

Molecular Evolution, Phylogenetics, and Phylogeography (3:0:0)

(TNC Vidya: Basic Course, 200 level)

Topics

1. Molecular Markers, techniques
2. Molecular Evolution - neutral theory, mismatch distributions
3. Phylogenetic methods - parsimony, distance methods, maximum likelihood, Bayesian method, coalescent trees
4. Population genetic structure
5. Phylogeography

Details:

- The history of interest in genetic variation, the Classical-Balance debate
- Molecular markers and techniques to assess genetic variation: protein immunology, electrophoresis, DNA-DNA hybridization, RFLP (animal mtDNA, plant chloroplast DNA, scnDNA, minisatellites, DNA fingerprinting), RAPD, AFLP, microsatellites, SSCP, single-nucleotide polymorphisms, DNA sequencing (Maxam-Gilbert method, Sanger sequencing, Next Gen sequencing)
- Measures of genetic diversity: standard diversity indices, molecular indices
- Concept of genetic load
- An introduction to neutral theory
- The Neutralist-Selectionist debate
- Expected genetic variability derived from the neutral theory
- Tests based on the neutral theory and infinite alleles model
- Infinite sites model and the coalescent
- Mismatch distributions and inferring population demographic history
- Estimating rates of sequence (amino acid and DNA) divergence
- An introduction to phylogenetics, molecular clocks, gene trees versus species trees
- Phylogenetic methods: parsimony, compatibility, distance methods (least squares, minimum evolution, UPGMA, neighbour joining), maximum likelihood, Bayesian method
- Finding the best tree: heuristic search, branch and bound search
- Bootstrapping, jackknifing, permutation tests, consensus trees
- Minimum spanning networks
- Population genetic structure estimation
- Phylogeographic methods, nested clade analysis

Suggested reading

- Avise JC. Molecular markers, natural history, and evolution.
- Baker AJ (ed.) Molecular methods in ecology.
- Hall BG. Phylogenetic trees made easy: a how-to manual for molecular biologists.
- Felsenstein J. Inferring phylogenies.
- Rob deSalle (ed.) Techniques in molecular systematics and evolution.
- Different sets of papers will be given for presentation/discussion.