

CHEMISTRY

## A Marriage of Opposites

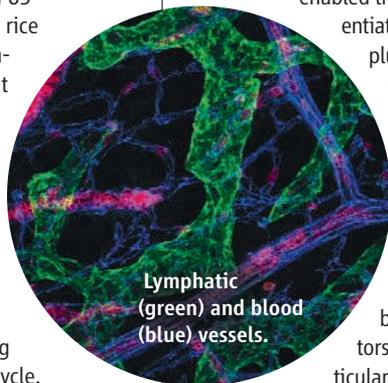
Janus particles are colloidal particles whose two hemispheres have different properties, such as optical or magnetic behavior, polarity, or the ability to attract or repel water. Berger *et al.* combined two polymerization reactions to create Janus particles with distinct acid/base reactivity. Multiple silica particles 800 nm in diameter were appended to a solid wax core, after which the exposed portions were functionalized with an acrylate polymer by surface-initiated atom-transfer radical polymerization. Once released from the wax, the previously masked hemispheres were linked to pre-formed chains of poly(2-vinylpyridine). The particles were then hydrolyzed to convert the acrylate esters to acids. The distinct basicities of the two polymers led to varying charge accumulation and consequent aggregation behavior in response to pH changes. The authors envision extending this approach for use in emulsion stabilization or for control of molecular transport at the interface between two immiscible liquids. — MSL

*Macromolecules* 10.1021/ma802089h (2008).

PLANT SCIENCE

## Mapping Out Diversity

In plants, microtubules in the cell cortex help align cellulose fibrils in the cell wall, which in turn shape tissue structure. Microtubules are constantly in flux: growing at one end, disintegrating at the other end, and bundling together with neighbors. Microtubule-associated proteins (MAPs), specifically the MAP65 family, add some control to this otherwise fluid and self-assembling skeleton. Although animals have 1 or 2 MAP65 homologs, *Arabidopsis* has 9, and rice has 11. Smertenko *et al.* have analyzed this abundance and find that the genes fall into five families. Both rice and *Arabidopsis*, representing the ancient evolutionary divergence between monocots and dicots, have representatives of each of the five families. The MAP65 isoforms show different localizations within the cell and variable expression during development or through the cell cycle. Some are ubiquitously expressed, and others are unique to a particular tissue type, such as pollen. Some are preferentially expressed during G<sub>1</sub> and others during G<sub>2</sub>. The domain respon-



Lymphatic (green) and blood (blue) vessels.

sible for this diversity among the MAP65 proteins seems to harbor the similarly diverse phosphorylation sites. — PJH

*Plant Cell* 20, 10.1105/tpc.108.063362 (2008).

DEVELOPMENT

## Turning On and Staying On

During metazoan development, cells generally progress inexorably to a terminally differentiated fate. However, recent in vitro manipulations have enabled the conversion of one differentiated cell type either to a pluripotent state (as occurs with somatic cell nuclear transfer and induced pluripotent cells) or to another differentiated cell type (for example, reprogramming of mature B cells into T cells). Although quite a bit is known about the factors necessary to specify particular cell types, relatively little is known about the factors required to maintain the terminally differentiated phenotype. For specification of lymphatic endothelial cells (LECs), *Prox1* expression is crucial, and Johnson *et*

*al.* extend this finding to show an additional role of *Prox1* in maintaining the lymphatic fate. Downregulation of mouse *Prox1* results in mispatterned lymphatic vessels that fill with blood; LECs are effectively reprogrammed into blood endothelial cells (BECs). Hence, *Prox1* acts as a binary switch participating in the known roles of suppressing BEC fate and promoting LEC fate; furthermore, sustained *Prox1* expression is necessary to maintain the lymphatic cell phenotype. — BAP

*Genes Dev.* 22, 10.1101/gad.1727208 (2008).

PSYCHOLOGY

## Reading from Left to Right

Categorical perception is a robust phenomenon and can be illustrated by the more rapid discrimination of two colors separated by a fixed chromatic distance when the colors fall on opposite sides of a category boundary, such as blue/green, than when they both lie within a single category. Both adults and infants exhibit this capacity, and Franklin *et al.* have investigated the influence of hemispheric lateralization and of language in a pair of studies. First, by presenting the colors in the left or right visual field (LVF or RVF), they show that adults react more quickly to RVF stimuli and hence that categorical perception of color is lateralized (in a relative, though not absolute,

CREDITS (TOP TO BOTTOM): BERGER ET AL., MACROMOLECULES 10.1021/MA802089H (2008); JOHNSON ET AL., GENES DEV. 22, 10.1101/GAD.1727208 (2008)

sense) to the left hemisphere, to which the RVF projects. Consistent with a left-hemispheric predominance of language skills, a verbal interference task blocked categorical perception in adults, whereas a visual interference task did not. Prelinguistic infants, on the other hand, displayed a right-hemispheric (LVF) superiority in the categorical perception of colors. Second, they recruited a group of toddlers 2 to 5 years of age and assessed their comprehension of the words blue and green. When tested on the same paired colors, the reaction times of these toddlers did not vary as a function of semantic knowledge, but those that had mastered the words demonstrated a hemispheric lateralization that was adult-like; that is, categorical perception for RVF stimuli. Toddlers who were still learning about blue and green retained the LVF pattern of categorical perception. — GJC

*Proc. Natl. Acad. Sci. U.S.A.* **105**, 3221; 18221 (2008).

