

Protein Synthesis Pre-Test

Name:

Key:

*Misconception Question & answer

1. Which type of molecule contains genetic information that is passed from parents to offspring?
 - a. Fat molecules
 - b. DNA molecules**
 - c. Protein molecules
 - d. Carbohydrate molecules
2. What are the subunits that make up DNA molecules?
 - a. Amino acids*
 - b. Nucleotides**
 - c. Fatty acids
 - d. Proteins
3. Which of the following is TRUE about genes?
 - a. Genes are traits
 - b. Genes are proteins
 - c. Genes are sequences of nucleotides**
 - d. Genes are sequences of amino acids
4. In sexually reproducing organisms, such as humans, which of the following statements is TRUE about the DNA that is passed from parents to children?
 - a. All of the DNA comes from one of the parents*
 - b. Half of the DNA comes from each of the parents**
 - c. Some of the DNA comes from each of the parents, but the amount that comes from each parent cannot be predicted
 - d. Sons receive most of their DNA from their fathers and daughters receive most of their DNA from their mothers*
5. How many different types of amino acids are used to make proteins?
 - a. One
 - b. Three
 - c. Four
 - d. Twenty**
6. Mutations in the DNA sequence are
 - a. Detrimental
 - b. Beneficial
 - c. Neutral
 - d. All of the above**
7. Mutations in the DNA sequence can cause changes in which molecule(s)?
 - a. mRNA
 - b. Protein
 - c. Amino acids
 - d. Both A and B**
 - e. All of the above
8. True or **False**? Explain your choice: All DNA codes for proteins that conduct the essential functions of the body.

9. Construct a model that explains how the structure of DNA determines the structure of proteins.

10. Write or draw a sequence of steps (algorithm) explaining the cause of early onset Alzheimer's in humans.

11. Do you have any experience with Alzheimer's? What do you know about Alzheimer's?

There are several types of mutation:

DELETION (a base is lost)

INSERTION (an extra base is inserted)

Deletion and insertion may cause what's called a **FRAMESHIFT**, meaning the reading "frame" changes, changing the amino acid sequence.

SUBSTITUTION (one base is substituted for another)

If a substitution *changes* the amino acid, it's called a **MISSENSE** mutation.

If a substitution *does not change* the amino acid, it's called a **SILENT** mutation.

If a substitution *changes the amino acid to a "stop,"* it's called a **NONSENSE** mutation.

Complete the boxes below. Classify each as either Deletion, Insertion, or Substitution **AND** as either frameshift, missense, silent or nonsense (hint: deletion or insertion will always be frameshift).

Original DNA Sequence:	T A C A C C T T G G C G A C G A C T
mRNA Sequence:	<u>A U G U G G A A C C G C U G C U G A</u>
Amino Acid Sequence:	<u>METHIONINE -TRYPTOPHAN - ASPARAGINE - ARGININE- CYSTEINE - (STOP)</u>
Amino Acid Properties:	<u>Hydrophobic-Hydrophobic-Hydrophilic-Positively charged-hydrophilic</u>

Mutated DNA Sequence #1:	T A C A <u>T</u> C T T G G C G A C G A C T
What's the mRNA sequence?	<u>A U G U A G A A C C G C U G C U G A</u> (Circle the change)
What will be the amino acid sequence?	<u>METHIONINE -(STOP)</u>
Will there likely be effects in protein folding? Why or why not?	<u>YES, because the ribosome will read the stop codon and disassemble before the rest of the sequence can be read.</u>
What kind of mutation is this?	<u>SUBSTITUTION - NONSENSE</u>

Mutated DNA Sequence #2:	T A C <u>G</u> A C C T T G G C G A C G A C T
What's the mRNA sequence?	<u>A U G C U G G A A C C G C U G C U G A</u> (Circle the change)
What will be the amino acid sequence?	<u>METHIONINE -LEUCINE -GLUTAMIC ACID - PROLINE- Leucine-Leucine...</u>
Will there likely be effects in protein folding? Why or why not?	<u>Maybe, there is a change in the amino acid from trp to leu, but both are hydrophobic, so there may not be changes in the folding pattern</u>
What kind of mutation is this?	<u>INSERTION - FRAME SHIFT</u>

Mutated DNA Sequence #3:	T A C A C C T T <u>A</u> G C G A C G A C T
What's the mRNA sequence?	<u>A U G U G G A A U C G C U G C U G A</u> (Circle the change)
What will be the amino acid sequence?	<u>METHIONINE-TRYPTOPHAN-ASPARAGINE- ARGININE- Cysteine-(STOP)</u>
Will there likely be effects in protein folding? Why or why not?	<u>NO because the amino acid did not change</u>
What kind of mutation is this?	<u>SUBSTITUTION - SILENT MUTATION</u>

