Discovery could be game-changer for pharmaceuticals

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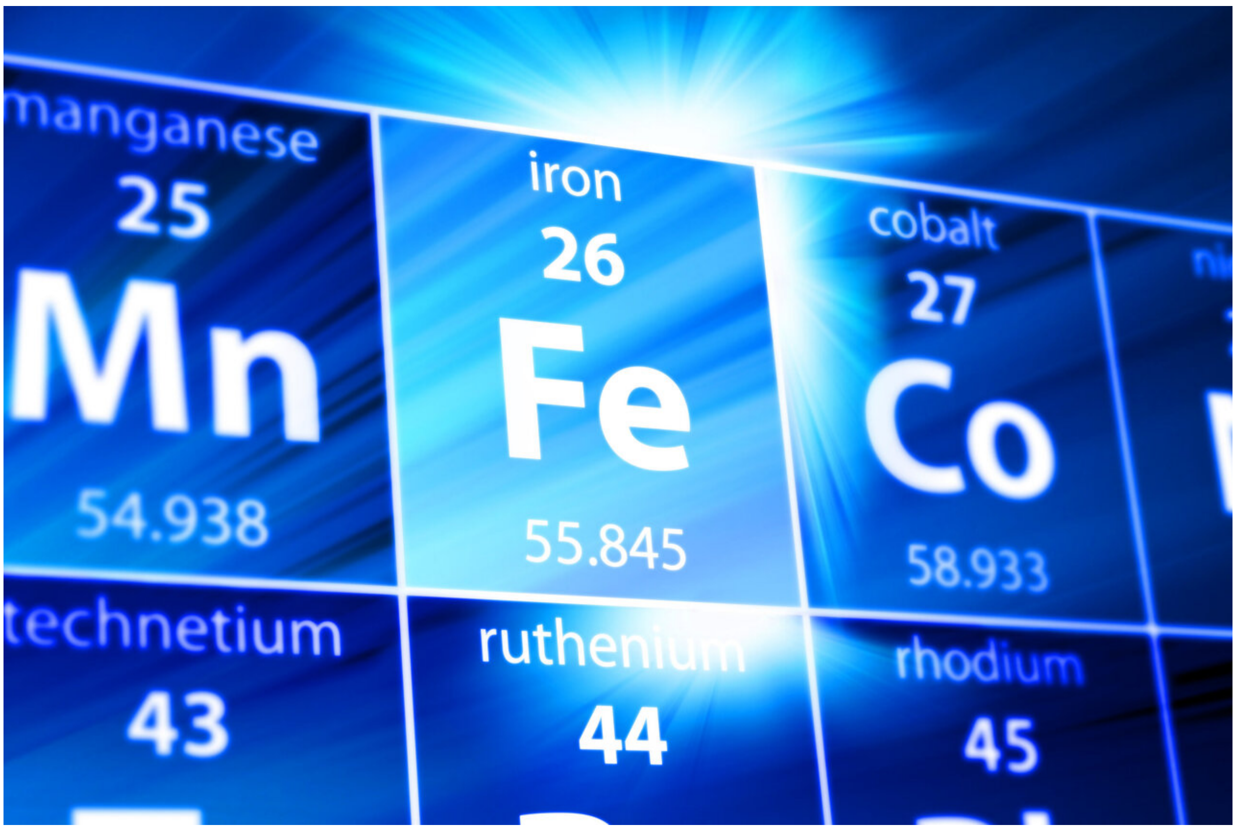

A team led by Florida International University chemistry professor Raphael Raptis developed an iron-based material that can distinguish chiral molecules that occur naturally in right- and left-handed forms. In the case of pharmaceuticals, this could be one way to ensure toxic versions of molecules are not included in a formula. Credit: Florida International University

Manufacturing drugs may one day become more efficient, courtesy of a recent discovery by researchers at Florida International University.

Until today, platinum was one of only a select group of costly precious metals that can be used in chiral catalysts to remove potentially dangerous molecules from medicines before they hit the market. But platinum is rare. Platinum is expensive. FIU chemists have developed an iron-based material that may be able to perform the same function. And unlike platinum, iron is abundant. Iron is cheap.

Certain molecules with the same chemical composition can exist in two mirrored configurations, much like human hands. This is what scientists call chirality.

"In nature, receptors sometimes are chiral – they are left or right," said chemistry professor Raphael Raptis who leads the research team that made the discovery. "In that case, it matters which "hand" of the drug interacts with them."

The team's iron-based material can distinguish chiral molecules that occur naturally in right- and left-handed forms. In the case of pharmaceuticals, this could be one way to ensure toxic versions of molecules are not included in a formula.

Konstantinos Lazarou, a chemistry Ph.D. student and lead author of the study, took an iron-based molecule Raptis developed 20 years ago and began the intricate work of searching for a method to separate its left and right forms. Using polarized light, Lazarou was able to distinguish crystals of the two mirror image molecules.

"If we can make chiral catalysts out of iron, it will be amazing," said Lazarou, a student in Raptis's lab.

Many of the world's most frequently used medicines have these chiral molecules. Lazarou points to thalidomide, as a prime example. The drug contains two seemingly identical molecules – yet one is therapeutic, the other is toxic. In the 1950s, the manufacturer did not know one part of the drug was dangerous when it hit the market. It was prescribed to pregnant women as a sleep aid. It did not adversely affect the women, but more than 10,000 children in 46 countries were born with deformities.

The ability to separate mirror image molecules has transformed the pharmaceutical industry and has made medicines safer. While more research is needed, the FIU team's discovery could be the catalyst for making this process much more affordable. The findings were published in the journal *Angewandte Chemie*.

More information: Konstantinos A. Lazarou et al. Spontaneous Resolution by Crystallization of an Octanuclear Iron(III) Complex Using Only Racemic Reagents, *Angewandte Chemie International Edition* (2019). DOI: 10.1002/anie.201901877

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