EDITORS' CHOICE

edited by Gilbert Chin

APPLIED PHYSICS

Infrared Detection

The detection and characterization of carrier flow is invaluable in microelectronics. For macroscopic circuitry and materials, the response of a material to infrared (IR) radiation is a useful signature of the subsurface carrier conductivity. However, as feature sizes are reduced below the wavelength of the IR light, it can no longer be used as a direct probe.

Knoll and Keilmann show that this resolution limit can be overcome by incorporating the IR probe light into a scanning near-field optical microscope (SNOM), in which the effective resolvable size can be smaller than one one-hundredth of the wavelength of the probe light. Using probe light 9.2 to 10.7 micrometers in wavelength, they demonstrate the ability to image regions of enhanced conductivity only 250 nanometers wide at a resolution of 30 nm. The applicability of this technique across a wide range of tunable wavelengths suggests that it could be extended readily to specific observations on a wealth of nanoscale systems, such as potential modulation along nanotubes and nanowires, Cooper-pair breaking in superconductors, and two-dimensional electron gases. — ISO

Appl. Phys. Lett. **77**, 3980 (2000).

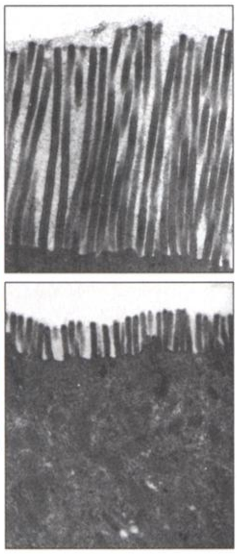
PHYSIOLOGY

Pump First, Pay Later

Pythons feed irregularly, with lengthy periods of fasting punctuated by meals that may constitute an appreciable fraction of the animal's own body mass. It has been suggested that the epithelial cells of the small intestine are primed for the extensive digestive process by an initial investment from energy reserves that supports the conversion of a dormant organ into one capable of nutrient absorption and peristalsis.

Starck and Beese have performed histological and sonographic imaging measurements on Burmese pythons fed at intervals over several years. They found that the mucosal lining of the intestine increased three-fold in thickness within 3 days after meals and that this increase was due to fluid-driven expansion of cells and not to cell proliferation. After digestion, new cells were produced, and these apparently shrank (with much shorter microvilli and numerous infoldings of the plasma membrane) to await the next intake of food. The authors suggest that building and investing in a fully functional intestine whilst energy levels are high enables even a starving python to mobilize its digestive system rapidly whenever the next meal appears. — GJC

J. Exp. Biol. **204**, 325 (2001).



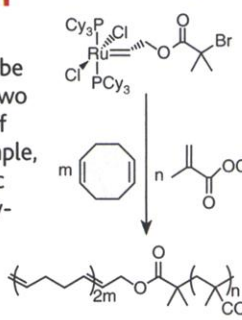
Python molurus bivittatus **(above), and enterocyte microvilli just after (upper right) and before (lower right) a meal.**

SOURCE: (FROM LEFT) MICHAEL HAZUDA; STARCKE AND BEESE, *J. EXP. BIOL.* **204**, 325 (2001); BIELAWSKI *ET AL.*, *J. AM. CHEM. SOC.* **122**, 12872 (2000).

CHEMISTRY

Bipartisan Catalyst

Polymers can be made in which two different kinds of chains (for example, one hydrophobic and the other hydrophilic) are linked together; this can produce effects such as nanophase separation. Usually, the chemistries needed to make different kinds of chains require that the polymerization reactions be performed sequentially. Bielawski *et al.* now report on a ruthenium catalyst that can perform both the ring-opening metathesis polymerization (ROMP) of 1,5-cyclooctadiene and the atom-transfer radical polymerization of methacrylate. They combined a ROMP catalyst and allyl-2-bromo-2-methylpropionate to prepare a catalyst that can perform both polymerizations at once, thus growing the two kinds of chains outward from the middle. — PDS



Polymerizing 1,5-cyclooctadiene to the left and methyl methacrylate to the right.

J. Am. Chem. Soc. **122**, 12872 (2000).

GEOCHEMISTRY

Tracing a Plume

The Hawaiian islands are a chain of basaltic volcanoes within the Pacific Plate and may represent the surface manifestation of a classic hot spot plume. Chemical analyses of the concentrations of trace elements such as noble gases or the platinum group elements in the lavas have suggested that the plume samples the core-mantle boundary. Recent Os isotopic data has been explained by either the addition of Os from the metallic core, implying a core-mantle boundary source, or the addition of Os from recycled oceanic crust, implying a shallow crustal source.

Bennett *et al.* have measured the platinum group elements and Re from different volcanoes and found variations in these elements that are not consistent with either model. They suggest that variable amounts of residual sulfides in the magma reservoir may be producing these variations. — LR

Earth Planet. Sci. Lett. **183**, 513 (2000).

