

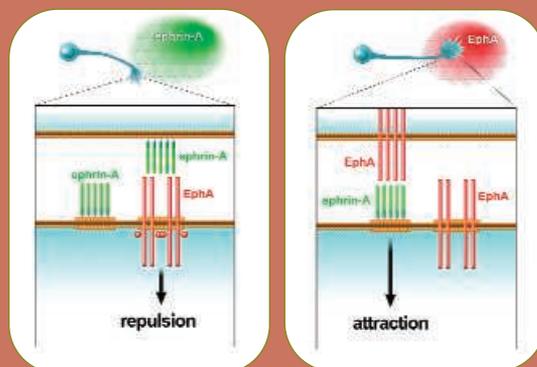
edited by Gilbert Chin

### NEUROSCIENCE

#### Stop on Green, Go on Red

Neuronal growth cones flaunt cell surface receptors that sense attractive and repulsive guidance cues as axons make their way to their destinations. Some of these cues are cell-surface proteins, too, and serve as receptor ligands. But what if both receptor and ligand are present in the same growth cone, as is the case with the Eph receptor tyrosine kinases and ephrins, their cognate, membrane-bound ligands?

Marquardt *et al.* propose that Eph receptors and ephrins segregate into subdomains of the growth cone membrane, allowing them to mediate repulsion and attraction independently. Motor neurons from the chick embryo spinal cord express the receptor EphA and the ligand ephrin-A. When neurons were treated with soluble EphA or ephrin-A, and then with antibodies that promoted clustering, the corresponding cell-surface receptors and ligands were observed to be partitioned into distinct membrane domains on the growth cone. Chimeric EphA and ephrin-A molecules were engineered to force a spatial intermingling of ligand and receptor, and expression of either chimera interfered with the growth cone response to soluble EphA or ephrin-A, indicating that spatial separation of endogenous receptors and ligands facilitates their responses to transcellular cues. The segregation of Eph and ephrin molecules in growth cones may enable axons to see both stop and go signals as they travel to their targets. — LDC



Repulsion by exogenous ephrin-A (green) and attraction by EphA (red).

*Cell* 121, 127 (2005).

hydrothermal synthesis that yielded  $\text{Ag}_4\text{V}_2\text{O}_6\text{F}_2$ , which increased the silver content of the material without sacrificing the framework structure that allows facile lithium and silver diffusion. This material has about 50% higher capacity above 3 V than does SVO, and because of the fluoride incorporation, delivers it at a potential that is 0.3 V higher. — PDS

*J. Am. Chem. Soc.* 10.1021/ja050150f (2005).

### PSYCHOLOGY

#### Deciding to Opt In

Humans are social animals, and, as such, it is to be expected that acceptance into a group would confer benefits on oneself, whereas rejection would affect one's behavior adversely. Baumeister *et al.* have performed a set of six experiments to identify the underlying cause of impaired behavior. In this and earlier work, the primary hypothesis has been that social exclusion leads to emotional distress, which in turn has a detrimental impact on task performance. However, in a variety of scenarios, negative mood evoked directly (via bad news) did not affect behavior, and there was no evidence for mood or self-esteem as a mediating factor for the effects of social exclusion on performance. What was observed was a lack of self-

regulation, meaning that excluded individuals (in comparison to socially accepted individuals) were less able to drink a healthy but unpleasant-tasting beverage and were more likely to eat unhealthy but tasty snacks. Because the adverse effect of rejection could be ameliorated by introducing a cash incentive for performance, the authors propose that

### CELL BIOLOGY

#### Nuclear Waste Disposal

Quality-control systems within the cytosol are important for the overall health of the cell; aberrant proteins (incorrectly assembled or damaged during use) may not function properly, and the cell has mechanisms for disposing of such waste (and recycling the components) if they cannot be repaired. Gardner *et al.* find that a similar quality-control system operates within the cell nucleus of the yeast *Saccharomyces cerevisiae*.

Mutant nuclear proteins are targeted for destruction by the proteasome: a proteolytic machine of the cytosol. A set of nuclear quality-control proteins—San1, which is a ubiquitin-protein ligase, and two ubiquitin-conjugating enzymes, Cdc34 and Ubc1—act together to tag mutant

proteins with ubiquitin, the molecular label for proteasomal degradation. San1 possesses a nuclear localization signal that is required for its function, and cells lacking San1 suffer from chronic stress, presumably due to the accumulation of aberrant proteins within the nucleus. Thus, the eukaryotic cell has surveillance and quality-control strategies to protect each of its compartments from the harmful consequences of dysfunctional proteins. — SMH

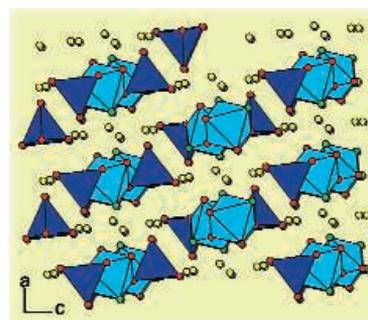
*Cell* 120, 803 (2005).

