Biology 115D Schulze 2023
Evolution, Behavior, & Ecology Exam #1

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I completed this exam in accordance with the Austin College academic integrity policy. Emma G. **(your signature)**

- Read each question carefully.
- If a question appears ambiguous, ask for clarification.
- Keep an eye on the clock. Do not get bogged down on difficult questions when relatively easy questions remain to be answered.
- Write legibly and try to confine your answers to the space provided. If you must have more space, continue elsewhere on the exam – but indicate that you have done so.

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1. Evolution is a result of three circumstances and one consequence of those circumstances. Define evolution, list the 3 circumstances, and explain how the consequence of those circumstances results in evolution. Use natural processes, not intentional human processes, as the basis of your explanation. (15 points)

Individuals not identical some dif.
↓
heritable
more than can support
↓
Natural selection

Evolution is a change in the gene pool due to usually natural selection. There are 3 circumstances that lead to natural selection. Individuals are not all identical, some differences are heritable, and when more individuals are born in a population than it can support. When one or more of those things happen it can lead to natural selection. Natural selection then causes Evolution to happen. Say there is a giraffe. This giraffe has a very long neck thats perfect for reaching trees and its fitness is the best in its population. Another giraffe is exactly the same except it's neck is too short. It's overall fitness is low and it will struggle to survive and have fertile offspring. This is natural selection simplified.

2. Explain three reasons why genetic diversity persists within populations despite the processes that cause evolution. (15 points) If populations didn't have genetic diversity there would be a huge mass extinction. Processes like mutations help to make sure theres always a change in the genetic [redacted] diversity of population. Inbreeding severly enough can cause [redacted] fatal mutations.

I think you misunderstood the question ~10

Multiple choice and similar questions. Choose the single best answer. Do not select 2 or more answers. (2 points unless noted otherwise)

3. Is a mutation ever helpful?

___ No, because mutations are random.
___ No, because mutations are rapidly eliminated in the next generation.
✓ Yes, because some mutations increase fitness and genetic diversity of populations.
___ Yes, because mutations are only harmful when they are dominant.

4. Adaptive radiation is most likely if…

___ many reproductively-isolated populations exist
✓ different populations experience different selective conditions
___ small numbers of individuals found the various populations
X all the above
___ none of the above

5. The definition of an allele is …

___ an ancestral form of a gene.
X a variant of a gene.
✓ anything that causes a gene to give its bearer higher fitness.
___ all the above.
___ none of the above.

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6. Which of the following is an example of an anatomical homology?
___ The vertical orientation of whale tail flukes (fins).
___ The pattern of gradual change in horse fossils.
___ The similarities in the body shapes of a shark and a whale. – Convergent evolution
✓ The bones of your arm and a bird wing.
___ All the above
___ None of the above

7. Which is most likely to reduce the genetic diversity of a population?
✓ mutations
___ gene flow
___ genetic drift
X a bottleneck event
___ all the above
___ none of the above

8. Which is true of the guppies modeled in the guppy spot simulation
✓ The males have bright spots after several generations when few predators are present because females select for bright males.
___ Camouflaged guppies always have the highest fitness.
___ The females are most brightly colored after several generations with predators present because the predators avoid the toxic females.
___ The males have bright colors when dangerous predators are present because the coloration serves as a warning that the males are toxic to predators.
___ All of the above.
___ None of the above.

9. Which of the following two organisms would you expect to have the most similar amino acid sequences in their hemoglobin molecules? (You do not need to know anything about hemoglobin, including what it is, to answer this question.)
___ a cat and a frog
✓ a tiger and a leopard
___ a human and a trout
___ a salamander and an elephant
___ none of the above – none of them would be expected to have any similarities in the amino acid sequences of their hemoglobin molecules.

10. What is the purpose of a mutation?
___ To create new genetic variants.
___ To enable populations to develop genetic diversity.
___ To ensure that natural selection occurs.
✓ Mutations do not have a purpose. They have consequences (effects), but do not occur on purpose.

