad. Sci. U.S.A. **110**, 10.1073/pnas.1211049110 (2013).

BIOMEDICINE

Doxorubicin Revisited

Doxorubicin (Dox) is a chemotherapeutic drug with efficacy in many cancers, yet after 40 years of clinical use, there are lingering mysteries about its mechanism of action. The prevailing hypothesis is that Dox forms a complex with topoisomerase II, a DNA-unwinding enzyme, and this leads to DNA strand breaks that induce cell cycle arrest. Although much evidence supports this model, not all data are consistent with it. New insights into Dox's cellular effects could help optimize its antitumor activity, reduce its adverse side effects, and/or help oncologists identify which patients are most likely to respond to the drug.

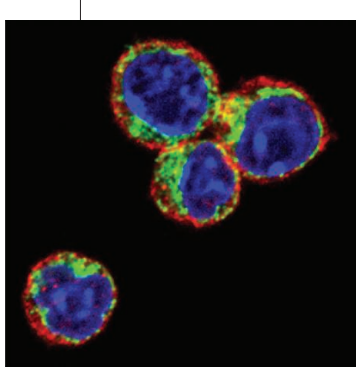
Denard *et al*. propose that the membrane-associated transcription factor CREB3L1 plays a key role in Dox's antitumor activity. In cultured cells, Dox increased synthesis of the lipid ceramide, which in turn caused proteolytic activation of CREB3L1 and its entry into the nucleus, where it increased transcription of cell cycle–inhibitory genes. When CREB3L1 levels were experimentally suppressed, cancer cells became resistant to Dox. These results suggest that CREB3L1 may be a biomarker of Dox-responsive cancer cells or even a druggable target itself. — PAK

eLife **1**, e00090 (2012).

IMMUNOLOGY

T Cells Stay FIT During Flu

Immunological memory is critical for keeping us from getting sick from many pathogens for a second time. For example, infection with chicken pox usually confers lifelong immunity. Tissue-resident memory $CD8^+$ T cells are a key population that is responsible for this protection. By being poised at sites of pathogen entry, such as the lung, they can quickly kill virus-infected cells. But what protects these cells from virus-induced cell death so that they can carry out their duties? Wakim *et al*. revealed that during influenza infection in mice, the antiviral protein IFITM3 affords such protection to lung, $CD8^+$ memory T cells. IFITM3 is expressed specifically by resident $CD8^+$ memory T cells in the lung, and cells deficient in IFITM3 did not survive well in response to secondary infection with influenza as compared to controls. Moreover, mice whose lung-resident $CD8^+$ memory T cells were deficient in IFITM3 were more susceptible to infection with influenza. These results suggest that the selective expression of an antiviral factor in memory T cells allows the host to protect itself against subsequent viral infection. — KLM



Nat. Immunol. **14**, 10.1038/ni.2525 (2013).

PHYSICS

Hastatic Order

Phase transitions are usually associated with the breaking of symmetry; the colder phase is generally more ordered than the hotter one. Normally, it is easy to deduce which symmetry is broken. A rare exception to that rule is the heavy fermion compound URu_2Si_2, which forms a mysterious phase below 17.5 K, known as "hidden order," that is yet to reveal its true nature in spite of intense experimental and theoretical efforts. Inspired by recent experimental findings, Chandra *et al.* propose that the exotic state breaks not only the time reversal symmetry (as is the case in magnetism), but also the doubly applied time reversal symmetry. This hastatic order is achieved through the hybridization of conduction electrons with the f-orbital states of uranium, which leads to the mixing of states of integer and half-integer spin, the latter ones causing the peculiar behavior. The theory makes testable predictions, and whether or not future experiments confirm that this is the correct

Published by AAAS

description of the hidden order in URu_2Si_2, it describes an attractive mechanism that may be at work in other similar compounds. — JS

