**BIOPHYSICS**

**Airborne communication creates synthetic ecosystem**

Bacterial cells of the same species can communicate with each other to coordinate population control and other activities, a phenomenon known as quorum sensing. Such signaling also occurs between bacterial species, controls collective behavior in eukaryotes such as slime molds, and enables cellular differentiation in multicellular organisms. Wilfried Weber et al. show that cells from one species can communicate across species and kingdoms to establish higher-order ecosystems in which many organisms can coexist. The authors demonstrate these communication systems by engineering “sender” cells that produce volatile compounds, such as aldehydes, that trigger gene expression in the “receiver” cells of another species. The system is nicknamed “AT&T,” for “airborne transmission of transcription.” In one example, Saccharomyces cerevisiae metabolizes glucose to produce ethanol and actealdehyde, which diffuses to a nearby well containing mammalian HEK cells that have been engineered to express β-lactamase under control of an acetaldehyde-inducible promoter. The β-lactamase degrades ampicillin in the growth medium, which allows Escherichia coli to proliferate, consume nutrients, and suppress HEK growth. The authors propose that this type of communication forms the foundation of such fundamental relations in nature as symbiosis, parasitism, and predator–prey interaction. — K.M.

“Synthetic ecosystems based on airborne inter- and intrakingdom communication” by Wilfried Weber, Marie Daoud-El Baba, and Martin Fussenegger (see pages 10435–10440)

**ECOLOGY**

**Aphid saliva thwarts calcium-based plant defense**

Aphids feed by using piercing mouthparts to puncture a plant’s sieve tube. They siphon off phloem sap, which transports carbohydrates and other nutrients from the leaves to the fruits and roots. Normally, the plant’s defenses would respond with a clot at the puncture point. Torsten Will et al. show that the aphid thwarts this response with its saliva. Using electrical recordings, the authors found that aphids change their feeding behavior when the plant’s sieve tube is blocked: they secrete large quantities of watery saliva. The authors hypothesized that proteins in the saliva might act to disperse protein bodies called forisomes, which are essential for plugging punctures in plants. Upon binding calcium, forisomes change conformation from dense spin-dles to spherical dispersions that occupy much larger volume. One possibility was that saliva proteins might chelate calcium in the manner of ethylene diamine tetraacetic acid (EDTA). The authors collected aphid saliva and concentrated the proteins by centrifugation. The aphid saliva induced forisome dispersion in vitro in a manner similar to EDTA. Radiolabeling and staining with ruthenium red, which interacts with calcium-binding proteins, revealed that several components of aphid saliva bind calcium. The authors suggest that the aphid’s saliva is a key evolutionary adaptation. — K.M.

“Molecular sabotage of plant defense by aphid saliva” by Torsten Will, W. Fred Tjallingii, Alexandra Thönnessen, and Aart J. E. van Bel (see pages 10536–10541)
Bone loss reversed by bone-building therapy

Several osteoporosis therapies help protect against bone loss, but few can help rebuild bone already lost. Leonard Buckbinder et al. report a strategy for building bone by inhibiting an enzyme called PYK2 (proline-rich tyrosine kinase 2). PYK2, expressed in both bone-building osteoblasts and bone-resorbing osteoclasts, stimulates the maturation of osteoclasts and enhances bone degradation in vitro. However, the in vivo effects of PYK2 deficiency, which theoretically should enhance bone growth, are unclear. Mice lacking PYK2 showed increased bone mass due to an increase in bone formation. Contrary to studies suggesting that PYK2 is vital to osteoclast function, the authors found no essential role of PYK2 on osteoclast activity or bone resorption. However, PYK2 inhibition enhanced differentiation and activity of both human and mouse osteoprogenitor cells, suggesting an anabolic role for PYK2 inhibitors. Additionally, daily administration of a PYK2 inhibitor to ovariectomized rats, a model of postmenopausal osteoporosis, prevented bone loss and increased bone formation. With additional study, PYK2 inhibitors could offer an attractive alternative for treating bone loss, a major unmet medical need in the aging population. — M.M.

Antibodies suppress colorectal tumors in mice

Vascular endothelial growth factor A (VEGF-A) is a key signaling molecule in establishing the blood capillary network necessary for tumor growth. Previous studies have shown that patients treated with antibodies against VEGF-A, in concert with chemotherapy, are more likely to survive metastatic colorectal cancer or lung cancer than untreated patients. Experiments on a mouse model of colon cancer now suggest that antibody therapy may prevent polyps from becoming malignant. Nina Korsisaari et al. injected monoclonal VEGF-A antibodies into the Apc^{+/min} line of mice, which are susceptible to developing intestinal adenomas. The mice typically develop 60–150 polyps and, although the tumors are nominally benign, die from complications such as anemia after 5 months. Mice treated over the short term with antibodies developed the same number of polyps as untreated mice. However, the polyps were smaller and vasculature was greatly reduced. In a 52-week experiment, the authors observed that the median survival time increased from 24 weeks to 33, a substantial improvement. In longer-living mice, some kidney damage was apparent. The authors caution that a full exploration of possible side effects is necessary, but suggest that similar antibody therapy may provide an avenue for treatment of colorectal cancer independent of chemotherapy. — K.M.