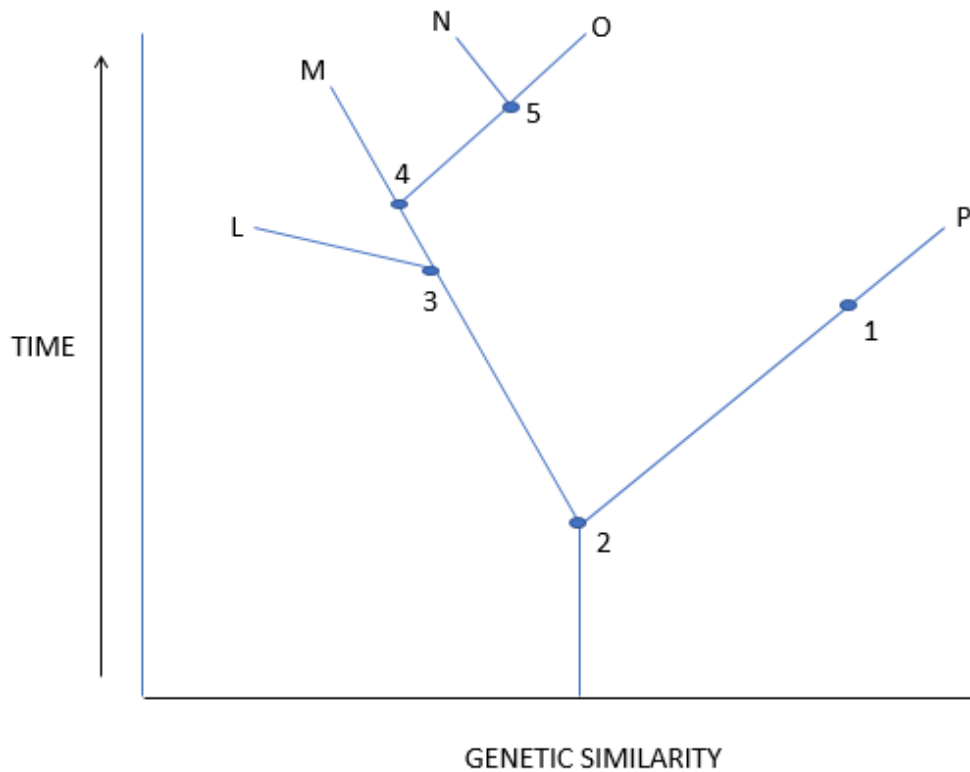


## LECTURE 6 – Evolution & Phylogeny

### QUESTIONS TO TRY FOR PRACTICE

1. How did Louis Pasteur's experiment support the cell theory?
  - a. It proved all organisms are made of cells.
  - b. It proved all cells share a common ancestry.
  - c. It showed that cells do not arise from by spontaneous generation.
  - d. It proved that all cells evolve.
  
2. You enter a dim building on a sunny day and immediately your eyes dilate to allow more light in. What property of life does this represent?
  - a) Growth
  - b) Energy use
  - c) Irritability
  - d) Movement
  
3. Which of the following principles is NOT part of Darwin's theory of evolution by natural selection?
  - A. Evolution is a gradual process that occurs over long periods of time.
  - B. Variation occurs among individuals in a population.
  - C. Mutations are the ultimate source of genetic variation
  - D. More individuals are born than will survive
  - E. Individuals that possess the most favorable variations have the best chance of reproducing.
  
4. A phylogenetic tree is a diagram:
  - A) that extends back to the origin of life in the Universe
  - B) at whose base is located the common ancestor of all taxa depicted on that tree.
  - C) that illustrates DNA mutations
  - D) with very few branch points.
  
5. The common ancestor of two species is most analogous to which anatomical tree part?
  - A) a node where two twigs diverge
  - B) a twig that branches with time
  - C) the trunk
  - D) neighboring twigs attached to the same stem

Use the diagram below to answer # 6-8



6. A common ancestor for both species O and P could be at position number

- A) 5
- B) 2
- C) 3
- D) 4

7. The two existing species that are most closely related to each other are:

- A) N and O
- B) P and L
- C) N and M
- D) M and L

8. Which species are extinct?

- A) N and O
- B) P and L
- C) N and M
- D) M and L

9) Which of the following observations demonstrates the fundamental characteristic of life known as energy?

