edited by Gilbert Chin

CLIMATE SCIENCE

Eddies and the Seesaw

A series of warm episodes, each lasting several thousand years, occurred in Antarctica between 90,000 and 30,000 years ago. These events correlated with rapid climate oscillations in the Arctic, with Antarctica warming while the Arctic was cooling or already cold. This bipolar seesaw is thought to have been driven by changes in the strength of the deep overturning circulation in the North Atlantic Ocean, but some have questioned how completely that process can account for the fine details of Antarctic warming events.

Keeling and Visbeck offer an explanation that builds upon earlier suggestions that include the effects of shallow-water processes as well as deep ones. They suggest that changes in the surface salinity gradient across the Antarctic Circumpolar Current were caused by the melting of icebergs discharged from the Arctic, which allowed increased heat transport to Antarctica by ocean eddies. This mechanism produces Antarctic warming of the magnitude observed in ice core records. — HJS

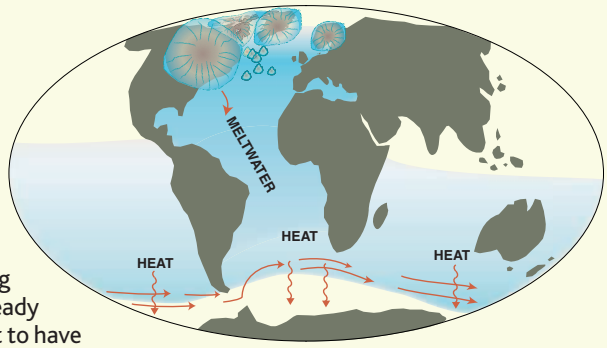


Diagram of the eddy-meltwater explanation.

Quat. Sci. Rev. 10.1016/j/quascirev.2005.04.005 (2005).

CHEMISTRY

Combichem Sensors

The design of fluorescent chemosensors that can be used to detect metal ions often begins by identifying a molecule with an appropriate metal-binding specificity and then derivatizing the compound so that binding initiates a fluorescent signal. However, once the binding scaffold is set, synthetic routes to fluorescent derivatives may be few.

Mello and Finney have approached the problem from the opposite direction by using fluorescence to screen combinatorial libraries. They took advantage of cases where binding of a metal ion restricts torsional motion between aryl groups and hence favors an extended aromatic network. A 2,6-biaryl-4-vinylpyridine core bound to a resin support was functionalized with identical arms that consisted of an amino acid and an acyl end group. Screening an initial library of 198 such compounds with a variety of mono- and divalent cations, they identified a fluorophore that bound Hg^{2+} with an affinity of about 1.8×10^{-6} M^{-1}, which is about an order of magnitude greater than the affinity of K^+ for 18-crown-6 ether. — PDS

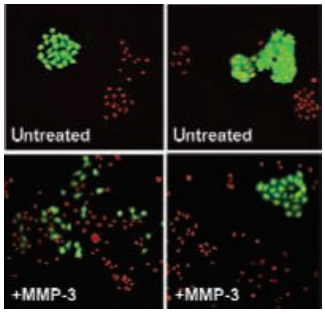
J. Am. Chem. Soc. 10.1021/ja043682p (2005).

BIOMEDICINE

Outside Influences

One of the current concepts in cancer research is that tumor epithelial cells do not grow in isolation, but in the context of a stromal microenvironment that can be permissive or nonpermissive for malignancy. Although this hypothesis was proposed many years ago, only recently have microenvironmental influences on tumorigenesis been explored at the level of specific cell types and signaling molecules.

Two papers focus on the cellular microenvironment in breast cancer. Radisky *et al.* describe a cascade of signaling events triggered in mouse mammary epithelial cells that are exposed to matrix metalloproteinase-3 (MMP-3), a stromal enzyme that is overexpressed in human breast cancer and that has been shown to confer tumorigenic potential to normal epithelial cells. These signaling events culminate in the production of reactive oxygen species (ROS) that damage DNA and cause genomic instability in the epithelial cells. Hu *et al.* investigated whether stromal cells in human breast cancer undergo genomic modifications that might influence stromal cell gene expression during tumorigenesis. An assay of genome-wide methylation revealed that epigenetic changes occur in stromal cells in a tumor stage– and cell type–specific manner, supporting the idea that the dialogue between tumor cells and microenvironment evolves as tumors progress. — PAK



Mitochondrial superoxide dismutase (SOD; right, green cells) blocks the ROS-mediated cell scattering produced by MMP-3, but cytoplasmic SOD does not (left).

CREDITS: (TOP) KEELING AND VISBECK, *QUAT. SCI. REV.* 10.1016/J/QUASCIREV.2005.04.005 (2005); (BOTTOM) RADISKY *ET AL.*, *NATURE* **436**, 123 (2005)

Nature **436**, 123 (2005); *Nat. Genet.* 10.1038/ng1596 (2005).

MICROBIOLOGY

What's in a Name?

The human pathogen *Staphylococcus aureus* exhibits a golden hue, which comes from a carotenoid that is made by joining two molecules of farnesyl pyrophosphate, a reaction that is catalyzed by dehydrosqualene synthase (encoded by the gene *crt*M). Liu *et al.* have looked closely at this bacterium and find that its pigment is in fact a defensive weapon. Deleting *crt*M changed *S. aureus* color from gold to pale yellow and increased its sensitivity to being killed by reactive oxygen species (ROS). Conversely, adding this gene to another human pathogen, *Streptococcus pyogenes*, enhanced its color as well as its resistance to singlet oxygen. Survival of *crt*M-deleted *S. aureus* when challenged by human neutrophils or by whole blood from mice and humans was much lower than for wild-type bacteria. Protection could be conferred by an inhibitor of NADPH oxidase, which generates ROS; this was consistent with no difference in the survival of mutant and wild-type bacteria when cocultured with blood from a patient with chronic granulomatous disease (CGD; caused by NADPH oxidase deficiency) or from a mouse model of human CGD. Taken together, these results suggest that

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