EDITORS' CHOICE

edited by Gilbert Chin

MICROBIOLOGY

Signaling Disease

Theileria spp. are intracellular protozoan parasites that cause an economically damaging disease in African cattle, East Coast fever. They reversibly transform leukocytes by interfering with several host cell signaling pathways in the absence of antigen or exogenous growth factors.

Theileria are known to induce activation of the transcription factor NF-κB. This enables the protozoan to block initiation of apoptosis (programmed cell death) that would otherwise be provoked by inappropriate cell proliferation. The activation of NF-κB was thought to be routed via the second messenger phosphoinositide 3-kinase (PI3-K) and the serine-threonine kinase Akt/PKB, but Heussler *et al.* show that although Akt/PKB is indeed activated, it does not appear to be linked to the NF-κB pathway. It seems that PI3-K is activated indirectly via an adhesion molecule on the transformed cells, resulting in the stimulation of Akt/PKB; instead of protecting against apoptosis, Akt/PKB appears to have a more directly aggressive role in stimulating the proliferation of *Theileria*-transformed T cells. — CA

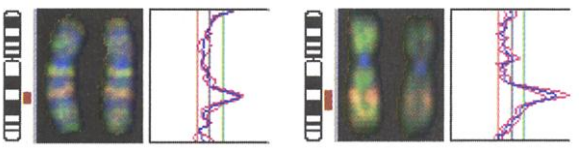
Cell. Microbiol. **3**, 537 (2001).

GENETICS

Potential for Tumor Classification

Assessing normal and aberrant patterns of gene expression, such as occur in tumor cells, presents challenges in compiling and organizing large amounts of data. Lu *et al.* have extended the comparative genomic hybridization (CGH) approach, which detects chromosomal imbalances, in order to survey differences in gene expression across chromosomes in a straightforward and hypothesis-independent manner. In comparative expressed sequence hybridization (CESH), two batches of cDNA probes—one representing RNA from a drug-resistant leukemia cell line (W1L2:R865) and labeled with a red fluorophore, the other representing RNA from the parent drug-sensitive cell line and labeled with a green fluorophore—were applied to the usual metaphase chromosome preparation. The ratio of red to green revealed differential expression of chromosome regions, which then can be investigated further for specific genes with microdissection or microarray analysis. — GJC

Proc. Natl. Acad. Sci. U.S.A. **98**, 9197 (2001).



CESH (left) and CGH (right) detect expression and amplification of genes at 7q22 in the daughter cell line.

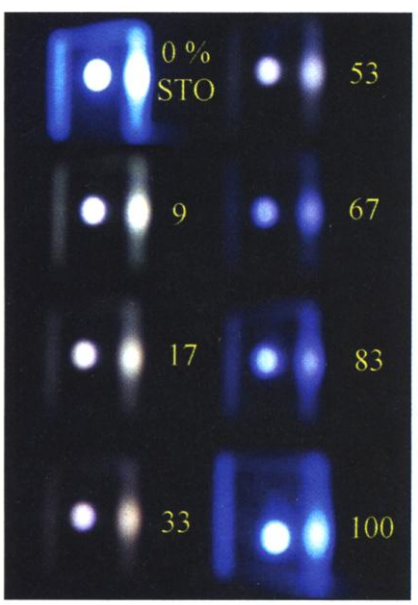
GEOCHEMISTRY

Any Clues Left of the Early Crust?

The Earth's crust and mantle have different chemical compositions. Hence it might be expected that the timing of the extraction of the crust from the mantle of the early Earth would be recorded in the isotopic signatures of radioactive elements and their daughter products in these two reservoirs. This simple notion, however, is complicated by several factors. For example, some of the crust is recycled at subduction zones, and the mantle cannot be considered as a single or simple reservoir.

Albarède suggests that many commonly used isotopic systems, including Sm-Nd, Rb-Sr, Lu-Hf, and several of the U-Pb isotopes, have attained secular equilibrium in the Earth and do not record a memory of the early differentiation of the crust, and also that their systematics require the presence at depth in the mantle of an additional reservoir containing early recycled crust. One Pb isotope with a shorter half-life (^{207}Pb) and ^{4}He, which is largely produced by its decay, however, are not at secular equilibrium and may yet provide information on the early differentiation and recycling of the crust, a possibility addressed by Moriera and Kurz. — BH

Earth Planet. Sci. Lett. **189**, 59; 47 (2001).



Photoluminescence from thin films of blends of STO and TPD.

