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First complete gene sequence of a plant

The Arabidopsis Genome Initiative , an international consortium of researchers from the U.S., Europe, and Japan, has reported the first complete genome of a plant--that of thale cress, *Arabidopsis thaliana*, a weed in the mustard family. The sequencing work is described in four papers in *Nature* [**408,** 796, 816, 820, 823 (2000)], and three analyses of the genome sequence appear in *Science* [**290,** 2105, 2110, 2114 (2000)]. The team began sequencing Arabidopsis in 1996, reported the sequence of chromosomes 2 and 4 last year, and has now completed the plant's other three chromosomes (1, 3, and 5). Arabidopsis genes have counterparts in plants of much greater economic importance, such as wheat, corn, rice, cotton, and soybeans, and some correspond to human genes as well. Potential applications of the findings include the development of plants that grow faster and larger, have better resistance to disease, or are engineered to produce desired chemicals. NSF, which helped fund the effort, has now begun a 2010 Project to determine the function of Arabidopsis genes over the next decade.

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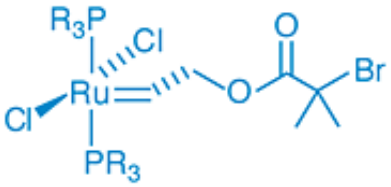
Ruthenium complex is three-in-one catalyst

A ruthenium complex that mediates three mechanistically distinct reactions offers a rapid route to well-defined block copolymers [*J. Am. Chem. Soc.*, **122,**12872 (2000)]. Caltech chemistry profes-sor Robert H. Grubbs and colleagues Christopher W. Bielawski and Janis Louie prepared the complex (shown, R = cyclohexyl) by hitching together a ruthenium dichloride compound, which initiates the ring-opening metathesis polymerization of various cyclic olefins, and allyl 2-bromo-2-methylpropionate, which in conjunction with ruthenium dichlorides initiates the atom-transfer radical polymerization of methyl methacrylate. After confirming that the bifunctional complex mediates both polymerizations independently, the team exploited it for a one-pot copolymerization of methyl methacrylate and cyclooctadiene. In various experiments, the researchers show that the copolymers produced are structurally diblock and the two different types of polymerizations occur simultaneously under appropriate conditions. The third reaction--hydrogenation of the alkene bonds in the copolymer--is induced at the conclusion of the copolymerization by exposing the reaction vessel to a stream of hydrogen, which transforms the ruthenium complex into a known hydrogenation catalyst. Their achievement offers an extremely efficient route to polyethylene-poly(methyl methacrylate) copolymers from cyclooctadiene and methyl methacrylate, the researchers say.



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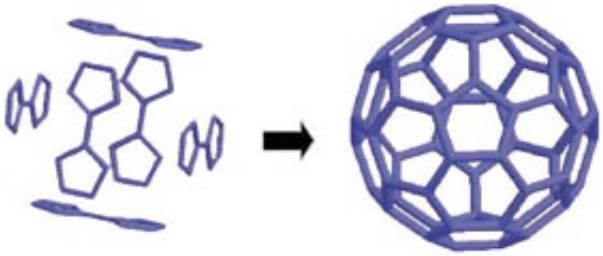
All-nitrogen fullerene?

Scientists have entertained visions of numerous analogs of the famous C_{60} molecule, but perhaps none would be quite so exotic as one made entirely of nitrogen. M. Riad Manaa, a theoretical chemist at Lawrence Livermore National Laboratory, reports results of computational studies that suggest such a super-high-energy molecule of N_{60} could be assembled from six bicyclic N_{10} molecules, as shown here [*Chem. Phys. Lett.*, **331,** 262 (2000)]. Manaa modeled the structure of N_{10} using a variety of computational techniques based on density functional theory and post-Hartree-Fock methods. The results indicate the N_{10} molecule would contain a mixture of single and double bonds and could be relatively stable. Manaa proposes that six N_{10} molecules might be able to form a soccer-ball-shaped molecule of N_{60}. He's now expanding on the work, studying possible routes to N_{10}, noting that a recent synthesis of an N_5^+ ion could be a useful starting point. As for N_{60}, such a high-energy molecule probably would only be metastable, and would likely have to be prepared under extreme conditions, such as high pressure. "It is, however, the rare events that distinguish chemical research," Manaa writes.



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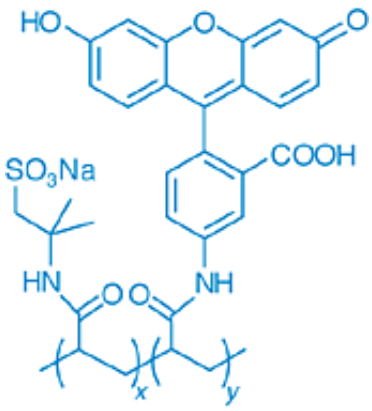
Harvested light amplifies sensor signal

Energy harvested from conjugated polymers can amplify the output of analyte-sensitive fluorophores in chemosensors. Previous sensors using conjugated polymer thin films have relied on quench-ing the fluorescence, so-called turn-off sensors. Turn-on sensors, however, are potential-ly more sensitive. Chemistry professor Timothy M. Swager and coworkers D. Tyler McQuade and Ashleigh H. Hegedus at Massachusetts Institute of Technology describe a turn-on chemosensor with alternating layers of a conjugated phenylene ethynylene polymer and a polyacrylate with the pH-sensitive dye fluoresceinamine attached to it (shown) [*J. Am. Chem. Soc.*, **122,** 12389 (2000)]. Efficient energy transfer occurs as a result of an overlay of the emission spectrum of the conjugated polymer with the absorption spectrum of the dye. In the pH range 6 to 11, the fluorescence emission of the dye increases 10-fold when the sensor is excited at the absorption maximum of the polymer rather than the dye. Swager says chemosensors for other analytes can be made with different combinations of conjugated polymer and analyte-sensitive dye.



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New reagent family for making cyclopropanes

Iodomethylzinc phenoxides are stable, highly reactive cyclopropanation reagents for less reactive olefins, according to chemists at the University of Montreal [*Angew. Chem. Int. Ed.,* **39,** 4539 (2000)]. Ortho-substituted phenols give best results. For example, organic chemistry professor André B. Charette, graduate students Sébastien Francoeur and Jonathan Martel, and postdoc Nicole Wilb mix diethylzinc with 2,4,6-trichlorophenol to give the ethylzinc phenoxide, which reacts with methylene iodide to yield the iodomethylzinc 2,4,6-trichlorophenoxide reagent. This reagent converts many olefins, including styrene, indene, and benzyl cinnamyl ether, to the corresponding cyclopropane in yields over 90%.

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