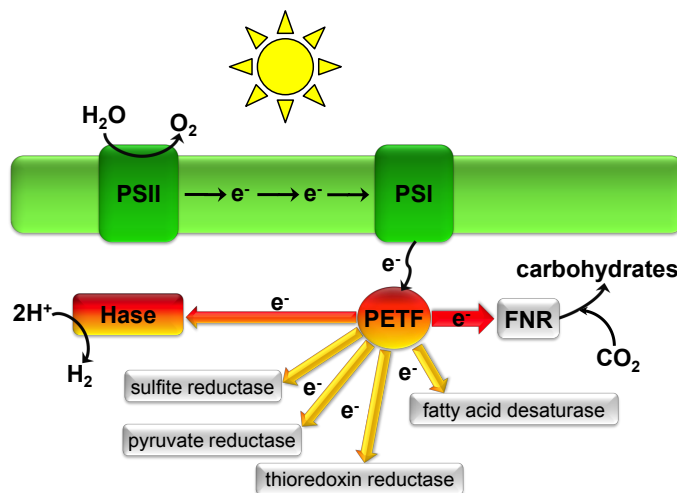


## Press release

Bochum / Mülheim, 18.08.2014

### Efficient production of hydrogen by algae

Scientists from Bochum and Mülheim report in *Energy and Environmental Science*



**Figure:** Electrontransfer in the alga *C. reinhardtii*, that leads to the production of hydrogen or other substances. Hase = Hydrogenase  
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Microalgae need only sunlight and water for the production of hydrogen. However, in order to make hydrogen production by microalgae economically feasible their efficiency has to be increased by 1-2 orders of magnitude. In the current issue of *Energy and Environmental Science* scientists from the AG Photobiotechnology of the Ruhr University Bochum and the Max Planck Institutes in Mülheim present how an improvement in efficiency can be achieved.

Microalgae use light-energy to extract electrons from water during

photosynthesis. Most of these electrons are transported by a small, iron-containing protein, the ferredoxin PETF, to the protein ferredoxin-NADP<sup>+</sup>-oxidoreductase (FNR), which feeds the electrons into the production chain of carbohydrates. PETF passes only a small fraction of the electrons to other proteins like the Hydrogenase. This protein is a very powerful enzyme, whose amino acid chain harbours a unique six-iron cluster, in which electrons (e<sup>-</sup>) are transferred to protons (H<sup>+</sup>) to produce hydrogen (H<sub>2</sub>).

Using nuclear magnetic resonance spectroscopy (NMR) the scientists investigated in great detail which amino acids of PETF interact with Hydrogenase and which with FNR. Thereby they identified two amino acids of PETF with negatively charged side chains that are exclusively important for binding FNR. The directed genetic modification of exactly those two residues to amino acids with uncharged side chains led to an increased production of hydrogen. Together with further modifications of the FNR this resulted in a five-fold increased rate for hydrogen production.

The knowledge-based change of electron transfer pathways has the potential to make further enhancements of hydrogen production possible. The efficiency necessary for an economic application of biological hydrogen production can probably be achieved by the combination of different modifications. Thus, the presented results are important for the development of an environmentally friendly, regenerative energy supply that does not depend on expensive and rare noble metals.

#### Further information

The link to the publication in *Energy and Environmental Science*:

<http://pubs.rsc.org/en/content/articlelanding/2014/ee/c4ee01444h>

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