EDITORS' CHOICE

edited by Gilbert Chin

BIOTECHNOLOGY

Receptor Slide Show

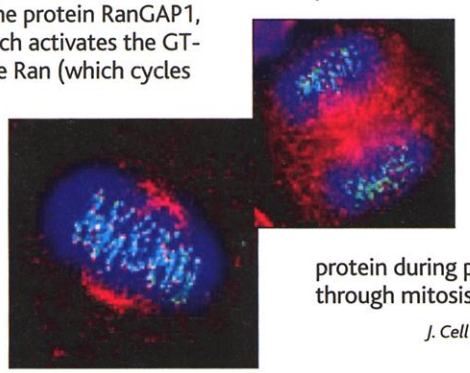
Developing small molecule drugs starts with selection of the target macromolecule, such as a cell surface receptor, and screening of candidate compounds that either block or mimic the effect of the naturally occurring ligand. Fang *et al.* have adapted microprinting techniques to fabricate microarrays of G protein–coupled receptors (one of the largest family of receptors), deposited from vesicular suspensions onto silane-derivatized glass slides. These membrane proteins were displayed in a structurally intact fashion as demonstrated by binding of the β-adrenergic receptor ligand CGP 12177 to both β1 and β2 receptor subtypes and not to the α2A subtype; furthermore, the β2-selective antagonist ICI 118551 preferentially diminished the β2 signal. — GJC

J. Am. Chem. Soc., 10.1021/ja017346+ (2002).

CELL BIOLOGY

Right on Target

SUMO-1 is a recently discovered ubiquitin-like protein modifier that can be linked to various substrates. One of these is the protein RanGAP1, which activates the GTPase Ran (which cycles through GTP- and GDP-bound states) during nuclear transport and cell division. Dasso *et al.* find that sumoylation (addition of SUMO) was critical for the correct localization of RanGAP1 during mitosis. A mutated form of RanGAP1 that could not be sumoylated no longer associated with mitotic spindles. The spindle association of RanGAP1 also appeared to involve an interaction with a nuclear pore protein, RanBP2, that enhances sumoylation, as shown by Pichler *et al.* Thus, sumoylation of RanGAP1 is important for the spatial regulation of this key protein during progression through mitosis. — SMH



RanGAP1 (red) localizes to the spindle in metaphase.

J. Cell Biol. **156**, 595 (2002); *Cell* **108**, 109 (2002).

BIOMEDICINE

Fueling Tumor Growth

Uterine leiomyomata, or "fibroids," are smooth muscle tumors that affect a substantial proportion of the female population. Although benign, uterine fibroids can cause excessive bleeding and impair fertility, and they account for about 40% of the 600,000 hysterectomies performed each year in the United States.

An important clue to the molecular pathogenesis of these tumors is provided by the Multiple Leiomyoma Consortium, who have studied families with a rare inherited disorder in which affected females develop fibroids in the skin and uterus at a young age. The consortium traced the disease-causing mutations to the *FH* gene at chromosome 1q42.3-q43, which encodes the mitochondrial enzyme fumarate hydratase. As part of the tricarboxylic acid (TCA) cycle, fumarate hydratase functions in a fundamental metabolic pathway that provides energy to all cells in the body, and it is the second enzyme (after succinate dehydrogenase) in this pathway that has been classified as a tumor suppressor. Future investigation of the mechanism by which *FH* mutations disrupt cell growth control may provide new leads for the prevention and treatment of the more common forms of uterine fibroids. — PAK

Nature Genet., 10.1038/ng849 (2002).

MICROBIOLOGY

Working Together

Cellular nitrogen is a critical component for microbial growth. Many bacteria can use ammonium ions as a nitrogen source and have developed a sophisticated apparatus to coordinate gene expression and enzyme activities. Previous work has shown that the PII protein (encoded by *glnB*), in addition to its global effects on expression via the *ntr* genes, serves as an enzyme regulator. Unmodified PII stimulates adenylyl transferase (*glnE*) to modify glutamine synthetase (*glnA*), inhibiting its enzymatic activity when ammonium is abundant. In contrast, when glutamine levels decline (signal-

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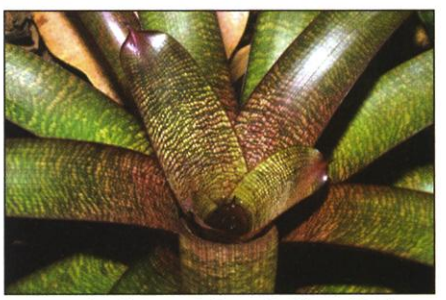
ECOLOGY/EVOLUTION

Brimming Bromeliads

Tropical forest canopies are suspected to harbor a significant proportion of the world's animal species. Epiphytes—plants that grow on the stems and branches of other plants—are a common feature of these forests. In the neotropics, rosette-forming bromeliads impound water in their leaf axils; these natural tanks provide an array of microhabitats for animals, particularly arthropods, in the forest canopy, but their contribution to the overall animal species diversity of tropical forests is still poorly known.

