1. *JD* As discussed in class, *replication* in experimental design means:

A. copying results from another scientist's work
B. ensuring that only one variable is changed at a time
C. repeating an experiment if the original results are unclear
D. **subjecting multiple individuals (or groups) to the same experimental condition**

2. *JD* Which of the following is the best example of a controlled experiment?

A. A researcher studies whether sunlight affects plant colour by planting flowers in two gardens with different sun exposure
B. A researcher studies whether fish change algae growth patterns by comparing a pond with fish to a nearby pond without fish
C. **A researcher studies whether fertilizer affects plant growth by giving one group of plants fertilizer and leaving another group with no fertilizer**
D. A researcher studies whether female dung beetles are attracted to large-horned males by exposing them to males of varying horn sizes and seeing which on they choose

3. *JD* Which of the following is NOT one of the steps in Darwin's theory of natural selection?

A. Variation: Individuals in a population differ in traits
B. **Acclimation: Individuals are changed by the environment during their lifetime**
C. Reproductive Success: Some individuals produce more offspring than others
D. Heritability: Some traits are passed onto offspring
E. Correlation: Differences in reproductive success are related to heritable traits

4. *JD* The Bajau are a population in Southeast Asia known for their freediving ability, helped by larger than average spleens (which can store oxygenated blood). Based on this information, we can conclude that the larger spleen is primarily an:

A. acclimation
B. adaptation
C. acclimation, *if* we know that it occurs in individuals who don't freedive as well as those who do
D. **adaptation, *if* we know that it occurs in individuals who don't freedive as well as those who do**

5. *JD* The _____ of an organism is determined both by its _____, and by _____.

A. genotype; phenotype; acclimations
B. genotype; phenotype; adaptations
C. **phenotype; genotype; acclimations**
D. phenotype; genotype; adaptations

6. *JD* A population of peppered moths has 20% peppered individuals and 80% dark individuals. If the peppered allele (L) is recessive, we can conclude that the *genotype* frequency of LL individuals is:

A. **20% no matter what**
B. 20% if we assume HW distribution
C. 45% no matter what
D. 45% if we assume HW distribution

7. *JD* Which of the following best explains why adaptive radiation can occur rapidly after a mass extinction?

A. Species to evolve more quickly to replace those that went extinct
B. **It opens ecological niches, allowing surviving lineages to diversify rapidly**
C. Mutation rates increase to meet environmental demands
D. More acquired traits are developed and inherited because there is more ecological opportunity.
E. The extinction event "resets" the molecular clock, triggering a phylogenetic renaissance.

8. *JD* Scientists have observed populations of beetle with disruptive selection: big beetles are very efficient at eating seeds; small beetles can hide, and survive, and reproduce quickly; medium-sized beetles tend to struggle. What is a likely reason that these populations have *not* split into separate species?

A. disruptive selection
B. heterozygote advantage
C. genetic drift
D. **gene flow**

9. *JD* A species with more sexual dimorphism is expected to have relatively _____ differences between the two sexes in investment in each offspring, and is _____ likely to form large social groups.

A. **large; less**
B. large; more
C. small; less
D. small; more

10. *JD* How did the rapid diversification of flowering plants likely influence primate evolution?

A. It reduced insect populations, forcing primates toward herbivory.
B. **It created new ecological niches involving fruits and insects, favouring new adaptations**
C. It caused a cooling climate that drove primates from arboreal to terrestrial habitats.
D. It led to competition from reptiles, limiting primate radiations.

11. *JD* Which of the following is *least* likely to be involved in an adaptive loop with big brains in our ancestors?

