How algae alter the cell division cycle – Dynamic interplay of cell cycle and metabolism

Rabinder Singh

The cell division cycle (CDC) in microalgae, ranging from simple division into two cells, to formation of four and up to several daughter cells, in single cell cycle dividing by multiple fission. Clock-like cycles of genome duplication are controlled by a series of complex biochemical reactions prompted by external stimuli and permitted by intrinsic checkpoints. Under optimal conditions growth rates are fast which shortens commitment point (CP) attainment, allows attainment of multiple CPs, leading several rounds of overlapping DNA replication division sequences occurring within one cell cycle resulting in production of more than 2 daughter cells with reduced doubling time. Here, we are proposing an integrated multi-omics analysis of the metabolic states underlining the attainment of CP and occurrence of overlapping DNA replication division sequences to study CDC with different number of overlapping DNA replication division sequences producing 2, 4 or 8 daughter cells and to identify metabolic pathways, protein and gene parameters common and distinct among them. Thus, we plan to understand a system level blueprint underlining the process of switch to multiple fission, as well as general mechanisms required for CDC entry/exit. To this goal, we have chosen a unicellular green alga Chlamydomonas reinhardtii, which is currently most developed model organism among green algae with available tools for molecular biology and genetics. Multomics profiling will be done to decipher and identify genes/proteins and metabolites associated with CDC transitions. The function of one or two most interesting genes/proteins/metabolic pathways identified will be analyzed and verified by gene knock-down, followed by phenotypic characterization. Thus, our study will bring new perspective and fill gaps related to CDC in unicellular microalgae *C. reinhardtii*, which shall be shared with mammalian and plant cells.