

1. Which of the following is often an advantage of experimental studies as compared to observational studies?
 - A. It is not necessary to replicate the study units
 - B. It is not necessary 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 “Only 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 tetrapod eating insects

3. When McMaster researchers study the effects of medical radiation on mice, they often carry two sets of mice to the nuclear reactor building, one of which is exposed to radiation and one of which isn't. What is a likely reason they carry mice that they don't expose?
 - A. To increase replicability of the experiment
 - B. Because they don't want to randomize the mice into groups until they have to
 - C. **To make the control group as similar as possible to the treatment group**
 - D. To test the possibility that there is radiation in unexpected parts of the reactor building

4. We discussed experiments that showed that an eye-promoter gene from mice promotes eye growth in flies. This provides strong evidence that eye placement in mice and flies is
 - A. convergent
 - B. **homologous**
 - C. heterologous
 - D. dominant
 - E. recessive

Use the following information for the next two questions. For the purpose of these questions, consider what is sometimes called “artificial” selection to be a type of natural selection.

5. When tuberculosis bacilli are exposed to streptomycin, most of the bacilli die, but the population often becomes drug resistant during treatment, because the population has heritable variation in their drug response. This is an example of:

- A. **evolution by natural selection**
- B. evolution (only)
- C. natural selection (only)
- D. neither evolution nor natural selection

6. A related species is killed (at first) at a similar rate, and has a similar amount of variation, but the variation is not heritable. This population is expected to gain drug resistance:

- A. more quickly than the tuberculosis bacilli
- B. more slowly than the tuberculosis bacilli
- C. it depends on whether the resistance allele is dominant
- D. **not at all**

7. Which of the following provides evidence that all organisms come from a single common ancestor?

- A. Species fall naturally into groups
- B. **The genetic code is similar in all known species**
- C. Embryos of all tetrapods follow similar patterns of development
- D. Genetic and morphological evidence often agree about which traits are homologous
- E. All of the above

8. A population of cheetahs and a population of leopards live in the same area. It is observed that all of the cheetahs hunt impala, and are speedy enough to do so, but only some of the leopards hunt impala. The leopards that hunt impala are speedy, but the other leopards are not. Leopard choice of whether to hunt impala is shaped by availability of other antelopes when they are younger, and does not seem to be heritable. It is likely that speediness in cheetahs is an _____ and speediness in leopards is an _____.

- A. adaptation; adaptation
- B. **adaptation; acclimation**
- C. acclimation; adaptation
- D. acclimation; acclimation

Use this information for the following two questions: Peppered moths with DD or DL alleles at the wing color locus look equally dark; scientists can't tell the two types apart without genetic sequencing.

9. The D allele is:

- A. homozygous
- B. diploid
- C. polyploid
- D. **dominant**
- E. recessive

10. Compared to DD moths, DL moths have _____ phenotypes and _____ genotypes:

- A. the same; the same
- B. **the same; different**
- C. different; the same
- D. different; different

11. The Dunkers are a religious group that moved from Germany to Pennsylvania in the mid-1700s. They do not marry with members outside their own immediate community. Today, the Dunkers differ in gene frequencies, at many loci, from all other populations including those in their original homeland. Which of the following likely explains the genetic uniqueness of this population?

- A. Population bottleneck and Hardy-Weinberg equilibrium
- B. Heterozygote advantage and stabilizing selection
- C. Sexual selection and inbreeding depression
- D. Mutation and natural selection
- E. **Founder effect and genetic drift**

12. Natural selection occurs when there is heritable variation in traits related to reproductive success. What is the main source of new heritable variation for natural selection to act on?

- A. sexual reproduction
- B. **random mutation**
- C. the need to adapt to the environment
- D. gene flow from better-adapted populations
- E. genetic drift

