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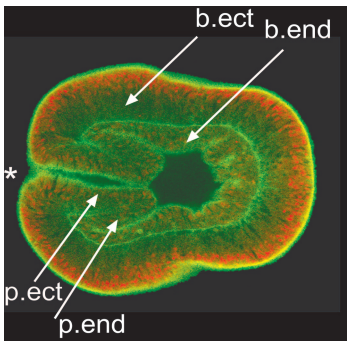
In This Issue

DEVELOPMENTAL BIOLOGY

Bilaterality may have evolved earlier than thought

Cnidarians such as jellyfish, corals, and sea anemones are generally radially symmetric, but morphologists have found some species with apparent bilateral symmetry. David Matus *et al*. report that cnidarians control development and produce anatomical bilaterality with some of the same genes as bilateral organisms (bilaterians), suggesting that bilaterality originated much earlier than previously thought. Matus *et al*. found that the starlet sea anemone, *Nematostella vectensis*, uses six genes that bilaterians use to control dorsoventral polarity, despite having a body that is morphologically simple. Two of these genes, *NvGbx* and *NvChordin*, were expressed in a left–right fashion. *N. vectensis*' nervous system has not been fully characterized, but Matus *et al.* predict that it will initially develop as bilaterally symmetric, even though the anemone appears fairly simple to the naked eye. *N. vectensis* may possess a genetic control system that resembles the 500-million-year-old common ancestor of cnidarians and bilaterians, and the authors suggest that the ancestor of cnidarians originally could have been bilateral and subsequently evolved the more radial patterns seen today. — P.D.



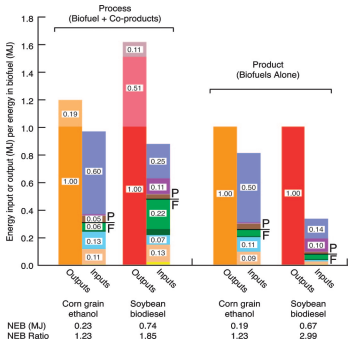
Body plan of anemone *N. vectensis*.

"Molecular evidence for deep evolutionary roots of bilaterality in animal development" by David Q. Matus, Kevin Pang, Heather Marlow, Casey W. Dunn, Gerald H. Thomsen, and Mark Q. Martindale (see pages 11195–11200)

ECOLOGY, SUSTAINABILITY SCIENCE

Advantages of biodiesel over ethanol as a fuel source

Rising fuel costs, fears of a dwindling petroleum supply, and environmental concerns have driven the search for alternative energy sources. In the United States, biofuels derived from staple crops, such as corn ethanol and soybean biodiesel, are attractive options. To examine how viable biodiesel and ethanol can become, Jason Hill *et al.* analyzed the combined economic, environmental, and energetic costs and benefits associated with these biofuels. Although both fuels have a positive net energy balance (NEB), corn ethanol produces only 25% more energy than was invested in its production, whereas soybean biodiesel has an NEB of 93%. Biodiesel also has a significantly lower environmental impact, producing 41% less greenhouse gas emissions compared with fossil fuels, whereas ethanol produces only 14% less emissions. Hill *et al.* suggest that the efficiency of biodiesel, but not ethanol, is high enough to warrant government subsidies, but also note that even if all yearly corn and soybean yields were converted to fuel, they would offset only 11% and 9% of gasoline and diesel demand, respectively. With consumption needs for corn and soybeans also increasing, Hill *et al.* suggest that biofuels produced from low-input, nonagricultural sources such as prairie grasses or waste biomass may provide even larger fuel supplies with greater environmental benefits. — P.D./N.Z.



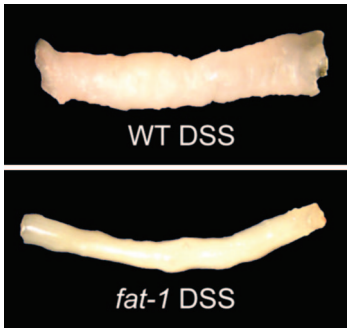
NEB of corn ethanol and soybean biodiesel production.

"Environmental, economic, and energetic costs and benefits of biodiesel and ethanol biofuels" by Jason Hill, Erik Nelson, David Tilman, Stephen Polasky, and Douglas Tiffany (see pages 11206–11210)

MEDICAL SCIENCES

Fatty acids protect against colon inflammation in mice

Omega-3 polyunsaturated fatty acids from dietary sources are thought to provide numerous health benefits, including a lower risk of heart disease and cancer, perhaps through their conversion to antiinflammatory molecules. However, their role in the body's tissues has remained unclear. Christian Hudert *et al.* demonstrate that, in genetically engineered mice, omega-3 fatty acids may protect the colon against inflammation through increased production of antiinflammatory mediators. To investigate this protective effect, the authors created transgenic mice with high tissue levels of omega-3 fatty acids. They found that inflammation and tissue injury in the colon of these mice were much less severe than in their wild-type littermates. The mice also produced increased amounts of antiinflammatory resolvins, molecules derived from omega-3 fatty acids, as well as several mucoprotective proteins. In addition to providing a unique animal model for the study of these lipid mediators, the findings suggest that having high tissue levels of omega-3 fatty acids could protect against inflammatory bowel diseases such as Crohn's disease and ulcerative colitis. — M.M.



