Research Theme: **Data science / Microbiology**

MSc Research Project Title: **Codon usage bias in fungal species**

Principal Investigator/Supervisor: Dr. Tang Bozeng

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

Project Description

a) Background: Codon usage bias (CUB) refers to the unequal frequency with which synonymous codons—different nucleotide triplets that encode the same amino acid—are used in protein-coding sequences. Although the genetic code includes 64 possible codons, they encode only 20 amino acids and 3 stop signals, meaning that most amino acids are represented by multiple codons. These synonymous codons are not used uniformly across genes or species. CUB arises from a combination of mutational biases (e.g., GC vs. AT content), natural selection for translational efficiency and accuracy, and random genetic drift. Genes that are highly expressed often prefer “optimal” codons that match abundant tRNAs, thereby improving translation speed and fidelity. In contrast, rare codons can slow down translation, supporting processes such as co-translational protein folding or temporal regulation of protein production.

b) Proposed work: This research program aims to investigate the relationship between codon usage bias and ecological traits in fungal pathogens. By analyzing genome-wide codon usage patterns across diverse fungal species, we will assess correlations with host ranges, lifestyle (e.g., biotrophic vs. necrotrophic), and other ecological factors and traits. The study will employ bioinformatic tools to calculate metrics such as Relative Synonymous Codon Usage (RSCU) and Codon Adaptation Index (CAI), and integrate these with phenotypic and ecological data. The goal is to elucidate how codon usage bias contributes to fungal adaptation and pathogenicity, potentially informing strategies for disease control in agriculture.

c) Preferred skills: A strong curiosity about fungal biology;
Experience of data science is a plus, but not compulsory

Supervisor contact:
If you have questions regarding this project, please email the Principal Investigator:
bozeng.tang@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:

NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

School of Biological Sciences
College of Science

Reg. No. 200604393R

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

60 Nanyang Drive, Singapore 637551