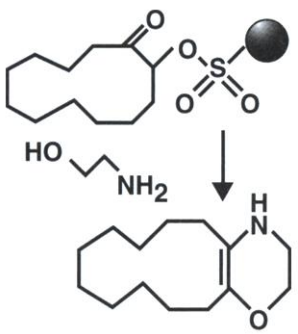
EDITORS' CHOICE

edited by Stella Hurtley

CHEMISTRY

Tag-and-Release Synthesis

The solid-phase supports used in combinatorial chemistry help to keep track of different compounds that have been



synthesized or separated. However, the final cleavage step from the resin or bead has rarely been used to introduce chemical diversity.

Nicolaou *et al.* report that olefin compounds can be derivatized and attached to solid supports through an α-sulfonated ketone "tag," and then released using numerous different chemical reactions to create libraries of new compounds. Several of these reactions yielded heterocyclic compounds, such as those containing diamines and dithiols. — PDS

J. Am. Chem. Soc., in press.

DEVELOPMENT

Bypassing Death

Cells are continually exposed to environmental insults that damage DNA. If this damage escapes detection by DNA repair enzymes it can stall the DNA replication machinery and lead to cell death. To prevent this, cells recruit specialized DNA polymerases that can replicate past the damage. These "lesion bypass" polymerases are often error-prone—they show low accuracy in reading the template DNA and introduce mutations into the newly formed DNA.

Three research groups (Bemark *et al.*, Wittschieben *et al.*, Esposito *et al.*) independently created mice deficient in one of these error-prone polymerases, pol ζ. Absence of the enzyme caused death of the mice in utero due to defects in many different embryonic tissues. This absolute requirement for pol ζ is surprising in light of the large number of lesion bypass polymerases that might be expected to compensate for its loss and because pol ζ is not required for viability in yeast. Thus, pol ζ may perform another yet-to-be-discovered function that is crucial in the early stages of mammalian development. — PAK

Current Biol. **10**, 1213; 1217; 1221 (2000).

GEOLOGY

Shared Plumbing

Most volcanoes occur either in chains along a volcanic arc or in clusters, and each volcano may have several active vents. A major question in geology is how and whether these vents and volcanic centers are connected at depth. The island of Hawaii, Earth's most active volcanic system, is composed of seven volcanoes and the most recent eruptions of each volcano have slightly different compositions, due to the evolution of each center as it ages.

Kauahikaua *et al.* performed detailed gravity measurements on Hawaii and offshore to examine how the volcanic systems are connected beneath the surface. Gravity measurements are useful because dense

minerals accumulate in the dikes and subsurface intrusions that feed the edifices during eruptions; these perturb the Earth's local gravity field. Fine-scale measurements were used to resolve features at depth and to remove the regional effects of the large mass of volcanic rocks that form Hawaii. The data imply that the plumbing systems of at least some of the volcanoes are connected at depths of 10 to 14 km, perhaps along relic cracks or faults in the Pacific Ocean plate. — BH

Geology **28**, 883 (2000).

BIOCHEMISTRY

Coordination Matters

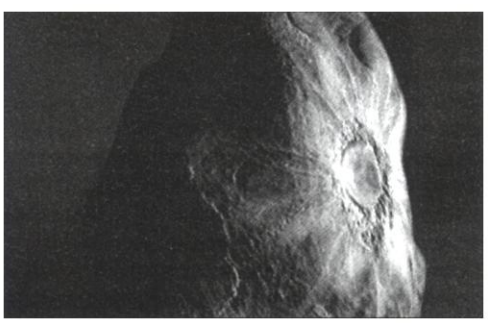
Replication Protein A (RPA) binds to single-stranded DNA (ssDNA) and is involved in DNA replication, recombination, and repair. RPA contains a four–cysteine-type zinc-finger that is not essential for DNA binding. Instead the zinc-finger motif has been implicated in regulation of RPA function. Under oxidizing conditions, or in the presence of chelators of zinc, the DNA binding of RPA is impaired significantly.

Now You *et al.* have found that mutating any single zinc-binding cysteine has little effect upon DNA binding under reducing conditions, but prevents loss of DNA binding under oxidizing conditions. A mutant RPA protein lacking all four cysteines retained high-affinity binding to

CONTINUED ON PAGE 411

PLANETARY SCIENCE

Bright Spot on a Centaur



Centaurs are primitive icy objects that are tens of kilometers in diameter that reside for a few million years in chaotic orbits between Jupiter and Neptune. Centaurs may originate in the Kuiper Belt, which is a zone of icy objects on the edge of the solar system beyond Neptune. They can provide clues to the composition of the original solar nebula, but observing these small distant objects is difficult, and there has been controversy about their size, shape, and composition.

