

My Name _____

Student ID _____

These questions are all **multiple choice**, but in some cases more than one answer is correct! Over the five numbered questions, a total of 12 answers are correct. Please **underline** your 12 correct answers.

1. Darwin introduced:

population thinking into biology

essentialism into biology

Antony to Cleopatra

Ernst Mayr to Ernst Haeckel

pigeons to a wider audience

the concept of the phylogenetic tree

the hypothesis that natural selection causes adaptation

the hypothesis that natural selection causes homology

2. The closest relatives of baleen whales are:

hippopotamuses

cows and deer

toothed whales

elephant seals

Democrats

3. The closest relatives of hippopotamuses are

pigs and peccaries

baleen whales

toothed whales

all whales

cows and deer

3. Homologous structures are

boring

derived by unbroken descent from a shared ancestral structure

gay

always morphological

always genetic

often highly modified in form

never highly modified in form

4. HIV

stands for Homologous Inserted Virus

rapidly evolves resistance to AZT

rapidly evolves resistance to SINEs

cannot evolve because its genome is made of RNA

was transferred into the human species from African Green Monkeys

is expected to become non-virulent by the year 2010

is less likely to infect people with mutated CCR5 genes

is less likely to infect people with mutated LINEs

5. Natural selection can't cause evolutionary change unless

the environment changes

new species are formed

some variation is heritable

the Red Sea parts

the Red Sox win

species compete with each other for resources

individuals (within a species) differ in reproductive success

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Please *circle* T for “true” or F for “false”.

- T F Darwin proposed the germ-plasm theory of inheritance in the *Origin of Species*.
- T F Homozygotes for the *Fast* allele of *Adh* have 23-hour circadian rhythms.
- T F Enzyme polymorphisms are much more common in animals than in plants.
- T F The $\Delta 32$ mutation of the CCR5 gene makes a protein with 32 extra amino acids.
- T F When selection is “turned off” in a mutation-accumulation experiment, fitness decreases.
- T F Genes are frequently duplicated by the process of unequal crossing-over.
- T F The four basic “forces” of evolution are mutation, drift, selection, and inbreeding.
- T F At a locus with *two alleles*, under *random mating*, heterozygotes are as frequent as both homozygotes combined.
- T F The marginal fitness of an allele is (by definition) the fitness of its homozygote.
- T F The marginal fitness of a lethal recessive allele is equal to the average fitnesses of the heterozygotes in which it occurs, weighted by their relative frequencies.

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Please *circle* T for “true” or F for “false”.

- T F A genotype with a fitness $W = 1$ is (by definition) neither increasing nor decreasing in the population.
- T F A genotype with a lower rate of increase when rare may nonetheless be more fit than one with a higher maximum rate of increase, in a constant environment, if it has a higher carrying capacity (K).
- T F “No-phenotype knockouts” are mutations that destroy a gene’s function without causing any obvious problems for individuals that are homozygous for the mutation.
- T F No-phenotype knockouts are common in simple organisms like bacteria and yeast, but not in macroscopic animals like *C. elegans* and mice.
- T F No-phenotype knockouts usually increase in frequency when placed in direct competition with their wild-type (unmutated) parent strains.
- T F “Positive” selection increases the mean of a trait, and “negative” selection decreases it
- T F If the fitness of the A_2A_2 homozygote is higher than that of the A_1A_1 homozygote, then from any initial allele frequency, A_2 will go to fixation (assuming A_1 and A_2 are the only two alleles, no mutation, no significant effect of genetic drift, etc.).
- T F Heterozygote disadvantage is a form of negative frequency dependence.
- T F A locus with a stable interior allele-frequency equilibrium is more likely to be polymorphic than one with an unstable interior equilibrium.
- T F Functional “tradeoffs” among different properties of an enzyme may help to maintain nucleotide and amino-acid polymorphism at the genetic locus encoding that enzyme.