



OCEAN SCIENCE

## Toxic Assets

Atmospheric aerosols can be important sources of nutrients and trace metals, such as phosphorus and iron, to marine organisms, and have been shown to stimulate productivity under favorable conditions, but they also have the potential to be toxic. Predicting what the effects of aerosol deposition might be on biological activity in the surface ocean depends on a complex array of parameters, such as the specific composition of the aerosols, the chemistry of the ocean, and the types of organisms present. Paytan *et al.* begin to investigate some of the effects of aerosols on marine phytoplankton with a combination of laboratory experiments and field work, concluding that copper may be a source of the toxic effects that they observe in the northern Red Sea. They show that different plankton respond in different ways to chemically different aerosols, and that aerosol deposition is not always an asset to marine ecosystems. Because dust deposition is likely to increase over the coming century, and anthropogenic pollutants such as copper have increased greatly over the past 150 years (and likely will continue to increase as growing populations continue to use more resources) aerosols could have substantial effects on marine ecosystems. — HJS

*Proc. Natl. Acad. Sci. U.S.A.* **106**, 4601 (2009).

## CHEMISTRY

## All in the Family

The nitrogen column in the periodic table is perhaps the most diverse, ranging from the light, tightly bound  $N_2$  gas, through cluster-prone phosphorus and arsenic (As), on down to the semi-metals antimony (Sb) and bismuth (Bi). Molecular phosphoramides that combine the two lighter elements are well known, and recently a simple compound of phosphorus (P) and As emerged stably from solution (see Cos-sairt *et al.*, *Brevia*, 30 January 2009, p. 602). Alloys of the heavier elements, in keeping with

their semimetallic character, are also known. However, coordination complexes of As with its heavier congeners are comparatively rare. Conrad *et al.* present a straightforward synthetic route to this class of compounds, mixing trialkyl or triaryl arsines with chlorinated Sb and Bi substrates in dichloromethane solution. In addition to a neutral As-Sb adduct, the authors isolated cationic As-Sb and As<sub>2</sub>-Bi adducts after chloride abstraction by trimethylsilyltriflate, as well as a fourth cationic As-Sb adduct using aluminum trichloride as the abstracting agent. All three structures were crystallographically characterized and exhibited geometries consis-

tent with electron donation from As to the heavier acceptor. — JSY

*J. Am. Chem. Soc.* **131**, 10.1021/ja900968j (2009).

## CELL BIOLOGY

## Tagging Troublesome Trash

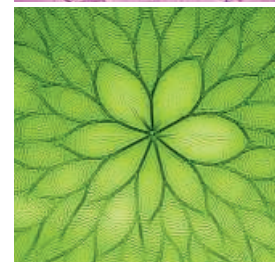
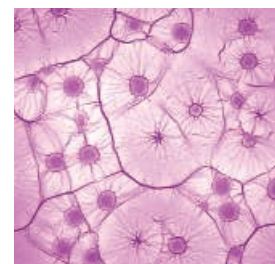
Huntington's disease is caused by the accumulation of a mutant form of the protein huntingtin, which folds improperly, leading to neurodegeneration and death. Autophagy provides a means by which cells can degrade aberrant cytosolic proteins within lysosomes. Jeong *et al.* wondered if the damage caused by mutant huntingtin could be prevented by promoting the clearance of the misfolded protein from affected neurons. In animal and cellular models of Huntington's disease, they found that increasing acetylation of the pathological form of huntingtin enhanced its trafficking via autophagy into lysosomes and its subsequent degradation. Blocking acetylation promoted neurodegeneration in cultured neurons and in mutant mice. Thus, this posttranslational modification might be exploited therapeutically if some means can be devised for the specific acetylation of pathological aggregates of huntingtin. — SMH

*Cell* **137**, 10.1016/j.cell.2009.03.018 (2009).

