EDITED BY KRISTEN MUELLER AND JAKE YESTON

EVOLUTION

Oh the noise!

Cities and highways are noisy. Such anthropogenic noise causes substantial interference with the acoustic communication of many species. Most urban noise is low in frequency, and birds that live in noisy areas have been shown to alter the frequency of their songs, shifting from low to high frequencies in order to be heard above the din. This may seem like a reasonable solution to the problem; however, Halfwerk *et al.* show that singing higher-frequency songs has fitness costs. They recorded the songs of pairs of great tits (*Parus major*) in a Dutch forest and found that low-frequency song is related to female fertility and that the mates of low-frequency–singing males are less likely to stray. In fact, males with higher-frequency songs were less likely to be the sole father of their mate's offspring. When they experimentally exposed the birds to sound similar in frequency to urban noise, males shifted to singing high-frequency songs. This shift allowed them to be heard, but also placed them at frequencies less preferred by females. These results suggest that species facing noisy conditions are faced with a trade-off: Sing high and be heard or demonstrate your quality by singing low and be drowned out by ambient noise. Such a trade-off demonstrates the divergent selection pressures of anthropogenic environmental changes. — SNV

Proc. Natl. Acad. Sci. U.S.A. **108**, 10.1073/pnas.1109091108 (2011).

CREDIT: HERMAN BERKHOUDT

MOLECULAR BIOLOGY

Keeping the Genome Safe

The germ line of an organism must necessarily be sacrosanct; this, after all, is the genetic information transmitted to all subsequent generations. Germline integrity is preserved by a specialized RNA interference system involving Piwi proteins and tiny noncoding RNAs (piRNAs), which suppress the activity of transposable elements (TEs): parasitic DNA elements that are abundant in many eukaryotic genomes. piRNAs are derived from clusters of derelict and defunct TEs in the genome, which are bundled up into heterochromatin.

Rangan *et al.* show that this normally repressive heterochromatin wrapper is critical for the proper expression of the piRNA clusters. Mutation of the *Drosophila* histone methyl transferase dSETDB1 results in the loss of repressive heterochromatin marks as well as piRNA cluster transcription, and subsequent activation of TEs. TEs, in turn, suppresses germline stem cell differentation. During normal development, gene transcription is broadly activated in the germ line to promote differentiation, and the heterochromatic piRNA clusters are expressed at the same time, to smother any chance activation of TEs. — GR

Curr. Biol. **21**, 1373 (2011).

EDUCATION

Easy A

Most students enter college aiming for a 4.0 GPA. Given that grading in American educational institutions is unregulated, how meaningful is a 4.0? Rojstaczer and Healy examined grade distributions from 200 American colleges and universities over the past 70 years. They report that movement away from the traditional bell-shaped grading curve began in the 1960s and 1970s in order to help students avoid the military draft. A continual rising of grades followed, without the accompaniment of increased student achievement. Graduation rates have remained largely static for decades, the literacy of graduates has declined, and college entrance exam scores of applicants have fallen. America's educational institutions have gradually created an illusion where excellence is widespread and failure is rare. In fact, "A" is now the most common grade. Efforts at grade regulation are controversial, but without grading oversight, either on a school-by-school or national basis, it is unlikely that meaningful grades will return to American education. — MM

Teach. Coll. Rec. **114** (2012).

EVOLUTION

Stick Together to Evolve

How did multicellularity arise? Koschwanez *et al.* propose that advantages in the use of limited amounts of food may have provided a selective advantage that promoted the evolution of single-celled organisms into multicellular forms. In yeast, simple mutations that alter the completion of cell division or prevent final digestion of the cell wall are sufficient to cause yeast to form aggregates or clumps of cells. Indeed, wild yeast grow in such multicellular forms, although common lab strains have been selected to grow as individual cells. Mathematical modeling and experiments show that when concentrations of sucrose are limiting, growing in clumps is

