The production of H\textsubscript{2}, especially with visible light, has attracted great attention because of its potential use as a source of clean and renewable energy. The splitting of water into H\textsubscript{2} and O\textsubscript{2} is one of the greatest challenges facing us today. In nature, water splitting is accomplished in photosynthesis process by the Mn\textsubscript{4}CaO\textsubscript{5} cluster of the oxygen-evolving center (OEC) in photosystem II, while the proton reduction and H\textsubscript{2} oxidation are realized by the Ni- and Fe-based active sites in hydrogenases.

Besides water splitting, H\textsubscript{2} production from alternative sources such as abundant biomass has also been a subject of intense interest. Inspired by natural photosynthesis, oxidation of hydrocarbons with light and water has been reported to reduce the use of hazardous chemicals and waste production. Our progress in photocatalytic H\textsubscript{2} production coupled with hydrocarbon oxidation from water, or catalyzed by a Co complex in aqueous solution will be discussed.