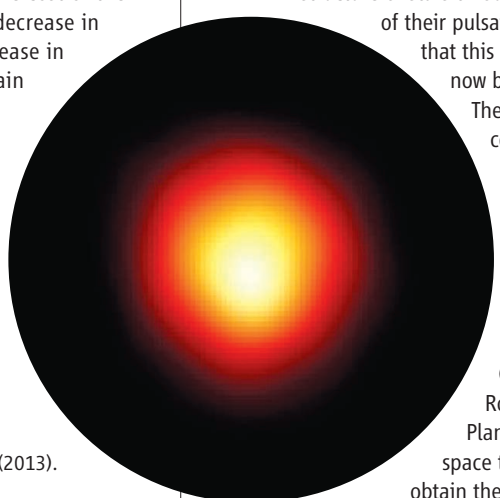
Nature **493**, 621 (2013).

EVOLUTION

Getting a Big Head

Brain size correlates roughly with intelligence. So, assuming that more intelligence gives a selective advantage, what limits the size of our heads? To see if bigger brains are better and what the tradeoffs might be, Kotrschal *et al.* experimentally addressed the effects of selection for brain size in guppies (*Poecilia reticulata*). After only two generations of selection, the authors obtained populations of fish whose brains were larger or smaller than normal and differed from one another by about 10%. The big-brained female fish (but not the males, for some unknown reason) were better than those with smaller brains at a task where the fish associated the number of symbols (two or four) with a food reward. The cost of the increased brain power was a decrease in the size of the gut and a decrease in reproductive function. The brain is very active metabolically, and thus its growth must be balanced against the cost of maintaining other processes in the organism. The offsetting effect on reproductive function is consistent with interspecies comparisons in which more intelligent mammals, such as humans, whales, and dolphins, have decreased fertility. — LBR

Curr. Biol. **23**, 168 (2013).



CREDIT: ANDREA DUPREE/HARVARD-SMITHSONIAN CFA, RONALD GILLILAND/STSCI, NASA AND ESA

EDUCATION

Stats for Scientists

Most science students receive their math instruction through the math department. Not surprisingly, math professors teach the math itself, without describing how it could be applied in a scientific setting. What would happen if instead, science departments began teaching core math skills in the context of science curriculums? Schlotter suggests that in chemistry, this question can be evaluated once a statistics curriculum addressing the specific needs of chemistry majors has been established. The main challenge in developing such a curriculum is to truly keep topics to a core minimum; a difficult task considering that the availability of computers and software has not only increased the amount and frequency of routine statistical tests, but has also put a larger emphasis on students needing to understand how, and when, to apply statistical concepts appropriately. Although a tradeoff exists in removing chemistry topics from the curriculum to make room for statistics instruction, Schlotter argues that without it students will have little more understanding of statistical tests than where to find the buttons on their calculators. A draft version of a statistics curriculum for chemists is presented, and Schlotter welcomes comments from the science community. — MM

J. Chem. Educ. **90**, 51 (2013).

ASTRONOMY

Pulsing with History

Understanding the history of our galaxy depends on having precise measurements of the properties of its stars. This has only been possible for stars that are within around 300 light-years from Earth, but as Miglio *et al.* demonstrate, advances in asteroseismology—the study of the interior structure of stars through the analysis of their pulsations—mean that this limitation can now be overcome. The authors combined color measurements from the Two Micron All Sky Survey with pulsation data from the CoRoT (Convection Rotation and Planetary Transits) space telescope to obtain the radii, masses, distances, and ages of a sample of just over 2000 red giant stars. These are stars that do not burn hydrogen in their cores any more and that, as a result, have expanded and cooled down; the Sun is expected to become a red giant star in about 5 billion years. The analysis shows that the stars in the sample spread across nearly 50,000 light-years over two separate regions in the disc of our galaxy and that their ages range from 0.3 to 12 billion years, spanning the entire history of the Milky Way. The two regions show significantly different mass distributions. The region higher below the galactic plane has a larger fraction of low-mass and hence older stars, supporting the idea that dynamical processes in the disc increase the velocity dispersion of stars over time. — MJC

Mon. Not. R. Astron. Soc. **429**, 423 (2013).