

Part B: Short Answer Questions - Please answer in the space provided (worth 15 marks)

1. What conclusion would have been made by Pasteur if both the broth in the straight-necked flask and the broth in the swan-necked flask were filled with cells? (1 mark)

Cells arise spontaneously from nonliving materials.

Contamination also acceptable.

2. Scientifically, there is no such thing as "higher" or "lower" organisms. Justify this statement. (1 mark)

Any one of the following statements:

Evolution is not goal directed.

Evolution is not progressive.

Evolution may cause organisms to become simpler or more complex over time.

3. What can be deduced about mating if a population is not in Hardy-Weinberg equilibrium? (1 mark)

Accept any or all of these four possibilities: the population has experienced any of the following: genetic drift, natural selection, non-random mating, or mutation. It is also acceptable to list different types of natural selection (e.g. directional selection, heterozygote advantage) or different types of non-random mating (inbreeding, outbreeding)

4. Please list and explain two possible evolutionary consequences of gene duplication. (2 points)

Consequence 1 and explanation:

Consequence 2 and explanation:

Acceptable answers (1 mark each):

(a) gene loss/ nonfunctionalization

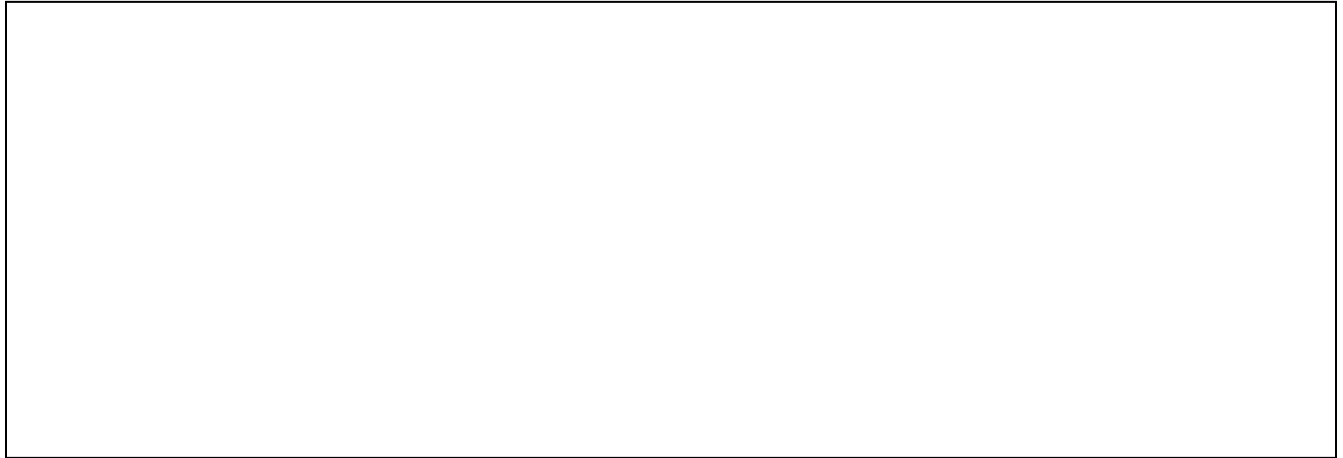
(b) redundancy – the persistence of both duplicates

(c) neofunctionalization – the evolution of novel function in one duplicate

(d) subfunctionalization – the degradation of function in both duplicates such that the remaining functions are complementary and together can carry out the original function of the protein before duplication.

(e) Subneofunctionalization also acceptable

5. Using the box below, draw the result of a scenario that illustrates the divergence of POPULATION “A” AND POPULATION “B” due to dispersal and colonization. Use the caption line (the line below the box) to BRIEFLY describe what has occurred. (2 marks)



Caption: _____

A diagram should be drawn that illustrates a PRE-EXISTING BARRIER. Then a population would disperse over this barrier and then speciate. The key here is that the age of the barrier must be older than the age of the speciation event. A possible diagram could have an island, for example.

1 MARK FOR CORRECT ILLUSTRATION (THERE IS AN EXAMPLE IN THE TEXTBOOK)

1 MARK FOR CAPTION EMPHASIZING PRE-EXISTING BARRIER.

6. Using the space below, please draw phylogenetic relationships between the following taxa: (1) a species in the domain Bacteria, (2) a fish, (3) a lizard, and (4) a platypus (which is a monotreme mammal). On this phylogeny please label (A) the root and (B) where the origin of shelled eggs occurred. (5 marks)

Give 3 marks for correct phylogeny (Bacteria, (fish, (lizard, platypus))). Give 1 point partial marks if the phylogeny is wrong but Bacteria is still sister to (fish, lizard, and platypus) with the root in between these clades.

Give one mark for labeling the root between (Bacteria) and (fish, (lizard, platypus))

Give one mark for labeling the origin of shelled eggs on the branch leading to (lizard, platypus)

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7. Please describe **three** features of metazoan Hox genes that make them unique from all other types of genes. Please fully **explain** and define your response. (3 marks)

Spatial (0.5 MARK), EXPLANATION (0.5 MARK)

Temporal (0.5 MARK), EXPLANATION (0.5 MARK)

Quantitative colinearity (0.5 MARK), EXPLANATION (0.5 MARK)

Which respectively mean that the order of these genes on the chromosome correspond with the location, timing, and expression level in the developing embryo.