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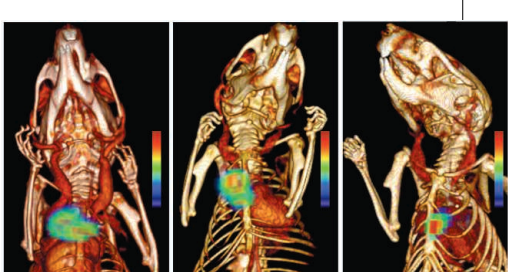
advantageous because the cells secrete the enzyme invertase, which splits sucrose into the glucose and fructose the yeast use to fuel metabolism. Thus, it pays to be near other cells to have access to the sugars that are available in their immediate vicinity. In their experiments, clumps of yeast cells grew in concentrations of sucrose that were too low to support the growth of equivalent numbers of individual cells. Furthermore, clumping also helped cells compete with "cheater" yeast cells, which freeload off other cells and do not make any invertase themselves, thus gaining a small survival advantage. The occurrence of secreted enzymes pre-dates the emergence of multicellularity, so the authors propose that the social advantages such enzymes afford could have provided the impetus for the emergence of multicellular life forms. — LBR

PLoS Biol. **9**, e1001122 (2011).

BIOMEDICINE

Imaging Heart Infection

Acute endocarditis, an infection of the heart valve, is most deadly when the causative agent is the bacterium *Staphylococcus aureus*. *S. aureus* establishes a localized infection in the heart through secretion of staphylocoagulase, a protein that recruits and tethers to the infection site a host protein called prothrombin. This protein complex then triggers the formation of blood clots that help shield the bacterium from the immune system. Blood cultures are used for clinical diagnosis. Conceivably, methods to identify the culprit pathogen directly in the heart could provide information about the precise site and extent of infection, which in turn could optimize treatment. Panizzi *et al.* have designed a noninvasive imaging strategy for detecting *S. aureus* endocarditis that exploits the pathogen's dependence on prothrombin to establish infection. Systemic injection of



CREDIT: PANIZZI *ET AL.*, *NAT. MED.* **17**, 10.1038/NM.2423 (2011)

prothrombin analogs tagged with fluorescent or PET (positron emission tomography) imaging probes enabled the authors to visualize *S. aureus* endocarditis in mice and monitor the response to antibiotic therapy. Whether this strategy can be applied safely and effectively in a clinical setting is not yet known. — PAK

Nat. Med. **17**, 10.1038/nm.2423 (2011).

CHEMISTRY

Curvy Capsules

Over the past several decades, chemists have taken advantage of the precise directionality of hydrogen bonding and metal-ligand coordination to assemble cages and capsules in solution from relatively simple building blocks. These assemblies can trap molecular guests inside and thereby facilitate separations, detection, and a range of chemical reactions exhibiting intriguing selectivity. However, in part to render the cavity geometries predictably equivalent throughout the ensemble, the structures have tended to be fairly high-symmetry affairs. Tiefenbacher *et al.* now demonstrate a more versatile set of building blocks that enable a sort of molecular shrink-wrapping of awkwardly shaped guests. The key is the introduction of loosely Y-shaped propanediurea blocks that can flexibly bridge two capping groups offset from one another's central axis (somewhat akin to the accordion-like connectors holding together tandem buses as they turn a corner). The authors explored guests ranging from C_{14} to C_{23} linear hydrocarbons and confirmed associated capsules in S and banana shapes using nuclear magnetic resonance spectroscopy. — JSY

Angew. Chem. Int. Ed. **50**, 10.1002/anie.201102548 (2011).

CLIMATE SCIENCE

Not So Clear

Water vapor is the greenhouse gas with the greatest effect on the radiative balance of Earth's atmosphere, and it amplifies climate warming through positive feedback. Therefore, knowing precisely how much radiative forcing water vapor provides is of great importance for understanding atmospheric physics and climate change. Ptashnik *et al.* report laboratory measurements of the absorption of radiation by water in the near-infrared, performed at a range of temperatures and pressures. The data show that spectrally broad continuum absorption (as distinct from the better-characterized series of sharper, higher–cross-section resonances) is actually much higher than commonly assumed in atmospheric models. The result of this difference amounts to a globally averaged value of about 0.75 W/m^2 of additional radiative forcing, roughly 0.2% of the total solar input at the top of the atmosphere and about 1% of the global mean clear-sky atmospheric absorption. The authors speculate that this extra absorption could be due to the effect of water dimers. — HJS

J. Geophys. Res. **116**, D16305 (2011).

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