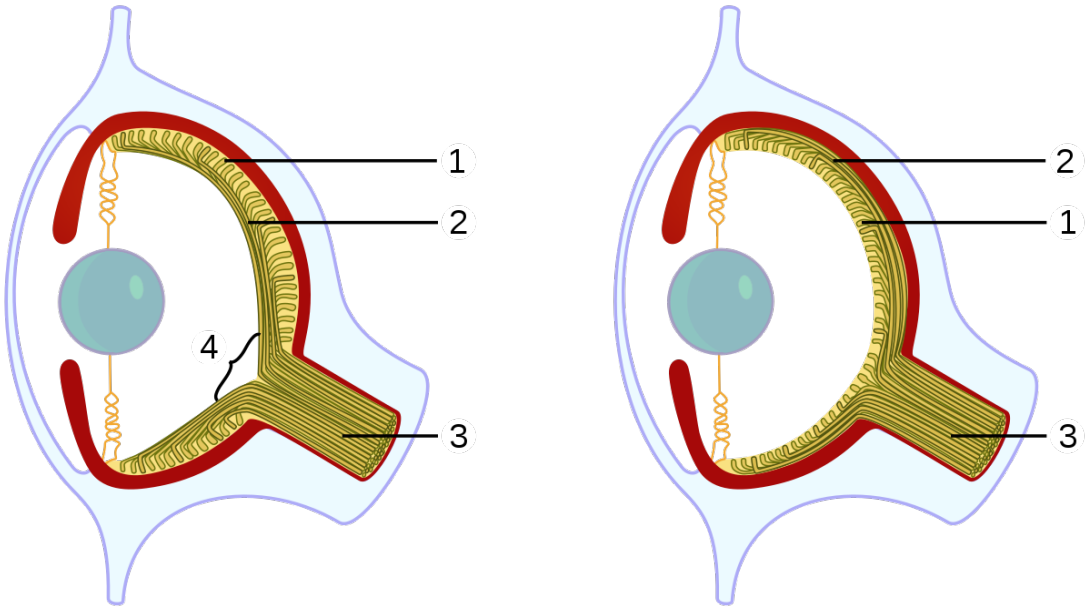
1. Which of the following is often an advantage of observational studies as compared to experimental studies?

A. It is easier to be sure you've taken relevant factors into account
B. It is easier to manipulate the study organisms
C. **It is easier to ensure that conditions are realistic**
D. It is easier to randomize which individuals receive which treatment

2. What sort of evidence would falsify the statement "No insects have interneurons"?

A. An insect without interneurons
B. **An insect with interneurons**
C. A tetrapod with interneurons
D. A tetrapod without interneurons
E. A flying cow



3. Vertebrates (like us) have a blind spot in the eye (indicated by 4 in the diagram above), where nerves pass in front of the light-detecting cells. Cephalopods (like octopi) have a similar design, but the nerves go behind the light-detecting cells. Which of the following is a likely explanation for the less-effective design in vertebrates?

A. Evolution operates by natural selection, and not by inheritance of acquired characteristics
B. **Evolution happens gradually, and is not goal directed**
C. Adaptation is often the result of compromise between conflicting goals
D. Natural selection is less efficient in more advanced taxa

4. "Evolution" refers most generally to:

A. **species changing through time**
B. relationships between different species
C. heritable variation in traits
D. variable reproduction (fitness)
E. adaptation to new environments or ecosystems

5. Which of the following is *not* evidence that species have evolved?

A. Species fall naturally into groups
B. **Acquired characteristics cannot be inherited**
C. The genetic code is similar in all known species
D. Embryos of all tetrapods follow similar patterns of development
E. Genetic and morphological evidence often agree about which traits are homologous

6. In a population, it is observed that larger leopards are better at hunting the available prey than smaller (adult) leopards are, but there is no evidence that leopards are evolving to be larger in this population. Which of the following is *not* a likely explanation for this?

A. There is a tradeoff in size between hunting ability and ability to mature quickly
B. **The population is too large for random drift to be important**
C. The population is subject to gene flow from a population in a different environment
D. The observed variation in adult size is not heritable in this population

7. _____ is _____ determined by _____.

A. phenotype; entirely; genotype
B. genotype; entirely; phenotype
C. **phenotype; largely (not entirely); genotype**
D. genotype; largely (not entirely); phenotype

8. Which of the following is *not* an assumption of the Hardy-Weinberg calculation?

A. **One allele is dominant and the other recessive**
B. The population is closed
C. Mating is random
D. No differences in fitness between genotypes

Use the following information for the next 3 questions. A researcher measures genotypes in a population and finds 60 individuals of type AA, 20 individuals of type AB and 10 individuals of type BB.

