**EDITORS’ CHOICE**

**CELL BIOLOGY**

**Bending Bugs**

The familiar laboratory organism *Escherichia coli* displays a rodlike shape, but other bacteria adopt other morphologies, such as spheres or spirals. *Caulobacter crescentus*, as the name implies, favors a crescent shape, and Ausmees *et al.* have characterized a protein, termed “crescentin,” that is structurally similar to eukaryotic intermediate filament proteins. Crescentin preferentially localizes to one side of the growing bacterium where it assembles into a helical structure, which induces curvature of the surface membrane. In the absence of cell division, when the bacteria are maintained in stationary phase, elongated helical forms are produced. Thus, crescentin appears to represent the prokaryotic archetype of the third class of cytoskeletal proteins, joining FtsZ and MreB, which represent thin and thick filaments, respectively. — SMH


**PLANT SCIENCE**

**Less and More**

Is it better to grow efficiently within a limited range of conditions or safely across a broader range? Factors that influence this choice are illustrated by comparing water-conducting tissues (xylem) in plants. Wide and long vessels support low-resistance flow of water, but are susceptible to catastrophic failure provoked by a few untoward bubbles. Narrower, shorter xylem vessels struggle to carry as much water, but are a more robust conduit for facing the vagaries of life. Because transpiration and photosynthesis go hand in hand, the amount of water delivered to the leaves determines the amount of photosynthesis that can be supported.

Kocacin and Sage, examining xylem structure in relation to metabolism and environment, find that some species favor a secure water supply and others favor a maximized water supply that supports more leaf area. An increased leaf canopy is a competitive solution in resource-rich habitats, whereas reliability of water supply is the solution favored for species growing in drought-prone habitats. In either case, *C₄* photosynthetic plants, which use water more efficiently than do *C₃* photosynthetic plants, have the advantage of being able to go further with a given amount of xylem tissue. Thus, the advantages of *C₄* metabolism include not only metabolic efficiency, but also doing more with less in plant infrastructure. — PJH


**BIOMEDICINE**

**The Plus Side of CIN**

Tumor cells often exhibit dramatic karyotypic changes, including gains and losses of chromosomes. This chromosomal instability (CIN) has been proposed to play a role in tumor progression, and the mechanism(s) by which it arises are of great interest.

Studying a series of CIN⁺ colorectal cancer cell lines, Green and Kaplan identified aberrations in the mitotic spindle, the cellular apparatus that ensures proper chromosome segregation during cell division. Notably, the CIN⁺ cells showed inefficient attachment of spindle microtubule plus-ends to the chromosome kinetochores and cell cortex, leading to defects in chromosome alignment during metaphase. Similar defects were observed when a mutant version of the adenomatous polyposis coli

**PLANETARY SCIENCE**

**Protostellar Ping-Pong**

Forming a jovian-sized planet in a protostellar disk is not an easy thing to do. It is difficult to get the gas and dust in a swirling disk around a young star to coalesce into a giant gas planet before the gas and dust are lost to space and the disk dissolves. Core accretion, whereby particle collisions lead to the formation of solid-body cores and core collisions lead to terrestrial-sized planets, assumes that jovian-sized planets form by accumulating a gaseous atmosphere that then contracts around these cores. Gravitational disk instability, in which instabilities in the disk cause fragmentation and the formation of self-gravitating gaseous regions, assumes that jovian-sized planets form from contraction of these gaseous regions.

Rice *et al.* combine hydrodynamic simulations of disk fragmentation with orbital integrations of objects created by disk instability and the predominance of self-gravity to follow the evolution of a disk to a planetary system. After about 12,000 years, 83 objects have formed. Over the course of another 21 million years, 74 of these objects are ejected (19 of which have masses equal to or greater than Jupiter), 7 are removed by encounters with other stars, 1 (the most massive of the 83 objects) remains bound to the central star. These simulations suggest that the most massive planets (5 to 10 times Jupiter’s mass) may preferentially form by disk instabilities and that there may be a lot of free-floating planets in interstellar space that are unaccounted for because they are nearly impossible to detect. — LR

(APC) tumor suppressor protein was introduced into normal cells. These results add to the accumulating evidence (see Reports, 12 September 2003, p.1547) that APC, which was once thought to function in tumorigenesis primarily through its effects on the Wnt signal transduction pathway, may also play a critical role in the positioning and function of the mitotic spindle. — PAK


CHEMISTRY

Attenuating Molecular NDR

Negative differential resistance (NDR), in which current through a device drops with increasing bias voltage, can be seen in resonant tunneling diodes, which are semiconductor devices in which a quantum well is confined by two tunneling barriers. Applying a bias can bring energy levels in a quantum well into and out of resonance with a tunneling electron and thus modulate the current flow. Such devices can be modified by changing the height or width of the tunneling barriers. Wassel et al. report similar modifications in a molecular junction exhibiting NDR—in this case, one formed from a ferrocene-terminated self-assembled monolayer (SAM) on gold probed with gold or platinum-iridium scanning tunneling microscope tips. The barrier between the tip and the molecule was increased in two different ways, either by adsorbing n-alkanethiol SAMs on the tips or by capping the ferrocenyl groups with bulky β-cyclodextrin molecules. In both cases, the NDR peaks were attenuated but not eliminated. — PDS


IMMUNOLOGY

Minding the Matrix

The extracellular matrix (ECM) is a structural complex composed mainly of glycoproteins and proteoglycans, which supports and secures cells in many tissues. Although features inherent to its composition permit some degree of colonization by microorganisms, the mechanisms by which the ECM protects tissues from pathogen invasion remain relatively unexplored. He et al. cloned and characterized mouse mindin, one of a family of widely expressed secreted ECM proteins. In mindin-deficient mice, macrophages responded weakly to various microbial stimuli, including lipopolysaccharide (LPS), producing only low levels of proinflammatory cytokines and hence not inducing septic shock. Mindin deficiency also resulted in impaired bacterial clearance after infection and persistence of associated histopathology, paralleling the poor bacterial agglutination and phagocytosis by macrophages observed in vitro. The broad spectrum of activities displayed by mindin suggests an important role in handling specific bacterial infections within the ECM, most likely via interaction with an as-yet-unidentified macrophage surface receptor. — SJS

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