Light-Induced Water Splitting and Hydrogen Production in Nature: Basis for the Design of Bioinspired Molecular Catalysts

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Storage of the sun's energy in „solar fuels" like molecular hydrogen or related molecules using water as a basic material is a research topic of great importance for our society.

A promising start point for the development of synthetic sun light-driven water splitting catalyst, is to use Nature's approach for inspiration that is realized by the tetranuclear manganese cluster in photosystem (PS) II of *oxygenic photosynthesis*.[1] Many bacteria and green algae also contain enzymes that enable hydrogen evolution from excess protons, the hydrogenases.[2]

In recent years high resolution X-ray crystallographic structures of PS II[4] and different hydrogenases[2,3] have been obtained and additional spectroscopic and electrochemical experiments have very significantly increased our knowledge about the structure and function of the native enzymes leading to a mechanistic understanding of the underlying processes. This knowledge will help to advance the field of *artificial photosynthesis*, aiming at synthesizing new catalyst for large scale water splitting, hydrogen production or energy storage in other chemical compounds, processes that are of key importance for a sustainable energy future.

In this lecture the native metalloenzymes *wateroxidase* and *hydrogenase* are presented and their working mechanisms are discussed. Prospects of native biological and artificial chemical systems to solve the energy problems will also be addressed.

References

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