Speciation - BIOL 7117
Fall 2025 - Exam 1 Review Material

Names and terms:

cryptic species	Charles Darwin
monophyly vs. paraphyly vs. polyphyly	Ernst Mayr
gene tree vs species tree	Jordan's Law
allopatry vs sympatry	parallel speciation
magic trait	Theodosius Dobzhansky
immigrant inviability	meiotic drive
conspecific male precedence	Haldane's Rule
Dobzhansky-Muller incompatibilities	linkage disequilibrium
reinforcement	pleiotropy
reproductive character displacement	epistasis
incomplete lineage sorting	*Wolbachia*
coalescence	positive selection
(non)synonymous substitutions	Tajima's D

Lecture Questions: (although complete answers may require consulting background review papers, discussion papers or other sources).

Contrast Aristotle's essentialist view of species with Darwin's view

For each of the following species concepts, provide a definition, a name most closely associated with it, a relative strength of the concept, and a major weakness: Biological, Phylogenetic, Genotypic Cluster.

Describe three lines of evidence supporting allopatric speciation. What are the two major problems for sympatric speciation?

Outline four different lines of evidence that can be used to support ecological speciation, providing an example for each.

What is Haldane's Rule? Explain the dominance explanation for Haldane's Rule.

Describe the influential figure of Coyne and Orr (1989 Evolution) comparing pre-zygotic isolation between sympatric and allopatric species pairs and how it supports reinforcement. What is lacking that would be needed to distinguish this pattern from one caused by reproductive character displacement?

Use drawing of (and labels on) a phylogenetic tree to explain the six parameters that can be estimated under an Isolation with Migration model. How is this framework used to test for speciation with gene flow?

From Discussion papers: These questions arose mainly from the papers we read. In some cases, relevant information appeared in the paper, but you may need to consult textbooks or other sources to get a satisfactory answer.

What about the two *Howea* palms of Lord Howe Island make them candidates for having diverged in sympatry? What are the ecological and reproductive traits that differ most between them? How did Coathup et al. (2024) try and test whether these traits were the pleiotropic effects the same genes?

Outline the logic by which Schield et al. (2024) argue that sexual selection promotes the maintenance of reproductive isolation between subspecies of barn swallows.

Define Dobzhansky-Muller incompatibility. Explain why genes involved in mito-nuclear interactions might be especially likely to exhibit DMIs. Describe the series of comparisons Moran et al. (2024) used to conclude that hybrids between two swordtails (*Xiphophorus malinche* and *X. birchmanni*) show DMIs stemming from interactions between the products of *ndufs5* and *ndufa13* and a mitochondrial protein in respiratory complex I.

Describe how reconstructed demographic history helped provide insights into reinforcement in Bemmels et al. (2021).