RENEWABLE HYDROGEN PRODUCTION

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This poster provides an overview of renewable hydrogen production research at Oak Ridge National Laboratory and The University of Tennessee. Four areas are covered:

- An original design for a photobiological reactor for the simultaneous photoproduction of hydrogen and oxygen is presented. Data were obtained for more than 1400 hours indicating that unicellular green algae are rugged organisms with respect to renewable hydrogen and oxygen production by photosynthetic water splitting.

- We have performed enzymatic production of biohydrogen from glucose-6-phosphate [Woodward et al., *Nature* **405**, 1014 (2000)]. Using the enzymes of the oxidative pentose phosphate cycle, a value close to the theoretical maximum of H_2 from glucose was obtained. The maximum is 12 moles hydrogen per mole of glucose. The value we obtained was 11.6.

- We have applied nanoscience and nanotechnology to photoproduction of hydrogen. Photosystem I reaction centers that were extracted from spinach leaves were catalytically transformed by precipitation of metallic platinum. Using sodium ascorbate and plastocyanin as the electron donor system, photoevolution of hydrogen was observed.

- Our recent work demonstrates discovery of a new electron pathway for algal hydrogen production in the presence of low levels of oxygen in which reducing equivalents are shunted away from the hydrogen pathway. The pathway is ATP-dependent and may provide new insights into the longstanding problem of oxygen inactivation of hydrogenase.