**Microbiology**

*Breaking Away*

The streptomycetes group of soil bacteria is familiar as the source of medically important antibiotics, such as streptomycin and other small macrocyclic molecules collectively known as polyketides for their mode of biosynthesis. During the life cycle of *S. coelicolor*, multinauclear aerial structures called hyphae extend from the substratum into the air; subsequently, each nucleus is walled off to form a spore. In order to push the hyphae through the air/water interface, the bacterium secretes SapB, a spore-associated peptide that acts as a surfactant and reduces surface tension.

Kodani *et al.* connect bacterial morphogenesis to antibiotic biosynthesis by showing that SapB is encoded by the *ramS* gene and that its structure is akin to those of antimicrobial oligopeptides known as lantibiotics, named for the posttranslational processing that generates intramolecular thioether (lanthionine) crosslinks. These posttranslational modifications are effected in part by the protein encoded by an-ramC. — GJC


**Climate Science**

*An Ice-Free Arctic?*

Coupled atmosphere-ice-ocean climate models predict that greenhouse global warming in the Arctic should be greater than the global mean. Two questions spring to mind. First, how much of the changing atmosphere-ice-ocean conditions in the Arctic is a consequence of natural climate processes, and how much is due to external factors such as anthropogenic greenhouse gas forcing? Second, what fraction of the Arctic sea-ice cover will disappear in this century due to anthropogenic factors?

Johannessen *et al.* have compiled observational data of surface air temperature and sea ice for the quarter century between 1978 and 2003, and compared them with the output of the ECHAM4 and HadCM3 models. They conclude that warming in the early 20th century was due to natural internal climate system variability but that a substantial part of the recent changes is a response to anthropogenic forcing. The area of Arctic sea ice has decreased by 7.4% or 8 x 10^6 km^2 in the past 25 years, with the minimum summer ice coverage occurring in September 2002. Their simulations predict that the Arctic will be almost free of sea ice during the summers toward the end of the this century (for another climate prediction for the late 21st century, see Meehl and Tebaldi, this issue, p. 994). — HJS


**Material Science**

*Tougher and Stiffer*

Composites are typically designed so that the addition of a small amount of secondary material, in the form of particles or fibers, enhances specific properties of the primary matrix material. However, when the size of the added particles approaches the nanometer scale, they can alter the crystal structure or bulk morphology, and hence can stabilize metastable or otherwise inaccessible phases.

Shah *et al.* have examined composites of clay particles (montmorillonite) dispersed into poly(vinylidene fluoride) (PVDF), a commercially important polymer with five known crystalline forms. The α form is most common, but it is the all-trans β form that exhibits the largest piezo- and pyroelectric responses and thus is of the greatest technological interest. Mixing in a surface-modified montmorillonite clay made it energetically favorable for the polymer chains to intercalate between the layers of the clay particles and promoted a transition from ordered α crystallites to disordered, fiber-like β crystallites in the PVDF matrix. In mechanical tests, composites made with this modified clay showed an increase in both toughness and stiffness, whereas in most cases an increase in one property comes at the expense of the other. — MSL

PHYSICS

Laser-Produced Radioactive Isotopes

Tagging pharmaceuticals with short-lived positron-emitting isotopes makes it possible to use the imaging technique positron emission tomography (PET) to follow the fate of these compounds noninvasively; for instance, in measuring neurotransmitter receptor distributions in the brain. Although essential from a biosafety point of view, the short lifetimes of these radioactive isotopes present logistical limitations on the locations of the scanners—requiring them to be in proximity to an isotope-producing nuclear facility or synchrotron—which may not always be where the patients are. Using the powerful VULCAN laser, Ledingham et al. present a proof-of-principle demonstration in which radioactive isotopes of carbon and fluorine are produced in sufficient abundance during the interaction between petawatt laser pulses and a solid target such as gold, aluminum, or mylar foils. As high-power lasers continue to shrink in size, the prospects for radioactive isotopes being produced in-house will improve. — ISO


NEUROSCIENCE

Aggression and Survival

The visible burrow system, comprising an open field, tunnels, and chambers, provides rats with a seminaturalistic environment. Rats housed in such a structure explore the field, sleep in the chambers, and compete for access to food and water via two narrow ramps. These behaviors and, in particular, the associated social interactions result in the establishment of a dominance hierarchy after only 3 days of habitation.

Kozorovitskiy and Gould document the extent of neurogenesis in the dentate gyrus of the hippocampal formation as a function of social position. They find that subordinate and dominant rats generate the same number of new neurons, but that more of these cells survive in the more aggressive individuals. The difference in number does not appear to be due directly to stress (which might be expected to dampen neurogenesis), because corticosterone levels did not differ; it is possible, however, that behavioral history may influence the glucocorticoid sensitivity of neuronal proliferation, as suggested by Mirescu et al. in a related study. — GJC


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Questions and Answers.

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An Ice-Free Arctic?

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