9. The *allele* frequency of B in the sample is

A. 11%
B. **22%**
C. 33%
D. 44%
E. 56%

10. The *genotype* frequency of BB in the sample is

A. **11%**
B. 22%
C. 33%
D. 44%
E. 56%

11. How would you describe this population, based on the sample?

A. It is in Hardy-Weinberg equilibrium
B. It has more A than expected
C. It has more B than expected
D. **It has more homozygotes than expected**
E. It has more heterozygotes than expected

12. Sex is important to evolution because it can:

A. Change allele frequencies
B. **Bring alleles together in new combinations**
C. Generate new allelic variants
D. All of the above
E. None of the above: sex is important, but not to evolution

13. Two related populations are under divergent selection, and cannot produce fertile offspring. These populations are *less* likely to persist and form two stable species if they are in _____ because of _____.

A. allopatry; gene flow
B. sympatry; gene flow
C. allopatry; competition
D. **sympatry; competition**

14. Which of the following is an advantage of the morphological species concept?

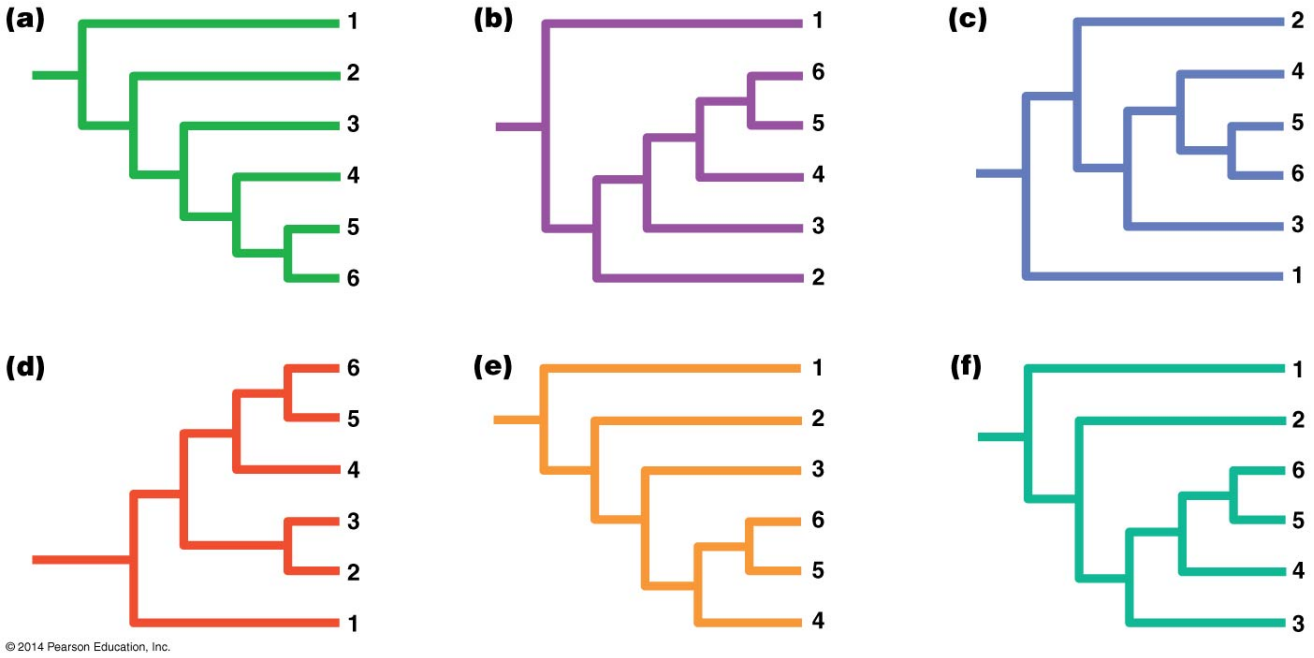
A. It is well defined, in theory
B. It is straightforward to apply
C. **It is appropriate for analyzing species known only from fossils**
D. It doesn't depend on identifying populations of organisms

15. Several species of Amazon trumpeters evolved from a common ancestor which was split into separate populations by the rising of the Andes and the formation of large rivers. This is an example of _____ speciation due to _____.

A. **allopatric; vicariance**
B. allopatric; dispersal
C. sympatric; vicariance
D. sympatric; dispersal

16. Different species of closely related frogs in the same area often have very different mating calls. This is likely an example of _____ selected for by _____.

A. Reinforcement; competition
B. **Reinforcement; reduced hybrid fitness**
C. Exclusion; competition
D. Exclusion; reduced hybrid fitness



17. In the figure above, which tree shows a *different* model of evolution than the one shown in a)?

A. f
B. b
C. c
D. **d**
E. e

18. A research team is studying a very wide variety of viruses, using morphological factors. They are able to estimate the *difference* between any pair of viruses, but are not able to infer ancestral states, or paths of evolution. They should use _____ analysis to infer phylogenies, because it is _____.

A. cladistic; more consistent with how evolution occurs
B. phenetic; more consistent with how evolution occurs
C. cladistic; the only one that can be used with the available data
D. **phenetic; the only one that can be used with the available data**

19. Which is *not* a reason to prefer using periods (e.g., Cambrian) to dates (e.g., 520mya)?

A. Links between period transitions and specific events
B. **Easier for people to keep the order straight**
C. Historical usage
D. Cool names may help people make mental connections

20. Plains zebras live in male-centered groups with 4-9 individuals. Grevy's zebras live in large, well-mixed groups with lots of interactions between males and females. We would expect _____ to show more sexual dimorphism in body size because sexual competition is more likely to involve _____ in that species.

