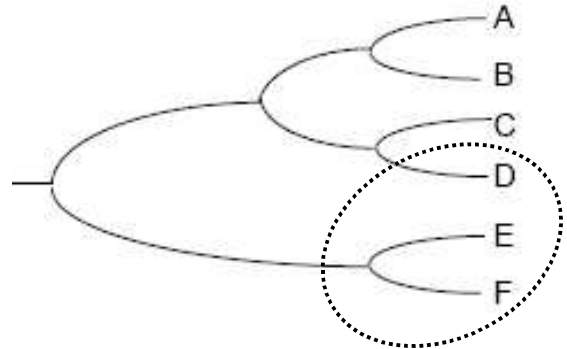


Ecology 182 T/Th 2 PM
1st Midterm – Tough Questions.

3. What is the best way to describe the group containing species D, E, and F as circled?

- a. Monophyletic
- b. Paraphyletic
- c. Parsiphyletic
- d. Polyphyletic
- e. Synapomorphic



Comment: Many biologists prefer to discuss monophyletic groups as a general rule. A Monophyletic group includes a COMMON ANCESTOR and ALL of its descendants. The circled group in the figure does not include a common ancestor so it cannot be Monophyletic. That leaves Paraphyletic or Polyphyletic. A Paraphyletic group includes a common ancestor and SOME, but NOT all of its descendants. A common example of a paraphyletic group would be ‘reptiles’ WITHOUT birds. A *Polyphyletic group does not include a common ancestor.* That is the case as circled. Parsiphyletic is a made-up word and synapomorphic refers to shared derived traits – not groups of taxa.

9. Terrestrial organisms convert ammonia to urea

- a. as a way of producing energy.
- b. because ammonia is more highly neurotoxic in terrestrial than in aquatic environments.
- c. to prevent excessive water loss that would result from producing a dilute urine.
- d. a. and b.
- e. a., b. and c.

Comment: Because ammonia is highly neurotoxic, organisms that excrete ammonia have to keep the blood (and hence urine) concentration very dilute. That’s OK if you’re a fish, because water is always available. But for land vertebrates, water can be hard to get. Excreting a dilute urine would result in dehydration. So they expend energy to convert ammonia to urea (uric acid in birds and reptiles). This question was trickier than I intended. **b.** is wrong because ammonia is highly neurotoxic regardless of the environment. However, this requires a close read. Had **b.** and **c.** been a possible answer, I would have accepted it. But the alternatives to **c.**, which is the correct answer, both included **a.**, which is incorrect since excess ammonia interferes with proper TCA cycling and consequently reduces energy production.

- 13. At the molecular level, cell differentiation during development is mediated by**
- a. differential gene expression.
 - b. gene cascades.
 - c. somatic mutation.
 - d. a. and b.**
 - e. a. and c.

Comment: A lot of you chose **a.**, which is correct. But **b.** is also correct – see the notes (Lecture 1, Page 8, Figure 8). Not sure why people forgot about that.

- 20. Consider a single gene, with two alleles, A and a . Let p be the frequency of gene A . Let the fitnesses of these alleles be w_{AA} , w_{Aa} and w_{aa} . If $w_{AA} > w_{Aa} < w_{aa}$. The equilibrium value(s), p^* , of p is (are)**
- a. $p^* = 0$.
 - b. $0 < p^* < 1$.
 - c. $p^* = 1$.
 - d. $p^* = 0$ or 1 depending on the initial value of p .**

Comment: The most frequent answer was **b.**, which is what obtains when the heterozygote has greater fitness than either homozygote. In this case, the question would have read $w_{AA} < w_{Aa} > w_{aa}$. Possibly the problem was knowing the meanings of “>” (greater than) and “<” (less than).

- 28. Species are held together by _____ and pulled apart by _____.**
- a. reproduction; divergent selective pressures in different parts of their ranges.
 - b. reproduction; neutral mutation.
 - c. gene flow; neutral mutation.
 - d. gene flow; divergent selective pressures in different parts of their ranges.**
 - e. c. and d.

Comment: Reproduction by itself doesn’t hold species together. The glue is “reproduction at a distance” – either adults travel widely, or seeds, larvae or juveniles disperse. In either case, the result is gene flow. Contrary to what was posted, **d.** is the correct answer. Genetic drift (small local populations) can also pull populations apart, and neutral mutation produces drift, which, conceivably, could result in reproductive isolation down the line. So we will give credit for c., d. or e.

- 35. One interpretation of Ediacaran “animals” is that**
- a. they were giant, plasmodial protozoans.
 - b. they constituted a “failed experiment” and left no descendants.
 - c. they were, in fact, the soft-bodied ancestors (no teeth, skeletons) of modern organisms
 - d. a. and b.**
 - e. a., b. and c.

Comment: **a.** and **b.** are consistent with each other and *inconsistent* with **c.**, which is the other possibility. So the answer can’t be **a.**, **b.** and **c.** – which leaves **a.** and **b.** But the question could have been better written. We will give credit for a., b., c. and d.

41. Which of the following lophotrochozoans have a lophophore?

- a. flatworms.
- b. rotifers.
- c. bryozoans
- d. spiralian
- e. mollusks.

Comment: Within the lophotrochozoans, only lophophorates have a lophophore – I made a big deal of this, poking fun at systemacists. Of the groups listed, only bryozoans are lophophorates – I showed you a picture of one extending and retracting the lophophore.

42. Which of the following lophotrochozoan groups contain species that are “jet propelled?”

- a. flatworms.
- b. rotifers.
- c. bryozoans.
- d. spiralian.
- e. mollusks.

Comment: Remember the cephalopod siphon (modified mantle) that allows the animal to expel a jet of water and dart rapidly backwards – see Lecture 6 (towards the bottom).

48. If vertebrates evolved from tunicate-like ancestors, the transition involved

- a. parthenogenesis.
- b. neoteny.
- c. a saltatory (large, discontinuous) evolutionary jump.
- d. a. and b.
- e. b. and c.

Comment: Seems like most of you forgot the meaning of the word “neoteny.” Point stressed in lecture (and notes) was that vertebrates descended from larval tunicates (have a notochord and tail) that became sexually competent.

51. Which of the following statements about molecular clocks is TRUE?

- a. The measurable mutation rate is the same across all genes in a given population
- b. A synonymous mutation is considered silent because the genetic code is redundant and the mutation does not change the amino acid added to a growing protein
- c. The measurable mutation rate is the same across all base pairs in the genome
- d. A non-synonymous mutation is more often selected for than it is selected against
- e. The neutral theory states that mutations in the amino acid composition of proteins are usually selectively neutral

Comment: a. is not true because some genes are more important for survival, and therefore fitness, than others. Mutations that clearly reduce fitness will generally be lost from the population and therefore are not readily measured in future generations by biologists.

b. is TRUE because a mutation in nucleotide sequence that does not change the amino acid composition of a protein (the definition of a synonymous mutation) will generally not be ‘observable’ by natural selection.

- c. is not true because of the same reason as a.
- d. is not true because most non-synonymous mutations (change in nucleotide sequence *does* change the amino acid in the protein) are deleterious, not advantageous.
- e. is not true because the neutral theory is about nucleotide changes not amino acid changes per se. See the rationale for b. and d.

52.-55.

Comment: Dr. S. will discuss in class.