## PSYCHOLOGY

## A Walk in the Woods

Spending time in the outdoors is commonly regarded as a wholesome approach to coping with the cacophony of contemporary developed societies. But does immersion in a natural environment lead to more than simply a sense of feeling refreshed—that is, might the metaphorical recharging of one's batteries be real? Berman *et al.* find that the less obtrusive sensory stimuli pro-



vided by a walk through an arboretum enabled people to perform better on a standard working memory task (backward digit span), in comparison to the stimuli of a stroll through a downtown landscape. Subsequent testing revealed a specific effect of scenic as opposed to urban settings on the executive portions (versus the alerting or orienting components) of an attentional network task, suggesting that a brief hiatus from focused application of attention allows for the replenishment and renewal of cognitive control centers. — GJC

*Psychol. Sci.* **19**, 1207 (2008).

## CHEMISTRY

## Weighing Down Pyridine

A common technique for unraveling the mechanism of complex organic reactions is to substitute the hydrogen atoms on different carbon

centers with heavier deuterium isotopes. The mass shift can influence reaction rates through changes in the molecule's vibrational structure, thereby revealing key sites of reactivity. In general, though, isotopic substitution tends not to perturb the overall outcome of chemical or physical transformations. Crawford *et al.* uncover an intriguing exception, in which deuteration of the five carbons in pyridine leads to a distinct crystalline arrangement at low temperature. Through a careful series of x-ray and neutron diffraction studies on single-crystal and powder samples, the authors established that below 215 K, the deuterated isotopologue crystallizes in a layered phase along the (110) planes; above this temperature, the solid rearranges to align along the (100) planes, as observed across the whole temperature range for protio pyridine. Although such isotopic polymorphism has previously been observed in a number of polyatomic salts, the behavior is rare in neutral organics. — JSY

*Angew. Chem. Int. Ed.* **47**, 10.1002/anie.200803589 (2008).

## CELL BIOLOGY

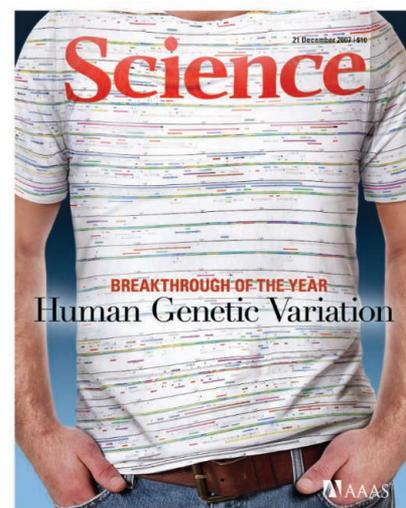
## Hidden Change

Biological systems are buffered against variation by proteins termed phenotypic capacitors, of which heat shock protein 90 (Hsp90) is the founding member. This protein chaperone reveals diverse phenotypic variation when its level falls, exposing previously silenced genotypes. Given that species advancement requires genetic diversity and phenotypic change, phenotypic capacitors have been suggested to support evolution; the reduction of Hsp90, which occurs under stressful conditions, would release phenotypes that can be acted on by natural selection to drive evolution. Whether other cellular proteins harbor capacitor function is unclear. Levy and Siegel used high-throughput morphological phenotyping and found that more than 5% of yeast genes act as capacitors by buffering environmental variation and suppressing phenotypic diversity. These capacitors were found to control cellular processes, such as cell cycle regulation and stress responses. Beyond a role in natural selection, phenotypic capacitors may also support the evolution of cancer cells, which are notoriously resilient to many environmental stresses and exhibit widespread genetic instability. Hsp90 is thought to buffer these tumorigenic properties and promote survival, and Hsp90 inhibitors may have potential as cancer chemotherapeutics. — HP\*

*PLoS Biol.* **6**, e264 (2008).

\*Helen Pickersgill is a locum editor in *Science's* editorial department.

Wrap yourself  
in something  
groundbreaking  
this year



Our *Science* Gene  
Sequence T-shirt—  
get yours today!

By popular demand! Created to celebrate our Breakthrough of the Year for 2007, this T-shirt is designed from an annotated gene sequence map of human chromosome 1.

Since the shirt appeared on the cover of *Science*, we've been flooded with requests. **Now it's yours for just \$22.50** plus tax (where applicable), and shipping & handling. Photos of the actual shirt are available at the website below.



To order:

[www.aaas.org/go/geneshirt](http://www.aaas.org/go/geneshirt)

