

Towards solving the hydrogenase maturation mystery

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We generate most of the energy from fossil fuels. Almost all fossil fuel energy sources generate harmful CO₂. Hydrogen can be one of the main sources of fuel energy in the future. The hydrogenase enzyme is involved in the formation and degradation of hydrogen in various biochemical reactions and it can be used as an efficient source to generate hydrogen. The hydrogenase uses a special kind of iron-sulfur cluster (called the H-cluster) to generate hydrogen and this H-cluster is made by three maturase enzymes: HydF (~46 KDa), HydE (40KDa), and HydG (~55KDa). The missing link of the mechanism is the formation of the H-cluster (maturation process). Structural data on the maturation process is lacking which may be required to differentiate between the different mechanism hypotheses. First, we did chemical cross-linking mass spectrometry (CXMS) to determine interactions between different combinations of maturase enzymes. CXMS data suggests the three-way interaction between maturation enzymes at the same time. CXMS data is backed up with the SEC data which suggests the ~175KDa complex containing dimeric HydF, monomeric HydG, and HydE. We have an initial negative stain low-resolution structure of the maturation complex and a future step will be to find a high-resolution cryo-EM structure of the maturase complex.