EDITORS' CHOICE

edited by Gilbert Chin

BIOMEDICINE

Is More p53 Better?

The p53 tumor suppressor protein has been dubbed the guardian of the genome because it prevents the proliferation of cells containing damaged DNA—cells that have the potential to become cancerous. Indeed, defects in p53 itself or in the pathways that activate it occur in the vast majority of human cancers.

To explore whether an extra copy of p53 might boost an organism's ability to defend against cancer, García-Cao *et al.* generated transgenic mice carrying a third copy of wild-type p53, the expression properties of which closely resembled those of the endogenous p53 alleles. These "super p53" mice not only showed enhanced activation of the p53-dependent response to DNA damage, but they developed significantly fewer tumors after exposure to chemical carcinogens. Interestingly, the "super p53" mice had a normal life-span, a finding that contrasts with results of an earlier study that had linked elevated p53 activity in mice to premature aging. Therapeutic up-regulation of p53 expression may help prevent cancer development. — PAK

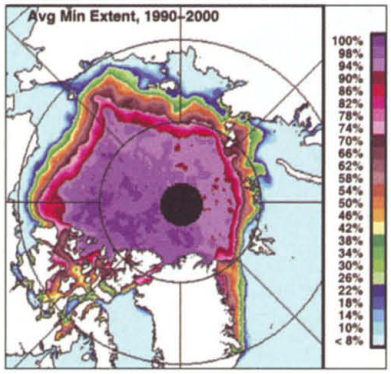
EMBO J., **21**, 6225 (2002).

CHEMISTRY

Artificial Signal Transduction

Extracellular signals can be transmitted to the cell interior when external molecules (ligands) induce the dimerization of membrane-spanning molecules (receptors), triggering a chemical reaction as the intracellular domains are brought together. Barton *et al.* have developed synthetic membrane-spanning transducers by joining two cholesterol groups with a linker; these can be incorporated into liposomes with a transmembrane topology. The sensor unit outside and the signaling unit inside the vesicle both use thiol-disulfide chemistry and are derived from the amino acid cysteine. Oxidation of the external sensor unit dimerizes the membrane-spanning transducers, followed by disulfide formation between the internal signaling units, which liberates a chromophore that can be measured with ultraviolet-visible spectroscopy. The system should be adaptable to other sensor and signaling molecules and may be used for both sensing and controlled release. — JFU

Angew. Chem. Int. Ed. **41**, 3878 (2002).



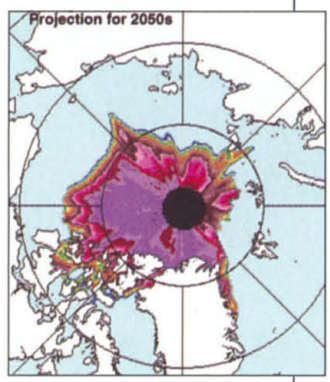
Ice concentration, averaged over the past decade (above) and extrapolated to mid-century (right).

CLIMATE SCIENCE

Deicing the Arctic

Arctic sea ice is an important influence on regional albedo and on ocean temperature, chemistry, biology, and circulation. Much of this ice is perennial, with an average thickness of 3 to 4 meters, and survives the summer melt because convection in the strongly stratified Arctic Ocean is weak. Global warming, including changes in sea surface temperature, is thought to be a threat to the continued presence of this ice.

Comiso presents a map of Arctic sea ice, using satellite microwave data from 1978 through 2000. The area covered perennially by sea ice has declined at a rate of 9% per decade during this period and, at this rate, will disappear altogether later this century, with drastic consequences for the Arctic climate system. Surface ice temperatures in the Arctic are negatively correlated with perennial ice area and are increasing at the rate of 1.2 K per decade, which implies longer melt periods and potentially greater rates of ice loss in the future. — HJS



Geophys. Res. Lett. **29**, 1956 (2002).

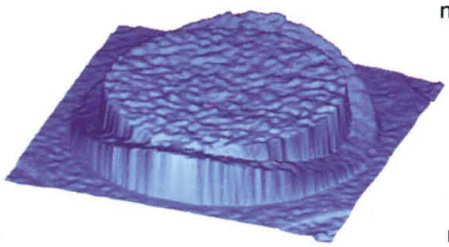
MICROBIOLOGY

A Wake-Up Call

Intercellular signaling among bacteria is well documented, but autocrine signalling is less well known. In a pair of papers, Mukamolova *et al.* describe a protein called resuscitation-promoting factor (Rpf) that is secreted by Gram-positive bacteria. Rpf awakens dormant *Micrococcus luteus* cells, which have become nonculturable after reaching stationary phase. Not merely a rescuer, Rpf also acts like a cytokine to maintain the growth of actively replicating cells; if Rpf is washed away, bacterial growth halts. Several bacterial species, including the pathogen *Mycobacterium tuberculosis*, encode *rpf*-like genes. Of particular note is the fact that *M. tuberculosis* is known to persist in a latent state in individuals, with disease reappearing if the host becomes immunocompromised. If latency involves regulation via Rpf, this protein and its as yet unidentified receptor could be attractive drug or vaccine targets. — CA

Molec. Microbiol. **46**, 611; 623 (2002).

Light-propelled motion of a mirror (inner cylinder) and gimbal (concentric ring).



