EDITED BY KRISTEN MUELLER AND JAKE YESTON

ENGINEERING

Lithium Batteries in the Afterlife

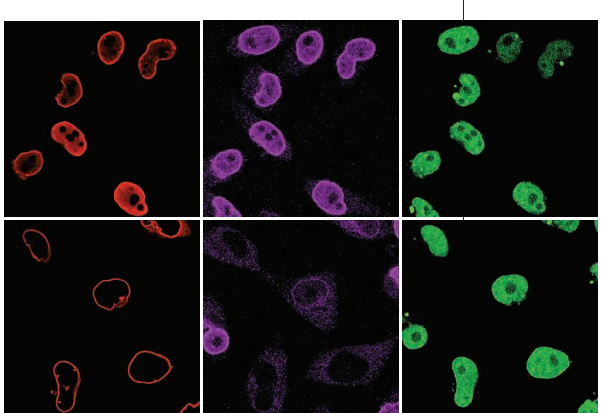
We are accustomed to collecting single-use batteries for recycling, but what about rechargeable lithium batteries in consumer electronic products? Many of these products are disposed of in the normal rubbish with the batteries still inside. The harmful nature of this e-waste has been recognized, but previous studies have focused on the impacts of the electronic products—such as cellphones—themselves, rather than the batteries contained in them. Kang *et al*. have performed leaching tests and applied life-cycle impact and hazard assessment models to determine the environmental impacts and human toxicity potentials of lithium-ion batteries used in cell phones. They analyzed 16 batteries from cell phones sent for recycling, representing the three types of lithium battery that are most abundant in e-waste: lithium-ion and lithium-polymer from traditional phones and small, high–energy-density lithium batteries from smartphones. The authors show that these batteries contain several metals, including lead and cobalt, that can leach out under simulated landfill conditions at concentrations exceeding U.S. federal and state regulations. They call for regulatory efforts to increase recycling and reuse of rechargeable batteries and to reduce the levels of toxic metals in these batteries and in consumer electronics as a whole. — JFU

Environ. Sci. Technol. **47**, 10.1021/es400614y (2013).

CELL BIOLOGY

Little and Large

The import of proteins into the nucleus occurs through pores in the nuclear envelope and depends on the Ran GTPase system. Previous work has shown that the nuclear import of the protein Tpr (translocated promoter region) is compromised in fibroblasts that express the Progerin protein associated with Hutchinson-Gilford progeria syndrome (HGPS) (below; see bottom row, purple). These findings were attributed to deficiencies in the Ran GTPase system, whereby Ran GTP accumulates in the nucleus to promote the release of nuclear import cargoes from their receptors. Following up on these findings,



Snow *et al*. now show that, rather than a global reduction in nuclear import, the limitations on Tpr import reflect difficulties in the import of large protein cargoes into the nucleus. Tpr is a nucleoporin that forms a basketlike structure on the nuclear side of nuclear pores. Its import into the nucleus is particularly sensitive to the Ran gradient across the nuclear envelope. The extent to which problems with Tpr import or the import of other large protein cargoes contributes to the premature aging phenotypes observed in HGPS patients remains unclear. — SMH

J. Cell Biol. 10.1083/jcb.201212117 (2013).

PSYCHOLOGY

Lean In for Equality

The importance of collaborative groups is being promoted in many school systems, and increasingly, scientific progress is made by groups of scientists rather than individual efforts. How do women perform in collaborations? Haynes and Heilman examined how gender stereotypes and self-perceptions manifest in collaborations in experiments with students from an introductory psychology class. Participants could not see their "partner" (whose description and performance were created by the experimenters). In the first experiment, participants either received feedback about the performance of their group as a whole or received feedback about their own performance. Unless given specific feedback, women tended to undervalue their own contributions. This was observed regardless of whether participants worked on the task as a unit or each had their own components to fulfill. However, this was affected by the gender of the "partner": Women who thought their partner was male tended to devalue their own contributions but did not devalue them if they thought they had collaborated with another woman. These results suggest that women tend to minimize their own contributions, and they indicate that this is an additional obstacle that must be overcome in efforts to gain gender equality in the workplace. — BJ

Pers. Soc. Psychol. Bull. 10.1177/0146167213486358 (2013).