11. Natural selection acts upon_____.
✓ phenotypes
___ genotypes
___ recessive alleles
___ heterozygotes
___ homozygotes
___ None of the above

12. Which of the following is correct?

___ When sticklebacks move from lakes to the ocean, they lose their armor because in the ocean they need to maneuver quickly to catch prey.

___ When sticklebacks move from the ocean to lakes, they evolve more armor because armor protects them from freshwater predators.

___ When sticklebacks move from the ocean to lakes their teeth evolve from adapted to crushing to adapted to tearing.

___ All of the above.

✓ None of the above.

13. The text discusses side-blotched lizards as an example of

___ molecular homology

✓ frequency dependent selection

___ non-random mating

___ punctuated equilibrium

___ all the above

___ none of the above

14. Medical officials recommend flu and coronavirus vaccines, but if you get the shots you may still get ill. What is the basic reason (described in the assigned reading) that a flu shot may be ineffective? didn't do this reading.

✓ Viruses like the Flu are constantly mutating. Also, usually vaccines have the virus in it and is subjecting your white blood cells to small amounts of the virus in hopes of creating anti-bodies for it.

15. Choose the best scientific definition of theory.

___ Someone's idea regarding the workings of something.

___ An idea that may be right or wrong.

___ A hypothesis that has been proven correct.

___ An idea for which there is not yet any strong evidence.

___ A synonym for a hypothesis. In other words, all hypotheses are theories, and vice-versa.

✓ A hypothesis that explains a great deal and is supported by extensive evidence.

___ None of the above.

16. If an individual has two different alleles for a gene that individual is

heterozygous for that gene.

17. Compared to large populations, small populations are at a higher risk for_____.

___ Mutation

✓ Inbreeding depression

___ Natural selection

___ Heterozygosity

✓ Gene flow

✓ All of the above

___ None of the above

18. Is it possible to prove that every bluebird has blue feathers? Why or why not? (4 points) It wouldn't logically be possible to prove every single bluebird has blue feathers. Also, there are genetic disorders (mutations) such as albinism.

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19. If the 10-meter width of our classroom represents the time since life first arose on Earth until the present, the most recent two hundred of years, since the beginning of the industrial revolution and thus the first substantial use of fossil fuels, the invention of plastics, electronics and the great majority of toxic chemicals, the invention of air travel and space flight, etc. all occurred in the last

Why? not? Explain

___ 1 meter
_✓_ 1 centimeter (a bit less than ½ inch)
___ 1 millimeter (about the width of a pen tip)
___ 100 micrometers (about the width of a piece of paper)
(X) 1 micrometer (about 1/20th of the diameter of a human hair)

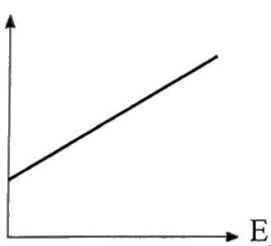
X

20. Which of the following is true of mutations

___ As far as anyone can tell they occur randomly
___ When expressed in the phenotype they are more likely to reduce than increase individual fitness
___ They are the ultimate source of new genetic variation
___ They increase the genetic diversity of populations and thus the potential of populations to evolve in response to new circumstances
_✓_ All the above
___ None of the above

21. Which graph (some may be on the next page) represents directional selection? [The solid line is the earlier situation. The dotted line is the later situation. The x-axis is a quantitative (numerical) measure of the phenotype. The y-axis is the frequency of individuals with any given x-axis value.]

A___ B✓ C___



D___ E___ None of the above.

22. Which of the following examples was described as a case of stabilizing selection?
___ horn lengths of longhorn cattle.
___ selection for sickle cell heterozygotes in areas with malaria.
___ beak depths of Galapagos finches on the island Daphne Major.
X ___ birth weight of human babies.
___ all the above.
___ none of the above.