- A) Organisms are made of membrane-bound units called cells.
- B) A bacterium replicates to become two bacteria.
- C) Plants absorb sunlight to stay alive and reproduce.
- D) The gene that specifies skin colour in frogs is passed from parent to offspring.
- E) The use of antibiotics has increased the frequency of bacteria populations that are resistant to those antibiotics.

10) How does a scientific theory differ from a scientific hypothesis?

- A) There is no difference—the terms are interchangeable.
- B) A theory is an explanation for a very general phenomenon or observation; hypotheses treat more specific observations.
- C) A hypothesis is an explanation for a very general phenomenon; theories treat more specific issues.
- D) Theories define scientific laws; hypotheses are used to set up experiments.

11) Algae in the genus *Caulerpa* typically grow to a length of over half a meter and have structures similar to stems, leaves, and roots. Reproduction occurs when adults produce sperm and eggs that fuse to form offspring. Each adult *Caulerpa*, however, consists of just a single cell. Which of the following statements is true?

- A) *Caulerpa* violate the pattern component of the cell theory—that all organisms consist of cells.
- B) *Caulerpa* violate the process component of the cell theory—that all cells come from preexisting cells.
- C) *Caulerpa* violate both the pattern and process components of the cell theory.
- D) The existence of *Caulerpa* is consistent with the cell theory.

12) Which statement about spontaneous generation is FALSE?

- A) Pasteur demonstrated that it does not occur under normal laboratory conditions.
- B) It apparently occurred at least once—when life on Earth began.
- C) It occurs every time a new species evolves from a preexisting species.
- D) It addresses the formation of living cells from previously nonliving material.

13) Recall Pasteur's experiment on spontaneous generation. Originally, he used sealed and unsealed flasks instead of swan-necked and unsealed flasks. Critics claimed that the experiment was inconclusive. Which of the following criticisms would be addressed by using a swan-necked flask instead of the sealed flask?

- A) The broth was heated too intensively.
- B) There had not been enough time for spontaneous generation to occur.
- C) Fresh air is required for spontaneous generation.
- D) The broth was not nutritious enough.

14) Which of the following is the best example of a heritable variation?

- A) skin cancer
- B) amputation
- C) red hair
- D) love for music

15) How does artificial selection differ from natural selection?

- A) Artificial selection occurs only in computer simulations, not with actual organisms.
- B) Artificial selection is based on conscious choices by humans.
- C) Artificial selection occurs only with plants.
- D) Artificial selection is not based on heritable variation, but on new mutations.

16) Over the past several decades, natural selection has caused populations of *Staphylococcus aureus* (an infectious wound bacterium) to evolve resistance to most antibiotics. If antibiotic use were stopped, what would you predict would happen to these *S. aureus* populations?

- A) They will go extinct without the antibiotic.
- B) The populations will begin colonizing new environments.
- C) The frequency of nonresistant forms will increase in these populations.
- D) The frequency of resistant forms will definitely increase in these populations.

17) Environments all over the world are changing as a result of global warming. Could this influence natural selection?

- A) No. The environment is always changing. Global warming is nothing new.
- B) Yes. Traits that help individuals produce more offspring in warmer environments will increase in frequency.
- C) No. The only change will be that species from hot environments will expand their ranges.
- D) Yes. Mutations occur more frequently in hot environments.

18) The "heat" in chili peppers is due to a molecule called capsaicin. Suppose you breed chili peppers that have low amounts of capsaicin over many generations in order to make them milder (have less capsaicin). What process is occurring?

- A) heritable variation
- B) environmental change
- C) natural selection
- D) artificial selection

19) The "heat" in chili peppers is due to a molecule called capsaicin. Suppose you breed only the hottest chili peppers over many generations—predict the characteristics of the resulting individuals.

- A) larger fruits
- B) smaller fruits
- C) less capsaicin
- D) more capsaicin

20) Starting from the wild mustard *Brassica oleracea*, breeders have created the strains known as Brussel sprouts, broccoli, kale, and cabbage. Which of the following statements is supported by this observation?

