

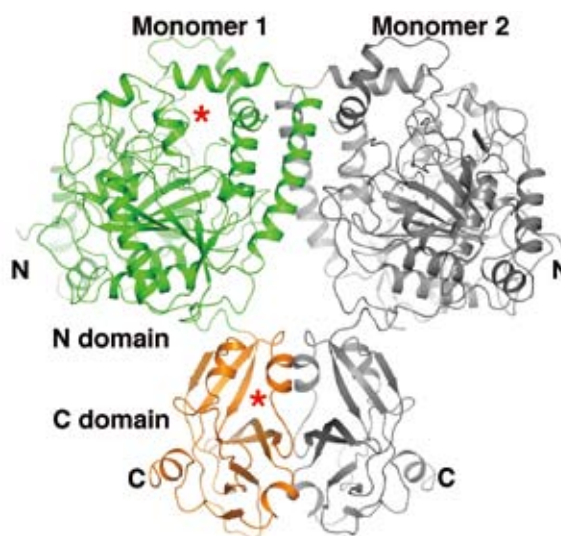
Scientists Reveal Crystal Structure of Allophanate Hydrolase

Urea is the degradation product of a wide range of nitrogen containing biomolecules. In mammals, urea is excreted. Many plants, bacteria, algae, and fungi can use urea for their anabolism, reintegrating its nitrogen into the biosphere. The first step of their urea utilization is converting it to ammonium and carbon dioxide. One of the enzymes catalyzing such a reaction is urea amidolyase (UA), which also plays roles in pyrimidine nucleic acid precursor degradation, and the yeast-hyphal transition that several pathogens use to escape the host defense. UA consists of urea carboxylase (UC), which carboxylates urea to allophanate, and allophanate hydrolase (AH) subunits, which converts allophanate to ammonium. Besides working with urea carboxylase in converting urea to ammonium and carbon dioxide, AH also has an important function in a newly evolved s-triazine herbicide degradation pathway.

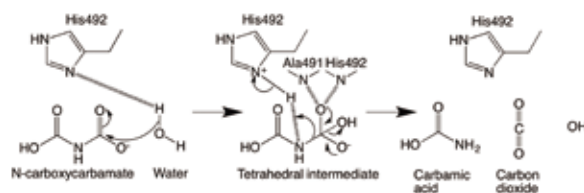
Recently a team of researchers, led by Professor XIANG Song, at the Institute for Nutritional Sciences (INS), Shanghai Institutes for Biological Sciences, CAS, has determined the crystal structure of allophanate hydrolase (AH).

The structure revealed that AH is composed of N and C domains. Structure-directed functional studies indicate that these domains catalyze sequential reactions: the N domain converts allophanate to N-carboxycarbamate, and the C domain converts it to carbon dioxide and ammonium. They also contribute to maintaining a dimeric form of the enzyme that is essential for their optimal activities. Whereas the N domain catalyzes an amide hydrolysis reaction typical for the amidase signature (AS) family members, the reaction catalyzed by the C domain probably represents a novel kind of decarboxylation reaction. These studies have provided molecular insights into AH catalysis and a framework to further understand important biological processes, including urea utilization, pyrimidine nucleic acid precursor degradation, and s-triazine herbicide degradation in many organisms, and to develop novel antifungal drugs.

The above results, entitled “Structure and Function of Allophanate Hydrolase”, were published in *The Journal of Biological Chemistry* on July 19, 2013.



The crystal structure of allophanate hydrolase.



Proposed reaction scheme for AH C domain. (Images by Dr. XIANG Song's group)