Degree project in applied biotechnology (30hp), Master of Science, 2012
Supervisor: Dr.Felix Ho (Assistant Professor), Dept of Chemistry, Uppsala University.

Construction and characterisations of Photosystem Ⅱ mutants in *Chlamydomonas reinhardtii* for study of proton pathway

JIA LI (Jia.Li.5242@student.uu.se)

As we all known, solar energy provides our planet plenty of energy. If the solar energy conversion efficiency is 10%, solar energy received on only 0.07% of the land surface would fulfill the total world energy use in 2008. Among several ways of storing solar energy, photosynthesis is the major driving force for life in our planet since ancient times. Thus understanding of process involving photosynthesis has potential in development of solar energy storage.

The most common type of photosynthesis we know is oxygenic photosynthesis which release oxygen as by-product and organisms like green plants, algae and cyanobacteria all can conduct photosynthesis. *Chlamydomonas reinhardtii* is a kind of single cell algae which has been widely used as research tools by far. Many study results dealt with photosynthesis using *Chlamydomonas reinhardtii* (short for *C. reinhardtii*) as model have been published. For quite a long time, *C. reinhardtii* has been used as a model organism in research of basic cell topics like 'How do cells respond to light?' There are also many mutants of *C. reinhardtii* act as tools for various biological processes.

Often oxygenic photosynthesis can be divided into two main processes, light transduction reactions and carbon assimilation reactions. One crucial step in light transduction is catalyzing water into protons and oxygen molecule. Photosystem Ⅱ (PS Ⅱ) which is the important enzyme having catalytic center in role of water oxidation in light conversion. In one cycle of reactions, four protons and an oxygen molecule are released. From energy level angle, the released protons have to be removed for the sake of further reactions. Previous great scientists accomplished excellent work in uncovering the mystery mask of PS Ⅱ catalyic center and related mechanisms. Study results showed the catalytic center can not accomplish the reaction by itself but have to cooperate with surrounding amino acids. Therefore, the overall goal of this master degree project is to identify and study the role of the amino acid residues involved in the proton release way in Photosystem Ⅱ in *C. reinhardtii* by construction of sited-directed mutants.

According to computing stimulation study results, Arginine334 (R334) and Asparagine335 (N335) which are surrounded the catalytic center, play an important role in holding water and residues in place. R334 and N335 appear to play an important role in proton release. The project aims to mutate these two amino acids and measure the growth parameters of *C. reinhardtii*.

The project includes firstly obtaining the overview of photosynthesis reaction process of green algae and PS Ⅱ catalytic center by reviewing literature journals. Secondly, sketch out the project plan for the experimental work on the basis of constructs. Thirdly, carry out the experiments by construction of site-directed mutants. The project has significance for understanding how these residues affect proton transport from the PS Ⅱ catalytic center, and is a foundation for explaining the transitions mechanism more clearly.