

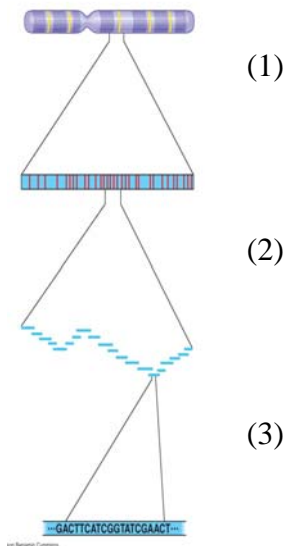
Name _____ Period _____

Chapter 21: Genomes and Their Evolution

Most AP Biology teachers think this chapter involves an advanced topic. The questions posed here will help you understand the general concepts over much of the chapter as well as a few more detailed questions in areas that are considered more typical of biology courses at the freshman college level.

Concept 21.1 New approaches have accelerated the pace of genome sequencing

1. The *Human Genome Project* sequenced the entire human genome utilizing a three-stage approach. Use the unlabeled Figure 21.2 below to name and explain each of the three stages.



2. *Craig Venter* used an approach to genome sequencing that he termed the *whole-genome shotgun approach*. Explain how this concept can be used to sequence genomes.

Concept 21.2 Scientists use bioinformatics to analyze genomes and their functions

3. What is *bioinformatics*?
4. What is the goal of scientists who study *proteomics*?
5. How might a human gene microarray chip be of medical importance?

Concept 21.3 Genomes vary in size, number of genes, and gene density

6. How do prokaryotic genomes of the two domains Bacteria and Archaea compare to eukaryotic genomes?
7. What relationship, if any, does a comparison of eukaryotic genomes indicate? Explain your response.
8. How are humans able to successfully compete in nature even though they have about the same number of genes as the nematode *C. elegans*?

9. What relationship does Chart 21.1 indicate for gene density comparisons between prokaryotes and eukaryotes?

Concept 21.4 Multicellular eukaryotes have much noncoding DNA and many multigene families

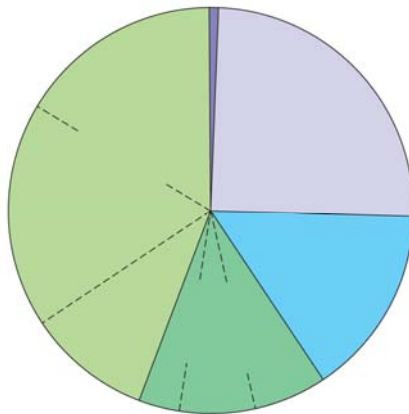
10. Define the following two terms.

pseudogene

repetitive DNA

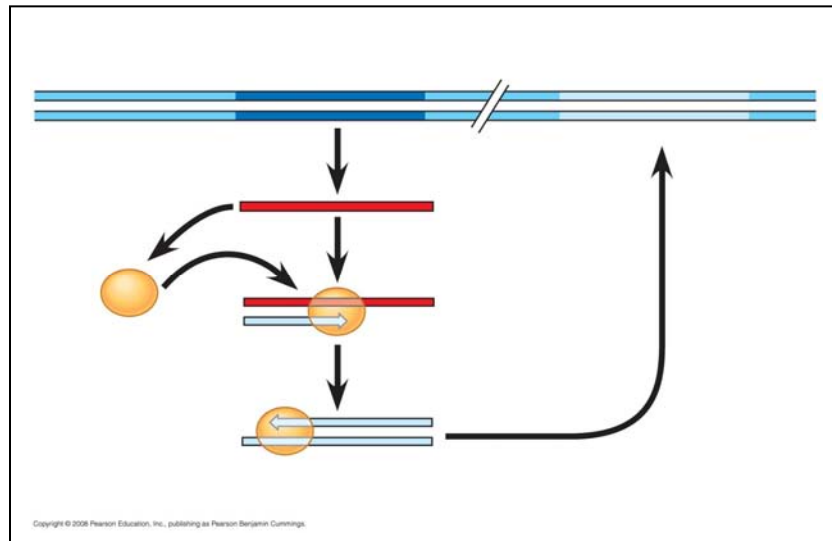
11. What are *transposable elements*, and what percentage of our genome is made of them?

12. Using Figure 21.7 as a guide, label the types of DNA sequences in the human genome and give their percentages.



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13. What is the difference between a “copy and paste” transposon and a “cut and paste” transposon?
14. *Retrotransposons* move by means of an RNA intermediate. Label and explain how these common transposons accomplish this movement in Figure 21.9 below.



15. What is the significance of the enzyme involved with retrotransposons?
16. With transposons and retrotransposons comprising such a large percentage of vertebrate genomes, what possible function might they have?

17. What are *short tandem repeats (STRs)*, and why is Earl Washington (see page 420) interested in them?

18. Explain the significance of the following concepts:

multigene families of identical DNA sequences

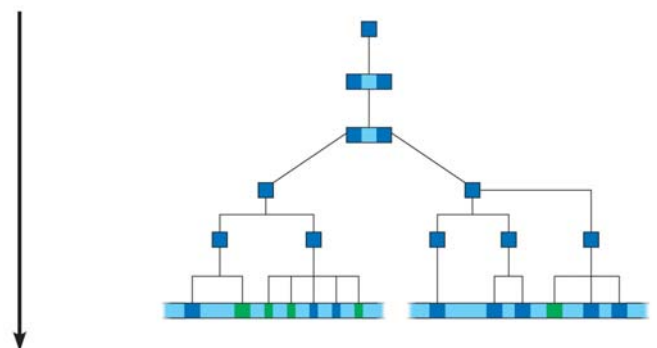
multigene families of nonidentical genes

The selective advantage of having one of the β -globin family genes expressed in the embryo

Concept 21.5 Duplication, rearrangement, and mutation of DNA contribute to genome evolution

19. What is the evolutionary significance of the relationship between the genes on human chromosome 16 and those same blocks of genes on mouse chromosomes 7, 8, 16, and 17?

20. A good summary of several processes involved in genomic evolution can be found in the globin gene families. Label and explain these processes as described in Figure 21.13.



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21. Using the concept of a protein domain in your answer, explain why exon shuffling could lead to a novel protein.

Concept 21.6 Comparing genome sequences provides clues to evolution and development

22. The more _____ in sequence the genes and genomes of two species are, the more closely related those species are in their _____ history.

23. What are three genes that are evolving much faster in humans than chimpanzees?

24. What is *evo-devo*, and how does it relate to understanding the evolution of genomes?

25. Explain what a *homeobox* is, and describe how it functions.

Testing Your Knowledge: Self-Quiz Answers

Now you should be ready to test your knowledge. Place your answers here:

1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____