



IMMUNOLOGY

Mangabeys, Memory Cells, and SIV

Infection of humans with HIV and rhesus macaques with the simian counterpart, SIV, is eventually fatal if left untreated. Some species of monkeys, however, are able to be infected with SIV and not progress to AIDS, even in the face of high viral loads. These so-called "natural hosts," which include sooty mangabeys and African green monkeys, are of interest to researchers because they may provide insight into the ways in which the immune system can combat HIV. Because high viral loads are seen in the SIV-infected sooty mangabeys, but relatively little depletion of CD4⁺ T cells is seen as compared to SIV-infected rhesus macaques, Paiardini *et al.* sought to determine whether differences in the CD4⁺ T cell subsets might result in the different outcomes of SIV infection in these animals. The authors found that in contrast to rhesus macaques, activated CD4⁺ central memory T cells from sooty mangabeys did not up-regulate the chemokine receptor CCR5, the co-receptor required for SIV infection. These CCR5^{low} central memory CD4⁺ T cells were less susceptible to SIV infection than central memory CD4⁺ T cells from rhesus macaques. These data suggest that the failure to up-regulate CCR5 expression on a subset of T cells particularly important for defending animals against infection may be what allows sooty mangabeys to maintain a chronic SIV infection without succumbing to AIDS. — KLM
Nat. Med. 17, 830 (2011).

PALEONTOLOGY

Up from the Depths

More than 90% of species are thought to have become extinct at the end of the Permian (245 million years ago). It was initially thought that ecosystems took millions of years to recover, and that both diversity and origination rates were suppressed for most groups, but a variety of recent work is beginning to show a more rapid and complex pattern of recovery. Song *et al.* examined marine microfossils after the extinction from seven sections in China, particularly focusing on ocean floor environments. Their data show that recovery of deep ocean environments was delayed only about 1 million years. Interestingly, rapid recovery seems to have begun in offshore areas first, and progressed to shallower and coastal environments, in contrast to the situation seen for open-ocean species. Other studies have shown rapid recovery of some organisms (ammonoids, for example), soon after the extinction, whereas coral reef environments seem to reappear much later after about 5 million years. The authors thus suggest that recovery may reflect intrinsic evolutionary rates in surviving taxa, along with the effects of minor selective extinctions. — BH

Geology 39, 739 (2011).

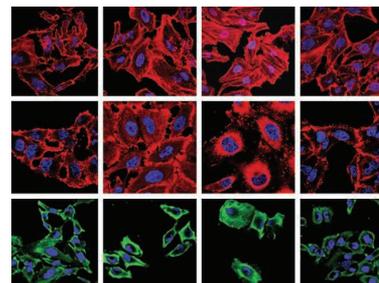
CELL SIGNALING

Akt Acetylation

The protein kinase Akt is activated in response to growth factors and is implicated in diseases such as cancer and cardiac hypertrophy. Inhibition of Akt has been associated with extended life span. Activity of Akt thus requires tight control, as evidenced by the multiple means by which Akt is regulated: phosphorylation, ubiquitination, and binding to phospholipids. Sundaresan *et al.* add another layer of regulation to the mix: reversible acetylation.

Akt was acetylated in mouse cells in a manner inversely related to its activation. The kinase was associated with the histone deacetylase SIRT1, and deacetylation enhanced its ability to be activated. In contrast, activation of Akt in response to a growth factor was inhibited in cells lacking SIRT1. Cells expressing a mutant form of Akt designed to act as though it was always acetylated, formed smaller tumors in a mouse model. Effects on cardiac hypertrophy in mice lacking or overexpressing SIRT1 were associated with altered regulation of Akt. Thus, acetylation of Akt, as regulated by SIRT1, appears to be an important aspect of control of diverse biological activities of the enzyme. — LBR

Sci. Sig. 4, ra46 (2011).



NEUROSCIENCE

All Together Now

Information processing in the brain occurs by the selective recruitment of nerve cells into transient assemblies, whose coordinated patterns of activity underlie different cognitive or behavioral functions. Such assemblies comprise groups of pyramidal neurons that fire together, in determined temporal order. Little is known, however, about how individual

Continued on page 677

Continued from page 675

neurons are bound into such functional groups. Böhner *et al.* combined electrophysiological recordings in brain slices with computer modeling to describe a cellular mechanism that may underlie assembly formation in hippocampal networks. By focusing on complexes involved in memory consolidation, they found that pyramidal cells formed two clearly distinct functional groups with respect to their participation in such complexes. Participating pyramidal cells had peculiar properties: They generated antidromic axonal action potentials that were facilitated by axonal GABA_A receptors. Classical perisomatic GABAergic inhibition, in contrast, suppressed background activity and ensured that nonparticipating neurons were silenced during these periods. These results provide a mechanism of assembly formation in oscillating networks. — PRS

Proc. Natl. Acad. Sci. U.S.A. **108**, 10.1073/pnas.1103546108 (2011).