Armbruster *et al.* and Stuntz *et al.* have begun to quantify the role of selected epiphyte species in determining arthropod species diversity and community structure in lowland forests in Ecuador and Panama, respectively. In both studies, the abundance and diversity of animals (mainly arthropods) was related to individual plant parameters such as biomass, leaf number, and tank volume. In the Panamanian forest, arthropod species composition was also dependent on epiphyte species. Given the diversity of bromeliads and other epiphytes, these results point to a central role for these plants in the maintenance of high species richness in the tropics. — AMS



***Guzmania globosa* (above left) and *Vriesea fosteriana* x *gigantea*.**

Oikos **96**, 225 (2002); *J. Trop. Ecol.* **18**, 161 (2002).

CREDITS: (TOP PHOTOS) KEN MARKS, WWW.BSI.ORG; (BOTTOM) DASSO *ET AL.*, *J. CELL BIOL.* **156**, 595 (2002)

ing nitrogen deprivation), PII itself is subject to uridylylation [by uridylyltransferase (*glnD*)] and induces a deadenylylation and reactivation of the synthetase.

Coutts *et al.* have expanded this network by showing that another member of the PII family, GlnK, is also subject to uridylylation. Unmodified GlnK binds to and inhibits the high-affinity ammonium transporter AmtB; when uridylylated (under low nitrogen conditions), GlnK is released from the membrane. This translocation to the cytoplasmic compartment has two consequences: (i) AmtB becomes an active scavenger of environmental ammonium, and (ii) GlnK relieves the inhibition of NifA (the transcriptional activator of the nitrogen fixation or *nif* genes) by NifL, likely through a direct interaction as suggested by Little *et al.* and Rudnick *et al.* — GJC

EMBO J. **21**, 536 (2002); *J. Biol. Chem.*, 10.1071/jbc.M112262200 (2002); *J. Bacteriol.* **184**, 812 (2002).

CLIMATE SCIENCE

A Record of Holocene N_2O

Carbon dioxide, methane, and nitrous oxide are the three most radiatively important trace greenhouse gases, and their atmospheric concentrations contain important clues to biogeochemistry. Furthermore, knowing how their abundances have varied during preindustrial times is essential for understanding their modern behavior. Detailed records of CO_2 and CH_4 across the Holocene (the 11,000 years of relatively warm climate that have followed the last deglaciation) have been extracted from polar ice, but a similarly resolved chronicle of N_2O has not been available.

Flückiger *et al.* present such a record, using ice from the European Project for Ice Coring in Antarctica Dome C core, in conjunction with parallel determinations of CO_2 and CH_4 from the same samples. They find that a minimum in the abundance of preanthropogenic N_2O occurred about 8000 years ago, approximately coincident with the minimum for CO_2. On the other hand, the long-term N_2O variability during the Holocene was only half as great as the change during the period of deglaciation and less than a quarter as large as the recent anthropogenic increase. These results provide a framework for further studies, including isotopic measurements and better models of the nitrogen cycle in the terrestrial biosphere and the oceans (the predominant sources), that will help determine the causes of the observed variations in the concentration of atmospheric N_2O (the primary sink). — HJS

Global Biogeochem. Cycles, 10.1029/2001GB001417 (2002).

CHEMISTRY

Still Twisted After All These Years

A long-standing puzzle in photochemistry has been the nature of the fluorescence from *p*-dimethylaminobenzonitrile and numerous related compounds in polar solvents. In 1962, Lippert reported two emission peaks for this compound: the expected vertically excited state and an anomalous red-shifted feature. In Grabowski's twisted internal charge transfer model, the red-shifted peak originates from a charge-transfer state in which the amino group twists to stabilize a positive charge. Direct verification for this structural change has been elusive. Dobkowski *et al.* have prepared a less symmetric analog that shows syn-anti isomerization and anomalous emission when photoexcited at low temperatures (–90°C) in methanol, but no isomerization and only normal emission when the experiment was repeated in nonpolar tetrahydrofuran. The structural assignments were made by nuclear magnetic resonance. — PDS

J. Am. Chem. Soc., 10.1021/ja012326t (2002).

CHEMISTRY

Magnetic Minerals Made from Scratch

The jarosite minerals exhibit unusual spin-frustrated antiferromagnetic behavior; this arises from Fe^{3+} and Cr^{3+} ions that reside in octahedral oxygen-coordinated sites that are connected in sheets. Difficulties in synthesizing these minerals in a pure form have stymied attempts to resolve questions concerning their magnetic properties.

Using a redox step to improve kinetic control, Grohol and Nocera present a general approach to hydrothermal synthesis of the jarosites and have prepared a vanadium derivative. Papoutsakis *et al.* examined the structural basis for the magnetic properties of these minerals and show that, although the Fe and Cr compounds use their d orbitals to form σ bonds to the O atoms, in the V mineral the d orbitals form π bonds that lead to a ferromagnetic material. — PDS

Single crystals of $KV_3(OH)_6(SO_4)_2$.

CREDIT: GROHOL & NOCERA, *J. AM. CHEM. SOC.*, 10.1021/JA016832U

J Am. Chem. Soc., 10.1021/ja016832u; 10.1021/ja016833m (2002).