EDITORS' CHOICE

edited by Gilbert Chin

ECOLOGY AND EVOLUTION

How Ants Invade

Some plant and animal species become highly invasive when introduced to alien habitats by humans, and much ecological research effort is currently devoted to understanding what confers invasive characteristics on such species. The Argentine ant was introduced to the United States from South America a century ago and has displaced many other species of ant.

Tsutsui *et al.* have pinpointed a key difference between introduced and native populations of the Argentine ant. The former apparently have passed through a genetic bottleneck and have lower genetic variability (half as many alleles at the seven microsatellite loci sampled) than the ancestral Argentinian populations. The reduction in genetic variation reduces, in turn, the amount of intraspecific aggression among the ants, permitting the existence of much larger supercolonies and thus conferring more invasive potential.

The results also may resolve a longstanding puzzle in kin selection theory: individuals display altruism to (related) nestmates and aggression to (unrelated) conspecifics from other nests. The existence of huge single colonies or networks of connected colonies, like those of the Argentine ant, has been a problem for the theory. However, loss of genetic diversity appears to accommodate unicoloniality within the framework of kin selection. — AMS

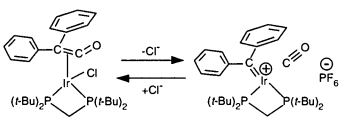
Proc. Natl. Acad. Sci. U.S.A. **97**, 5948 (2000).

CHEMISTRY

Of Ketenes and Carbenes

A number of important synthetic reactions take advantage of the formation of a ketene (which contains a C=C=O group) from a carbene (containing M=C) and a carbonyl (M-CO) that are coordinated to the same metal center. Adding a new ligand augments the electronic sphere of the metal and allows the carbene and carbonyl to combine with each other.

Grotjahn *et al.* now have observed this reaction running in reverse in a complex containing a single iridium atom. The key was finding a ligand that would create an open coordination site next to the ketene,



Ketene to carbene-CO conversion.

in this case, the chelating diphosphine (tert-butyl)$_2$PCH$_2$P(tert-butyl)$_2$. Removal of the chloride ligand through the formation of AgCl yielded the carbene-Ir-carbonyl complex. This reaction could be driven backwards to the ketene by addition of chloride. The synthesis of other analogs of this system should reveal insights into the steric and electronic factors that control this interconversion. — PDS

J. Am. Chem. Soc., in press

GEOPHYSICS

Tabletop Volcanic Eruptions

Violent volcanic eruptions are thought to be triggered, in part, by the rapid expansion of gases (and gas bubbles) in a magma chamber or conduit, but the causes of this process and what leads to a violent eruption versus a less hazardous outpouring of bubble-rich lava are subjects of debate. Because of the high pressures and temperatures at which real magmas exist, most laboratory simulations (and many science fair projects) have used analog systems that foam at conditions close to ambient, and thus there has been concern that the important dynamics of eruptions have not been simulated accurately.

Martel *et al.* have performed a systematic study of which factors contribute to fragmentation of a bubble-rich magma. In their experiments, they hydrated a sample of rhyolite (a Si-rich volcanic rock), raised it to high pressure and temperature where foaming occurred, then rapidly lowered the pressure by puncturing a diaphragm. The degree of decompression was more important in fragmenting the magma than the quantity of bubbles or their shape. These results are consistent with explosive dome-building eruptions, seen for example in Soufriere Hills, Montserrat. — BH

Earth Planet. Sci. Lett. **178**, 47 (2000).

CLIMATOLOGY

A Century of El Niños

How can we assess whether anthropogenic activity has influenced the El Niño–Southern Oscillation (ENSO), an ocean-atmosphere system that influences weather worldwide? A detailed record of changes in the frequency and intensity of ENSO would be helpful, but direct instrumental data extend back only to about 1950, and spatial differences in the expression of the oscillation require documentation over wide geographic areas. In order to construct a history of ENSO long enough to evaluate its decadal variability, proxies such as coral records must be used.

A recorder of the El Niño–Southern Oscillation.

Linsley *et al.* have measured 101 years of stable oxygen and carbon isotope ratios in coral from Clipperton Atoll, in the eastern Pacific Ocean, in order to examine the past behavior of ENSO. Their finding that oscillation was less intense between 1925 and 1940 provides independent confirmation of similar findings in the central and western Pacific and in the southwest Indian Ocean. They also find a long-term trend in the oxygen isotopes that could be due to a combination of surface ocean warming and decreasing salinity. The decadal variability they observe appears to be related, at least in part, to variation in the Pacific Decadal Oscillation and North Pacific sea surface temperatures, which they suggest is due to changes in surface ocean circulation. — HJS

Paleoceanography **15**, 322 (2000).

