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Attempt 1 of 3

Written Feb 28, 2024 9:49 AM - Feb 28, 2024 9:50 AM

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Question 1

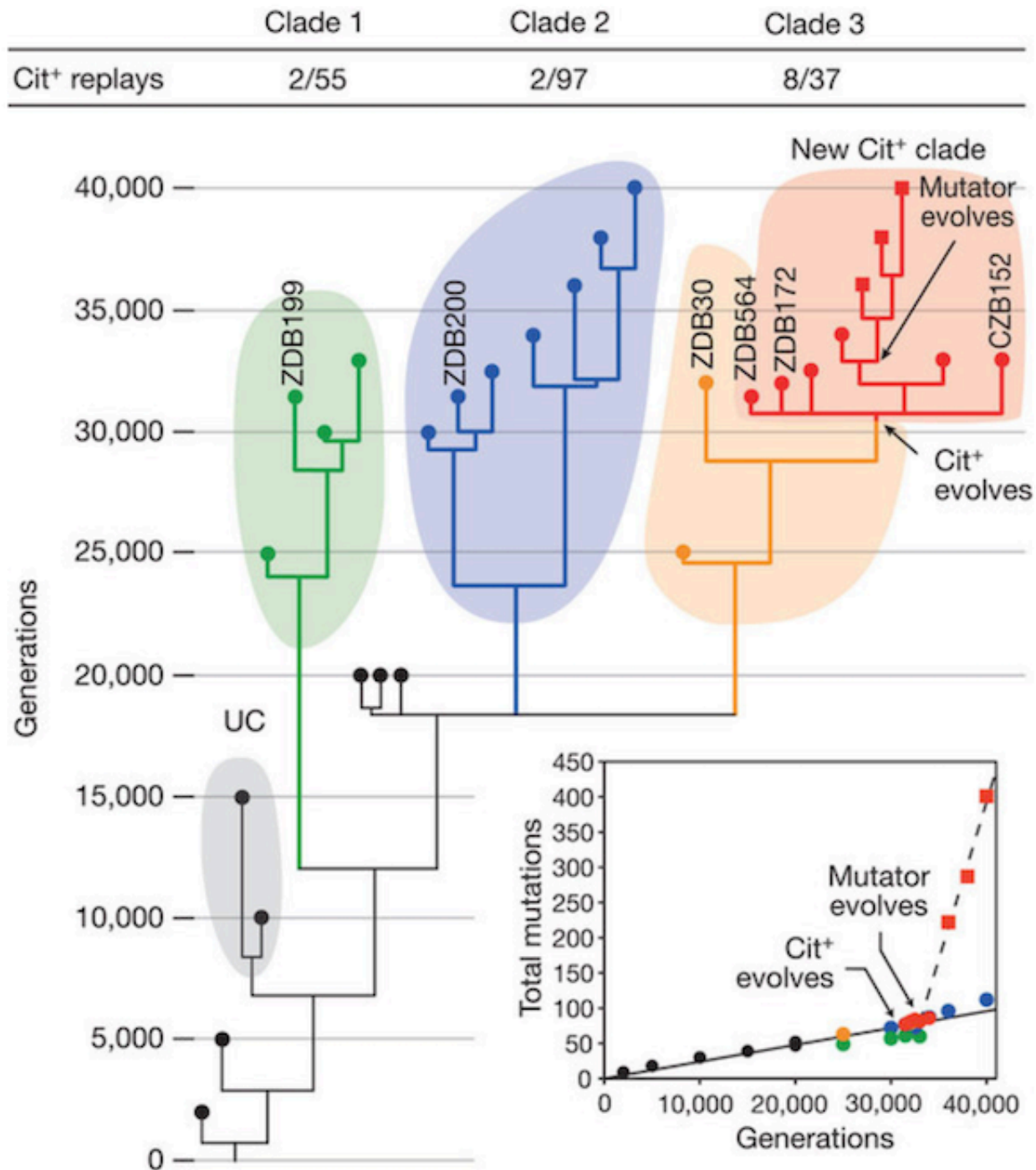
0 / 1 point

"Greater reproductive success of heterozygous individuals compared with homozygotes" is a pretty good definition of