## MATERIALS SCIENCE

## A Wrinkle in Time and Space

If you squeeze together a supported piece of paper, or place a weight on a constrained plastic film, a wrinkled pattern will appear. The wrinkles tend to form perpendicular to the axis of the principal stress, so that it is possible to obtain concentric ring patterns (like an archery target) or spoke-like patterns (like a bicycle wheel) or combinations thereof. The correlation between film properties, applied stress, and the static wrinkle patterns that form are now well understood. Chung *et al.* examined the dynamics of the wrinkling process—specifically, by monitoring patterns that formed during toluene swelling of polystyrene that



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had been partially surface–cross-linked through exposure to ultraviolet light and ozone (UVO). For low UVO exposure times, spoke patterns emerged, which the authors attribute to Fickian diffusion of the toluene with a radial growth rate that scaled with the square root of time. Longer UVO exposure generated a thicker cross-linked layer, with the toluene diffusion limited by this barrier. For these films, an induction time was required before wrinkling occurred, and a linear concentration could develop within the rubbery parts of the film, causing a concentric ring pattern to form. In all cases, the initiation and focal points of the patterns appeared to be at surface defects. The authors tested this observation either by masking a portion of the film with glass beads before UVO exposure, to create an elevated area that was not cross-linked, or by indenting the film after UVO exposure to make a gap in the cross-linked surface: These sites proved to be the focal points for the wrinkling on toluene exposure. Because the wrinkling patterns reflect the solvent front and the diffusion kinetics, the authors envision that this technique could be used to easily extract diffusion coefficients for a range of solvent/polymer pairs. — MSL

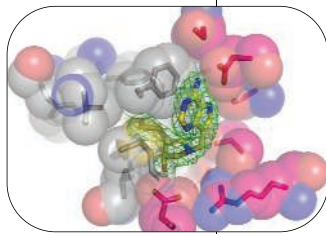
*Adv. Mater.* **21**, 1358 (2009).

## BIOCHEMISTRY

## Nonlethal Drugs

The repeated appearance of bacteria that have developed resistance to the latest generation of antibiotics has fueled the search for other kinds of anti-infective drugs. Gutierrez *et al.* have targeted quorum sensing, the process by which bacteria signal to each other through molecules called autoinducers. These signals coordinate gene expression across individuals in a community, and in the case of pathogenic bacteria, regulate virulence. The bacterial enzyme 5'-methylthioadenosine/S-adenosylhomocysteine nucleosidase (MTAN) is involved in the production of autoinducers.

Transition-state analogs that inhibited MTAN activity *in vitro* also inhibited the production of autoinducers *in vivo* but did not affect the growth of *Vibrio cholerae* or *Escherichia coli*. This sensitivity persisted during growth for 26 generations in the presence of the inhibitor; furthermore, a reduction in the formation of



Complex of MTAN (red + gray) and inhibitor (yellow + blue).

biofilms—a protective lifestyle for bacteria—was also observed. MTAN is expressed by other bacterial pathogens, so attacking virulence in this nonlethal manner may delay the development of drug resistance. — LC

*Nat. Chem. Biol.* **5**, 251 (2009).

## EVOLUTION

## Enforced Separation

Speciation resulting from divergence within a population (sympatry) generally assumes that gene flow is a constraint; however, evidence for this has come from correlations that sidestep the possibility that multiple causal pathways could be important. In order to determine whether gene flow can indeed hold back divergence, Nosil investigated this effect in polymorphic populations of the stick insect *Timema cristinae* in two different habitats. Each population was tracked over several years, and about halfway through this period, the gene flow between one pair was interrupted. In contrast to the control groups, the perturbed populations showed a divergence in morph frequencies in following generations that were attributed to a lack of dispersal and reduced population size. This study provides experimental evidence showing that gene flow does constrain adaptive divergence in the wild. — LMZ

*Evolution* **63**, 10.1111/j.1558-5646.2009.00671.x (2009).

## SYSTEMS BIOLOGY

## Intrinsically Responsive

Members of the mitogen-activated protein kinase family regulate a wide range of biological processes. Macia *et al.* have found that although the activity of the yeast mitogen-activated protein kinase (MAPK) Hog1, which helps yeast to survive osmotic stress, increases when yeast is exposed to high salt concentrations, the kinase appeared to be active under basal conditions. In fact, signaling activity in the absence of stress was held in check by a negative feedback loop that required the kinase activity of Hog1. A model of this circuit recapitulated the experimental data and suggested that intrinsic basal signaling poises the system to respond rapidly to even small changes in osmolarity. A similar basal activity was detected for two additional yeast MAPKs, which are involved in the pheromone response, suggesting that high basal signaling may be a common property of MAPK pathways. — NRG\*

*Sci. Signal.* **2**, ra13 (2009).

# Science

## A Wrinkle in Time and Space

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