EDITORS' CHOICE

edited by Gilbert Chin

SYSTEMATICS

Here Now, Gone Later

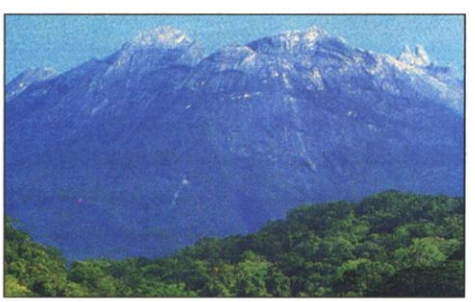
Discussions about the disparity between current and past rates of species extinction and the varying estimates of the number of extant species (from 3 million to 30 million) have rarely touched on the issue of how often named species are found to be invalid (or synonymous with those already described). Using a database of 4861 North American fossil mammal species, Alroy analyzes this issue with a flux-ratio model that incorporates the movement of species from recognized to unrecognized taxa (invalidation) and the backward flux (revalidation). This model is used to assess two centuries of taxonomic effort covering approximately 65 million years of evolutionary time. He finds that about 27% of currently acknowledged mammalian species will become invalid, translating into an overestimate of about 38% in biodiversity, which may also be applicable to more abundant groups such as insects and fungi. Nevertheless, taxonomic reclassification is insufficient to alter values of modern-day extinction rates. — GJC

Proc. Natl. Acad. Sci. U.S.A. **99**, 3706 (2002).

ECOLOGY

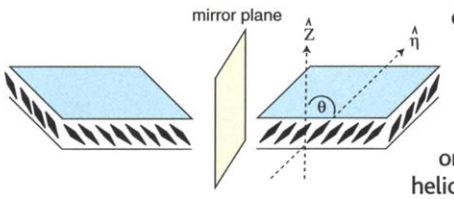
Forest Productivity

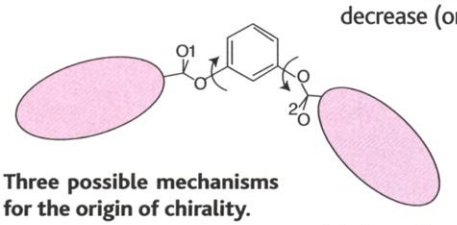
The stature of forests on tropical mountains typically decreases with increasing altitude. Determining the interplay of ecological factors (temperature, precipitation, cloud cover, and soil nutrient availability) that cause this pattern has proved a long and complex quest. When natural circumstances control one of these variables, the task becomes more tractable. Kitayama and Aiba compared the annual net primary productivity (ANPP) and other properties of two altitudinal sequences of forest from 700 to 3100 meters on Mount Kinabalu, Borneo, growing on two substrates differing in nutrient status: sedimentary and ultrabasic rock. Litter decomposition rates and ANPP were greater on the sedimentary substrates throughout the sequence, consistent with the idea that low fertility limits these processes on ultrabasic soils. The decline of ANPP with altitude was similar on both substrates, but that of aboveground biomass was steeper on the ultrabasic soils, despite the ability of the latter to compensate by improved efficiency in nutrient use. — AMS



South face of Mount Kinabalu with lower mountane forest (1600m).

J. Ecol. **90**, 37 (2002).



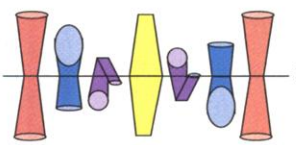


Three possible mechanisms for the origin of chirality.

CHEMISTRY

Side Arms Change Pitch

When a nematic liquid crystal is made up of chiral (or handed) molecules, the molecules themselves not only orient with respect to each other but can also adopt a helical pitch. Adding achiral molecules would be expected to decrease (or dilute) the twisting power of the chiral nematic and to increase the helical pitch. Thisayukta *et al.* examined what happened when banana-shaped molecules, with similar side arms but different central linkers, were added to a linear chiral nematic. Surprisingly, they observed an increase in the twisting power of the chiral nematic and a decrease in the optical pitch. Liquid crystals made of banana-shaped molecules (which lack an asymmetic carbon atom) have been known to form chiral smectic phases. These phases are believed to form as a result of a layering of the molecules, an inherent twisting of the side arms, or a helical twisting of the molecules about the director. In this case, the authors conclude that the chirality does not arise from how the molecules pack but instead is caused by twisting of the side arms. — MSL



J. Am. Chem. Soc., 10.1021/ja0123249.

MICROBIOLOGY

New Host for Old Pathogen

The free-living amoeba *Dictyostelium discoideum* grazes on bacteria. Pukatzki *et al.* have developed a variant system in which, as food for the amoebae, they substitute the opportunistic bacterial pathogen *Pseudomonas aeruginosa*, notorious for colonizing the lungs of cystic fibrosis patients. On bacterial lawns, amoebae can feed on avirulent mutants of *P. aeruginosa*; a mutation in the bacterial *lasR* gene, which encodes a transcriptional activator of quorum-sensing genes (a pathway that produces virulence factors only when the pathogen is present in high numbers), converts the bacteria into fodder for the amoebae. If the mutation is complemented, then virulence is restored, and the amoebae fall prey to the bacteria. Likewise, mutations in the type III secretion system for cytotoxin render the bacteria vulnerable to the amoebae. This system could offer a convenient model for investigating bacterial virulence mechanisms, not least because *D. discoideum* is haploid and genetically tractable and its genome is being sequenced. — CA

Proc. Natl. Acad. Sci. U.S.A. **99**, 3159 (2002).