- ☐ epistasis
- ☐ frequency dependent selection
- ☐ disruptive selection
- ☐ phenotypic plasticity
- ☒ heterozygous advantage

Question 2

0 / 1 point



One of twelve *E. coli* populations in Richard Lenski's Long Term Evolution Experiment evolved the ability to transport citrate from the growing medium. Reconstruction of the events that occurred showed that the mutation that caused the transport ability (expression of the *citT* transporter) required one of several prior mutations (those in the green, blue, and orange shaded regions) - yet these prior mutations had no

phenotypic effect or correlation with fitness (these are **neutral**). This experiment is a beautiful example of

- ☒ how neutral mutations can be necessary for adaptive evolution
- ☐ how the need for citrate transport results in the evolution of citrate transport
- ☐ how selection is the only mechanism explaining adaptation
- ☐ how neutral mutations inhibit adaptation
- ☐ how adaptations can evolve entirely by genetic drift

Question 3

0 / 1 point

In the M & M lab, in the last simulation, the probability that an M & M reproduced was higher for the red color than that for the other color. Would you expect the red M & M to go to fixation in all replays of this simulation?

- ☐ Yes, because red has the highest relative fitness.
- ☐ No, because all colors have an equal probability of going to fixation unless the relative fitness for red is 1.0 and that for other colors is 0.0
- ☐ No, because the final frequency should match the relative fitness of each color.
- ☒ No, because the population is finite and there will be some change in frequency due to random sampling. This could fix a non-red color.
- ☐ Yes, because the frequency of red can only increase each generation

Question 4

0 / 1 point

If the frequency of an allele in a population is 0.5 and the allele has high

relative fitness, what can we say about this allele?

- ☐ the allele frequency will probably fluctuate around 0.5 forever
- ➡ ☒ there is a higher probability of fixation than elimination
- ☐ the allele will probably be eliminated
- ☐ there is a higher probability of elimination than fixation
- ☐ the allele will evolve to fixation

Question 5

0 / 1 point

"Genes located close enough together on a chromosome that they tend to be inherited together" is a pretty good definition of

- ☐ recombination
- ☐ locus
- ➡ ☒ linkage
- ☐ epistasis
- ☐ pleiotropy

Question 6

0 / 1 point

Recombination is an important source of genetic variation within a population. What is a pretty good definition of recombination?

- ☐ the transfer of genetic material from one population to another
- ☐ phenomenon in which the effect of a gene variant is dependent on the specific variants of one or more other genes

- ➡ ☐ the reshuffling of genetic material leading to production of offspring with combinations of genes that differ from those found in either parent
- ☐ occurs when one gene influences two or more seemingly unrelated phenotypic traits
- ☐ the tendency of DNA segments that are close together on a chromosome to be inherited together during the meiosis phase of sexual reproduction.