- A) In this species, there is enough heritable variation to create a variety of features.
- B) Heritable variation is low—otherwise the wild strain would have different characteristics.
- C) Natural selection has not occurred very frequently in the wild populations.
- D) In this species, most of the variation present is due to differences in soil, nutrition, amount of sunlight, or other aspects of the environment.

21) The structure of double helical DNA

- A) serves as a template for protein synthesis.
- B) is used to synthesize messenger RNA.
- C) contains two identical single strands of DNA.
- D) must be accurately copied to ensure variation in organisms.

22) Which of the following describes the flow of genetic information in cells according to the central dogma?

- A) DNA codes for RNA, which codes for protein.
- B) DNA codes for protein, which codes for RNA.
- C) RNA codes for DNA, which codes for protein.
- D) RNA codes for protein, which codes for DNA.
- E) Protein codes for RNA, which codes for DNA.

23) Which of the following best reflects a phylogenetic conclusion regarding chimpanzees and baboons?

- A) They are grouped together because they both have opposable thumbs.
- B) They are grouped together because they both feed their young breast milk.
- C) They are grouped together because they have a common ancestor in recent history.
- D) They are grouped together because they live in similar habitats.

24) One aspect of Darwin's theory of natural selection is that adaptations not useful to fitness are lost faster if they have a greater cost. With this in mind, which of the following explanation is most likely true?

- A) Our little toe is not going away in the near future.
- B) The human appendix must currently serve an essential function or it would not be in our bodies.
- C) It is a mystery why we do not have tails.
- D) Humans are relatively hairless because we look better without hair.

25) Many phylogenetic trees are based on DNA sequence similarities. What is the practical result of this similarity?

- A) Closely related species will not look similar to each other.
- B) Artificial selection can bring closely related species even closer to each other.
- C) Species with very similar DNA will have similar structures, enzymes, and appearance.
- D) Mitochondrial DNA might be different from nuclear DNA.

26) Which of the following would not be a good reason for studying SSU RNA to understand the major branches in the evolutionary history of life?

- A) This molecule is found in every species.
- B) It is passed on through evolutionary history with only minor modifications.
- C) It is a necessary part of the cellular machinery for reproduction and other purposes.
- D) It mutates very frequently.

27) Which taxon would generally include the largest number of species?

- A) species
- B) phylum
- C) domain
- D) genus

28) Why did the five-kingdom system of classification fall out of favor?

- A) It was too complex—Linnaeus' original two-kingdom system was more useful.
- B) It was too difficult to distinguish plants from fungi and animals from protists.
- C) There were too few monerans to justify their classification at the kingdom level.
- D) It did not reflect the actual evolutionary relationships among organisms very well.

29) What do the nodes and branch points on a phylogenetic tree represent?

- A) species
- B) new kingdoms or domains
- C) ancestral groups that split into two descendant groups
- D) groups that got new names

30) On an evolutionary tree, any group that includes a common ancestor and all of its descendants is called monophyletic ("one-tribe"). Draw the tree for Bacteria, Archaea, and Eukarya. Are prokaryotes monophyletic?

- A) yes
- B) no

31) On an evolutionary tree, any group that includes a common ancestor and all of its descendants is called monophyletic ("one-tribe"). Draw the tree for Bacteria, Archaea, and Eukarya that we think best represents the current data. According to this tree, are all organisms alive today monophyletic?

- A) yes
- B) no

32) On the tree of life, the branch leading to animals is closer to fungi than it is to the branch leading to land plants. Which of the following statements is correct?

- A) Animals and plants do not have a common ancestor.
- B) Animals and land plants are more closely related to each other than either is to fungi.
- C) Fungi and animals do not have a common ancestor.
- D) Animals and fungi are more closely related to each other than animals are to land plants.

33) On the tree of life, branches that lead to several groups of green algae branch off from the one that leads to land plants. Which one of the following statements is correct?

- A) Green algae and land plants are not related.
- B) Green algae are very closely related to the fungi.
- C) Land plants appeared first in the fossil record.
- D) Land plants and algae have a common ancestor.