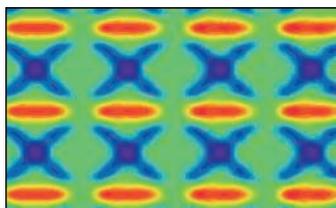


## Nano-Motion Pictures

One goal of ultrafast x-ray structural studies is to image atomic motions in materials in a nondestructive manner.

**Bargheer et al.** (p. 1771; see the Perspective by **Bucksbaum**) imaged coherent atomic motions in a GaAs/AlGaAs superlattice that were induced by exciting electron-hole pairs in the GaAs subband. This excitation process weakens the bonding in the GaAs layers, which causes them to expand and the AlGaAs layers to contract. From their analysis of the small changes they observed in weak reflections, the authors argue that the layers cycle between expansion and contraction every 3.5 picoseconds and launch coherent acoustic standing waves.



## Gas Leak on Mars

Spectra obtained by the Planetary Fourier Spectrometer onboard the Mars Express spacecraft show a detection of methane in the martian atmosphere. **Formisano et al.** (p. 1758, published online 28 October 2004; see the Perspective by **Kargel** and the Special Section on Mars Opportunity beginning on p. 1697) found that the amount of methane detected varies with space and time, and they suggest that there might be some localized sources. The possible sources of this methane are diverse and include microorganisms, hydrothermal activity, cometary impacts, and dissociation of hydrated clathrates.

## Amphibians in Decline

The IUCN Global Amphibian Assessment (GAA), which commenced in 2001, has just been completed, and **Stuart et al.** (p. 1783, published online 14 October 2004) present the key findings. The data set covers 5743 species, and confirms that the current conservation status of amphibians is alarming, with 1856 species (32.5% of the total) being globally threatened, 2468 (43.2%) in decline, 435 (7.6%) in rapid decline, and 129 (2.2%) having disappeared since 1980 (many of which are probably extinct). These numbers indicate a much worse situation than seen so far for any other taxonomic group. Of the rapidly declining species, 50 are subject to overharvesting, and 183 are facing severe habitat loss. A third group of 207 species has declined catastrophically, even in situations where there are no obvious threats.

## Giving a Self-Antigen Its Natural Identity

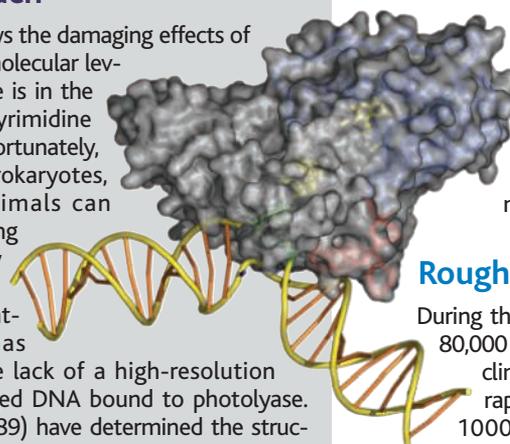
Natural killer (NK) T cells recognize lipids, rather than protein-derived antigens, that are presented by major histocompatibility class 1-like CD1 molecules. Although certain artificial lipids and a handful derived from bacteria have been shown to stimulate NKT cells, the identity of naturally occurring endogenous lipid ligands has been elusive. **Zhou et al.** (p. 1786, published online 11 November 2004; see the Perspective by **Godfrey et al.**) now reveal that a single mammalian lysosomal glycosphingolipid, isoglobotrihexosylceramide, or iGb3, can stimulate large numbers of human and mouse NKT cells, and found that mice lacking a subunit of an enzyme responsible for generating iGb3 have a profound deficiency in NKT cell development in the thymus. This lipid antigen may thus play a role in directing NKT cell development and function and may contribute to a variety of disease states, from infection to cancer.

## A Daily Measure

How can we measure in a rigorous and cost-effective way how people spend their time and how they experience the various activities and settings of their lives? **Kahneman et al.** (p. 1776) propose a technique to help people reconstruct their daily activities and to report on their daily psychological experiences in the process. Using this technique, about 1000 full-time employed women in urban Texas reported on their activities for the previous day and on their feelings related to these activities in a personal interview. Particular life circumstances (such as income and marital status) had a surprisingly small effect on the enjoyment of life.

## A Day at the Beach

Any Sun worshiper knows the damaging effects of ultraviolet rays. At the molecular level, much of this damage is in the form of cyclobutane pyrimidine dimers (CPD) in DNA. Fortunately, DNA photolyases in prokaryotes, plants, and many animals can repair these lesions using blue light as an energy source. Understanding the mechanism of light-driven DNA repair has been hampered by the lack of a high-resolution structure of UV-damaged DNA bound to photolyase. Now **Mees et al.** (p. 1789) have determined the structure of *Anacystis nidulans* photolyase in a complex with duplex DNA containing a CPD-like lesion at 1.8 Å resolution. Apparently synchrotron radiation triggered repair of the CPD so that the structure represents a cryo-trapped cleavage intermediate in which the thymine dimer is flipped into the active site of the photolyase. The structure explains much existing biochemical data and provides a basis for future studies of mechanism.