A. **Ability to survive temperature shifts**
B. Adaptive foraging
C. Flexible arm joints
D. Slow development of juveniles
E. Stereoscopic vision

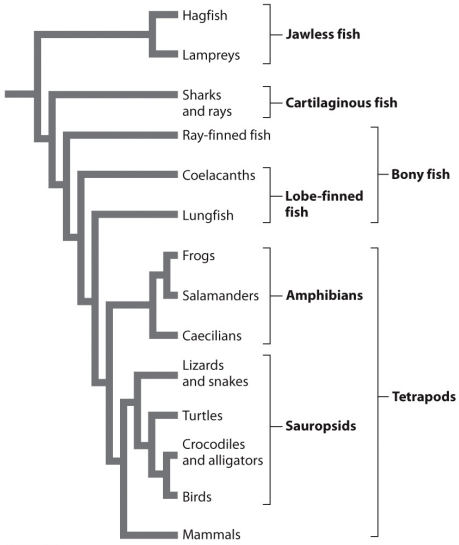

Figure 22.2
Biology: How Life Works
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Use the picture above for the next two questions

12. *JD* According to the model above, the sister taxon for lungfish is:

A. Coelacanths
B. Amphibians
C. Amphibians and sauropsids
D. **Tetrapods**

13. *JD* According to the model above, which of the following groups is not monophyletic?

A. Cartilaginous fish
B. **Lobe-finned fish**
C. Amphibians
D. Sauropsids

14. *JD* Which of the following best shows observer bias?

A. A human incorrectly believes that humans are more closely related to whales than to dolphins
B. **A chimpanzee believes that bonobos (their sister species) is closer to humans than to chimpanzees**
C. A ray-finned fish believes that it is closely related to lungfish
D. a Gorillas have more sexual dimorphism than chimpanzees

15. *JD* Scientists are studying extinct species of sea slug and crab that lived in the same environment 150 million years ago. They find many fossils of the crab, but very few of the slug. Before concluding that there were more crabs than slugs from this evidence, the scientists should be particularly concerned about:

A. Habitat bias
B. **Taxonomic bias**
C. Temporal bias
D. Abundance bias

16. *JK* An ecologist recorded 12 white-tailed deer, *Odocoileus virginianus*, per square mile in one woodlot, and 20 per square mile on another woodlot. What was the ecologist comparing?

A. **Density**
B. Range
C. Size
D. Niche

17. *JK* Which of the following statements is best supported by the island biogeography theory (IBT)?

A. Large islands tend to experience more extinction when compared to small islands
B. **The rate of colonization by new species drops as species accumulate over time**
C. The rate of colonization and the rate of extinction display no direct influence on one another when measured in island environments
D. Equilibrium is reached when there is consistent variation in the number of species on an island
E. Warmer islands always provide more draw for new species because they prefer to bask in the sun

18. *JK* What circumstances are likely to cause a more even distribution of individuals in a population than predicted?

A. Resources are abundant
B. **Predators target this species in particular**
C. Resources are clustered together
D. The climate is very harsh and cold

19. *JK* What factor distinguishes exponential growth from logistic growth in populations?

A. Presence of predators
B. **Carrying capacity of the environment**
C. Number of species in the habitat
D. Rate of immigration and emigration

20. *JK* What is the consequence of competitive exclusion?

A. **One species is driven to local extinction due to being outcompeted for resources.**
B. Both species evolve to occupy the exact same niche more efficiently.
C. The competing species will always form a mutualistic relationship.
D. The environment changes to support both species equally.

21. *JK* Which of the following best describes population density?

A. The total number of individuals of a species alive at a given time in a specific location.
B. The area over which a population is spread.
C. **The number of individuals per unit area within a population's range.**
D. The geographic range a population can tolerate based on environmental conditions.

22. *JK* Turtles produce many offspring at once since they have low survival rates at birth. This is an example of a type _____ survivorship curve.

A. Type I
B. Type II
C. **Type III**

23. *JK* What are density-dependent factors and their examples?

A. Density-dependent factors are factors that can cause widespread mortality independent of population density. Examples: competition and predation.
B. **Density-dependent factors are factors that limit the population size but depend on the density of the population. Examples: competition and predation.**
C. Density-dependent factors are factors that limit the population size but depend on the density of the population. Examples: severe drought and prolonged cold periods.
D. Density-dependent factors are factors that can cause widespread mortality independent of population density. Examples: severe drought and prolonged cold period.

24. *JK* In a forest ecosystem, a dominant species is removed, resulting in significant changes to the structure of the plant and animal communities. Which of the following best explains this scenario?

