Biochemists convert greenhouse gas to fuel

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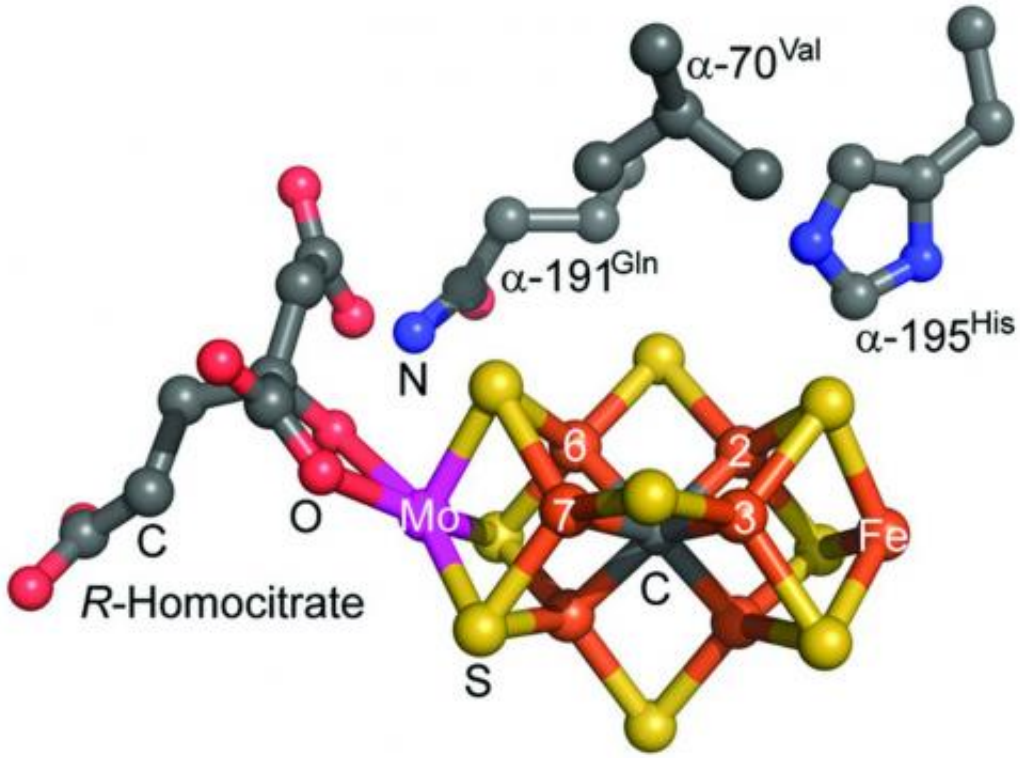

(Phys.org)—What if you could take greenhouse gas and convert it to fuel for an energy-hungry world?

"That's currently a 'holy grail' of science," says Utah State University biochemist Lance Seefeldt. "Imagine the far-reaching benefits of capturing environmentally damaging byproducts of burning fossil fuels

and using them to make alternative fuels."

Yet that's exactly what Seefeldt and USU graduate student Zhiyong Yang accomplished using modern genetics. With colleagues Vivian Moure of Brazil's Federal University of Paraná and Dennis Dean of Virginia Tech, the scientists published findings in the Nov. 12, 2012, online early edition of Proceedings of the National Academy of Sciences.

Yang, lead author on the paper, cautions the team's findings are just a first step toward converting carbon dioxide, one of the most abundant emissions from fossil fuel use, into usable hydrocarbons.

"We've only been able to convert a tiny amount of carbon dioxide to methane and our process is very slow and inefficient," says Yang, a USU doctoral student who earned his first doctorate in organic chemistry at China's Nankai University. "But now we can begin to understand the chemistry. We can establish the mechanistic principles for this conversion, on which other chemists can build to design better, more efficient catalysts to accomplish this process."

Reducing or "breaking apart" carbon dioxide molecules is difficult, Seefeldt says, because carbon dioxide is very stable.

He and Yang have long studied bacterial enzymes, known as nitrogenases, used in nitrogen reduction and, in the course of their research, discovered a molybdenum nitrogenase capable of converting carbon monoxide into hydrocarbons. The team reported their findings in June 3, 2011 issue of Journal of Biological Chemistry.

"Using this knowledge, we took a step back and wondered if we could use a similar process to convert carbon dioxide," Seefeldt says.

The biochemists used genetic engineering to remodel the nitrogenase

protein so it can now convert carbon dioxide into methane.

"An advantage of our process is it provides a path to learn how to turn carbon dioxide into useful chemicals and fuels," Yang says. "The continuing challenge will be figuring out how this process works and then transferring that knowledge to the construction of robust catalysts that can remove carbon dioxide from the atmosphere and turn it into something useful."

Provided by Utah State University