Mutated DNA Sequence #4:	T A C A C C T T G G C G A C <u>T</u> A C T
What's the mRNA sequence?	<u>A U G U G G A A C C G C U G A U G A</u> (Circle the change)
What will be the amino acid sequence?	<u>METHIONINE-TRYPTOPHAN-ASPARAGINE-Arginine (STOP)</u>
Will there likely be effects in protein folding? Why or why not?	<u>YES, because the ribosome will read the stop codon and disassemble before the rest of the sequence can be read.</u>
What kind of mutation is this?	<u>SUBSTITUTION - NONSENSE</u>

Mutated DNA Sequence #5: T A C A C C T T G G G A C G A C T

What will be the corresponding mRNA sequence? A U G U G G A A C C C U G C U G A

What will be the amino acid sequence? METHIONINE-TRYPTOPHAN-ASPARAGINE- PROLINE - ALANINE

Will there likely be effects in protein folding? Why or why not? YES, there is a change from arginine to proline, which is a change from a positively charged amino acid to a hydrophobic amino acid. There is also a change in the rest of the sequence that may result in different amino acids and possibly a longer chain if the stop codon is no longer read.

What kind of mutation is this? DELETION – FRAME SHIFT

Adjusted from: <http://staff.fcps.net/einman/biology/MutationsWS.doc>

Key:

*Misconception Question & answer

Protein Synthesis Summative Test

Name:

1. Which of the following is TRUE about genes? (1 pt)
 - a. Genes are traits
 - b. Genes are proteins
 - c. Genes are sequences of nucleotides**
 - d. Genes are sequences of amino acids
2. *In sexually reproducing organisms, such as humans, which of the following statements is TRUE about the DNA that is passed from parents to children? (1 pt)
 - a. All of the DNA comes from one of the parents*
 - b. Half of the DNA comes from each of the parents**
 - c. Some of the DNA comes from each of the parents, but the amount that comes from each parent cannot be predicted
 - d. Sons receive most of their DNA from their fathers and daughters receive most of their DNA from their mothers*
3. *Mutations in the DNA sequence are (1 pt)
 - a. Detrimental*
 - b. Beneficial
 - c. Neutral
 - d. All of the above**
4. The function of a protein is determined by: (1 pt)
 - a. the shape of the protein.
 - b. the number of amino acids.
 - c. the sequence of amino acids.
 - d. All of the above are correct.**
5. *Proteins are important in living cells because: (1 pt)
 - a. they contain genetic information for all living organisms.
 - b. they are a main source of energy for an organism's metabolism.*
 - c. they are involved in providing structure and controlling chemical reactions.**
 - d. they transport oxygen and carbon dioxide across cell membranes.
6. Which of the following is an example of a frame-shift mutation? (1 pt)
 - a. AGGCTT → AGGTT**
 - b. TTAGCG → TTCGCG
 - c. ATTATT → ATTATT
 - d. GAGCCA → GAGCCATTG
7. What molecule contains genetic information that is passed from parents to offspring? (1 pt)

DNA molecules
8. What are the subunits that make up DNA molecules? (1 pt)

Nucleotides

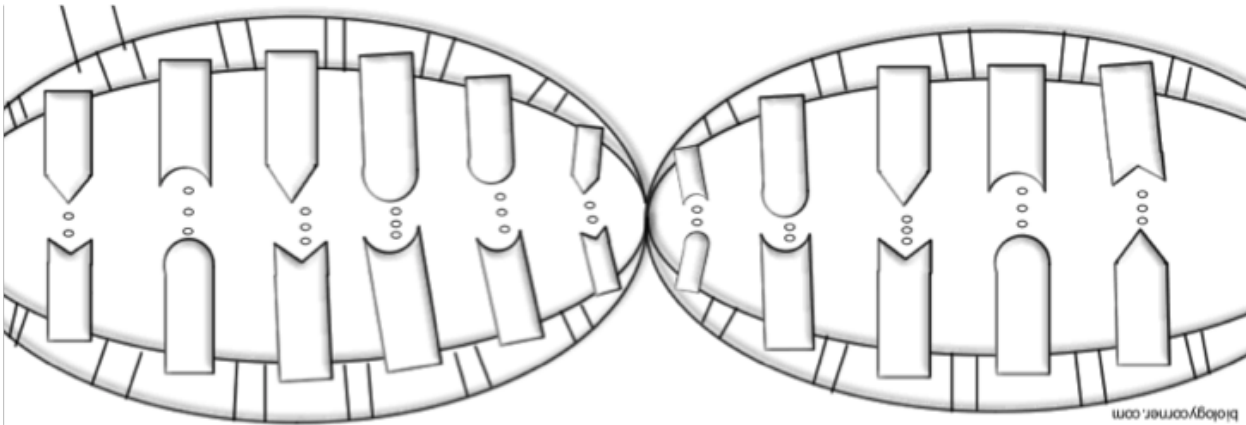
9. How many different types of amino acids are used to make proteins? (1 pt)

Twenty

10. Mutations in the DNA sequence can cause changes in which molecule(s)? (2 pts; one point for each answer)

mRNA, Protein

11. *True or **False**? Explain your choice: All DNA codes for proteins that conduct the essential functions of the body. (2 pts; one point for each answer)



Use the diagram of DNA molecule below to answer question 12.

