NANYANG TECHNOLOGICAL UNIVERSITY

School of Biological Sciences

Reg. No. 200604393R

Research Theme: Computational biology

Research Project Title: Elucidating adaptive mechanism conferring resilience to environmental stress

Principal Investigator/Supervisor: Asst/Prof Marek Mutwil (SBS)

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

Project Description

Background: Plants, unlike animals, are sessile and cannot outrun threats. Excessive drought, salinity, heat and cold cause a series of morphological, physiological, biochemical and molecular changes that unfavorably affect plant growth and development. To tolerate abiotic stresses, plants respond with physiological changes (e.g., closing of stomata during drought to reduce water loss), rewiring of metabolism (e.g., altering cellular osmolytes durin external osmotic stress) and altered gene expression (e.g., increasing biosynthesis of chaperones during heat stress). Still, abiotic stress is responsible for major crop losses, which results in millions of deaths and chronic hunger in one billion of the human population. As stress tolerance has been studied mainly in a few crop plants, our understanding of how other plants species or entire plant ecosystems cope with these stresses is rather limited. If we want to understand and react to local and especially gobal environmental changes, it is paramount to study stress adaptations across plant evolution, which includes unicellular algae, early land plants (mosses, and primitive vascular plants), gymnosperms (early seed plants) and angiosperms (flowering plants).

Proposed work: Our previous work established computational methods showing that gene expression is conserved across a wide range of plant species. You will work with model plants, including algae, early land plants, and angiosperms, with the aim to understand how adaptations to abiotic stresses (e.g., heat and freezing) have evolved (lab work 20%). To this end, you will generate gene expression (by RNA sequencing) and metabolomic data capturing the dynamics of adaptation to these stresses, and develop mathematical models to elucidate the evolution of these adaptations (computer work 80%). The outcome of this project will expand our understanding of evolution and stress adaptation, and will generate important data for basic research and agriculture.

About you: You have a degree in molecular biology, biochemistry (or related) and keen interest in programming, algorithm development, mathematics, complexity, and puzzles. Or, a degree in mathematics, physics, bioinformatics (or related) and keen interest in biology. You have strong analytical and problem-solving skills, experience with programming (preferred Python), or high interest to learn it. You are proficient in spoken and written English, have excellent communication and writing skills and are interested in working in a highly interdisciplinary team of experimentalists, theorists, and computational scientists. You are independent, creative and have team spirit.

Supervisor contact:

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

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SBS contact and how to apply:

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Please apply at the following: http://admissions.ntu.edu.sg/graduate/R-Programs/RWhenYouApply/

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