Question 7

0 / 1 point

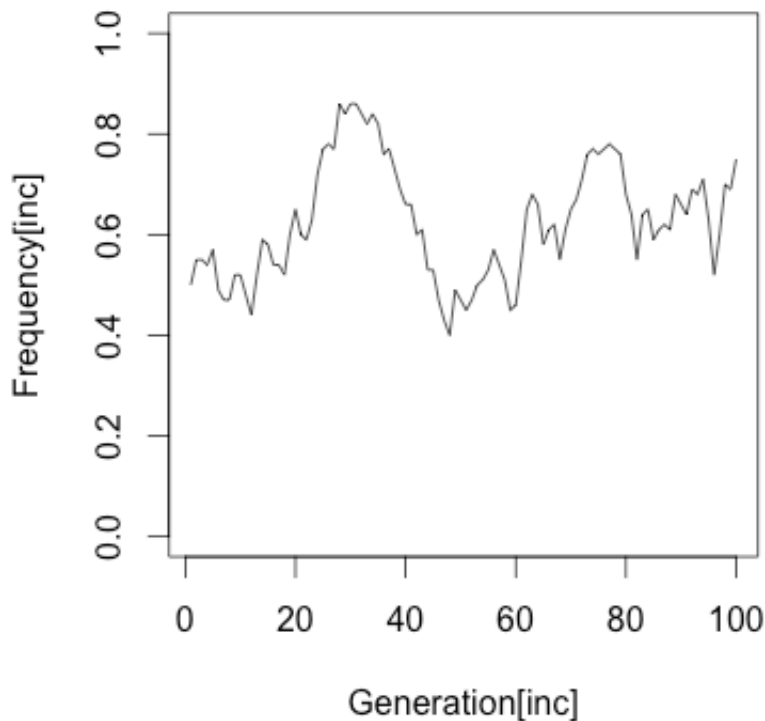
An experiment is conducted to estimate the effect of Ca^{++} on pelvic spine length in stickleback. Marine stickleback are randomly assigned to two groups - high Ca^{++} (that of Marine water) and low Ca^{++} (that typical of freshwater lakes).

Mean spine length is 1.2 mm shorter in the low Ca^{++} group. The p-value from the t-test is 0.26. What can we infer from this statistic?

- ☐ The p-value is not very small so we conclude there is **no effect** of Ca^{++} treatment on spine length
- ➡ ☐ The p-value is not very small so we conclude that the data are **too noisy** to conclude if there is an effect of Ca^{++} treatment on spine length

Question 8

0 / 1 point



The plot above shows a simulation of the frequency of an allele changing across generations due to genetic drift. Genetic drift is due to "random sampling" of the alleles in the parental generation. This random sampling includes all of the following EXCEPT

- ☐ random mating
- ☐ random survival
- ☐ random segregation of the alleles into gametes
- ☒ random mutation

Question 9

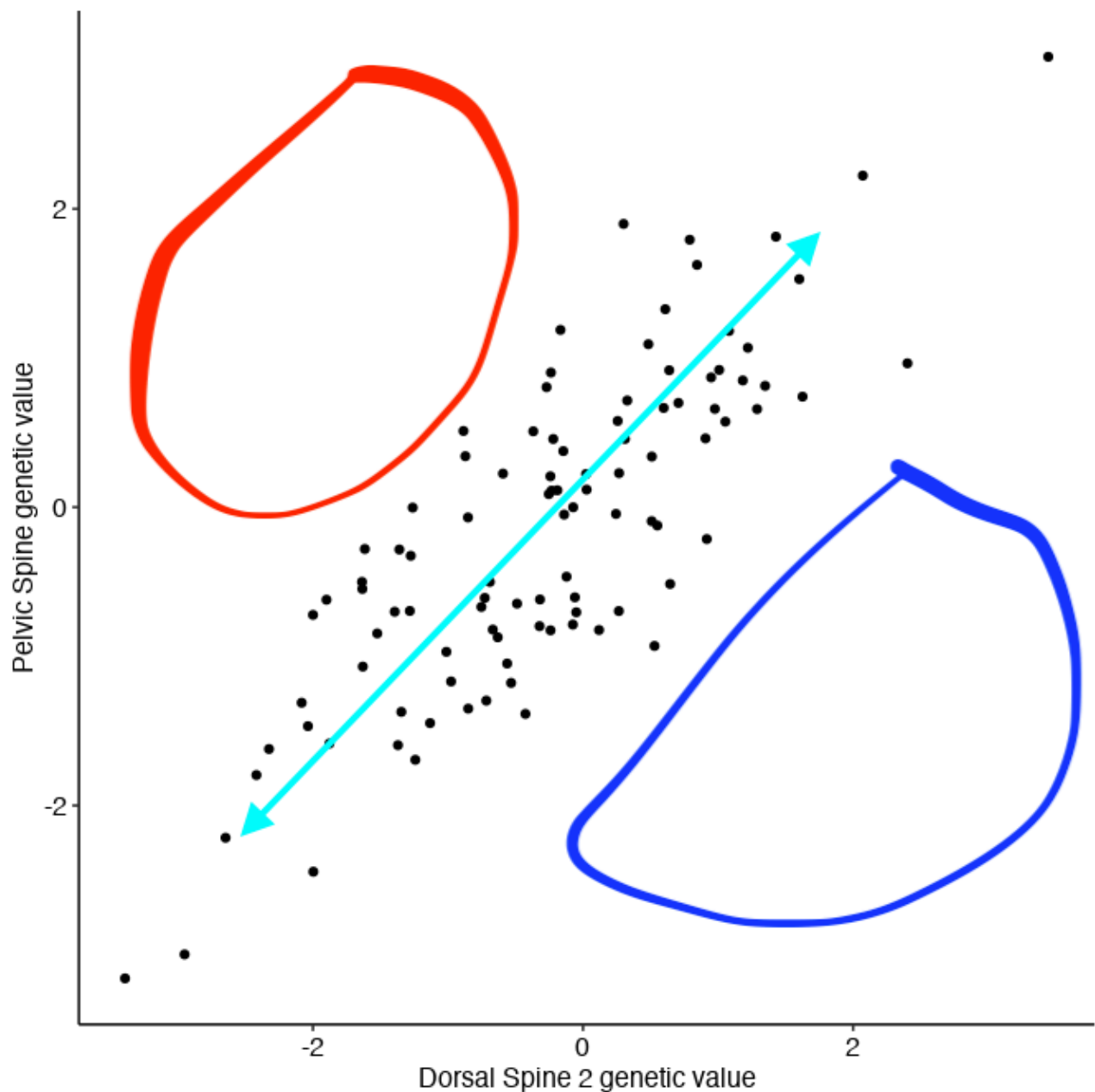
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a good definition of evolution is