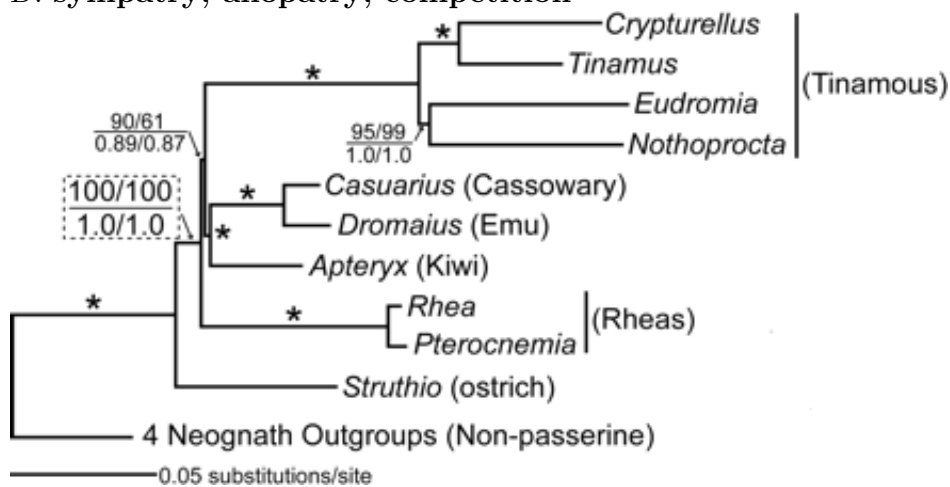
Use the following information for the next 3 questions. A researcher measures genotypes in a population and finds 20 individuals of type AA, 60 individuals of type AB and 10 individuals of type BB.

13. The *allele* frequency of B in the sample is
- A. 11%
 - B. 22%
 - C. 33%
 - D. **44%**
 - E. 56%
14. The *genotype* frequency of AA in the sample is
- A. 11%
 - B. **22%**
 - C. 33%
 - D. 44%
 - E. 56%
15. How would you describe the genotype distribution in 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**
16. Which of the following is an advantage of the phylogenetic 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

Use the following information for the next two questions. Ground finches in the Galapagos that prefer different-sized seeds evolved to have different-sized beaks and eventually to be separate species.

17. This is an example of _____ speciation due to _____.
- A. allopatric; vicariance
 - B. allopatric; dispersal
 - C. sympatric; balancing selection
 - D. **sympatric; disruptive selection**

18. These finch species at some point likely faced selection for
- Fusion
 - Gene flow
 - Pre-zygotic isolation**
 - Post-zygotic isolation
19. After a polyploidy event, it is less likely that a population will diverge into two stable species in _____ than in _____, because of _____.
- allopatry; sympatry; gene flow
 - sympatry; allopatry; gene flow
 - allopatry; sympatry; competition
 - sympatry; allopatry; competition**



Use the figure above for the next two questions. It shows a tree which changed the view of how this group of large birds evolved.

20. Classically, the “ratites” referred to cassowaries, emus, and ostriches (as far as I know). Based on this tree, a clade containing these ratites must also contain:
- Kiwis
 - The species labelled Rheas
 - Kiwis and the group labelled Rheas
 - Kiwis, the group labelled Rheas and the group labeled Tinamous**
21. According to this tree, the group labelled Rheas _____ a clade and the group labeled tinamous _____ a clade.
- is; is**
 - is; is not
 - is not; is
 - is not; is not

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

- A. Evolutionary loops
- B. Ecological changes
- C. **Goal-directed evolution**
- D. Physical changes

23. Leaf-cutter ants eat only a special species of fungus that they cultivate, and tend, and feed leaves to. This fungus has lost many genes and abilities since being “domesticated” by the ants. It has many well-studied close relatives, which are not domesticated, and have not lost a broad set of abilities. A scientist wants to study whether the ant-grown fungus is a sister to one of the other species in the taxon. They would be better off doing a:

- A. **Cladistic analysis**
- B. Phenetic analysis
- C. Either; both methods are similarly likely to get the right answer since the taxon is well studied
- D. Either; both methods are similarly *unlikely* to get the right answer since the other relatives are not domesticated

24. People used to think that chimpanzees were closely related to gorillas. Now we know that they are closer to us. Which is *not* a likely reason for the earlier mistaken conclusion?

- A. Humans have a lot of specialized adaptations
- B. Humans are particularly good at recognizing human traits
- C. The use of phenetic approaches
- D. **Convergent evolution**

25. Which of the following is *not* a likely reason why the hominin evolutionary tree is still not well understood?

- A. Changing environments
- B. **Coevolution**
- C. Convergent evolution
- D. Fossilization biases
- E. Radiation and contraction