ASTROPHYSICS

Stellar Signatures

Omega Centauri (ω Cen) is one of the most massive and luminous globular clusters in the Milky Way Galaxy. Clusters are among the earliest structures that formed in the universe, and the evolutionary origin of their stars has been a long-standing puzzle.

Pancino *et al.* examined the relative abundances of Ca, Si, Fe, and Cu in six red giant stars in ω Cen with high-resolution spectra obtained from the ESO Very Large Telescope. They find that three of the red giants belong to the metal-rich branch and are enriched in Cu relative to Fe. This is a signature of ejecta

CONTINUED ON PAGE 2181

from type Ia supernovae (SNe Ia) and suggests that the cluster retained SNe Ia–derived elements and subsequently incorporated them into these metal-rich stars. Furthermore, the relatively young age of the three red giants (about one billion years) implies that enrichment occurred rapidly or that they represent stars from a smaller and younger cluster that merged with the older cluster early in the life of the Milky Way. — LR

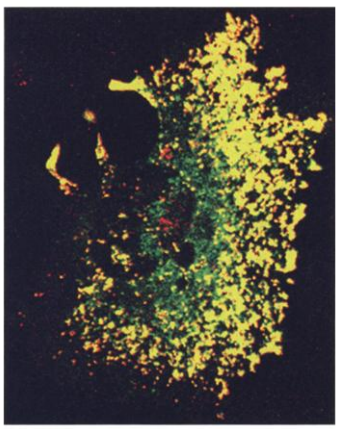
Astrophys. J., in press (astro-ph/0202397).

IMMUNOLOGY

Admirable Self Restraint

Peripheral suppression of autoreactive lymphocytes has been attributed to a subset of specialized regulatory T cells. Under the influence of these T-reg cells, which are defined by coexpression of $CD4^+CD25^+$ and a pattern of cytokine expression, organ-specific autoimmunity is inhibited.

By controlling tumor necrosis factor α (TNFα) expression in pancreatic islet cells, Green *et al.* were able to manipulate the advance of diabetes in a mouse model and to probe the function of T-reg cells. The onset of disease in mice whose TNFα expression was repressed during a critical period 21 to 25 days after birth was delayed in comparison to mice expressing TNFα constitutively. This delay coincided with an increase in $CD4^+$ $CD25^+$ T cells within pancreatic lymph nodes and islets, and adoptive transfer experiments confirmed that these cells were highly efficient in protecting against the development of diabetes. The appearance of these T-reg cells required a signaling pathway containing TNF-related activation-induced cytokine (TRANCE) and receptor activator of NF-κB (RANK). Inhibition of this pathway blocked recruitment of T-reg cells, allowing the differentiation of autodestructive $CD8^+$ cytotoxic T cells within the pancreas. — SJS



Colocalization of Rab27a (red) and melanophilin (green) on melanosomes in the periphery.

Immunity **16**, 183 (2002).

APPLIED PHYSICS

Nanofiber Tightrope

Probing the electronic and electromechanical properties of nanowires and nanofibers often requires delicate manipulation and advanced lithographic and deposition processes. In addition, because of chemical instabilities or limiting factors of fiber deposition, such processes are not always compatible with the materials of interest. Kim *et al.* demonstrate a general technique for the formation of suspended nanofibers. They mark out the top of a substrate with locator points and then deposit a photosensitive polymer that is used as a sacrificial layer. The nanofiber is placed on this polymer layer, its position is noted, and a further polymer layer is deposited that fully encapsulates the nanofiber. Local regions surrounding the nanofiber can be removed at points along its length by usual lithographic processes, and then those holes are filled in with metal. Finally, the remaining polymer is washed away, leaving the nanofiber suspended between the two metallic pillars. — ISO

Appl. Phys. Lett. **80**, 1815 (2002).

CELL BIOLOGY

Happy Motoring

Melanocytes are cells that control coat and skin color in most animals. Within melanocytes, melanosomes (the pigment-producing organelles) undergo startling rearrangements in response to external cues or due to mutations in transport and targeting machineries.

Melanosomes are clustered together near the center of the cell, but they can be rapidly distributed to the ends of dendritic processes; redistribution involves long-range transport from the center along microtubules and, in the periphery, short-range capture and transport promoted by the molecular motor myosin-Va.

In two studies, Wu *et al.* examine the molecular basis of peripheral motor-melanosome interaction. On the membrane of the melanosome, a receptor for the myosin-Va motor is formed by the GTP-dependent association of Rab27a (a small GTPase) and melanophilin. These proteins recruit a version of myosin-Va that contains a melanocyte-specific splicing variant encoded by exon F (in the myosin tail region). Similar strategies for specifying motor-vesicle interactions are likely to be found in other vesicle-targeting events. — SMH

Nature Cell Biol. 10.1038/ncb760; *Mol. Biol. Cell* 10.1091/mbc.01-12-0595.

CREDITS: WU *ET AL.*