CHEMICAL & Engineering News

Latest News

March 27, 2006
Volume 84, Number 13
p. 9

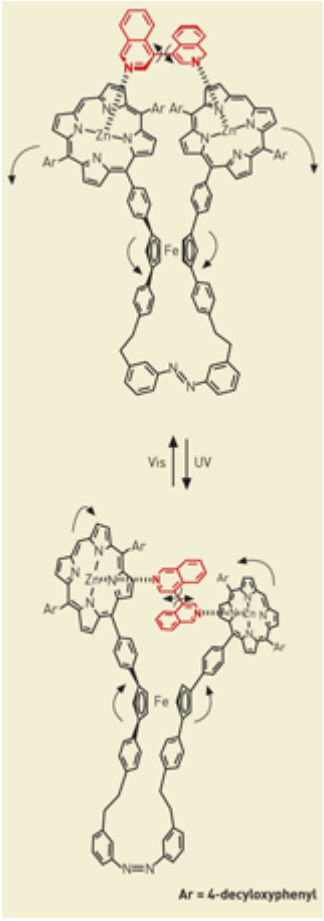
Nanodevices

Molecular Pas De Deux

Photoreactive host molecule mechanically twists guest compound

Bethany Halford

It's chemistry that could make Chubby Checker sing, "Let's do the twist." A molecular device that can twist a noncovalently bound guest molecule has been developed by chemists at the University o Tokyo (*Nature* **2006,** *440*, 512).



View Larger Image

The design concept behind Takahiro Muraoka, Kazushi Kinbara, and Takuzo Aida's system is an advance for so-called molecular machines, allowing controlled, reversible intermolecular movement. A similar approach, the scientists say, could be used to link more elaborate, interlocked molecular devices.

"This is a clever design of a molecular system in which several mechanical functions are coupled, and controlled motion in one part is transmitted as rotary motion in a bound guest molecule," says Ben L. Feringa, a chemistry professor at the University of Groningen, in the Netherlands. "It is a beautiful example of the rapid progress made in the construction of molecular motors and nanomachines," he adds.

The device features a central ferrocene unit attached to an azobenzene handle on one side and to two zinc porphyrin moieties on the other. The zinc ions in this host molecule bind a bidentate

guest compound. Shining light on the system begins a Rube Goldberg-like sequence of movements in the host that eventually twists the guest molecule, according to the Tokyo chemists.

In the presence of ultraviolet light, the azobenzene isomerizes from trans to cis, stretching one end of the host molecule in the process. This induces a scissoring movement in the rest of the compound with the ferrocene acting like a pivot. The scissoring of the porphyrins twists the guest molecule like a rotor. Visible light reverses the process.

There are still challenges to address with the system, Feringa points out, such as how to harvest the motion and how to perform useful work with the molecules. But he adds that the system's "joined operation of several mechanical functions is a significant step forward."

Takuzo Aida Image

TWISTER Light initiates a scissoring motion (indicated by arrows) in a host molecule (black), which twists a guest compound (red). Schematic shows how the light-induced contraction or expansion of the azobenzene moiety (orange and green) causes zinc porphyrin units (red) to scissor around a ferrocene pivot (blue), ultimately twisting a guest molecule (yellow).

Chemical & Engineering News
ISSN 0009-2347