

Molecular Evolution (分子演化學)

Wen-guey WU (吳文桂)

2021 Fall LSBS 515100 2 Credits (English)

LSII 206, Thursday 2:20-4:10 pm

Recent advances in Genome, Transcriptome, Structural Proteome and Metabolome have generated a tremendous amount of data at molecular level for a variety of biological and biomedical systems including cancer cells, venom gland, plant/animal biodiversity, infectious diseases and human behavior. It is generally accepted that “Nothing in biology makes sense except in the light of evolution”; but, understanding evolutionary biology will require a full analysis of the aforementioned data at the molecular level. In this class, we consider evolutionary biology and molecular biology as two valuable tools to explain why organisms are the way they are during the history of life on earth. We will spend ~ 1/3 of the class to introduce the basic concept of evolution, 1/3 to understand the evolutionary processes occurring at the molecular level and 1/3 to apply the analytical methods developed in the class to specific systems such as the convergent and divergent evolution of venom toxins, the origin and diversification of Eukaryotes and multicellularity and genetic basis of diseases.

Tentative Schedule:

- I) Overview of Evolutionary Biology and Molecular Biology
 - 1. Sep 16 History and Evolutionary Biology & Tree of Life (Ch 1, 2)
 - 2. Sep 23 Natural selections and History of Life (Ch 3, 17)
 - 3. Sep 30 Species and Speciation (Ch 9, 13)
 - 4. Oct 7 Origin of Life and Origin of Eukaryotes (Ch 12, 16)
 - 5. Oct 14 Midterm Exam I
- II) Evolutionary Processes
 - 6. Oct 21 Mutation and Recombination to generate variation (Ch 4, 5)
 - 7. Oct 28 Random genetic drift & Neutral theory (Ch 6, 7)
 - 8. Nov 4 Gene flow and sexual selections (Ch 8, 10)
 - 9. Nov 11 How to be fit and Evolution of cooperation (Ch 11, 12)
 - 10. Nov 18 Statistics & Quantitative variation (Appendix)
 - 11. Nov 25 Midterm Exam II
- III) Special Topics
 - 12. Dec 2 Genes and Genomes in Evo/Devo (Ch 14, 15)
 - 13. Dec 9 Geography and Biological diversity (Ch 18, 19)
 - 14. Dec 16 Human genome and Evolution (Ch 21)
 - 15. Dec 23 Evolution above species (Ch 20, 22)
 - 16. Dec 30 Cancer Evolution and Diseases
 - 17. Jan 6 Origin and Novelty of Life
 - 18. Jan 13 Final Examination

Textbook: I) Evolution (4th Ed) Sinauer 2017 by DJ Futuyma & M Kirkpatrick (Required Reading)

II) Bioinformatics (4th Ed) Wiley 2020 Ed by Baxevanis et. al.

III) Assigned review article and literatures