

PSYCHOLOGY

That Which We Call a Rose

There is great diversity in how colors are represented among the languages of the world, but there are common categories into which colors tend to be grouped. Lindsey and Brown have explored how those categories are pieced together into naming systems and how those systems vary both across and within languages. They analyzed data from the World Color Survey; over 2000 individuals, representing over 100 mostly unwritten languages from nonindustrialized societies, provided names for the Munsell set of 330 color samples. Following on earlier work, they looked for categories into

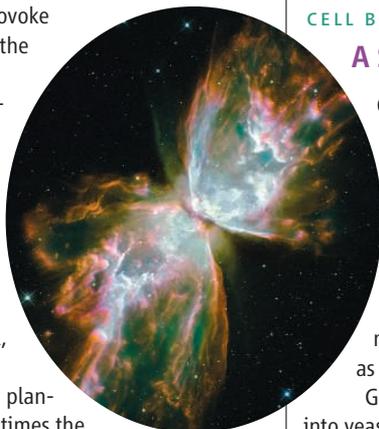
which each individual grouped similar colors and identified 11 clusters into which color space can be divided, regardless of language. But in spite of this universal glossary of basic color terms, the ways in which these clusters mapped onto color space—their borders and distinguishing categories—was not uniform across individuals. There were three to six distinct naming systems, or motifs, that accounted for how individuals organized categories in color space. These motifs occur in languages spread across the globe, suggesting shared underlying mechanisms. Within many languages, however, multiple motifs were used, reflecting variations in how individuals modify their language. — BW

Proc. Natl. Acad. Sci. U.S.A. **106**, 19785 (2009).

ASTRONOMY

Capturing a Butterfly

Stars radiate because thermonuclear reactions in their cores transform hydrogen into helium. For most of their lives, radiation pressure balances gravity, preventing expansion or collapse. Once hydrogen starts to run out, however, the core contracts rapidly, leading to a temperature increase and an expansion of the star's outer layers: The star becomes a red giant. Helium fusion then starts, leading to instabilities that provoke ejection of most of the star's atmosphere. The ultraviolet radiation from the now exposed, hot surface of the star ionizes its surroundings and drives a fast outflow into the circumstellar material, heating it up and making it glow as a planetary nebula. Sometimes the central dying star may be hidden by the nebula itself and by a circumstellar disk of gas and dust. Such is the case with NGC6302,



also known as the Butterfly Nebula because of its bipolar morphology. Its long-elusive central star has now been detected by Szyszka *et al.*, who acquired optical images with the Wide Field Camera 3 recently installed on the Hubble Space Telescope. The star is situated in the center of the large-scale outflows, as expected, lying on the eastern edge of the thick dust lane. The data suggest that it has a high mass as compared to other planetary nebulae. — MJC

Astrophys. J. **707**, L32 (2009).

CELL BIOLOGY

A Sticky Business

Cohesin is a complex of proteins that binds to DNA. The name cohesin is derived from its function in maintaining the cohesion of sister chromatids after DNA replication; this ensures their faithful segregation into daughter cells during mitosis. The effects of mutations in cohesin proteins suggest that they may be involved in other nuclear events as well, such as gene expression.

Gard *et al.* have introduced mutations into yeast cohesin genes that correspond to those that are linked to the human developmental disorders Roberts syndrome and Cornelia de Lange syndrome. No effects on chromosome

cohesion were detected, but there were clear anomalies in nuclear organization: specifically, chromosome condensation, telomere arrangement, and nucleolus morphology. Furthermore, mutations in two of the cohesin proteins impaired the localization of a gene to the nuclear periphery that normally would occur upon transcriptional activation. Cohesin itself is highly conserved, and its role in nuclear processes may explain in part the abnormalities found in cohesin-linked human diseases. — HP

J. Cell Biol. **187**, 455 (2009).

CHEMISTRY

PC Squared

Both urea and thiourea groups, which comprise two nitrogen centers respectively flanking a C=O or C=S center, have recently proven useful in asymmetric catalysis of a wide range of organic reactions. Zhu *et al.* have modified this scaffold by replacing the central carbonyl with a longer, two-carbon bridge contained within a cyclobutene-dione moiety, and then applied the new framework to the asymmetric addition of phosphites to nitroalkenes. The strained central square geometry of this catalyst proved highly effective for promoting the P-C bond-forming reaction, affording high yields and enantiomeric excesses with both aryl- and alkyl-substituted

CREDITS (TOP TO BOTTOM): D. T. LINDSEY AND A. M. BROWN; PROC. NATL. ACAD. SCI. U.S.A. **106**, 19785 (2009); NASA/ESA/HUBBLE SPACE TELESCOPE TEAM

nitroalkenes. Reduction of the nitro group in these products would afford β -amino phosphonic acids, intriguing analogs of the more common amino (carboxylic) acids. — JSY

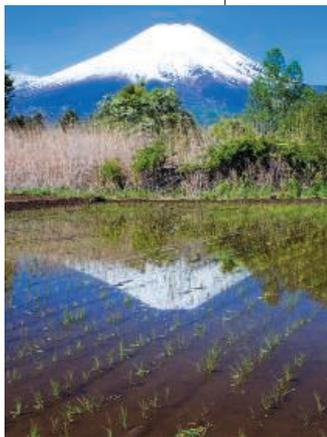
Angew. Chem. Int. Ed. 10.1002/anie.200904779 (2009).