CELL BIOLOGY

B Comes Before A

During mitosis, mammalian cells break down their nucleus in order to separate and allocate the replicated chromosomes. After mitosis, cells must rebuild the nucleus, which includes the construction of the nuclear envelope, a double membrane penetrated by nuclear pores through which macromolecules are transported. One kit of components of intact nuclear envelopes is a set of scaffolding proteins known as the lamins, which line the inside of the nuclear envelope.

Moir *et al.* used green fluorescent protein-tagged lamins to visualize nuclear lamin re-assembly. They observed that lamin B1 binds to the condensed chromosomes as soon as the cell starts to exit mitosis. As lipids are recruited to form the nuclear envelope, lamin B1 spreads out to line the newly formed nucleoplasmic surface of the membrane. Relatively late in the process lamin A

CONTINUED ON PAGE 17

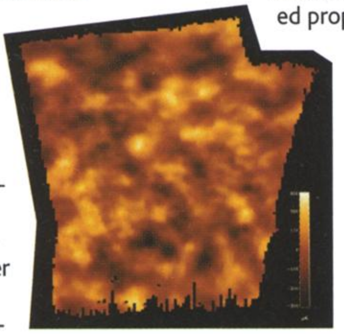
is co-opted into the nuclear lamina, probably serving to strengthen the final underpinning of the envelope. — SMH

J. Cell Biol. **151**, 1155 (2000).

ASTROPHYSICS

Balloon Mapping of a Flat Universe

Spatial fluctuations in the cosmic microwave background (CMB) radiation represent weak temperature anomalies produced right after the Big Bang as large-scale structure started to form in the universe. Measuring the CMB is difficult because the signal is weak and can be contaminated by Earth's atmosphere and other astrophysical foregrounds. Recent studies with the COBE satellite and the BOOMERANG balloon experiment in Antarctica have produced useful maps of the CMB temperature fluctuations.



Anisotropy of the cosmic microwave background.

Now, Hanany *et al.* have generated a map and power spectrum of CMB anisotropy using the MAXIMA-1 Balloon experiment which was launched from Palestine, Texas. The MAXIMA-1 results provide improved sensitivity and a broader range of angular scales than previous observations. A companion paper by Balbi *et al.* discusses the cosmological implications. The MAXIMA-1 CMB map and spectrum indicate a flat universe and strongly constrain the relative level of primordial density fluctuations between different angular scales; these results are consistent with predictions of a period of inflationary growth of the universe shortly after the Big Bang. An inventory of the energy in the universe and amounts of cold dark matter and ordinary matter (baryons) are also derived from these observations and analyzed together with results from recent supernova type I-A measurements. — LR

Astrophys. J. **545**, L5 (2000); *Astrophys. J.* **545**, L1 (2000).

DEVELOPMENT

Achieving Inequality

One of the ways that cellular diversity is generated is through asymmetric cell divisions, which produce two daughter cells of unequal size, protein content, or developmental potential. Prior to division, the cell fate determinants in the mother cell must become polarized and oriented properly with respect to the mitotic spindle.

In studies of the developing *Drosophila* nervous system, several groups report important progress in deciphering these mechanisms. Ohshiro *et al.*, Peng *et al.*, and Petronczki and Knoblich all identify several proteins that play critical roles in the localization of cell fate determinants to either the basal or apical cortex of neuroblasts in the central nervous system. These include the tumor suppressor proteins Lethal giant larvae and Lethal discs large, several myosins, and the DmPAR-6 protein. Meanwhile, work by Roegiers *et al.* illustrates that spindle orientation and determinant localization are also tightly coordinated in the sensory organ progenitor cells of the peripheral nervous system, and Bellaïche *et al.* show that the Frizzled protein is required for this coordination. — PAK

Nature **408**, 593 (2000); *Nature* **408**, 596 (2000); *Nature Cell Biol.* **3**, 43; 58; 50 (2000).

HIGHLIGHTED IN *SCIENCE*'S SIGNAL TRANSDUCTION KNOWLEDGE ENVIRONMENT

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Compartmentalized Destruction

Regulated proteolysis contributes to the proper control of many signal transduction pathways. Lenk and Sommer report that the turnover of the yeast transcriptional repressor Matα2 is controlled through an intrinsic degradation motif known as Deg1. The subcellular distribution and half-life of a Deg1 domain fused to green fluorescent protein in the presence or absence of an exogenous nuclear localization sequence was analyzed in wild-type yeast and in mutants that were defective in nuclear transport. Only those green fluorescent protein constructs that were imported into the nucleus and contained an intact Deg1 motif were degraded rapidly; conversely, adding a nuclear export sequence extended the half-life. The data suggest that there is nuclear-specific activity of components of the ubiquitin-proteasome degradation pathway and that subcellular trafficking of a signaling molecule can influence its susceptibility to destruction. — LBR

J. Biol. Chem. **275**, 39403 (2000).

CREDITS: HANANY *ET AL.*, *ASTROPHYS. J.* **545**, L5 (2000).