

DNA and Protein Synthesis Concept Questions

1. What are nucleotides? Describe their structure. (monomers which make up nucleic acids; made of five carbon sugar, phosphate and nitrogen base)
2. Describe how the work of Hershey and Chase, Chargaff, and Wilkins and Franklin contributed to the discovery by Watson and Crick of the double helix.
3. Describe how DNA and RNA differ in their composition, structure, function, and location. (composition - DNA contains deoxyribose and T, RNA contains ribose and U; structure - DNA double stranded, RNA single stranded; function - DNA genetic information, mRNA is the copy, rRNA is part of ribosome, tRNA brings amino acids to ribosome)
4. Why is DNA replication important for every cell?
5. Why is the making of exact copies of DNA called replication rather than duplication?
6. Compare the amount of DNA in a muscle cell with that in a brain cell.
7. What is meant by saying that DNA replication is semi-conservative?
8. Why is replication on one strand of DNA continuous, while on the other strand the replication must be discontinuous?
9. Proofreading enzymes scan DNA to check for base pairing errors. Explain why these enzymes are important.
10. A certain chemical is known to fuse thymine with adenine. Comment on the possible effects of exposure to this chemical.
11. If human DNA contains approximately 3×10^9 base pairs, and DNA polymerase can work at the rate of about 50 nucleotides per second, how can our DNA be replicated so quickly?
12. If 27 percent of the bases in a certain segment of DNA were adenine, what would be the percentages of thymine, cytosine, and guanine.
13. A segment of chromosomal DNA which contains instructions for one protein is a _____. Many genes are located on a piece of DNA called a _____.
14. Describe the technique of DNA fingerprinting. (see notes)
15. As a research biologist, you know of a bacterium that produces an antibiotic that is quite effective against a certain crop plant fungus. There would be great economic importance in enabling the plant to resist the fungus. How might you use DNA technology to accomplish this?
16. Briefly, what is accomplished by each of the two major steps in protein synthesis? (transcription makes a copy of a gene; translation changes it from nucleic acid to amino acid language). Where in the cell does each one occur?

17. Compare and contrast DNA replication and transcription.
18. Explain the role played by each of the following in protein synthesis.
 - a) template strand of DNA
 - (b) RNA codon
 - (c) RNA polymerase
 - (d) ribosome
 - (e) rRNA
 - (f) tRNA
19. During the process of translation what language change occurs? How is it possible to put together a polypeptide with the correct sequence of amino acids?
20. For the DNA triplet CGT, write the complementary mRNA codon and the tRNA anticodon. What amino acid does the triplet GCA represent?
21. How does a codon differ from a DNA triplet. How does an anticodon differ from a DNA triplet?
22. Explain the functions of start and stop codons.
23. What would be the effect on translation if the stop codon were changed by mutation?
24. What if the start codon were mutated?
25. What effect does the nucleotide sequence of DNA have on the cell?
26. Suppose that during protein synthesis, a cell is starved of uracil and another chemical of similar shape is supplied in its place. How will the proteins produced be affected by this substitution?
27. A molecular biologist discovers a drug that blocks the site of attachment of the ribosome to mRNA. How will the drug affect the functioning of the cell?
28. What kinds of factors act as mutagens? What effects could they have? Where or when might one be exposed to them?