- ☐ the origin of species
- ☐ the process by which species accumulate differences from their ancestors as they adapt to different environments over time
- ☒ change in allele frequencies within a population across generations
- ☐ descent with modification
- ☐ change in an individual in response to a novel environment

Question 10

0 / 1 point



The scatterplot of dorsal and pelvic spine genetic values shows

- ☐ long pelvic spines **cause** long dorsal spines
- ☐ the t-distribution of dorsal spine 2 and pelvic spine length
- ☒ a **genetic correlation** between dorsal spine 2 length and pelvic spine length
- ☐ a difference in length between dorsal and pelvic spines



☐ long dorsal 2 spines **cause** long pelvic spines

Question 11

0 / 1 point

What is an allele?



a variant of a gene



the genotype of an organism



a segment of DNA that encodes the amino acid sequence of a protein



on of the two strands of nucleotides in a DNA molecule



a phenotypic trait showing adaptation

Question 12

0 / 1 point

Animal skeletal muscle (the kind of muscle that moves the skeleton) is composed of three main types of muscles cells:

Type I - these are high endurance cells with many mitochondria and the enzymes of aerobic respiration

Type IIB/X - these are high power cells packed with contractile protein and the enzymes of glycolysis

Type IIA - these are intermediate cells

The muscles that are used to run in mammals are composed of all three types. Individuals with mostly Type I cells in these muscles have high endurance (they can walk or run slowly all day without fatiguing) but low power (they are poor jumpers and sprinters). Individuals with mostly Type

IIB/X cells have high power but low endurance. Individuals with mostly Type IIA are intermediate at both endurance and high power activities. A single individual cannot excel at both endurance AND high power activities. Consequently, it's really hard for a population to evolve both high endurance and high power. This constraint is an example of

- ☐ epistasis
- ☒ a functional trade-off
- ☐ recombination
- ☐ genetic correlation
- ☐ pleiotropy

Question 13

0 / 1 point

A small island is home to a unique population of land snails. This population was founded by 10 individuals that floated to the island on a log, and it has been isolated from the large mainland population ever since. The mainland population has consistently had about 10,000 individuals in it through time. The island population reached 1000 individuals after several generations, and then stayed at this size through time.

