EDUCATION

Respect My Authority

Graduate teaching assistants (TAs) are regular fixtures in science classrooms; however, their status and authority as teachers remain ambiguous. Kendall and Schussler present a thorough comparison of TAs and professors from the perspective of undergraduates in order to enhance TA professional development. Online surveys designed to evaluate skills such as leadership, personalization, involvement, and task orientation were sent to students enrolled in major and nonmajor biology courses that had a laboratory component taught by TAs, with lectures taught by faculty. Weakness in one instructor type appeared to be balanced by the strengths of the other: Although professors were perceived as confident, organized, boring, and out of touch, TAs were perceived as uncertain, hesitant, approachable, and able to personalize teaching. Additionally, although undergraduates perceived professors as having more knowledge of the curriculum, they favored the instructional style of TAs. Professional development programs can capitalize on these findings by increasing opportunities for TAs and professors to teach collaboratively, which should help both parties address perceived weaknesses. — MM

CBE—Life Sci. Educ. **11**, 187 (2012).

CHEMISTRY

Phenol Coming and Going

There are, broadly speaking, two ways to drive electric current. One is to separate the components of a chemical reaction so that the electrons travel separately from the ions; this is the working principle of a battery and yields direct current (dc). The other method is to rotate a wire loop through a magnetic field, which generates alternating current (ac). For the most part, when the process is inverted to drive chemistry via electricity, a dc approach is the most straightforward to implement, because it essentially runs a battery in reverse. However, ac-mediated chemistry can sometimes prove advantageous, as Lee *et al.* demonstrate in an exploratory small-scale electrolytic synthesis of phenol from benzene. The authors set up their cell so that benzene oxidation occurred at both the anode and the cathode, propelled in the former case by preliminary water oxidation and in the latter by oxygen reduction. Coupling vanadium oxide electrode catalysts with an indium-doped tin diphosphate solid electrolyte, they examined each half reaction in turn and found evidence for distinct mechanisms based on differences in temperature and potential dependences and Raman spectroscopic data. An alternating frequency of 30 Hz afforded optimal selectivity for the phenol product overall. — JSY

Angew. Chem. Int. Ed. **51**, 10.1002/anie.201202159 (2012).

BIOMEDICINE

The Healing Membrane

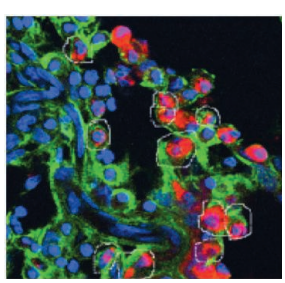
The omentum is a fold of smooth membrane that forms part of the lining of the abdominal cavity, extending from the stomach to adjacent lower abdominal organs. Although omentum has been observed to promote tissue healing and revascularization and to control inflammation when surgically grafted to injured sites, its mechanisms of action are not well known. Shah *et al.* found that in a mouse model of lung injury, animals injected with cells prepared from "activated" omentum showed a decrease in tissue inflammation, T cells, and proinflammatory cytokines in the damaged lung. Cells prepared from activated omentum tissue included mononuclear myeloid suppressor cells that could block the proliferation of effector/regulatory T cells, including T_H17 cells. Furthermore, activated omentum contained cells that could differentiate into various cell types under specific tissue culture conditions, including epithelial cells and osteoblasts, suggesting that the membrane harbors mesenchymal stem cells. How the omentum recruits these different cell types is not clear, but their presence in the membrane may have implications for omentum's clinical use in tissue repair and healing. — LDC

PLOS One. **7**, e38368 (2012).

CELL BIOLOGY

The Matter of the Heart

Cell proliferation and differentiation are directed by specific transcription factors and signaling molecules, but recent studies show that matrix stiffness can also have a major effect. Kshitiz *et al.* used polyacrylamide gels with different rigidity values to show that substrate stiffness is important for the morphogenesis and differentiation of human and rat cardiosphere-derived progenitor cells (CDCs) toward the endothelial fate. The optimal rigidity matched that of heart tissue. When compared to cells cultured on glass, cells that had been cultured



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CREDITS (TOP TO BOTTOM): BLACK HILLS STATE UNIVERSITY/AP PHOTO; KSHITIZ *ET AL.*, *SCI. SIGNAL.* **5**, RA41 (2012)

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on a myocardium rigidity–mimicking substratum (MRS) showed better survival and better integration into blood vessels, and expressed factors associated with endothelial differentiation when applied to a rat model of myocardial infarction. A c-Kit–positive cell population was implicated as the source of CDC-derived endothelium, with p190RhoGAP involved in this process via RhoA-dependent and independent mechanisms. Down-regulation of p190RhoGAP was sufficient to bias cell differentiation toward the endothelial lineage, whereas its up-regulation favored the cardiomyogenic lineage. Thus, the rigidity of the cell environment in cardiac tissue affects cell proliferation and differentiation, which could be important when considering therapeutic interventions. — BAP

Sci. Signal. **5**, ra41 (2012).

