



ECOLOGY

Caught in the Net

Coral reefs have turned out to be startlingly vulnerable to environmental events. Relatively small temperature rises make corals shed their essential symbionts in mass bleaching events; a small decrease in ocean pH erodes their apatite skeletons; seaweeds smother them if large fish are harvested to excess; crown-of-thorns starfish happily munch on them; and passing typhoons and hurricanes transform reefs into rubble. And these are only the things we know about!

Shima *et al.* have discovered in field surveys and experiments that a type of gastropod that lives buried and immobile within the coral superstructure is yet another threat to life. Wormsnails, or vermetids, are poorly studied and appear to feed by extruding a mucilaginous net across the substratum, and it seems to be this net that kills the coral through as yet unknown means. The presence of vermetids affects the growth rate of reef-building corals by 56%, causes dead patches, and reduces colony survival by 40%. Not all coral species are affected, indicating that resistance mechanisms may be at work and also that the wormsnails may exert a strong enough selective effect to change the species composition and, ultimately, the shape of a reef. — CA

Biol. Lett. **6**, 10.1098/rsbl.2010.0291 (2010).

IMMUNOLOGY

Less Can Be More

"Elite controllers" are HIV-infected individuals who manage to maintain low levels of viremia without therapy and who rarely progress to AIDS. They disproportionately express certain major histocompatibility complex (MHC) class I alleles, such as *HLA-B57*, which are strongly associated with viral control. HLA molecules present viral fragments (peptides) to CD8⁺ T cells, which can then go on to recognize and kill infected cells; however, how the expression of *HLA-B57* contributes to enhanced viral control is not well understood.

Košmrlj *et al.* are now able to address this question by using computational modeling to demonstrate that the expression of *HLA-B57* affects T cell development in a way that results in elevated frequencies of virus-specific T cells that are more cross-reactive. Compared to non-protective HLA molecules, *HLA-B57* binds to substantially fewer peptides derived from one-self in the thymus. This is important because the spectrum of specificities of the developing T cells is determined by interactions with MHC proteins that bind to self peptides in the thymus. The authors find that when T cells encounter fewer self

peptides in the thymus, T cells that recognize viral peptides on the basis of a small number of important contacts develop with higher frequency. The resulting cells are more cross-reactive, which means that they can also recognize viral peptides containing point mutations, a situation that often arises as HIV attempts to evade immune detection by mutating its proteins. These computational predictions were supported by comparative data from HLA-typed cohorts of controllers versus noncontrollers. Control of infection was associated with HLA molecules binding fewer self peptides. The number of self peptides bound by HLA molecules may mediate a general enhancement in viral surveillance because *HLA-B57* is also associated with control of hepatitis C virus. — KLM

Nature **465**, 350 (2010).

BIOMEDICINE

Inhaled Drugs

Lung cancer is the leading cause of cancer-related deaths for men and for women in the United States, and patient survival rates have not changed appreciably during the past 30 years. Recently, therapies that target specific genetic alterations in lung cancer cells have

offered new hope, but the response to these newer drugs is typically of short duration. Garbuzenko *et al.* have revisited a conventional cytotoxic drug used clinically for lung cancer treatment (doxorubicin) in order to explore whether it would be possible to increase its efficacy (i) by delivering the drug directly to lung tissue, thereby minimizing damage to healthy cells that are exposed to the drug when it is administered intravenously, and (ii) by simultaneously delivering other drugs that make lung cancer cells less able to develop resistance to doxorubicin. To achieve this, the authors generated liposomes that contained doxorubicin plus two antisense oligonucleotides directed against general drug resistance proteins and that—importantly—were in a form that could be introduced via the air passages into the lungs. Inhalation of this drug formulation by mice bearing lung tumors caused an inhibition of tumor growth with minimal adverse side effects, thus demonstrating that this approach might



CREDITS (TOP TO BOTTOM): JEFF SHIMA; THINKSTOCK

enable the delivery of higher doses of doxorubicin directly to lung tumors in humans and hence improve clinical outcomes. — PAK

Proc. Natl. Acad. Sci. U.S.A. **107**, 10.1073/pnas.1004604107 (2010).

