

EEB 2245 & EEB 2245W
STUDY GUIDE for EXAM 2
SPRING 2010

Evolution of Biodiversity and Extinction

- recognize that diversification includes increase in number of species (diversity per se) and increase in major body forms (disparity)
- total number of taxa at any time is a balance between extinction and diversification rates
- relationship between # fossils found and sediment volume (& explanation for this relationship)
- Pull of the recent: what is it? Example? Lazarus taxa: what are they? Example?
- Evidence that there have been qualitative changes in diversity over time?
- Evidence of quantitative changes in diversity over time; category of taxonomic classification most appropriate for addressing this question & why this category is most appropriate
- Description of, and differences between Background and Mass extinctions (global vs local causes, etc.); proposed cause of the Mass extinction at the end of the Cretaceous and evidence that supports this explanation; explanations for other 4 mass extinctions; same or different causes?
- What is a diversity profile? Be able to interpret diversity profiles of different taxa
- Sepkoski's 3 marine animal faunas: in general, what are they? How did they differ from one another over time in terms of general composition and diversity? Explanation that has been proposed to describe the greater diversity of the "Modern Fauna"

Characters, Homology and Homoplasy

- what is a character (e.g. morphology, molecular, etc.)? What is a character-state? Examples of each
- mosaic evolution: what is it? How does it relate to the concept of entire species being "primitive" or "advanced"
- in reconstructing trees from characters must recognize: problems with organisms that look different, but are conspecific (e.g. sexual dimorphism, larval stages) and problems with organisms that look similar, but are not closely related (i.e. homoplasy)
- understand and be able to define the concept of homology; basic criteria used to determine homology?
- be able to explain the difference between homoplasy and homology;
- why strive to use homologies over homoplasies for the generation of phylogenetic trees?
- definition of homoplasy; Describe/distinguish among the 3 different types of homoplasy: reversal- what is it? Describe an example of a reversal; recognize a reversal on a phylogenetic tree; parallelism- what is it? describe an example of a parallelism; recognize parallelism on a phylogenetic tree; convergence- what is it? Describe an example of convergence; recognize convergence on a phylogenetic tree. How would you distinguish parallelism from convergence? Homobatrachotoxin- describe its taxonomic distribution; it is an example of which type of homoplasy?

Reconstructing Evolutionary History from Indirect Evidence

- What is systematics? What is a phylogenetic tree?
- Fossil record acts as point source for taxa, but does not show how taxa are related to one another; alternative for determining phylogenetic relationships? i.e., How do we infer branching patterns among taxa? Understand the distinction between an ancestral homology and a derived homology
- Understand and be able to define, and/or recognize on a phylogenetic tree, the following terms: terminal taxon, node, branch, sister taxon (taxa), most recent common ancestor, root, clade, monophyletic group, paraphyletic group, dichotomy, polytomy, character, character-state, plesiomorphy, symplesiomorphy, apomorphy, synapomorphy; recognize reversals, parallelisms, and convergent characters on trees; ingroup vs outgroup- how do they differ? Criteria for selection of each.
- function outgroup plays in systematics (allows polarization of characters- i.e., determination of ancestral versus derived states of homologies)
- What are optimality criteria? What is parsimony? What role does the principle of parsimony play in systematics? Steps in conducting a parsimony analysis.
- Be able to identify the possible sets of relationships (tree topologies) for a SMALL set of taxa, identify plesiomorphic vs. apomorphic states of characters using an outgroup, map characters onto the possible tree topologies, determine the most parsimonious topology, etc.
- Why are computer programs required to determine the most parsimonious tree topology/set of

- relationships when dealing with greater than 4 or so taxa?
- other methods for generating phylogenetic trees (i.e, Likelihood, Bayesian methods)
- Molecular characters: Sources of sequence data: nuclear? (DNA, RNA-3 types), organelle genomes (mitochondria, chloroplasts, etc.); assumption associated with use of organelle genomes as sources of data for generating phylogenetic trees; examples of 3 types of homoplasy using molecular character data; understand polarization of molecular characters; be able to polarize molecular characters using an outgroup
- Molecular clock: what is it? How is it calibrated? Does it run at the same rate in all taxa? Does it run at the same rate in all genes?
- Adaptive radiation- What is it? Provide an example. Recognize the phenomenon from an example
- Potential causes of diversification: colonization of new/vacant areas, key innovations; be able to describe and provide an example of each; provide an example of each

Biogeography and Continental Drift

- What is biogeography? What are its 2 major components? (descriptions of distributions vs. explanations for distributions)
- What are the ecological aspects of biogeography? (provide examples of biotic and abiotic factors)
- Basic features of earth: percentage of surface covered by land; land in the N. hemisphere vs. S. hemisphere; 6 major continental landmasses (N. America, S. America, Africa, Eurasia, Australia, Antarctica)
- Continental shelf: what is it? where is it?
- Continental vs. Oceanic islands: distinguish between the 2; recognize islands of each type from a map illustrating continental shelf; provide an example of each type of island
- Importance of knowing the actual distribution of a taxon before attempting to explain it
- Importance of understanding phylogenetic relationships of taxon before attempting to explain its distribution
- The Biogeographic realms: Palearctic, Nearctic, Neotropical, Ethiopian, Oriental, Australian (Oceania & Antarctic) What are they? Where are they? Barriers bounding each biogeographic realm
- Endemism: what is it? Disjunct, cosmopolitan, contiguous distributions
- Continental Drift and the theory of plate tectonics; know basic sequence and timing events of continental drift from Mesozoic to present; what and when were: Pangaea? Laurasia? Gondwanaland
- vicariance vs dispersal explanations for geographic distributions of organisms; examples of each; importance of establishing age of a taxon and its phylogenetic relationships prior to developing explanations for its distribution.