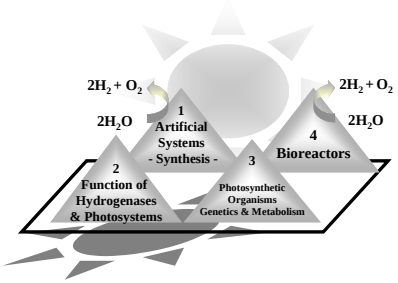
Executive summary

EU project number: **212508**

Project acronym: **SOLAR-H2**

Website: http://www.fotomol.uu.se/Forskning/Biomimetics/solarh2/Solarh2.shtm

Project title: **European Solar-Fuel Initiative – Renewable Hydrogen from Sun and Water. Science Linking Molecular Biomimetics and Genetics**



SOLAR-H2 brought together 12 world-leading European laboratories in 8 countries to carry out integrated, basic research aimed at achieving renewable hydrogen (H_2) production from environmentally safe resources. More than 100 scientists were involved in various phases of the program. The vision was to develop novel routes for the production of a solar fuel, in our case H_2, from the very abundant, effectively inexhaustible resources of solar energy and water. The multidisciplinary expertise ranged from molecular biology, biotechnology, via biochemistry and biophysics to organo-metallic and physical chemistry.

The project successfully integrated two frontline research topics: artificial photosynthesis in man-made biomimetic systems, and photobiological H_2 production in living organisms. Large-scale H_2 production by these methods is still distant, but has vast potential and will be of utmost importance for the European economy in the future. The scientific risk was high and the research conducted was very demanding. The overall objective was to explore and provide the basic science necessary to integrate and develop these novel routes and advance them toward new horizons. Along the first track (work packages 1 and 2), the knowledge gained from biochemical/biophysical studies of the efficient enzymes in photosynthesis and hydrogen metabolism was exploited by organometallic chemists to synthesize biomimetic compounds for artificial photosynthesis. The design of these molecules was based on molecular knowledge about how natural photosynthesis works and how hydrogenase enzymes catalyze H_2 formation. This research proved remarkably productive. Altogether 249 scientific articles from work packages 1 and 2 were published in, mainly, peer reviewed international journals. Along the second track (work packages 3 and 4), R & D was performed on the genetic level to increase our understanding of critical reactions in H_2 producing photosynthetic alga and cyanobacteria. The studies were aimed at the improvement of the H_2 producing capability of the organisms using novel genetic and metabolic engineering. The new organisms were studied in bioreactors which were developed to state of the art. The science in work packages 3 and 4 was published in 134, mainly peer-reviewed scientific articles.

In addition to the published articles the results in the program was presented at hundreds of scientific meetings worldwide, in lectures and on many hundred of posters, all acknowledging the work as originating from the SOLAR-H2 program.