CHEMISTRY

Chemical Warfare

When a plant is attacked by another organism, such as a fungus or a herbivorous insect, it cannot very well flee; instead it produces noxious chemical compounds. Engelberth *et al.* have studied the responses of the Lima bean plant to peptai-

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SOURCE: (LEFT) NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION; (RIGHT) GROTJAHN *ET AL., J. AM. CHEM. SOC.*, IN PRESS.

bols, which are small peptides emitted by soil fungi. Peptaibols appear to act by forming ion-conducting pores within cell membranes. In response to one peptaibol, alamethicin, a variety of volatile molecules, such as terpenoids and aromatics, were synthesized and released from the plant leaves. Several other plant species behaved similarly when treated with other peptaibols and also displayed a tendril-coiling response. — JU

Angew. Chem. Int. Ed. **39**, 1860 (2000).

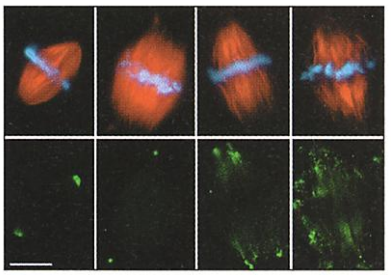
BIOCHEMISTRY

Warm, Hot, and Very Hot

The accumulation of high-resolution three-dimensional structures of proteins offers the opportunity to practice comparative structural genomics. Szilágyi and Závodszky have tackled the question of how protein structure is stabilized as the temperature at which the organism lives increases from something we would be comfortable with to 100°C. After carefully selecting well-determined data sets, they began with a database of 93 structures of 25 proteins, 29 from thermophiles and 64 from mesophiles.

In general, the number of hydrogen bonds and secondary structural elements (α-helices and β-sheets) do not correlate with temperature, while ion pairs (salt bridges) do. By subdividing their thermophilic data into hot (45 to 80°C) and very hot (100°C), they were then able to uncover correlations of fewer cavities in the very hot and of greater polarity of exposed surface in the merely hot. This apparent demarcation also was reflected in the type of ion pairings observed, with an increase only in weaker bonds (as defined by separation distance) in the hot subgroup but increases in strong and weak ion pairs for the very hot. (Approximately 14 more weak salt bridges are expected for a protein in an organism growing at 80°C than for its counterpart in a mesophilic host.) A particularly interesting outcome of the subgrouping into hot and very hot, tempered by the caveat that only five structures comprise the latter, is the possibility that different evolutionary histories of these classes of organisms are responsible for the distinct strategies adopted for protein stabilization. — GJC

Structure **8**, 493 (2000).



Spindle morphology (top) and NuMA localization (bottom).

CELL BIOLOGY

NuMA-tic Motoring

During mitosis, two arrays of microtubules form the bipolar mitotic spindle in order to effect partitioning of the duplicated chromosomes into the daughter cells. The fabrication of the spindle therefore is a key step in successful cell division, and a protein known as NuMA is needed to properly gather the ends of the microtubules at the poles.

Merdes *et al.* have found that, at the onset of mitosis, a complex of the microtubule motor protein dynein and dynactin powers NuMA transport along microtubules to the polar region. Transport and continued localization of NuMA at the pole is required to form and maintain an intact spindle, perhaps through binding of the individual microtubules to a NuMA multimer. Disruption of NuMA transport by addition of the dynactin inhibitor dynamitin, or by addition of anti-dynein antibodies, releases spindle microtubules from the tightly focused poles. — SMH

J. Cell Biol. **149**, 851 (2000).

BIOMEDICINE

Damage Control Team

Patients with the rare inherited diseases ataxia telangiectasia (AT) and Nijmegen breakage syndrome (NBS) present a similar profile of cellular symptoms, including radiation sensitivity and chromosome breakage, which is reflected clinically as an enhanced susceptibility to cancer. Four independent laboratories have converged on the reason for the similarity in cellular phenotype: the defective proteins in the two disorders (ATM, a protein kinase, and NBS1, a DNA repair protein) function in a common pathway for sensing and repairing a specific type of DNA damage. Their results reveal that when double-strand DNA breaks occur, ATM phosphorylates NBS1, and this phosphorylation is required for NBS1 to prevent damaged DNA from being copied. Thus, the integrity of the genome depends on the concerted action of ATM and NBS1, with loss of either protein producing the same devastating consequences. — PAK

Nature **404**, 613 (2000); *Nature* **405**, 473 (2000); *Nature* **405**, 477 (2000); *Nature Genet.* **25**, 115 (2000).

CREDITS: MERDES *ET AL.*, *J. CELL BIOL.* **149**, 851 (2000).