NANYANG TECHNOLOGICAL UNIVERSITY

School of Biological Sciences

Reg. No. 200604393R

Research Theme: **The biochemistry of photosynthesis**

Research Project Title: **Mechanistic studies concerning biological CO_2 fixation**

Pricipal Investigator/Supervisor: **Oliver Mueller-Cajar**

Co-supervisor/ Collaborator(s) (if any):

Project Description

a) Background

Almost all biomass production relies on the fixation of gaseous carbon dioxide during the process of photosynthesis. The enzyme catalysing this reaction, ribulose 1,5-bisphosphate carboxylase/oxygenase (Rubisco) is the most abundant protein on the planet, comprising up to 50% of total leaf protein in plants. Its abundance is a response to poor kinetics (low catalytic turnover rate and substrate specificity). In addition the active site of the enzyme must constantly be serviced by helper proteins known as rubisco activases, that remove non-productively bound inhibitor molecules from the active site. Improving rubisco performance is predicted to enhance the photosynthetic efficiency of plants, and thus has implications for fields such as agriculture and bioenergy.

Recent research has highlighted that diverse photosynthetic organisms have evolved various solutions to the short-comings of rubisco. Our laboratory uses biochemistry to explore and understand the functions of poorly studied proteins that have evolved to assist rubisco in its crucial task. In this way we aim to generate the tools required to enhance photosynthetic performance in organisms of interest to humans.

b) Proposed work

Various projects are available in the laboratory, all of which ultimately aim to increase our knowledge concerning rubisco function. This generally involves purification of rubisco and other proteins either recombinantly or from native sources. The interplay between pure components is then analysed using sensitive biochemical assays to elucidate the molecular mechanisms underlying protein function. Biophysical and structural biology approaches are engaged as required. In vivo work involves eukaryotic phytoplankton such as the diatom *Phaeodactylum tricornutum*, and recapitulation of CO_2 fixation in our rubisco dependent *Escherichia coli* system.

Supervisor contact:

If you have questions regarding this project, please email the Principal Investigator:
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