23. Inbreeding is harmful because it
___ maximizes the chance that deleterious dominant alleles will occur in homozygotes
___ maximizes the chance that deleterious dominant alleles will occur in heterozygotes
___ maximizes the chance that deleterious recessive alleles will occur in heterozygotes
X ___ causes mutations
___ all the above
___ none of the above

24. What is *the* key characteristic of science done well?
___ Science focuses upon natural phenomena.
___ Science is based on running controlled experiments.
___ Science is restricted to questions of great importance to society.
___ Science focuses on natural processes
X ___ All of the above
___ None of the above are the key characteristic of science done well.

25. Convergent evolution requires
___ that humans determine which individuals survive and reproduce.
___ recent common ancestors.
___ similar selective forces acting upon different species.
___ complex organisms such as vertebrates.
___ All of the above.
___ None of the above.

26. Genetic drift is most important to _____ populations.
___ small
___ large
___ adaptive
___ migratory
___ nonmigratory

27. Succinctly but precisely explain the difference between the definitions of a species and a population. A species is a population of individuals with similar genetic makeup that can produce fertile offspring. A population is a gene pool of a species that live in an area.

28. Which of the following does *not* make sense given the logic of evolution by natural selection and what you have learned about the species in question?

___ Commercial fishing with nets will lead to an increase in the size & maturity of harvested fish species.
___ If an El Niño causes a drought in the Galapagos Islands, then the bills of the finches on Daphne Island will evolve to a larger size.
___ If a new antibiotic is invented and widely used, it will eventually become useless.
___ If a new herbicide is invented to replace Roundup and widely used, weeds will eventually become resistant to it.
___ None of the above make sense.
___ All of the above make sense.

29. What is the difference between micro- and macroevolution?

___ Microevolution describes the evolution of small organisms, such as insects, while macroevolution describes the evolution of large organisms, like people and elephants.
___ Microevolution describes the evolution of microscopic entities, such as molecules and proteins, while macroevolution describes the evolution of whole organisms.
___ Microevolution describes the evolution of populations, while macroevolution describes the evolution of new species.
___ Microevolution describes the evolution of individual organisms over their lifetimes, while macroevolution describes the evolution of organisms over multiple generations.
___ None of the above. All the above are wrong.

30. Which of the following was used in class, the text, or simulations as example of directional selection?

___ horns of cattle
___ finch bills
___ sizes of African Seedcracker finches
___ peppered moths
___ all the above
___ none of the above

31. Which of the following does not cause evolution?

___ genetic drift
___ use of herbicides
___ gene flow
___ mutations
___ commercial fishing
___ All of the above cause evolution.
___ None of the above cause evolution.

32. An individual's complete set of genes is its [redacted] DNA (Genotype?)

33. The expression of an individual's genes is that individual's phenotype.

34. Which of the following *does not prevent* evolution from resulting in perfect organisms?

___ The environment frequently changes and natural selection has no means of anticipating changes.
___ Natural selection can only act upon existing genetic variation (can only select for or against individuals with existing traits).
___ Adaptations involve trade-offs.
___ All of the above prevent evolution from resulting in perfect organisms.
___ None of the above prevent evolution from resulting in perfect organisms.

35. Fitness (as the term is used by evolutionary biologists) *is*

___ the relative number of offspring an individual contributes to the next generation.
___ an organism's strength.
___ the age at which an organism dies.
___ the average life span of an individual's offspring.
___ all the above.
___ none of the above.

36. *Deleterious recessive* alleles accumulate in populations because of all the following except

___ Since they are recessive they cannot affect an organism's fitness and therefore are never selected against.
___ Unless inbreeding occurs, they are rarely expressed and therefore are rarely selected against.
___ Mutations are often harmful.
___ Most large populations are not inbred, they are outbred, because evolution selects against inbred mating.
___ All of the above are false.
___ None of the above are false. All the above statements are correct.

37. Neotropical birds called Jacanas are unusual in that the males raise the young. Based on just that information and your understanding of evolution, it is safe to predict that

___ the population is undergoing disruptive selection.
___ the population will go extinct because the male's behavior will be selected against and all the males display the same behavior.
___ the males are choosier than the females when selecting mates.
___ the population is undergoing directional selection.
___ all the above
___ none of the above