MATERIALS SCIENCE

The Shape of Things to Come

The Wulff construction uses thermodynamic arguments to predict the equilibrium shape of a crystal based on knowledge of the surface energies of the crystal faces. For single-component systems, the thermodynamic shape proves to be independent of the crystal size unless the crystal is highly strained. For an alloy system, where there is an additional degree of freedom due to the possibility of one of the species segregating to the surface, the size invariance of the thermodynamic shape is lost, and the infinite reservoir approximation used in the Wulff construction no longer holds true. Ringe *et al.* developed a modified Wulff construction for



CREDIT: RINGE ET AL., NANO LETT. 11, 10.1021/NL2018146 (2011)

alloy systems to account for concentration gradients. The behavior of a particular system was shown to depend on the alloy strength, which is determined by the difference between the actual bulk free energy and a linear interpolation of the idealized values. For weak alloys, there is a strong segregation of one of the components, and the thermodynamic shape of the crystal is similar to that determined from a basic Wulff construction. For strong alloys, which include many bimetallic catalysts such as CuAu and AuPd, there is a competition between lowering the surface energy and the bulk energy, with segregation to the surface a significant

factor for the smallest particles. The limited experimental data in the literature confirm the general trends seen by the authors. — MSL

Nano Lett. **11**, 10.1021/nl2018146 (2011).

GENETICS

Better Annotation Needed

In genomic studies, annotation of previously sequenced organisms provides an important starting reference point. These annotated genomes are often used for bioinformatic searches to determine the composition of the environmental microbiota, generated through the analyses of fragmented genomic sequences. Database errors, however, can negatively affect such analyses and/or produce misleading results. Tripp *et al.* analyzed sequencing results from a set of oceanic samples and human microbiome reference bacteria and found that misannotations of ribosomal RNA (rRNA) sequences were prevalent and are propagated, despite corrections. Given that sequences coding for rRNAs are often found in these samples and are used to determine their phylogenetic placement, such widespread errors suggest underlying problems in annotation. Furthermore, these errors can significantly bias analyses and be time-consuming to detect. On the basis of these results, the authors call for increased vigilance on the part of researchers and database curators to properly identify and annotate rRNAs. — LMZ

Nucleic Acids Res. **39**, 10.1093/nar/gkr576 (2011).

MATERIALS SCIENCE

Featured Ferroelectrics

Ferroelectric thin films can exhibit not only directional switching of polarization but also pyroelectric or piezoelectric effects that can be useful in micro- or nanoelectromechanical devices. However, unlike materials such as silicon, which can be readily patterned through techniques developed from chip manufacturing, the various methods for ferroelectric patterning of thin films often have limitations. Kim *et al.* describe a method that allows arbitrary patterning of ferroelectric films on any substrate, so long as it is undamaged by brief exposures to temperatures of 250° to 300°C. Thin films of sol-gel precursors for ferroelectrics such as lead zirconium titanate or lead titanate, on substrates such as silicon, glass, and polyimide tape, were heated for 1 min to these temperatures to remove organic molecules. Actual patterning is achieved with an atomic force microscope tip heated above ~550°C. Feature sizes run tens of nanometers in width and several micrometers in length. — PDS

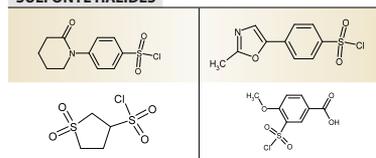
Adv. Mater. **23**, 10.1002/adma.201101991 (2011).

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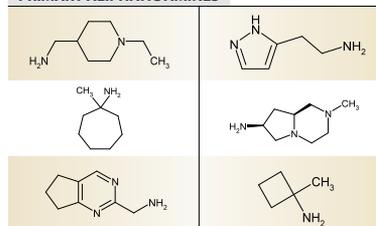
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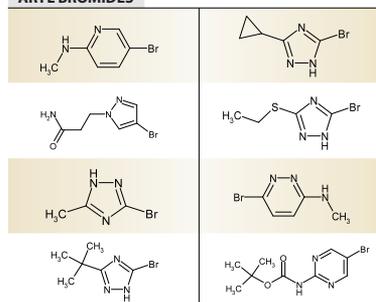
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