CROP SCIENCE

Up and Down the Paddy

When staple crops such as rice are grown in soils naturally rich in toxic metals, containing the risk of sickness or even death from exposure becomes a top priority. In Asia, with large and often growing populations to feed, simply abandoning land with contaminated soils is not a viable option; water management strategies are instead employed to decrease the uptake of problematic elements while still promoting abundant rice yields. In rice uptake experiments using Japanese soils, Arao *et al.* found that two common water management strategies, flooding and aerobic treatment, have opposing effects on arsenic (As) and cadmium (Cd) levels in rice. In flooding conditions, significant amounts of As were incorporated into the rice grain and straw, whereas Cd primarily remained in the soil. Conversely, aerobic treatment increased Cd content in rice but caused very little As uptake. The variable effect is explained by changes in mineral solubility with changing soil redox potential: The oxidizing conditions of aerobic treatment convert insoluble Cd sulfide into the mobile sulfate, whereas reducing conditions from flooding increase arsenite mineral dissolution and hence As mobility. However, redox potential alone does not explain why the organic fraction of As in the soil is translocated more easily. Biological factors such as methyltransferase activity in rice may be responsible for that observation. — NW

Environ. Sci. Technol. 10.1021/es9022738 (2009).



MARINE BIOLOGY

Carbon Capture, No Storage

Sponges that inhabit coral reefs act as high-volume water filters, acquiring up to 90% of their daily carbon intake from dissolved organic matter, yet the biomass of these sponges remains constant. De Goeij *et al.* have resolved this discrepancy by analyzing cell turnover in the

sponge *Halisarca caerulea*, collected from coral reef cavities off the island of Curaçao. 5-bromo-2'-deoxyuridine (BrdU) is a thymidine analog whose incorporation into DNA is a measure of cell proliferation. Analyses of BrdU levels in sponge tissue showed that choanocytes—flagellated cells that line the internal passageways—were the sole type of proliferating cells, with an unusually short cell division cycle of 5 hours. The authors observed a massive amount of choanocyte shedding in the central canals, which may be analogous to the loss of epithelial cells in the gastrointestinal tract. The rapid turnover of choanocytes, each containing roughly 3 pg of carbon, helps to avoid clogging of the filter chambers and balances the sponge's carbon intake. — LC

J. Exp. Biol. 212, 3892 (2009).

CANCER

An Inflammatory Path to Cancer

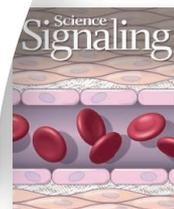
Switching normal cells into a transformed phenotype that is characterized by uncontrolled growth is central to the development of cancer. Iliopoulos *et al.* describe an epigenetic switch:

a stable phenotypic change, retained through multiple generations in proliferating cells, which is not due to changes in DNA sequence. Immortalized cells from mammary epithelial tissue were transformed by overexpressing Src, a protein tyrosine kinase; activation of Src for just 5 min produced cells that adopted a transformed phenotype and maintained it for at least 12 generations. Activating Src led to an increase in activity of the transcription factor NF- κ B, a central mediator of inflammatory responses. A key target of NF- κ B

in this system was Lin28, an RNA-binding protein that inhibits the accumulation of the microRNA let-7. In turn, let-7 reduces levels of interleukin-6 (IL-6), an inflammatory cytokine thought to contribute to human cancers. IL-6 signals through its receptor to activate NF- κ B, thus creating a positive feedback loop. Disruption of any step in the loop resulted in loss of transformation. The authors note that the signaling events defined in this study are known to be associated with certain human cancers. Thus, the epigenetic switch they describe could allow a transient inflammation to produce a long-lasting cancerous effect analogous to mutation of a tumor suppressor gene or activation of an oncogene. — LBR

Cell 139, 693 (2009).

Call for Papers



Science Signaling

Science Signaling, from the publisher of **Science**, AAAS, features top-notch, peer-reviewed, original research weekly. Submit your manuscripts in the following areas of cellular regulation:

- Biochemistry
- Bioinformatics
- Cell Biology
- Development
- Immunology
- Microbiology
- Molecular Biology
- Neuroscience
- Pharmacology
- Physiology and Medicine
- Systems Biology

Subscribing to **Science Signaling** ensures that you and your lab have the latest cell signaling resources. For more information visit www.ScienceSignaling.org

Chief Scientific Editor

Michael B. Yaffe, M.D., Ph.D.
Associate Professor, Department of Biology
Massachusetts Institute of Technology

Editor

Nancy R. Gough, Ph.D.
AAAS

Submit your research at:
www.sciencesignaling.org/about/help/research.dtl

Science Signaling