APPLIED PHYSICS

The Lightest of Touches

Microelectrical-mechanical systems (MEMs) are now seeing a broad range of applications from the likes of optical networking to force-sensing devices and resonators. However, many of the devices fabricated to date are activated electrically and therefore require external connection to the device. In remote sensing applications—for example in hostile environments—there is a desire to actuate the structures without the need to make direct contact. Using a MEMs mirror array as an example, with the micromirror located in the center of a gimbal, Graebner *et al.* demonstrate the ability to actuate the mirror using the radiation pressure of a 3-

CONTINUED ON PAGE 1303

CREDITS: (TOP) COMISO, *GEOPHYS. RES. LETT.* **29**, 1956 (2002); (BOTTOM) GRAEBNER *ET AL.*, *APPL. PHYS. LETT.* **81**, 3531 (2002)

CONTINUED FROM 1301

mW beam of light. In addition, the broad frequency range available to an optically actuated device may make the technique useful as a chemical sensor. — ISO

App. Phys. Lett. **81**, 3531 (2002).

ASTROPHYSICS

Observing Starquakes

Soft gamma-ray repeaters (SGRs) are a class of rotating neutron stars. Fewer than a dozen SGRs are known, and they are distinctive because, after years of quiet, they suddenly emit extremely luminous and energetic bursts of soft gamma rays. Ibrahim *et al.* analyzed spectra of SGR 1806-20 collected by the Rossi X-ray Timing Explorer (RXTE) during a series of outbursts in 1996. In the first paper, they discussed the detection of a 5000 eV absorption feature in the spectrum of one precursor, and in the second paper they describe the same absorption feature in other precursors and some of the smaller bursts.

The clear detection of this narrow absorption feature in several spectra and the amount of energy emitted are consistent with proton cyclotron resonances created by a quaking magnetar with a magnetic field strength of 10^{15} Gauss, one of the strongest magnetic fields ever measured. An outburst is caused by a starquake—literally, the breaking open of the neutron star surface induced by the strong magnetic field. The quaking magnetar releases plasma, and this plasma, caught in the very strong magnetic field, is radiated away from the surface and is also reflected back toward the surface of the star. In doing so, the plasma interacts with hydrogen in the atmosphere or magnetosphere and creates the proton cyclotron resonance observed in the spectra. — LR

Astrophys. J. **574**, L51 (2002); *Astrophys. J.*, in press (astro-ph/0210515).

BIOCHEMISTRY

Making Metal Ligands

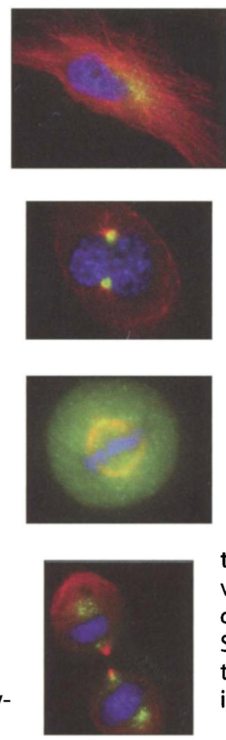
Metalloenzymes use metal atoms to augment their catalytic range and power. Recent structural determinations of enzymes involved in the metabolism of small molecules (such as dinitrogen and molecular hydrogen) have revealed clusters of asymmetrically arranged metal atoms, and some progress has been made in identifying the proteins that sequester and deliver the constituent transition metals (such as Mo and Ni). The Fe atom in bacterial [NiFe]-hydrogenase is coordinated by CO and CN^- ligands, and the genesis of these rather toxic moieties has been mysterious. Paschos *et al.* show that in vitro HypF catalyzes the hydrolysis of carbamoyl phosphate as well as the carbamoyl phosphate–dependent release of pyrophosphate from ATP. They suggest that in vivo HypF catalyzes adenylation at the oxygen of the tautomeric form of the carbamoyl group; subsequent abstraction of the hydrogen atom from the imino nitrogen would yield the cyano group. Rosano *et al.* have determined the structure of the HypF acylphosphatase domain, which may initiate this reaction by removing the phosphate and attaching the carbamoyl group to an amino acid residue in a tautomer-favoring environment. — GJC

J. Biol. Chem. 10.1074/jbc.M204601200 (2002); *J. Mol. Biol.* **321**, 785 (2002).

CELL BIOLOGY

Assembling the Centrosome

The centrosome acts as the focal point in generating the poles of mitotic spindles and as the microtubule organizing center at other stages of the cell cycle. The centrosome is composed of two centrioles and associated pericentriolar material.



Distribution of PCM-1 (green), microtubules (red), and DNA (blue) in interphase, prophase, metaphase, and telophase (top to bottom).

Two studies have focused on the recruitment of specific proteins to the centrosome during the cell cycle. Dammermann and Merdes found that a protein known as PCM-1 (found in the pericentriolar material) was a key component during interphase in the recruitment of other centrosomal proteins, including centrin, pericentrin, and ninein. The activity of PCM-1 seemed to involve the molecular motor dynactin. Quintyne and Schroer found a role for centrosomal dynactin in anchoring microtubules to the interphase centrosome. After S phase, dynein was also recruited to the centrosome, and the correct balance of dynein and dynactin at the centrosome helped to maintain appropriate microtubule organization and cell cycle progression. — SMH

J. Cell Biol. **159**, 255; 245 (2002).

CREDITS: DAMMERMANN & MERDES, *J. CELL BIOL.* **159**, 255 (2002)