1. Does variation arise in response to need or is it just produced randomly? Describe Luria and Delbruck's experimental evidence.

2. Does variation arise in response to need or is it just produced randomly? Describe the Lederberg's experimental evidence.

3. Using a starting nucleotide sequence in DNA, diagram two mutations in that sequence - one that is a "synonymous mutation" and one that is a "non-synonymous mutation." Explain why is labeled as such.

4. Using a starting nucleotide sequence in DNA, diagram a frameshift mutation. Make it clear that it results in a change in the reading frame.

5. Using two nucleotide sequences in DNA for a single gene that each contain a non-synonymous mutation, diagram an intragenic recombination event that results in a double mutant for that gene.

6. How can unequal crossing-over result in an increase in the number of tandemly repeated gene sequences?

7. How can unequal crossing-over result in the evolution of "gene families?"

8. How can transposable elements produce gene order inversions. Use an illustration.

9. Explain how the FOXP2 gene can be implicated as important in the development of speech in individuals and in the evolution of speech in our species.


11. If a lethal genetic disease that is expressed in heterozygotes occurs in 1 of every 500,000 births, what is the mutation rate?

12. If a lethal recessive allele is carried by 1 in 100 individuals in a population, what is the mutation rate? (Assume the population is in a equilibrium between mutation and selection).

13. If a deleterious recessive allele that results in a 25% fitness reduction in homozygotes (s = 0.25) arises through mutation in 1 of every 100,000 gametes, what should be the allele frequency in the population when the population reaches an equilibrium between mutation (creating the allele) and selection (removing the allele)?

14. How can an allele that is beneficial in one environment be deleterious in another environment?

15. Give two examples of alleles that are beneficial in one environment and deleterious in another.

16. How does sexual reproduction result in a faster evolutionary response to an environmental change than asexual reproduction?

17. How can mutations in multiple genes account for rapid evolution of adaptations?

18. Why are individuals with a polyploid karyotype usually sterile?

19. How can hybridization and polyploidization lead to the creation of a new species?

20. One of the potential advantages of gene order inversions is a reduction in recombination rate, thus keeping certain alleles of neighboring genes together. Describe how this occurs with a paracentric inversion. Use your own illustration.

21. One of the potential advantages of gene order inversions is a reduction in recombination rate, thus keeping certain alleles of neighboring genes together. Describe how this occurs with a pericentric inversion. Use your own illustration.

22. Why don't chromosomes appear to assort independently in a reciprocal translocation heterozygote? Use your own illustration.

23. Use your own illustration to describe how a change in the number of chromosomes can occur through fission or fusion.

24. If orangutans are the outgroup of humans, chimps and gorillas, what is the ancestral chromosomal number of humans, chimps, and gorillas and what type of chromosomal change resulted in the derived karyotype?