NANYANG TECHNOLOGICAL UNIVERSITY

School of Biological Sciences

Reg. No. 200604393R

Research Theme: Interdisciplinary Biology (Synthetic Biology, Systems Biology, Protein Engineering, Biophysics)

Research Project Title: **Synthetic and Systems Biology in Plant Signaling with AI-Guided Protein Engineering**

Principal Investigator/Supervisor: Professor Yansong MIAO

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

Project Description

a) Background:

This interdisciplinary project focuses on engineering plant signaling proteins by combining synthetic biology, artificial intelligence (AI), and systems approaches.
Plant signaling networks, from receptor activation to downstream cellular responses, are built from modular protein domains whose structures, interactions, and higher-order assemblies determine how cells sense and respond to their environment. Recent advances in AI-based protein structure prediction and protein design now make it possible to predict protein interactions at scale and to rationally engineer synthetic signaling components with new or improved functions. These tools open new opportunities both for understanding signaling mechanisms and for engineering crops with better performance.

This project will combine AI-guided protein engineering, high-throughput structural prediction, and systems-level data mining to decode the design principles of plant signaling proteins and to build synthetic signaling modules in transgenic plant . We are looking for a highly motivated PhD student to work on this novel and well-designed project, ensuring high-quality training, high-impact outcomes, and scientific publications.

We provide solid scientific training for your future career and aim to nurture the next generation of scientists. The Ph.D. candidate will work at the interface of computation and experiment, using AI and protein structure tools, synthetic engineering, and systems approaches for data mining and high-throughput structural prediction and analysis. Training in protein biophysics and cell signaling will be provided.

Miao lab students have different high-quality scientific training opportunities, such as international conferences, workshops, exchanges.

For our recent work and publications, please see https://blogs.ntu.edu.sg/miaolab/
For more details of ongoing and new projects, feel free to contact Prof. Miao at yansongm@ntu.edu.sg.

b) Proposed work:

The Ph.D. candidate will (i) mine genomic, proteomic, and structural datasets to identify signaling proteins and interaction modules across plant species; (ii) perform high-throughput structure and complex prediction to classify interaction interfaces, multivalent assemblies, and conformational switches; and (iii) design synthetic protein variants and signaling modules with AI-based tools, then test their biophysical properties and signaling outputs in vitro and in plant cells.

Our top-notch biotechnologies in the lab and long-term collaborations with computational biology, structural biology, and synthetic biology groups will ensure a comprehensive, systems-level understanding of plant signaling and its rational engineering.

c) Preferred skills:
Enthusiasm for science; Basic computational skills (e.g., Python, R, or command-line tools) are preferred; Interest in protein structure and protein biophysics; Excellent oral and written communication skills; Good collaboration skills.

Supervisor contact:

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

yansongm@ntu.edu.sg

SBS contact and how to apply:

Associate Chair-Biological Sciences (Graduate Studies) : AC-SBS-GS@ntu.edu.sg

Please apply at the following:

Application portal:

https://venus.wis.ntu.edu.sg/GOAL/OnlineApplicationModule/frmOnlineApplication.ASPX