MICROBIOLOGY

Living with *Legionella*

Legionnaire's disease is an adventitious severe infection of humans caused by a ubiquitous bacterium that naturally lives within aquatic protozoa that colonize inadequately maintained water cooling systems. *Legionella pneumophila* uses the IVB Dot/Icm translocation system to introduce proteins into the host cell that remodel an intracellular vacuole to make it habitable. The bacterium then replicates within the modified host cell vacuole. The Dot/Icm system has a large repertoire of translocatable substrates, which appears to endow this pathogen with a wide host range, allowing it even to colonize mammalian macrophages. In a series of evolution experiments, Ensminger *et al.* discovered that when grown exclusively in mouse macrophages for several months, *L. pneumophila* improved its ability to replicate in this abnormal host cell to the extent that it failed to thrive when returned to amoebae. Population genotyping revealed mutations in the flagellar regulator and defects in lysine biosynthesis that could act to increase uptake into and replication within macrophages. — CA

PLoS Pathogens **8**, e1002731 (2012).

MATERIALS SCIENCE

Refusing to Order

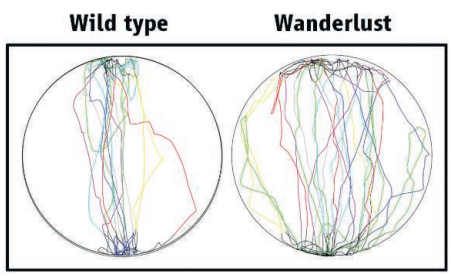
In magnetic materials, neighboring electron spins are aligned and point in either the same or opposite directions; the latter order is called antiferromagnetic. If the spins are arranged in, e.g., a triangular lattice, the antiferromagnetic condition cannot be satisfied everywhere simultaneously, and it is in principle possible for the system to remain disordered down to the lowest temperatures, giving rise to exotic ground states. However, other types of order or distortions usually intervene. Sheckelton *et al.* engineered the material $LiZn_2Mo_3O_8$, where clusters of Mo_3O_{13} are arranged in planes of triangular lattices. These clusters have an electron delocalized across the three Mo atoms, which makes the electronic structure stable against symmetry-breaking distortions; the clusters have an effective spin 1/2. Neutron diffraction and heat capacity measurements indicated that the material does not order magnetically down to 0.1 K and that at 96 K, two-thirds of the effective magnetic moments form singlets. Further experiments are needed to elucidate the nature of the ground state, but existing data suggest that the singlets are dynamic, forming an exotic condensed valence bond state, similar to the resonating valence bond state proposed to describe the high-temperature superconductivity of cuprates. — JS

Nat. Mater. **11**, 493 (2012).

NEUROSCIENCE

Restless Flies, Fragmented Sleep

Restless leg syndrome (RLS), characterized in humans by an irrepressible urge to move the legs, has been linked to the gene *BTBD9* and its cognate protein. The BTBD9 protein is



widely distributed through the central nervous system, where it seems to function as an adaptor for ubiquitin ligase. Freeman *et al.* have now identified a similar gene in *Drosophila* and analyzed its function. Deletion of the gene in *Drosophila* resulted in peripatetic flies with shortened life spans. These mutant flies also showed disrupted sleep patterns, with normal totals of sleep time delivered in fragmented, shortened bouts. Time spent walking, on the other hand, was greater than normal. Targeted knockdown experiments revealed a role for dopaminergic neuron subtypes. Treatment with a dopamine agonist reduced the flies' symptoms. In tissue culture cells, BTBD9 affected iron mobilization pathways through its interaction with iron regulatory protein-2. — PJH

Curr. Biol. **22**, 10.1016/j.cub.2012.04.027 (2012).

CREDIT: FREEMAN *ET AL.*, *CURR. BIOL.* **22**, 10.1016/J.CUB.2012.04.027 (2012)

Phenol Coming and Going

Jake Yeston

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