### CHEMISTRY

#### Cathode Fluoridation

One highly demanding application of lithium batteries is that of charging the capacitors of implantable cardioverter defibrillators. Recharging of the capacitors that deliver the shock to the heart requires batteries that can deliver high

voltage and power quickly. For this application, silver vanadium oxide (SVO,  $\text{Ag}_2\text{V}_4\text{O}_{11}$ ) has been a cathode of choice, but there is interest in increasing the capacity that can be delivered above 3 V, which is that portion associated with silver reduction (the rest is associated with  $\text{V}^{5+}/\text{V}^{4+}$  and  $\text{V}^{4+}/\text{V}^{3+}$  couples). Sorensen *et al.* incorporated fluoride into these materials through a low-temperature (150°C)



Packing in  $\text{Ag}_4\text{V}_2\text{O}_6\text{F}_2$  (Ag, yellow; O, red; F, green).

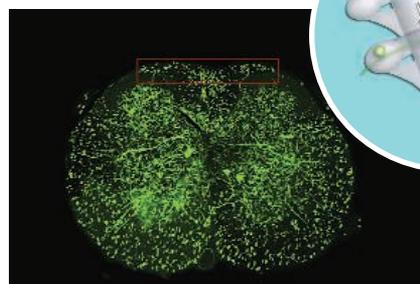
the capacity for self-regulation is intact but that a social rebuff lessens the willingness to make effortful short-term sacrifices in return for longer-term rewards (of good health or a slim physique). Looked at in another way, the consequences of rejection might be reflected at the neural level as a weight that alters the normative balance of decisions when faced with intertemporal choices. — GJC

*J. Pers. Soc. Psychol.* **88**, 589 (2005).

## BIOMEDICINE

### Neural Degeneration

When the spinal cord is injured, degeneration of the nerve fibers, or axons, is not instantaneous but rather is believed to occur in several stages over a period of hours. In principle, this delay creates a window of opportunity for the administration of therapies to reduce the extent of irreversible damage. The



GFP-labeled axons (green) in a spinal cord cross section (left) and a schematic of the technique (inset).

development of such therapies, however, requires a better understanding of how mammalian axons respond to injury.

Using time-lapse microscopic imaging of living mice expressing green fluorescent protein (GFP) in individual axons, Kerschensteiner *et al.* visualized the axonal response to traumatic injury. Beginning about 20 min after trauma, axons were found to die back at both proximal and distal ends by a rapid and previously uncharacterized fragmentation process termed "acute axonal degeneration."

This was followed by slow axonal retraction and ultimately by fragmentation of the axon's distal ends via the well-known Wallerian degeneration. Although many axons mounted a regenerative response within 24 hours of injury, this response was futile because the axons did not grow back to their original targets. This mouse model will likely prove useful for the testing of new therapies for spinal cord injury. — PAK

*Nat. Med.* **10**.1038/nm1229 (2005).

## ENVIRONMENTAL SCIENCE

### Reduced Mobility

Chromate ions ( $\text{CrO}_4^-$ ), such as those in industrial waste streams, are highly toxic, and a better understanding of their transport properties in groundwater would be useful. In the outdoors, the flow of chromate ions can be influenced by myriad chemical and microbial interactions, which researchers usually lump together into measured retardation factors.

Al-Abadleh *et al.* have used a model system to probe the molecular origins and details of retardation in silica-rich soils. They prepared monolayers of carboxylic acid- and ester-terminated alkyl chains, which were attached via siloxanes to a fused quartz substrate, and used second harmonic generation spectroscopy to monitor the reversible binding to these surfaces of aqueous chromate.

In comparison to bare silica, the organic acid layers, which are analogous to the humic acids in soil, nearly tripled the retardation factor, whereas esters increased it by 50%.

Moreover, the binding energy of chromate to acid increased with chromate concentration, and an analysis of this cooperative behavior quantified the lateral intermolecular forces in a hydrogen-bonded network of acids, perturbed by metal ions. — JSY

*J. Phys. Chem. B* **10**.1021/jp050782o (2005).

## ATMOSPHERIC SCIENCE

### Fat Coats

It has been suggested that atmospheric aerosols (particles containing a hydrophilic core of sulfate, nitrate, or ammonium salts) may carry organic surfactants on their surface. If so, this would have important effects on the chemical and physical properties of aerosols, as well as consequences for climate and human health. Recent analysis has shown that some marine aerosols do, in fact, sport an outer layer of fatty acids, but whether this is true for other aerosols has been unclear.

Tervahattu *et al.* report that some aerosols of continental origin are coated with fatty acids. They used time-of-flight secondary ion mass spectrometry to detect the presence of these molecules in the outermost 3 nm (of a 0.1- to 1.0- $\mu\text{m}$  particle) in aerosols derived from forest fires and from the burning of coal and straw. — HJS

*J. Geophys. Res.* **110**, 10.1029/2004JD005400 (2005).