Kern *et al.* now present two long-exposure spectra from two regions of the Centaur 8405 Asbolus from the near-infrared camera and multiobject spectrograph (NICMOS) on the Hubble Space Telescope. They conclude that Asbolus is a spherical object that rotates with a period of about 4 hours (instead of the previously estimated 9 hours) and that has an impact crater on one side. The spectrum for this side shows absorption features that they attribute to an exposed deeper water-ice layer against a darkened weathered surface. The spectrum for the other side is featureless. Asbolus may have been ejected from the Kuiper Belt by a collision that produced the observed crater, and this collision may have increased its rotation rate. The chemical and structural heterogeneity of Asbolus may help explain discrepant observations of other centaurs, some of which were thought to be homogeneous objects. — LR

Astrophys. J. **542**, L155 (2000).

SOURCE: (LEFT) NICOLAOU *ET AL.*, *J. AM. CHEM. SOC.*, IN PRESS; (CENTER) GREG BACON (STSCI/AVL); (RIGHT) J. D. GRIGGS/USGS, HAWAIIAN VOLCANO OVSERVATORY

ssDNA independent of the prevailing redox conditions. Thus it appears that the zinc contributes to ssDNA-binding activity by preventing disulfide bond formation between the four coordinated cysteines. The authors suggest that the role of the zinc-finger is in redox regulation of RPA-ssDNA binding. Oxidation of the Zn(II) thiolate bond would lead to zinc release, resulting in the disulfide-bonded conformation of RPA that binds only weakly to ssDNA. Under reducing conditions, the cysteines would be coordinated by zinc to give the high-affinity ssDNA-binding conformation of RPA. — VV

Biochemistry, in press.

IMMUNOLOGY

Going Around Again

Thymocytes that fail to complete their program of development undergo cell death, either by neglect resulting from a failure to recognize antigen, or by deletion through encounter with an antigen for which they are highly self-reactive.

McGargill *et al.* suggest that some developing thymocytes may use a novel mechanism, akin to the receptor editing already known in B cell development, to avoid deletion. Transgenic mice were created that expressed a peptide antigen within the thymus. When presented with peptide, the reactive thymocytes were no longer susceptible to deletion. Instead, encounter with the antigen led to down-regulation of surface T cell receptor (TCR) and fresh rearrangement of the second TCRα allele. This corresponded with extended expression of the recombinase-activating enzymes responsible for immune receptor gene rearrangement in B and T cells. In this way the door may be left open for small numbers of self-reactive T cells to try out once again for positive selection using a new receptor. — SJS

Nature Immunol. **1**, 336 (2000).

ECOLOGY/EVOLUTION

The More the Merrier

The distribution of species' phenotypes across natural temperature gradients due to changes in altitude and/or latitude may provide clues to their likely response to the effects of global warming. The freshwater shrimp genus *Gammarus* is particularly suitable for such studies, because it has several different species that are distributed abundantly across a wide range of heights in temperate lakes and streams.

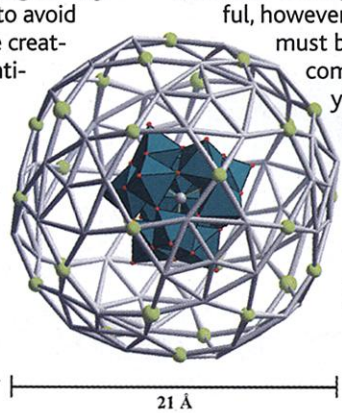
Wilhelm and Schindler studied the variation in reproductive parameters (including egg size, egg number, and embryo development time) of *G. lacustris* in Canadian lakes at altitudes ranging from 700 to 2400m. Their data suggest that global warming would be likely to be accompanied by a shift towards smaller, more numerous eggs, which would in turn lead to more rapid life cycles and increase the population density of these shrimps. — AMS

Funct. Ecol. **14**, 413 (2000).

MATERIALS

A Soupçon of Phosphate

The self-assembly of complex structures from simple molecular units may be useful in the future in the design of molecular electronic or magnetic devices. To be useful, however, the assembly conditions must be simple and the outcome highly controlled, to yield monodisperse, homogeneous products.



Cluster within a cluster—Fe(III) centers highlighted in yellow.

Müller *et al.* have previously made molybdenum oxide–based nanocapsules that can be opened, closed, and linked to each other. Now they have made a cluster-in-a-cluster compound that spontaneously forms crosslinked layers. The synthesis conditions are remarkably simple, and require only an acidic aqueous solution containing polymolybdate, iron (II) chloride, acetic acid, and a small amount of phosphate. A stepwise assembly process then leads directly to the formation of the layer compound. The encapsulated cluster is negatively charged, and is not covalently bound to the outer, oxidized shell, thus representing an electron reservoir. Furthermore, the individual cluster-in-a-cluster units are strongly paramagnetic, due to the presence of 30 Fe(III) centers per unit in the outer shell. — JU

Angew. Chem. Int. Ed. **39**, 3413 (2000).

CREDITS: (TOP) WILHEM & SCHINDLER *FUNCT. ECOL.* **14**, 413 (2000); (BOTTOM) MULLER *ET AL., ANGEW. CHEM. INT. ED.* **39**, 3413 (2000).