12. Appropriately label all of the nitrogen bases. (2 pts; one point for each strand)

ACAGGACGACT

T GTCCTGCTGA

Use the picture below to answer the following questions 13-18.

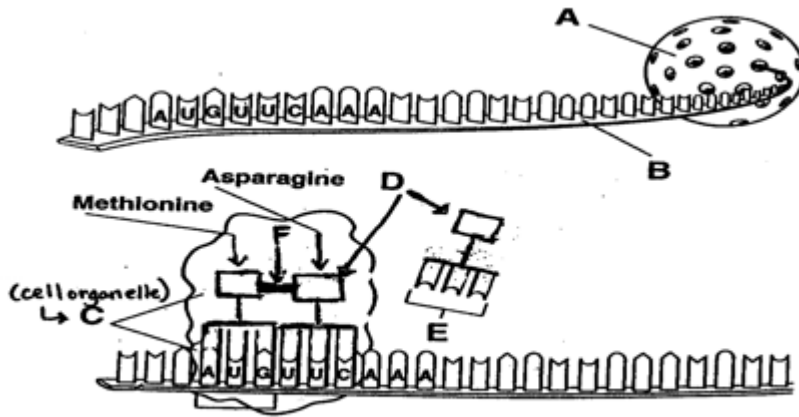


Figure 12-4

13. Label letters A-F above with the appropriate term. (6 pts; one point for each answer)
A. Nucleus, B. mRNA, C. ribosome, D. amino acid, E. tRNA, F. Peptide bond

14. In the space below, draw the half strand of DNA that was copied to make the portion of **B** that is shown. (1 pt)
TACAAGTTT

15. Name the process that already occurred inside of **A**. (1 pt)
Transcription

16. Label all of the bases on the tRNA molecules that correspond with the mRNA molecules. (3 pts; one point for each answer)
UAC AAG UUU

17. Use the attached codon chart to determine the first three amino acids in this protein chain. (3 pts; one point for each answer)
Methionine—Phenylalanine—Lysine

18. What would happen to the protein if the last codon was changed to AAG? What kind of mutation caused this change in the codon? (2 pts; one point for each answer)
Still calls for Lysine- substitution/silent mutation

Use the following information for questions 19 and 20.

Hemoglobin is a protein your red blood cells make to help them carry oxygen and carbon dioxide. It is a small protein with 100 amino acids hooked together.

19. How many bases of DNA must be transcribed to make hemoglobin? (1 pt)

300

20. How many tRNA molecules would be needed to bring amino acids to the transcribed mRNA? (1 pt)

100

21. *Indicate whether the following descriptors are true of DNA, RNA, BOTH, or NEITHER. (8 pts; one point for each answer)

 DNA a. double helix

 BOTH b. can be found in the nucleus

 RNA c. contains uracil

 BOTH d. made of nucleotides

 RNA e. contains ribose sugar

 RNA f. can be found in the cytoplasm

 NEITHER g. made of amino acids*

 RNA h. different types found within cells

22. *Briefly evaluate the validity of the following statement: *Your genes are completely responsible for determining your traits.* (3 pt)

3 points: This statement is not valid. Your genes are responsible for determining your traits along with environmental influences. Genes alone do not determine traits.

2 points: This statement is not valid. Genes alone do not determine traits.

1 point: This statement is not valid.

23. What are the different characteristics amino acids have that contribute to a protein's shape? (4 pts; one point for each answer)

Hydrophilic, hydrophobic, positively charged, negatively charged

24. *What causes mutations in the DNA sequence? (2 pts; one point for each answer)

Environmental factors, DNA replication errors

25. Construct a model that explains how the structure of DNA determines the structure of proteins. (25 points)

Scoring is as follows:

- Students may create model resulting in either a properly folded protein or a misfolded protein
- Students must use the components: chromosome, DNA, transcription, mRNA, translation, tRNA, amino acids, triplet codons, polypeptide, folded (or misfolded) protein
 - Students receive 2 points per component, if used correctly. 1 point if component is used but is incorrect=20 possible points.
- Students receive total of 5 points if they have the pathway from DNA to protein correct (5 possible steps, 1 point per step).
- See first question model document, also in our folder. Scanned image was too small when attempted to add to this document.

26. Write or draw a sequence of steps (algorithm) explaining the cause of early onset Alzheimer's in humans. (25 points)

Students are expected to include (5 points each):

1. Mutation in DNA
2. Transcription/Translation create protein
3. Protein is mutated and therefore is folded incorrectly
4. Misfolded proteins aggregate in the brain, forming plaques and neurofibrillary tangles
5. As a result, cell death and tissue loss occurs, resulting in reduced cognitive functioning