

### Guide Questions for Topic: Fundamentals of Genetic Inheritance & Expression

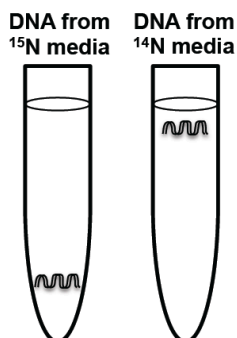
*What molecule provides the “genetic information”*

1. In the 1940s, researchers demonstrated that a mouse will survive if injected with either dead pathogenic pneumococcus or live nonpathogenic pneumococcus. However, injecting mice with both at the same time causes the mice die. What key insight/hypothesis did these experiments provide?
2. Did the experiment described in the previous question provide conclusive evidence that DNA is the genetic material of cells? Why or why not?
3. How did researchers convincingly demonstrate that DNA is the genetic material of cells?
4. If you injected mice with both dead pathogenic pneumococcus and dead nonpathogenic pneumococcus at the same time, would you predict that the mice would live or die? Explain your answer.

*How is genetic information (i.e., DNA) replicated for inheritance?*

5. In the key experiment by Meselson and Stahl, they grew cultures of *E. coli* in medium containing either  $^{14}\text{N}$  or  $^{15}\text{N}$ . If you compared the bacteria from those cultures, how would they differ?
6. What does the term “isotope labeling” refer to?
7. During equilibrium centrifugation, molecules will migrate through a gradient of CsCl until \_\_\_\_\_.
8. You have grown two cultures of bacteria: one in media containing  $^{15}\text{N}$  and one media containing  $^{14}\text{N}$ . Equilibrium centrifugation on DNA isolated from each culture yields the band patterns shown below (on the left).

You then transfer bacteria grown in  $^{14}\text{N}$  media to  $^{15}\text{N}$  media, and allow time for **TWO** rounds of cell division. What band pattern would you expect the DNA from these cells yield?



*How does genetic information (i.e., DNA) direct protein synthesis?*

9. One of the earliest insights into how DNA sequences are used by cells to generate proteins was the observation that the sequence of DNA in a gene is “colinear” with the sequence of amino acids in the protein it codes for. What does it mean to say that a gene and protein exhibit conlinearity?
10. As you know, DNA is located in the nucleus, whereas proteins are synthesized in the cytoplasm. How, then, are DNA sequences able to direct the synthesis of proteins despite their distinct localizations in cells?
11. Transfer RNAs are critical to the process of protein synthesis because they \_\_\_\_\_.
12. What does the term “nucleotide insertion” refer to?
13. What does the term “frame shift mutation” refer to?
14. The earliest experiments that provided evidence that DNA/RNA is read as a “triplet code” during translation stemmed from the fact that mutant forms of Bacteriophage T4 with a one or two nucleotide insertion in a gene yielded a mutant phenotype in the virus. However, mutant forms that had a three nucleotide insertion yielded a wildtype phenotype. What is the explanation for these different phenotypes?
15. What does the term “codon” refer to?
16. What does the term “*in vitro* translation” refer to?
17. What does it mean that the Genetic Code is “degenerate”?
18. The two codons \_\_\_\_\_ & \_\_\_\_\_ code for what two amino acids?  
(NOTE: The two blanks will be filled in for the quiz and the Genetic Code table will be provided.)

*Other important points*

19. What does the term “reverse transcription” refer to?