

Research Highlight: Reconciling the Species and Gene evolutionary trees

Work of Professor ZHANG Louxin

The idea of the “tree of life” dates back at least to Charles Darwin. In his seminal book “The Origin of Species”, he used a tree diagram to depict how all life evolved from a common ancestor through speciation events.

However, the recent studies of genome evolution suggest that genome evolution is subject to horizontal gene transfer, in which genetic material moved between organisms other than by the ("vertical") transmission of DNA from parent to offspring.

Horizontal gene transfer events had occurred so frequently within bacteria that Johann Peter Gogarten, a prominent biologist in molecular evolution, suggests to use “the metaphor of a mosaic to describe the different histories combined in individual genomes and use the metaphor of a net to visualize the rich exchange and cooperative effects of HGT among microbes”. Mathematics has played a crucial role in helping transforming the differences between DNA sequences of organisms into evolutionary trees and networks.

Professor Zhang Louxin and his former graduate student developed time-optimal methods that reconcile the evolutionary history of species with that of genes in different reconciliation models. These methods can be used to infer evolutionary events that likely happened in evolution.

Reference:

Y. Zheng and L.X. Zhang LX, "Reconciliation with nonbinary gene trees revisited." J. ACM, 64(2017): Article no. 24. Pages: 28, DOI: 10.1145/3088512