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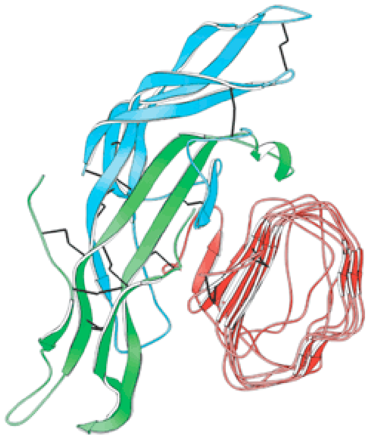
X-ray structure of bound hormone

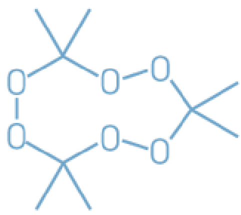


By determining the crystal structure of follicle-stimulating hormone (FSH) bound to its receptor, scientists have opened up multiple avenues for designing drugs that aid--or hinder--reproduction. In women, FSH encourages the ovarian follicles to mature each month. In men, FSH stimulates sperm production. Wayne A. Hendrickson and Qing Fan of Columbia University discovered that FSH (shown in blue and green) binds with the FSH receptor (red) in what looks like a handclasp [*Nature,* **433,** 269 (2005)]. The structure, which includes just a portion of the receptor, makes it clear that FSH changes conformation in a way that "we are guessing is important to activation," Hendrickson says. Knowing the exact binding could lead to the design of new contraceptives for both men and women. In addition, Hendrickson expects this binding mode to show up in similar hormones and their receptors: luteinizing hormone, thyroid-stimulating hormone, and chorionic gonadotropin (the hormone measured in pregnancy tests).

Toward 'green' Grignard chemistry

Phosphonium-based room-temperature ionic liquids have been found to be suitable as environmentally friendly reaction media for reactions involving Grignard reagents and other strong bases. Jason A. C. Clyburne and coworkers at Simon Fraser University, in British Columbia, showed that tetradecyl(trihexyl)phosphonium chloride and related ionic liquids support reactions involving Grignard reagents, N-heterocyclic carbenes, and some hydrides [*Chem. Commun.,* **2005,** 325]. "As far as we know, this is the first time that Grignard reagents have been used in ionic liquids," Clyburne says. The group employs a cosolvent, such as tetrahydrofuran, to carry out Grignard chemistry in the ionic liquids. The reactions are followed by aqueous workup and extraction with hexanes. The triphasic nature of the water, ionic liquid, and hexane combination facilitates product separation. Phosphonium ionic liquids may open the way for the 'greening' of Grignard chemistry, the authors suggest. "We are now looking at the reactivity of phosphonium-based ionic liquids with other highly reactive organometallic and main-group-element-based reagents," Clyburne says.

Device identifies peroxide explosives



Researchers have determined the mechanism of decomposition of an explosive called triacetone triperoxide (TATP) and have developed a device capable of identifying TATP and related explosives. TATP (shown) has been used in a number of terrorist bombings in past years, including a June 2001 attack on the Dolphinarium disco in Tel Aviv that killed 21 young Israelis. Conventional explosives release heat during an explosion. But Ehud Keinan of Technion–Israel Institute of Technology, Haifa, and coworkers now find that TATP's mechanism is unexpectedly different [*J. Am. Chem. Soc.,* **127,** 1146 (2005)]. Every solid-state molecule of TATP rapidly decomposes to form four gas-phase molecules. This "entropic explosion" mechanism is similar to that of the rapid reaction that produces gas when automobile air bags deploy. Keinan and coworkers have also developed a sensitive device for identification of TATP and related peroxide-based explosives. The pen-shaped tester releases three chemical mixtures that change color in the presence of the explosive materials, owing to an enzyme-catalyzed oxidation reaction.

New aerogels retain quantum dot properties

With their highly porous structure, vast surface area, and low density, aerogels have potential applications in catalysis, filtration, and insulation. However, until now most of these inorganic polymers have been made out of metal oxides, limiting the kinds of chemistry the materials can do. Scientists at Detroit's Wayne State University have, for the first time, prepared mesoporous semiconducting aerogels out of metal chalcogenides such as CdS, CdSe, ZnS, and PbS [*Science,* **307,** 397 (2005)]. Stephanie L. Brock, Jaya L. Mohanan, and Indika U. Arachchige make the materials by oxidatively removing surface groups from chalcogenide quantum dots. These nanoparticles assemble into a loosely joined network that the group then dries using supercritical CO_2 to form the aerogel. Remarkably, this macroscopic structure retains the optical properties of its quantum dot building blocks. Brock reckons the material would be ideal for photocatalysis or for making highly porous semiconductor sensors. She also notes that the strategy for making aerogels is quite general and could be used with other types of nonoxide compounds.

Easy conversion of chiral nitro compounds

Chiral nitroalkanes are useful intermediates in organic synthesis. Their utility would be enhanced if they could be transformed into other compound classes conveniently and without loss of optical activity. Chemists Constantin Czekelius and Erick M. Carreira at the Swiss Federal Institute of Technology, Zurich, have taken steps in this direction. A room-temperature method they have invented converts chiral nitroalkanes to chiral oximes using inexpensive reagents: benzyl bromide, potassium hydroxide, and tetrabutylammonium iodide. The method reduces a broad range of chiral nitroalkanes in good yield and with complete retention of optical activity without using heavy metals [*Angew. Chem. Int. Ed.,* **44,** 612 (2005)]. The chemists also have demonstrated one-pot transformation of chiral nitroalkanes to chiral nitriles through the chiral oxime intermediate. When the reduction of the nitroalkane to the oxime is deemed complete, simply adding thionyl chloride or trifluoroacetic anhydride to the pot produces the chiral nitrile in good yield and without loss of optical activity.

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