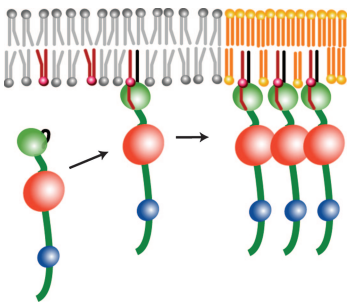
Colon inflammation in experimental mouse, normal (*Upper*) and expressing fatty acids (*Lower*).

"Transgenic mice rich in endogenous omega-3 fatty acids are protected from colitis" by Christian A. Hudert, Karsten H. Weylandt, Yan Lu, Jingdong Wang, Song Hong, Axel Dignass, Charles N. Serhan, and Jing X. Kang (see pages 11276–11281)

MICROBIOLOGY

Targeting HIV protein to plasma membrane

In most HIV-1-infected cells, the viral Gag polyproteins, which are the building blocks of the virus, are directed to lipid rafts in the plasma membrane where virus assembly occurs. However, exactly how Gag finds these membrane sites is unknown. Recent studies indicated that phosphatidylinositol-(4,5)-bisphosphate [$PI(4,5)P_2$], a component of the plasma membrane that recruits specific cellular proteins, also functions in the recruitment of Gag. Using nuclear magnetic resonance, Jamil Saad *et al.* explored the molecular interactions between $PI(4,5)P_2$ and the matrix (MA) protein, a cleavage product of the Gag polyprotein that regulates membrane binding. The authors found that $PI(4,5)P_2$ binds to a conserved cleft on the MA and triggers exposure of a part of the Gag protein that can then anchor the protein to the membrane. The $PI(4,5)P_2$ molecule also functions as an anchor by forming a bridge between the membrane and the protein. The authors suggest that these findings could be particularly valuable for developing drugs that inhibit HIV-1 capsid formation. — B.T.



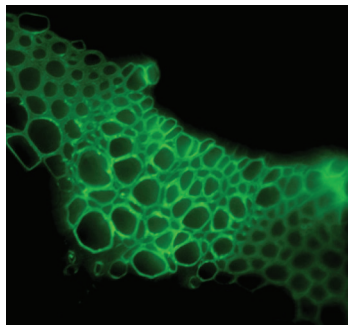
Membrane binding by HIV-1 Gag protein.

"Structural basis for targeting HIV-1 Gag proteins to the plasma membrane for virus assembly" by Jamil S. Saad, Jaime Miller, Janet Tai, Andrew Kim, Ruba H. Ghanam, and Michael F. Summers (see pages 11364–11369)

PLANT BIOLOGY

Using fungal enzymes to study plant cell walls

Plant cell wall polysaccharides are some of the most abundant organic compounds on earth and have become the focus of recent interest in biofuels, such as ethanol synthesis through the processing of the polysaccharide cellulose. Studying the structure of such polysaccharides is difficult because they are large molecules that are frequently branched in irregular ways. However, fungi can naturally degrade the cell wall sugars with a large variety of enzymes that can cut the polysaccharides at specific locations. Stefan Bauer *et al.* have developed a suite of molecular tools for analyzing these plant compounds, thanks to recent progress in sequencing fungus genomes. To adapt fungal enzymes for laboratory use, Bauer *et al.* searched recently completed genomic DNA sequences of three fungi for genes encoding various types of enzymes. The authors expressed 74 fungal genes separately in yeast cells, which secreted the corresponding enzymes in forms that facilitated purification. The recombinant enzymes were used to show that a plant mutant was deficient in xylan, a specific polysaccharide. Bauer *et al.* say that these fungal enzymes provide a powerful tool in analyzing wild-type and mutant plant cell walls, complementing traditional techniques, such as IR-spectroscopy, monosaccharide analysis, and immunolabeling, and they have deposited the enzyme-expressing yeast strains in a public stock center, making them freely available for study. — T.D.



Plant stem section.

"Development and application of a suite of polysaccharide-degrading enzymes for analyzing plant cell walls" by Stefan Bauer, Prasanna Vasu, Staffan Persson, Andrew J. Mort, and Chris R. Somerville (see pages 11417–11422)