A. The dominant species was a strong competitor for resources, and its removal allowed species lower in the food chain to thrive.
B. **The dominant species acted as a keystone species, stabilizing the ecosystem.**
C. The removal increased niche overlap, causing interspecies competition.
D. The ecosystem underwent primary succession, resetting community development.

25. *JK* According to the theory of island biogeography, which island would have the highest species richness at equilibrium?

A. Large island far from the mainland
B. Small island close to the mainland
C. **Large island close to the mainland**
D. Small island far from the mainland

26. *JK* What is a species niche?

A. A species physical habitat
B. Habitat requirements needed for a species survival and reproduction
C. **A species ecological role in a habitat**
D. A species physical habitat and its ecological role combined
E. None of the above

27. *JK* In a typical food chain, which of the following would occupy the third trophic level?

A. Grass growing in a meadow
B. Rabbit feeding on the grass
C. **Fox hunting and eating the rabbit**
D. Hawk preying on the fox

28. *JK* During the colonization of an island, the rate of colonization is high at first and then slowly starts decreasing while the extinction rate increases. At a certain point balance is achieved between the rate of colonization by new species and the extinction rate called an equilibrium. What would this imply about the island species diversity?

A. As balance is achieved, new species can no longer colonize the island due to competition and extinction rates will go up.
B. **New species can continue entering the island as long as it is matched by the extinction of a species already in place.**
C. The equilibrium will not be maintained as it is impossible to maintain an equilibrium.
D. As balance is achieved, new species can no longer colonize the island, but they will continue reproducing maintaining equilibrium.
E. New species will continue entering the island decreasing extinction rates.

29. *JK* What is a possible reason why larger animals tend to be K-strategists?

A. Because the offspring tend to survive better, they are able to grow to their full size.
B. **Because more energy is required for growth, less energy must go into reproducing.**
C. Because they live in unpredictable environments, with unpredictable resources
D. B and C
E. All of the above

30. *JK* After a volcanic eruption completely sterilizes an island, leaving only bare rock, which of the following sequences most accurately represents the order of ecological succession leading to a climax community?

A. **Lichens → Mosses and small invertebrates → Grasses and Weeds, larger invertebrates → Shrubs, small mammals → Trees, larger mammals, and birds**

B. Mosses and small invertebrates → Lichens → Grasses and Weeds, larger invertebrates → Shrubs, small mammals → Trees, larger mammals, and birds

C. Mosses and small invertebrates → Lichens → Shrubs, small mammals → Grasses and Weeds, larger invertebrates → Trees, larger mammals, and birds

31. *JD* Coelacanths and lungfish are sometimes called lobe-finned fish (picture above). It was believed for a long time that they were closely related to ray-finned fish (like tuna or cod), but now it's believed that they are closer to mammals than to ray-finned fish.

a) What sort of analysis probably led to the conclusion that the lobe-finned fish were closer to ray-finned fish?

A phenetic analysis: more differences are observed with mammals than with rayfins.

b) What is a specific reason why this analysis was likely to be misleading in this case?

Mammals have many adaptations to living on land; lobefins and rayfins stayed in the water.

c) What kind of characteristics would a newer analysis focus on, and why?

The newer analysis is cladistic and would focus on shared, derived characteristics, since those are the ones that need to be explained by evolution within the tree under consideration

32. *JK* In the keystone species scenario discussed in class, when otters were removed due to overhunting, the sea urchins they used to consume rose in abundance and ate most of the kelp. Without the kelp forests, many other species would disappear. Please associate the following terms with the species mentioned in the statement above (5 points)

a) Keystone species:

Sea otter (1 point)

b) Primary producer:

Kelp alga (1 point)

c) Herbivore:

Sea urchins (1 point)

d) Mutualist:

None (1 point)

e) Other common inhabitants of the kelp forests

Fish, seals, anything reasonable (1 point)

33. *JK* What are some examples of physical/abiotic features regarding environments? Please list five such features/factors (2 points)

Correct: Temperature; Water; Nutrients; Wind; Fire; Sunlight; Snow cover; Rocky surface.

Incorrect: Predators; Prey; Grass, etc; Population density; Commensals; Mutualists; Competitors; Plants or animals transforming physical structure of the environment.