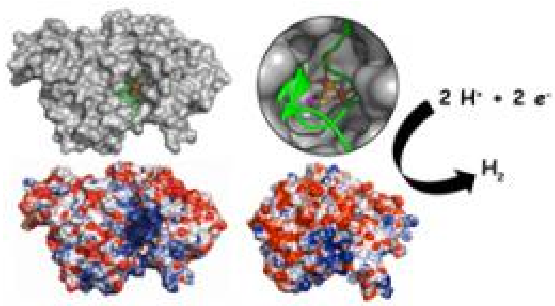
Researchers determine structure of intermediate form of unique enzyme

April 26 2010, by Evelyn Boswell



This shows the pathway for inserting an iron-sulfide cluster during a complex assembly. (Image courtesy of David Mulder).

(PhysOrg.com) -- Montana State University chemists have determined the structure of an intermediate form of a unique enzyme that participates in some of the most fundamental reactions in biology.

The discovery could lead to understanding life in ancient ecosystems. It could also play a role in producing alternate fuels and fighting pollution, according to MSU researchers who published their findings April 25 in the advance online publication of the journal *Nature*. Lead author David Mulder, a doctoral student in biochemistry, said he couldn't have been more thrilled to learn that their paper was accepted for publication in the prestigious journal.

"It was a great way to finish off graduate school," Mulder said.

Co-authors are postdoctoral researcher Eric Boyd, graduate student Ranjana Sarma, recent graduate Rachel Lange, postdoctoral researcher James Endrizzi, and faculty members Joan Broderick and John Peters. All are in MSU's Astrobiology Biogeocatalysis Research Center and the Department of Chemistry and Biochemistry. Peters is director of the research center. Broderick is a professor of chemistry and biochemistry.

Complex enzymes that contain iron-sulfide clusters are found everywhere in nature, and they're involved in many fundamental processes, the researchers said in their *Nature* abstract. Such processes include carbon dioxide fixation, nitrogen fixation and hydrogen metabolism.

The MSU researchers focused their study on one of three enzymes involved in hydrogen metabolism. They wanted to understand the structure of the enzyme and how it assembled one of the more complex clusters in biology. In the process, they saw a definite step-by-step process that may also have occurred in some manner in minerals. Broderick said the fact that the same process could have occurred in two different realms -- biology and chemistry -- is both fascinating and significant.

The discovery lends itself to discussions about evolution and environments that harbored early life, she noted. Peters said early life that couldn't assemble complicated clusters of iron and sulfide may have lived vicariously on transformations that occurred in minerals.

"This really brings together and implicates that there are general themes for the assembly of complex iron-sulfur centers in biology that likely were important for life's beginnings and impacts the way we think about iron-sulfur mineral reactivity before life emerged," Peters said.

He added that figuring out the enzyme's structure and how it assembles clusters of iron and sulfide may help scientists produce hydrogen in the lab. If they can simulate the synthesis of the important features of the enzyme in the lab, they may use it to produce renewable fuels.

Researchers said the enzyme they studied is widely distributed in nature, but the enzyme for their study came from algae manufactured in an MSU lab. The scientists inserted the gene for the enzyme into bacteria and mass-produced it so they'd have enough enzyme for their study.

Provided by Montana State University

Citation: Researchers determine structure of intermediate form of unique enzyme (2010, April 26) retrieved 9 April 2024 from
https://phys.org/news/2010-04-intermediate-unique-enzyme.html