NEUROSCIENCE

Detecting Subjective Truth

As a consequence of recent investigations that have used sophisticated methods of analyzing brain activity to propose that objective lie detection may be feasible, it has become apparent that designing a task in which subjects lie whole-heartedly and voluntarily (as opposed to being instructed to do so every fifth answer, for instance) is a nontrivial undertaking. Rissman *et al.* have approached this challenge by adapting a well-established laboratory paradigm—that of face recognition—to conditions that approximate those of quotidian experience. They asked subjects to study 200 faces and then interrogated them 1 hour later, using a mix of new and old test faces. The menu of responses offered a choice of (i) definitely remembered; (ii-iii) high and low confidence that the face was familiar; and (iv-v) high and low confidence that the face was new.

An analysis of brain activity during the response phase revealed distinctive patterns when old (that is, previously studied) faces were rated by the subject as definitely remembered versus strongly familiar, and also when they were rated as being strongly versus weakly familiar. In contrast, for faces rated as being weakly unfamiliar, it was not possible to tell from the neural activity patterns which were actually new and which had been seen during the study phase, and for weakly familiar faces, the new/old distinction was achievable only some of the time. Furthermore, if subjects were instead told to rate attractiveness during the study phase and then asked to categorize faces by gender during the response phase, it was not possible to diagnose which faces were new and which were not. Taken together, these findings suggest that brain activity reflects subjective, rather than objective, face recognition. — GJC

Proc. Natl. Acad. Natl. U.S.A. **107**, 9849 (2010).

ANTHROPOLOGY

A Rainforest's Recovery

The Mayan civilization thrived in Mesoamerica (a region now encompassing Mexico, Honduras, and Guatemala), developing a written language, art, and urban centers. The Mayans also cleared large areas of the rainforest for agriculture. Their civilization waned around 1000 CE; the population collapsed and urban and agricultural

areas were abandoned. Mueller *et al.* document this collapse and the rapid recovery of the rainforest afterward through a sediment and pollen record from Lake Petén Itzá, in the lowlands of Central America. The record shows that the lake received extensive clay and relatively little pollen up to perhaps as late as 1160 CE, indicating that the forest and shores were open. Thus, either the lake still attracted farming and



migrants after the main regional collapse, as the archaeological record suggests, or there was otherwise a brief lag in forest recovery. In any case, the pollen record shows that forest became widespread soon afterward, perhaps as quickly as 80 years after the main collapse. — BH

Geology **38**, 523 (2010).

MATERIALS SCIENCE

Preparing Pores

A challenge in making three-dimensional biomaterials or tissue scaffolds is the inclusion of a connected network of pores and channels to allow for fluid flow, cell migration, and the diffusion of gases, nutrients, and growth factors. Zawko and Schmidt have developed a simple procedure involving the crystallization of a small molecule within a polymeric gel. Once the crystal network has formed, the polymer is solidified via cross-linking and the crystals can be washed away. The authors focused on hyaluronic acid (HA), a biopolymer found in all tissues, and urea for the crystal network. Crystallization of the urea could be initiated at a single point, multiple points, or along a line. At low urea supersaturation a dendritic network formed, whereas for higher concentrations the crystals were more needle-like. When the density of the crystal branches was high, the HA polymerized into a fibrillar microstructure similar to the protein fibers found in extracellular matrix and basement membranes. The authors found that for a given polymer-crystal pair, the crystal template varied with molecular structure, solubility, degree of supersaturation, viscosity, and temperature, so that it should be possible to use this method for a wide range of cross-linkable gel materials. — MSL

Acta Biomater. **6**, 2415 (2010).