## Rough Glacial Times

During the last glacial period, roughly 80,000 to 20,000 years ago, Earth's climate changed frequently and rapidly, often within less than 1000 years. **Martrat et al.** (p. 1762) present a 250,000-year-long record of sea surface temperature from the western Mediterranean Sea which shows that such variations were during the previous glacial interval, between 230,000 and 130,000 years ago, as well. Abrupt warming was more common than abrupt cooling, and protracted cold periods were less numerous than extended warmer ones. Rates of warming or cooling were generally 2.5° to 5°C per thousand years, but in some cases, the climate warmed by as much as 10°C per thousand years.

## The Best of Both Worlds

Nearly all animal species use sexual reproduction despite that fact that each individual transmits only half of its genome to any progeny.

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**Pearcy et al.** (p. 1780; see the Perspective by **Gadagkar**) report an unusual system of reproduction in the ant *Cataglyphis cursor*, whereby it circumvents this cost. The queens use alternative modes of reproduction for the production of nonreproductive and reproductive offspring: Only the workers are produced by sexual reproduction, while new queens are almost exclusively produced by parthenogenesis. *C. cursor* has been able to capitalize on the ant caste system to minimize the costs and maximize the benefits associated with sexual reproduction, because queens increase the transmission rate of their genes to their reproductive female offspring while maintaining genetic diversity in the worker force.

## Hydrogen-Bond Sunscreen

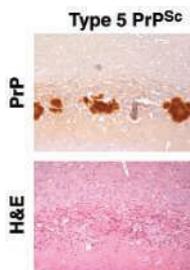
Life on Earth began before enough ozone built up in the atmosphere to screen out intense ultraviolet (UV) solar irradiation. Thus, DNA had to be exceptionally resistant to photo-induced structural damage. Because of the complexity of DNA structure, the origin of its resilience is difficult to probe. **Schultz et al.** (p. 1765) have thus studied gas-phase 2-aminopyridine clusters, which model isolated hydrogen bonded DNA base pairs. Using time-resolved photoionization, they found that the planar H-bonded dimer dissipates UV excitation energy within 65 picoseconds, more than 20 times faster than the monomer or larger clusters. Ab initio calculations implicated an intermediate state, formed by transient charge and proton transfer through the H-bond, to account for the rapid relaxation.

## Rare Attachment

Silicon nitride is a high-performance ceramic whose mechanical properties can be enhanced with the addition of rare earth atoms. However, it is not clear why this enhancement occurs, or why some rare earth species work better than others. Using high-resolution transmission electron microscopy and electron-energy loss spectroscopy, **Ziegler et al.** (p. 1768) show that the atoms are located at the sharp interfaces between the silicon nitride grains and the thin intergranular phase. The silicon nitride grains end in dangling bonds to which the rare earth atoms attach; the attachment position depends on the size of the particular rare earth atom, its electronic configuration, and the presence or absence of oxygen at the interface.

## The Good News, or the Bad News?

Clinical cases of variant Creutzfeldt-Jakob disease (vCJD), the human counterpart of bovine spongiform encephalopathy (BSE, or mad cow disease), has only been found in individuals homozygous for methionine at polymorphic residue 129 of the prion protein. Primary transmission of BSE or vCJD prions to transgenic mice expressing human PrP valine 129 exhibits a substantial transmission barrier, with a low rate of both clinical prion disease and subclinical prion infection. **Wadsworth et al.** (p. 1793, published online 11 November 2004; see the Perspective by **Carrell**) now report that this transmission barrier is not reduced upon second passage in these mice. A valine residue at position 129 of human PrP severely restricts the propagation of both BSE and vCJD prions, and this result suggests that humans of this genotype will be relatively resistant to BSE prion infection. If they do become infected, it will probably be as a result of propagation of a distinct prion strain that results in a disease phenotype distinct from that of vCJD.



## A Little Is Still Too Much

Benzene poses a significant health risk through environmental exposure. **Lan et al.** (p. 1774; see the news story by **Stokstad**) undertook a cross-sectional study of factory workers in China, who were either routinely exposed to benzene, ranging to below 1 part per million (the current permitted occupational standard in the United States), or who worked in benzene-free environments. The benzene-exposed workers showed significant hematopoietic defects, most notably in progenitor cells, although mature cells of the immune system were also affected. The defects were greatest among individuals carrying alleles for a variant of the gene for myeloperoxidase, an enzyme implicated in benzene hematotoxicity. A re-examination of standard occupational levels of benzene exposure in the workplace may thus be required.

# AAAS Travels

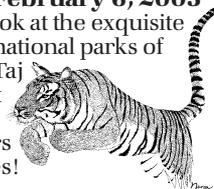
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