MOLECULAR EVOLUTION

20404 - BIOL435 - A01
January 8 – April 8, 2024

COURSE OUTLINE

LECTURER: JOHN S. TAYLOR

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Lectures: MR: 11:30 AM - 12:50 PM -108 Engineering and Comp Sci (ECS) Bldg.

COURSE DESCRIPTION. Ten topics in Molecular Evolution: 1. Alignments and conserved elements (UCEs). 2. Rapid and remarkable sequence evolution (e.g., positive selection and fish antifreeze glycoproteins). 3. 'Normal' molecular evolution (e.g., Blosum matrices). 4. Gene duplication and divergence (and gene 'essentially' in human cells lines). 5. Phylogenetics (incl. two in-class 'labs'). 6. Gene conversion. 7. 'de novo' protein coding genes. 8. RNA-coding genes and ribo-switches. 9. Sex chromosomes and distorter genomes (incl. booklice). 10. Mitochondrial DNA evolution.

EVALUATION

1. ASSIGNMENTS: (35 pts)
    a) Reading assignment (5)
    b) Sequence analysis assignment (10)
    c) Phylogenetics assignment (10)
    d) Paper Presentation (10)

2. MID-TERM EXAM: (30 pts)

3. FINAL EXAM: (35 pts)

Grading scheme: A+ (90%-100%), A (85-89.9%), A- (80-84.9%), B+ (77-79.9, B (73-76.9%), B- (70-72.9%), C+ (65-69.9%), C (60-64.9%), D (50-59.9%), F (<50%), N (max. = 49%): Failure to complete one or more of the following: Mid-term exam, paper presentation, final exam.

UVic is committed to promoting, providing and protecting a supportive and safe learning and working environment for all its members.

Lecture schedule (2024)

Lecture	Date		Topic
1	JAN. 8	Aligning and comparing vertebrate sequences	1
2	11	Multispecies Conserved Sequences	
3	15	Ultra-conserved elements I	
4	18	Ultra-conserved elements II	
5	22	Conserved protein-coding genes	
6	25	Rapid and remarkable sequence evolution	2
7	29	Positive selection	
8	FEB. 1	Blosum matrices and BLASTp	3
9	5	Gene duplication I	4
	8	**Midterm**	
10	12	Gene duplication II	
11	15	Gene conversion	5
	19	*Reading Break*	
	22	*Reading Break*	
12	26	De-novo genes	6
13	29	Positive selection: Lab exercises (Codon alignment)	7 *Last day to drop*
14	MAR. 4	Genetics Distance: Lab exercises (Phylogenetics)	
15	7	RNA-coding genes	8
16	11	Ribo-switches	
17	14	Sex chromosomes and distorter genomes	9
	18	Mitochondrial DNA	10
	21	Group 1/Group 2	
	25	Group 3/Group 4	
	28	Group 5/Group 6	
	Easter		
	APR. 4	Group 7/Group 8	
	8	Group 9/Group 10	

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Learning Objectives

1. Student will be able to draw a phylogeny showing relationships among the major groups of vertebrates.
2. Students will be able to remember examples of highly conserved DNA sequences and proteins and examples of sequences and/or domains that have evolved especially quickly.
3. Students will be able to explain the values reported in a BLOSUM matrix and understand how that matrix is used in the identification of homologous amino acid sequences.
4. Students will reconstruct a phylogenetic tree and discriminate between duplication and speciation nodes on that phylogeny.
5. Students will learn to generate and interpret dN/dS data.
6. Students will learn how to present (i.e., interpret and summarize) a paper to classmates.