A team of researchers compared the genetic variation of the mainland and the isolated island populations for a few generations after colonization. Would a biologist agree or disagree with the following statement?

Genetic drift is more pronounced in the island population than the mainland population in these first few generations

- ☒ True
- ☐ False

Question 14**0 / 1 point**

An experiment is conducted to estimate the effect of Ca^{++} on pelvic spine length in stickleback. Stickleback are randomly assigned to two groups - high Ca^{++} (that of Marine water) and low Ca^{++} (that typical of freshwater lakes).

Which statistic is a measure of the variability of spine length within the high Ca^{++} group?

- ☐ t-value
- ☐ difference between the means of the two groups
- ☐ standard error of the mean
- ☒ sample standard deviation
- ☐ p-value

Question 15**0 / 1 point**

Assortative mating occurs when

- ☐ males and females mate randomly with respect to each genotype
- ☒ individuals with similar genotypes/phenotypes mate more frequently than would be expected by random mating
- ☐ females of different age classes mate with equal probability
- ☐ males develop ostentatious secondary sexual traits to attract females
- ☐ males compete with each other for reproductive access to females

Question 16**0 / 1 point**

Male guppies attract females with an orange spot on the tail. The orange coloration is dependent on acquiring two types of pigments (yellow carotenoids and orange pteridines from unicellular algae in the diet. The intensity of the color is due to the availability of the algae, and this availability is a function of stream width -- wider streams have a more open canopy and are a better habitat for algae growth. The effect of the environment on the male phenotype is an example of

- ☐ heterozygosity
- ☐ a functional trade-off
- ☐ the founder effect
- ☐ epistasis
- ☒ phenotypic plasticity

Question 17**0 / 1 point**

gene flow occurs because of

- ☐ the recombination of chromosome segments during meiosis
- ☐ disruptive selection
- ☒ the transfer of new individuals into a population
- ☐ the random sampling of gametes
- ☐ directional selection

Question 18**0 / 1 point**

A founder effect

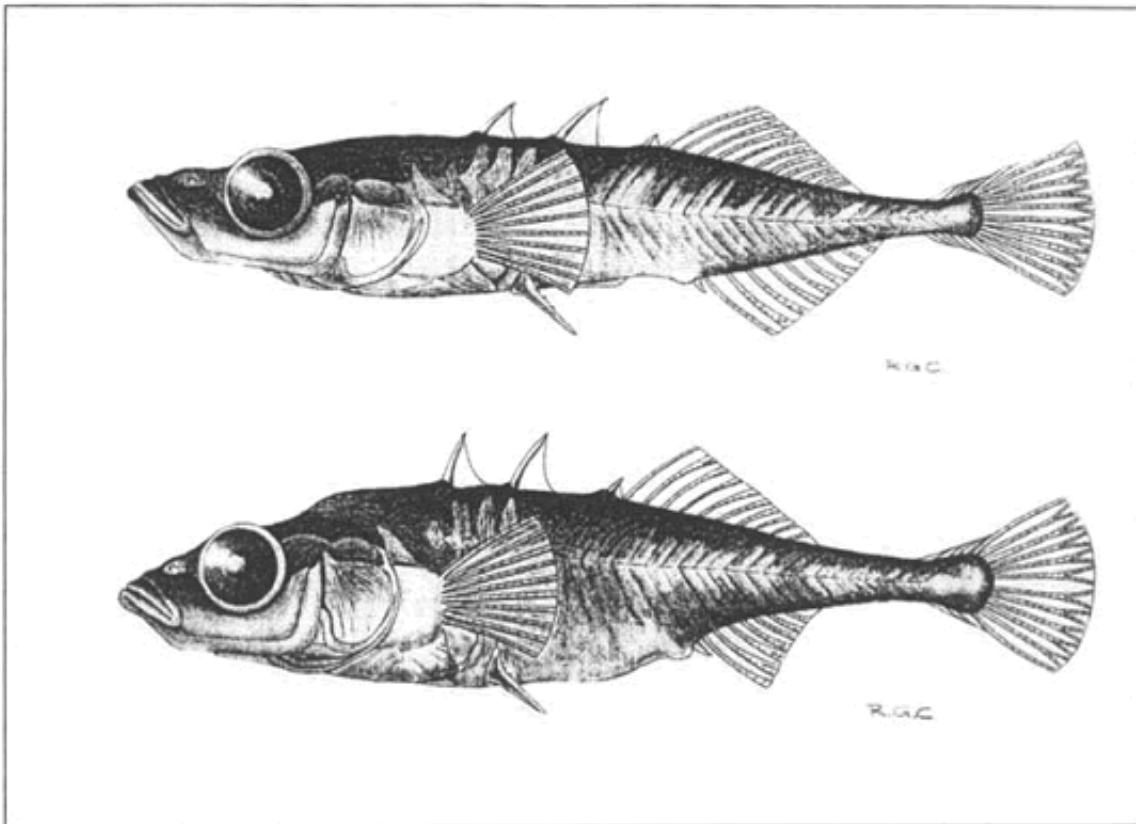
- ☒ *is a form of genetic drift in which a few individuals become isolated*