SOURCE: (TOP) LU *ET AL., PROC. NATL. ACAD. SCI. U.S.A.* **98**, 9197 (2001); (BOTTOM) IMAGE: THOMPSON

APPLIED PHYSICS

How Two Blue Lights Make a White Light

White light can be formed by mixing colors from different parts of the visible spectrum (red, green, and blue), but Thompson *et al.* now show that white photoluminescence can be generated from pairs of organic materials (which individually emit blue light) when excited with an ultraviolet laser. The redshifted emission spectrum was not caused by the formation of new chemical species, as determined by absorbance spectroscopy of thin spin-coated films. Instead, the authors show that a complex is formed from the excited state of one of the molecules [2,5-bis(trimethylsilyl thiophene)-1,1-dioxide or STO] and the ground state of the other [*N*,*N*′-bis(3-methylphenyl)-*N*,*N*′-diphenylbenzidine or TPD]. This "exciplex" lies between the excited and ground states and has an energy gap that is lower than those of the component materials; this broadens the emission to longer wavelengths, which provides the additional colors needed to make white light. The formation of such exciplexes is not limited either to polymer-polymer blends or by material interfaces. Thus, inexpensive, organic, white light–emitting diodes might be obtained by appropriate blending of blue-emitting materials. — MSL

Appl. Phys. Lett. **79**, 560 (2001).

NEUROSCIENCE

Dendritic Control of Rhythmicity

It has been shown that GABAergic interneurons can synchronize the firing behavior of their postsynaptic target cells. However, different types of interneurons innervate different parts of their targets, and earlier studies addressing synchronization either did not examine the loca-

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tion of the inhibitory input or concentrated on perisomatic mechanisms.

Szabadics *et al.* have combined electrophysiological recordings with light and electron microscopy in a painstaking analysis of the interactions between inhibitory interneurons at dendritic contacts. They concentrated on regularly spiking nonpyramidal cells contacting each other through chemical synapses, gap junctions, or a combination of both. Dendritic GABAergic synapses, which were exclusively unidirectional, were effective in timing spikes in postsynaptic cells. This phasing was effective at β (19 hertz) but not at γ frequency (37 hertz). Combined chemical and electrical connections caused β and γ frequency synchronization, but at both frequencies, the postsynaptic action potentials were rhythmically timed with a phase lag. These data indicate the existence of a network of regularly spiking nonpyramidal cells that speak to each other through dendritic synapses and are capable of engaging in coherent activity in functionally relevant frequency ranges. — PRS

J. Neurosci. **21**, 5824 (2001).

OCEANOGRAPHY

Mechanical Problems for Isotope Tracers

Elements with intermediate oceanic residence times—shorter than the time it takes for the oceans to mix but long enough for regional isotopic compositional differences to be affected by the movement of large water masses—are useful tracers of oceanic circulation in the past. The paleoceanographic distributions of lead and neodymium can be reconstructed from the crusts of deep-sea ferromanganese nodules.

von Blanckenburg and Nägler have measured the Pb and Nd isotopic compositions of sea water for the past 7 million years in a suite of such crusts and analyzed their data with a box model. They conclude that the changes in the isotopic composition of North Atlantic Deep Water during the Neogene were caused primarily by changes in erosion related to continental glaciation, rather than by changes in the source of the oceanic inputs or in thermohaline circulation. They support this conclusion with results from leaching experiments designed to simulate the effects of mechanical erosion on continental sources of Pb and Nd, and they suggest that the transition from chemical weathering to mechanical weathering accompanying the growth of large ice sheets could cause important isotopic changes in oceanic tracer compositions. — HJS

Paleoceanography **16**, 424 (2001).

ECOLOGY/EVOLUTION

Contributions Large and Small

The ecology of common species, for obvious reasons, tends to be better known than that of rare species. In a series of experiments in a California grassland ecosystem, Lyons and Schwartz have uncovered an unexpected role for the rarer plant species. The removal of rare species from experimental plots led to greater susceptibility to successful invasion by an exotic ryegrass (*Lolium temulentum*), suggesting that rare species contribute to the resistance of ecological communities to invasion. In the face of increasing threats to natural ecosystems from invasion by exotics, this result adds to the growing realization of the intrinsic conservation benefits of maintaining diversity. — AMS

Ecol. Lett. **4**, 358 (2001).

CHEMISTRY

Ion Balancing Act

Ion-selective electrodes allow for the quick determination of concentration, but at low concentrations, solvent polymeric ion-selective electrodes deviate from linear or Nernstian behavior. Some of these effects can be minimized if an ion buffer is included to prevent primary ion leaching from the internal solution, but minor ion fluxes can still produce nonlinearities. Pergel *et al.* show that the addition of a galvanostatic current control can be used to balance these fluxes and to improve the detection limit for a lead ion-selective electrode to 3×10^{-12} molar while maintaining a Nernstian response. — PDS

Anal. Chem. 10.1021/ac010094a.