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## Latest News

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### Interlocked Molecules

## Rotaxanes Go Hybrid

### New compounds combine inorganic and organic parts

[Bethany Halford](#)

**THE HYBRID TREND** isn't just for automobiles anymore. Now, molecular machines are taking up the fashionable hybrid label, thanks to a new type of interlocked organic-inorganic molecule synthesized by chemists in the U.K. (*Nature* **2009**, 458, 314). Combining two distinct chemistries into one molecule could expand the realm of applications for these systems in areas such as quantum computing.

The new hybrid molecules are rotaxanes—bead-on-a-string-type structures in which a linear molecule threads through at least one cyclic molecule. Bulky components at each end of the linear molecule act as stoppers to keep the compound from coming apart. A team led by [David A. Leigh](#) of Scotland's University of Edinburgh and [Richard E. P. Winpenny](#) of England's University of Manchester built hybrid rotaxane structures from linear secondary amine threads and heterometallic rings.

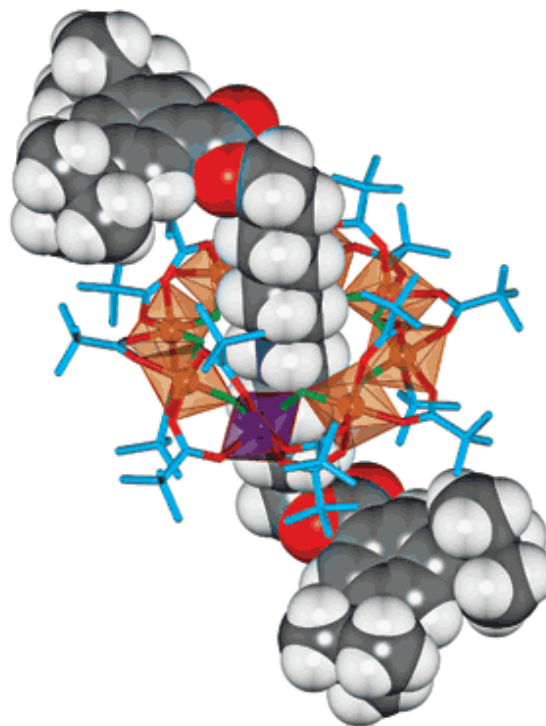
Although chemists previously have made rotaxanes that incorporate or bind to metal ions, "this is the first example of a discrete molecule in which wholly organic and essentially inorganic components are linked mechanically at the molecular level," Leigh says. One of the hybrid rotaxanes the group synthesized acts as a molecular shuttle, wherein the ring can move between two ammonium binding sites on the thread.

"Inorganic and organic structures are often associated with rather different types of chemistries: metal-based magnetism, electronic properties, and catalysis, on the one hand, and structurally, functionally, and dynamically complex organic molecules on the other," Leigh notes. "The combination of both types of structural unit in a single molecule—particularly one in which the components can move with respect to each other—leads to hybrid structures with characteristics and properties of both chemistries and perhaps some new property traits altogether."

"I must say that I find the results very exciting," comments [Jean-Pierre Sauvage](#), a pioneer in the field of mechanically interlocked molecules who teaches chemistry at Louis Pasteur University, in Strasbourg, France. "It could be envisioned that, one day, these frameworks could be set in motion by sending a given signal to the molecular assembly."

To that end, Leigh says that the next step for this project is to synthesize such stimuli-switchable shuttles. The magnetic properties of the inorganic ring make it a promising component for quantum computing systems, he adds.

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*Nature*

Mixed Media New hybrid rotaxane combines a heterometallic ring (Co is purple, Cr is orange, F is green, pivalate groups are light blue) and an organic thread (C is gray, H is white, O is red, N is dark blue).