from a larger population and form a new population whose gene pool composition differs from that of the original population

- ☐ is a form of natural selection where extreme phenotypes are selected against
- ☐ occurs when individuals from one population migrate into and transfer new genes into a neighbor population
- ☐ is a form of natural selection in which a subset of individuals from a parent population colonize a new environment and there is rapid adaptation to the new habitat
- ☐ occurs when an allele is rapidly driven to fixation

Question 19

0 / 1 point



In some lakes in Alaska and British Columbia there is an extensive zones of open water containing abundant zooplankton and an extensive zone of

vegetation containing benthic macroinvertebrates. The two zones are associated with different optimal feeding phenotypes, a limnetic (open water) phenotype (top fish) and a benthic (vegetation) phenotype (bottom fish). Remarkably, the limnetic phenotype has high fitness and the benthic phenotype has high fitness but the intermediate phenotype has low fitness. This is an example of

- ☐ stabilizing selection
- ☐ sexual selection
- ☒ disruptive selection
- ☐ frequency-dependent selection
- ☐ directional selection

Question 20

0 / 1 point

How does stabilizing selection differ from disruptional selection?

- ☐ stabilizing selection tends to change the mean trait value but disruptive selection does not
- ☐ stabilizing selection tends to increase variance but disruptive selection decreases variance
- ☐ stabilizing selection always makes traits smaller but disruptive selection makes traits bigger
- ☒ intermediate phenotypes are favored in stabilizing selection but selected against in disruptive selection
- ☐ stabilizing selection does not change the mean trait value but disruptive selection does change the mean value

Question 21

0 / 1 point

A small island is home to a unique population of land snails. This population was founded by 10 individuals that floated to the island on a log, and it has been isolated from the large mainland population ever since. The mainland population has consistently had about 10,000 individuals in it through time. The island population reached 1000 individuals after several generations, and then stayed at this size through time.

After forty generations, biologists measured the genetic variation of the isolated island snail population again. They concluded that the population of snails on the island had remained isolated and that genetic drift had occurred. Would a biologist agree or disagree with the following statement about the processes that contributed, at least in part, to genetic drift in the population of island snails?

The fact that individuals that were best suited to the environment had a higher rate of survival contributed, at least in part, to genetic drift

☐ True

➡ ☐ False

Question 22

0 / 1 point

Relative fitness is best defined as

☐ the number of offspring surviving relative to the total number of offspring of an individual

☐ the mean reproductive rate of a genotype

☐ the ability to survive relative to the ability to reproduce

➡ ☐ the expected reproductive rate of a genotype/phenotype relative to that of alternative genotypes/phenotypes

☐ the reproductive rate of an individual

Done