A. Grevy's zebras; fighting
B. **Grevy's zebras; genitals**
C. Plains zebras; fighting
D. Plains zebras; genitals

21. Which of the following is *not* a likely driver of highly evolved traits (like human brain size)?

A. Evolutionary loops
B. Ecological changes
C. **Long-term evolutionary goals**
D. Physical changes

22. Researchers of human evolution are interested in bimodality of tooth sizes among individuals because this is a way to measure _____, which is relevant for understanding _____.

A. Dietary habits; complex foraging
B. Jaw structure; language development
C. Jaw structure; brain size
D. **Sexual dimorphism; social structure**

23. Which of the following is *not* used to provide clues about the sociality of early hominins?

A. Sexual dimorphism
B. **Physical structures consistent with high metabolism**
C. Physical structures consistent with vocal communication
D. Physical structures consistent with slow development to adulthood

24. Tiger cubs often play, but adult tigers rarely do. This is likely because the cubs are displaying _____, and the adults are displaying _____.

A. adaptation; acclimation
B. acclimation; adaptation
C. **sensitivity; crystallization**
D. crystallization; sensitivity

25. The ability to traverse trees by swinging is characteristic of the clade commonly known as apes. Humans don't have this ability because of:

A. human exceptionalism
B. observer bias
C. **secondary loss**
D. phylogenetic misclassification
E. convergent evolution

26. (3 points) You want to conduct an experiment to find out if access to fresh vegetables can help male finches make their beaks orange. You have 40 male finches, some standard finch food (with no fresh vegetables) and some fresh vegetables. Explain specific steps you would take you would take to follow good experimental principles. Divide your answer clearly into 3 sentences; each should explicate a different principle.

The experiment should be *controlled*: we should have one group with access to fresh vegetables, and compare them to a grout with out. The experiment should be *randomized*: we use computer random numbers to assign finches to the treatment (vegetable) or control (no vegetable) group. The experiment should be *replicated*: finches in different groups should differ in nothing but access to vegetables, even random things like cages and feeding times should not differ systematically. The experiment should be *focused*: everything should be kept as similar as possible, for example the food given to both groups should be the same except for the vegetables.

27. (2 points) Ground finches with larger beaks can crack more different kinds of seeds than finches with smaller beaks, and do better when food is scarce. Give two likely reasons (separated by commas) why some finches have smaller beaks.

Smaller-beaked finches may: move around more efficiently, reproduce more efficiently, process small seeds more efficiently.

28. (2 points) List two theories for why upright posture and walking evolved in human ancestors

Adaptation for: walking on the ground, staying cool, harvesting food, carrying food.

29. (2 points) Give two examples of how "looping" might have led to sustained evolution for larger brain size in our ancestors

larger brains make it possible to evolve _____ which can increase selection for larger brains: complex culture, highly social societies, complex foraging, language

TABLE 26.1 The MN Blood Group of Humans: Observed and Expected Genotype Frequencies

The expected genotype frequencies are calculated from the observed allele frequencies, using the Hardy–Weinberg principle.

		Genotype Frequencies			Allele Frequencies	
Population and Location	**Data Type**	***MM***	***MN***	***NN***	***M***	***N***
Inuit (Greenland)	Observed	0.835	0.156	0.009	0.913	0.087
	Expected	0.834	0.159	0.008		
Native Americans (U.S.)	Observed	0.600	0.351	0.049	0.776	0.224
	Expected	0.602	0.348	0.050		
Caucasians (U.S.)	Observed	0.292	0.494	0.213	0.540	0.460
	Expected	0.290	0.497	0.212		
Aborigines (Australia)	Observed	0.025	0.304	0.672	0.176	0.824
	Expected	0.031	0.290	0.679		
Ainu (Japan)	Observed	0.179	0.502	0.319		
	Expected					

Step 1 → Step 2 → Step 3 → Step 4

DATA: W. C. Boyd. 1950. Boston: Little, Brown and Company.

30. (3 points) The figure above shows allele and genotype frequencies for the MN blood group in different groups of humans.

a) Describe the overall pattern within individual populations

The individual patterns are close to HW equilibrium.

b) Describe the overall global pattern (approximated by the average of these populations)

The global pattern shows more homozygotes than would be expected at HW equilibrium

c) Explain why these patterns are or are not similar.

The individual populations are mixing approximately randomly, but the global population shows a strong bias towards mixing within groups

31. Name and briefly describe three sources of possible bias that scientists try to correct for when examining the fossil record.

Habitat bias: things that live in swampy areas, or underground are more likely to fossilize

Taxonomic bias: hard things, or hard parts of things are more likely to be preserved

Temporal bias: things that lived more recently have had less time to be destroyed

Abundance bias: Things that are more abundant have more chances to be preserved