Photocatalytic H_2 Evolution Is Enhanced by Linking Photosynthetic Biocatalysts

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Photosynthesis is the natural process carried out by green plants and algae to convert light energy into chemical energy. These reactions are carried out by specialized proteins found in plant and algae. These molecules can be isolated and combined with metal ions and other chemical compounds to carry out novel light induced reactions. Researchers at Oak Ridge National Laboratory have shown that hydrogen is evolved during illumination when two of these photosynthetic proteins isolated from spinach, Photosystem I (PSI) and plastocyanin, are combined with a metal containing compound hexachloroplatinate and sodium ascorbate as an electron donor. Electrons from ascorbate are transferred by plastocyanin to PSI. When light impinges on PSI, it transfers electrons to transform the platinate ion to a platinum nanoparticle on the end of the PSI, which then releases a molecule of H_2. By chemically binding PSI and plastocyanin to form one combined species, rather than two separate molecules, the rate of platinum deposition and H_2 evolution are increased three-fold. This has important relevance to the generation of hydrogen gas.