Scientists invent method to create olefins

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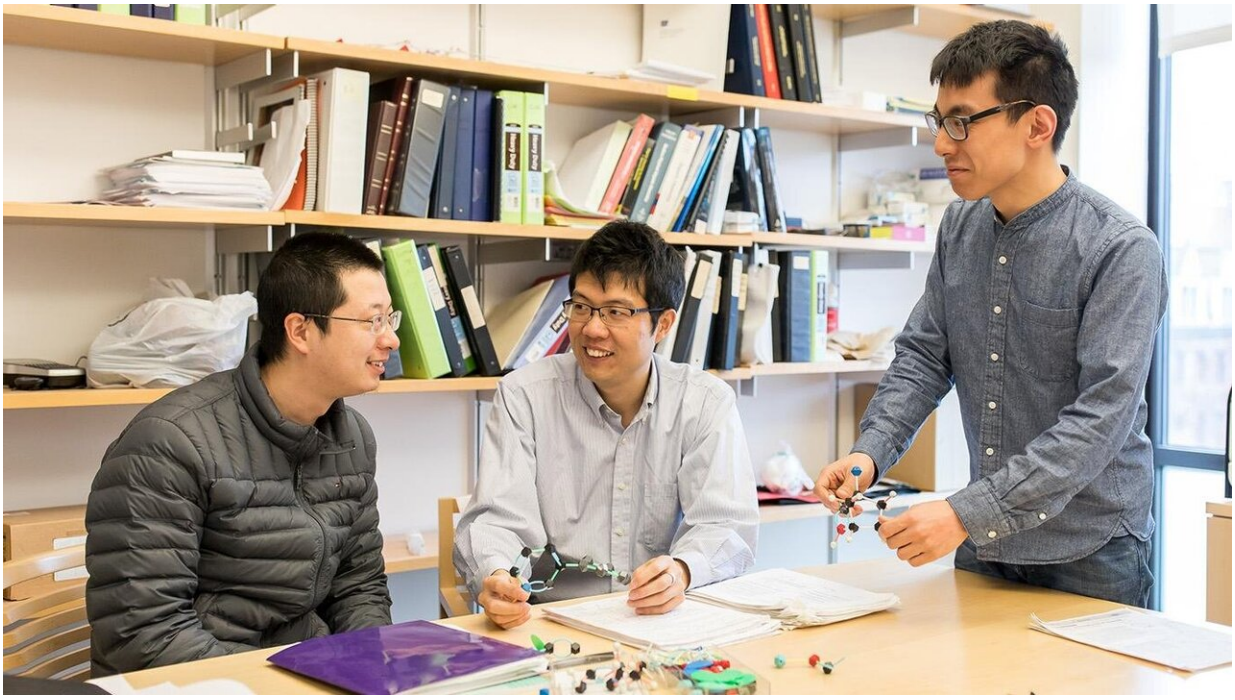

Prof. Guangbin Dong (center) works with members of his lab, postdoctoral researcher Jun Zhu (left) and graduate student Jianchun Wang. Credit: Nancy Wong

Olefins are one of those molecule types that most people don't recognize, but which appear everywhere: in bottles, in medicines, in wetsuits and in tires. Now, University of Chicago chemists have discovered an efficient method to make a kind of olefin with four different attachments—used in everything from medicines to new ways

to store data.

In a paper published Nov. 18 in *Nature Chemistry*, four UChicago scientists laid out the breakthrough in making these molecules, called tetra-substituted olefins. With the new method, they can easily and precisely select up to four different attachments, like a mix-n-match IKEA shelving unit. Plus, their catalyst cuts the number of steps to make the compounds, e.g. from seven to just two or three.

At least eight Nobel Prizes have been awarded for breakthroughs related to olefin molecules. Today the extraordinarily useful molecules are manufactured by the millions every day around the world, appearing in vitamins, medicines, plastic products and more.

But one particular kind of olefin, consisting of a central unit with four different attachments, has been tricky to prepare. Most methods involve a complicated process, in which a long sequence is typically required to install partners one by one—and it's difficult to get each part exactly where you want it to go.

"Especially for medicinal chemists who are trying to create a large number of new structures that could be useful in drugs to study, it's key to be able to select which structures to attach where, and to be able to produce them easily and quickly," said Prof. Guangbin Dong, a leading organic chemist and the paper's senior author.

Dong's team had the idea of building a different kind of catalyst: one that used norbornene (a common kind of olefin), but larger than the usual, with an extra branch attached.

The method not only worked, but could easily attach four different knobs of almost any different kind. This is particularly helpful for scientists who are looking to design and discover new kinds of molecules

that may be useful in drugs and medicines, for example.

"We tested the method on a variety of different molecules and they seem to all work, so the scope is quite broad," Dong said.

The method is primarily useful for discovery rather than manufacturing at this stage, but the team is pleased to have answered such a fundamental question.

"We've known about these catalyst systems for a long time, but no one's been able to successfully use it for normal olefins," Dong said.

More information: Jianchun Wang et al. Modular and regioselective synthesis of all-carbon tetrasubstituted olefins enabled by an alkenyl Catellani reaction, *Nature Chemistry* (2019). DOI: 10.1038/s41557-019-0358-y

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