Western Journal of Graduate Research Mosaic

Abstracts

Unravelling Pervasive Transcription in Organelle Genomes Using Publicly Available RNA-Sequencing Data

Matheus Sanita Lima

Background: Organelles (mitochondria and plastids) carry their own genomes, which are diverse in size, structure, content and modes of expression. Whereas organelle genomes are one of the most sequenced types of chromosomes, the study of organelle genome transcription has been lagging. Next generation sequencing techniques have been generating unprecedented amounts of transcriptomic data (RNA-sequencing data) that can be used to study organelle genome transcription. However, most of these data are used only for the study of nuclear transcription. Therefore, I decided to use this untapped data source to investigate the transcription of organelle genomes in plastid-bearing protists.

Methods: I performed RNA mapping analyses for 89 diverse protists using Bowtie 2 (the aligner algorithm) implemented through Geneious, a user-friendly software suit.
Results: Each organelle genome had a transcript coverage of at least 85%, indicating that organelle genomes are pervasively transcribed independent of their gene content, genome topology, genome size and taxonomic origin.

Discussion and Conclusions: RNA-seq data generated for cell nucleus studies can be used to investigate organelle genome transcription. Even though organelle genomes can exhibit large portions of non-coding DNA, these regions are still transcribed, potentially producing noncoding RNAs with regulatory functions within and outside the organelle. This pervasive transcription may point to novel regulatory mechanisms that ultimately can control the cell response to diverse stressors such as increased light and temperature.

Interdisciplinary Reflection: Unravelling the pervasive transcription of organelle genomes sheds light on possible regulatory mechanisms of organelle genome transcription. Understanding how organelles regulate the expression of their genes will help us: a) uncover how photosynthetic organisms (plants and algae) will adapt to future climate change conditions; b) develop crops better suited for high light and temperature stress.