BIOCHEMISTRY

A Turn-On for Kinases

Understanding of cellular regulatory mechanisms can be hindered by the inability to precisely control the activity of individual signaling components. Dagliyan *et al*. thus set out to create engineered protein kinases that could be activated by an exogenous ligand. They used the ligand-dependent protein-protein interaction between FKBP12 (12-kD FK506-binding protein) and FRB (FKBP12-rapamycin binding protein) that occurs in the presence of rapamycin. The goal was to confer ligand-dependent regulation in a manner that was generalizable to other proteins. Through a combination of rational design and trial and error, they were able to make a conformational switch module that allowed such control of several different

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protein kinases. Such a strategy is expected to help alleviate the challenges of elucidating the roles of individual components of complex cell regulatory circuits in vivo. — LBR

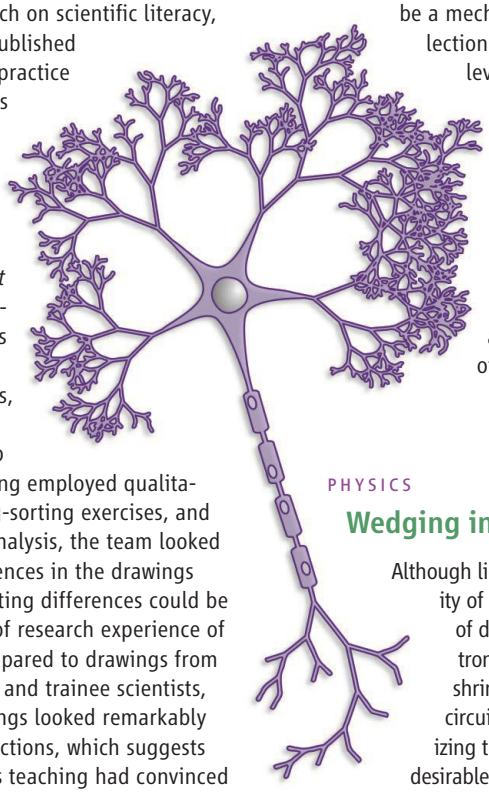
Proc. Natl. Acad. Sci. U.S.A. **110**, 6800 (2013).

EDUCATION

Drawing to Learn

Science education is shifting away from the memorization of facts and moving toward educational experiences that correspond with authentic research and the scientific process. Although this culture shift has resulted in gains being made in research on scientific literacy, there remains little published work on imaginative practice traits or how scientists learn to grasp and convey microscopically small subject matter. To investigate this learning system further, Hay *et al*. asked undergraduates, trainee scientists consisting of Ph.D. students and postdocs, and leading neuroscience researchers to "draw a neuron." Using employed qualitative analysis, drawing-sorting exercises, and hierarchical cluster analysis, the team looked for categorical differences in the drawings and whether any existing differences could be related to the levels of research experience of the participants. Compared to drawings from seasoned researchers and trainee scientists, undergraduate drawings looked remarkably like textbook reproductions, which suggests that years of previous teaching had convinced these students that textbooks are authoritative. The research team employed two different teaching interventions, designed for students to directly experience "life as a neuron," and upon completion students were again asked to "draw a neuron." Post-intervention drawings by students were found to be similar to experts' drawings, suggesting that interventions such as these have great potential to increase undergraduates' creative aptitude when it comes to science education. — MM

Sci. Educ. 10.1002/sce.21055 (2013).



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GENETICS

Tagging New Genes

Epialleles are heritable, nongenetic (epigenetic) differences in DNA methylation. Although variation among epialleles in the model plant *Arabidopsis thaliana* has been observed in laboratory populations, the frequency and effects of epialleles in natural populations are largely unknown. Silveira *et al*. examined epialleles of the *Qua-Quine Starch* (*QQS*) gene, which is unique to *Arabidopsis* and is believed to have evolved recently. *QQS* gene expression demonstrated epigenetic control. *QQS* expression correlated negatively with the degree of methylation at the promoter and varied among global accessions and wild populations. Thus, variation in gene expression via differentially regulated methylation in wild populations may be a mechanism for allowing selection to act on the expression levels of *QQS* and other evolutionarily de novo genes. Regions in the genome may undergo spontaneous changes in their epigenetic status, and these differences may be one evolutionary mechanism affecting the evolution of new genes. — LMZ

PLoS Genet. **9**, e1003437 (2013).

PHYSICS

Wedging in Plasmons

Although light provides the capability of transferring vast amounts of data quickly, nanoelectronics offer the ultimate in shrinkability for chip-scale circuits. Integrating or hybridizing the two technologies is desirable but challenging because of the several orders of magnitude difference in length scales between them. Surface plasmons, the light-induced collective electronic excitations that propagate at the surface of a metal, may offer the possibility of a robust bridge. Much effort, therefore, is being directed to manipulating the direction and lifetime of these propagating excitations. Using a graded index wedge of photoresist on top of a layer of gold, Bleckmann *et al*. show that the propagation of beams of nondiffracting (nonspreading) surface plasmons along the gold surface is dependent on the geometrical parameters of the wedge-shaped dielectric. The results suggest a fairly simple route to the launch and control of the directional propagation of surface plasmons for future nanoscale optoelectronic circuits. — ISO

Opt. Lett. **38**, 1443 (2013).

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