

## DNA/RNA and Gene Expression

Name: \_\_\_\_\_

Date: \_\_\_\_\_

1. A portion of one strand of a DNA molecule has the sequence shown below.

**ACCTGAAGG**

Assuming there are no mutations in this portion of the DNA, what is the corresponding sequence on the complementary DNA strand?

- A. **ACCTGAAGG**      B. **GTTCAGGAA**  
 C. **TGGACTTCC**      D. **UGGACUCC**

2. Partial amino acid sequences for a particular protein in three animal species are shown below. Each letter in the sequence stands for an amino acid. For example, Q stands for glutamine, and L stands for leucine.

Species	Amino Acid Sequence
Green junglefowl (bird)	QHEPHERKRM
Nile crocodile (reptile)	SHDPAQQKRL
Domestic chicken (bird)	QHEPHKRKRM

Which of the following statements *best* explains how these sequence data are evidence for evolution?

- A. All species translate the amino acid sequences of their proteins in a similar way.  
 B. The species that are most closely related have the most similar amino acid sequences.  
 C. Individual organisms acquire changes in their amino acid sequences over their lifetimes.  
 D. The organisms that evolved at the same time in geologic history have identical amino acid sequences.

3. The table below presents a variety of mRNA three-base sequences (codons) and the amino acids for which these sequences code.

First Base of mRNA	Second Base of mRNA	Third Base of mRNA	Amino Acid
G	A	A	glutamic acid
		C	aspartic acid
		G	glutamic acid
		U	aspartic acid
	G	A	glycine
		C	glycine
		G	glycine
		U	glycine
	U	A	valine
		C	valine
		G	valine
		U	valine

Based on the information in the table, which of the following changes is *least likely* to produce a phenotypic change in an organism?

- A. GAU to GGU      B. GAU to GUU  
 C. GAU to GAA      D. GAU to GAC

4. An RNA sequence is shown below.

**AUGCCGAAACGU**

Which of the following statements describes how the RNA sequence specifies the production of an amino acid chain?

- A. Each individual RNA base codes for a single amino acid.
- B. Each group of three RNA bases codes for a single amino acid.
- C. Each group of three RNA bases codes for an enzyme that helps join amino acids together.
- D. Each individual RNA base codes for the ribosome location where amino acids are assembled.

5. Which of the following describes the function of DNA?

- A. encoding genetic information
- B. storing energy in chemical bonds
- C. speeding up biochemical reactions
- D. destroying substances that enter the cell

6. The table below shows small portions of the amino acid sequences of a particular protein in four animal species.

Animal Species	Portion of Amino Acid Sequence
1	Met-His-Leu-Ala-Pro
2	Met-His-Leu-Glu-Glu
3	Met-Tyr-Leu-Ala-Pro
4	Met-Ala-Leu-Arg-Trp

- a) Based on the data in the table, which two species are most closely related? Explain your answer.
- b) Describe and explain *three* other forms of scientific evidence that could be used to study the relatedness of these four animal species.

7. The table below is a codon chart.

First Letter	Second Letter				Third Letter
	U	C	A	G	
U	phenylalanine	serine	tyrosine	cysteine	U
	phenylalanine	serine	tyrosine	cysteine	C
	leucine	serine	stop	stop	A
	leucine	serine	stop	tryptophan	G
C	leucine	proline	histidine	arginine	U
	leucine	proline	histidine	arginine	C
	leucine	proline	glutamine	arginine	A
	leucine	proline	glutamine	arginine	G
A	isoleucine	threonine	asparagine	serine	U
	isoleucine	threonine	asparagine	serine	C
	isoleucine	threonine	lysine	arginine	A
	<sup>(start)</sup> methionine	threonine	lysine	arginine	G
G	valine	alanine	aspartate	glycine	U
	valine	alanine	aspartate	glycine	C
	valine	alanine	glutamate	glycine	A
	valine	alanine	glutamate	glycine	G

What is the likely effect of a mutation that causes the sequence CGC to become CCG?

- A. The reading frame will be shifted.
- B. The protein formed will be unchanged.
- C. The protein will be translated incorrectly.
- D. The translation process will stop prematurely.

8. A strand of DNA has these bases:

AGC CAT GTA TAC

What is the complementary DNA strand?

- A. ACG GAT CTA TAG
- B. TCG GTA CAT ATG
- C. TGC CTA GAT ATC
- D. UCG CUA CAU AUG

9. A segment of DNA has this sequence:

ATA GCA CAT GTA

What is the mRNA sequence transcribed from this segment?

- A. TAT CGT GTA CAT
- B. TAT GCT CTA GAT
- C. UAU CGU GUA CAU
- D. UAU GCU CUA CAU

10. This chart shows which amino acids are coded for by different combinations of mRNA nucleotides.

First Base	Second Base							Third Base	
	U	C	A	G	U	C	A		
U	UUU	Phenylalanine	UCU	Serine	UAU	Tyrosine	UGU	Cysteine	U
	UUC	Phenylalanine	UCC	Serine	UAC	Tyrosine	UGC	Cysteine	C
	UUA	Leucine	UCA	Serine	UAA	Stop	UGA	Stop	A
	UUG	Leucine	UCG	Serine	UAG	Stop	UGG	Tryptophan	G
C	CUU	Leucine	CCU	Proline	CAU	Histidine	CGU	Arginine	U
	CUC	Leucine	CCC	Proline	CAC	Histidine	CGC	Arginine	C
	CUA	Leucine	CCA	Proline	CAA	Glutamine	CGA	Arginine	A
	CUG	Leucine	CCG	Proline	CAG	Glutamine	CGG	Arginine	G
A	AUU	Isoleucine	ACU	Threonine	AAU	Asparagine	AGU	Serine	U
	AUC	Isoleucine	ACC	Threonine	AAC	Asparagine	AGC	Serine	C
	AUA	Isoleucine	ACA	Threonine	AAA	Lysine	AGA	Arginine	A
	AUG	Methionine or start	ACG	Threonine	AAG	Lysine	AGG	Arginine	G
G	GUU	Valine	GCU	Alanine	GAU	Aspartic Acid	GGU	Glycine	U
	GUC	Valine	GCC	Alanine	GAC	Aspartic Acid	GGC	Glycine	C
	GUA	Valine	GCA	Alanine	GAA	Glutamic Acid	GGA	Glycine	A
	GUG	Valine	GCG	Alanine	GAG	Glutamic Acid	GGG	Glycine	G

Which amino acids are coded for by an mRNA segment that reads CAG GUG?

- A. arginine and valine
- B. isoleucine and arginine
- C. glutamine and valine
- D. valine and isoleucine

11. How does DNA code for proteins in a cell?
- A. by creating a new double helix structure
  - B. by using its phosphate and sugar molecules
  - C. by adding more hydrogen bonds to its structure
  - D. by arranging certain nitrogen bases of the cell in a particular order

12. Which factor *most* affects the order of amino acids in a protein?
- A. the DNA located in the nucleus of the cell
  - B. the cell in which the protein is located
  - C. the amount of ATP available for the cell's use
  - D. the area in a cell where proteins are produced

13. Which nitrogen base makes RNA different from DNA?

A. guanine      B. uracil      C. adenine

14. Which base bonds with adenine in DNA?

A. cytosine      B. uracil      C. thymine

Use the information to answer the the following question(s).

### DNA

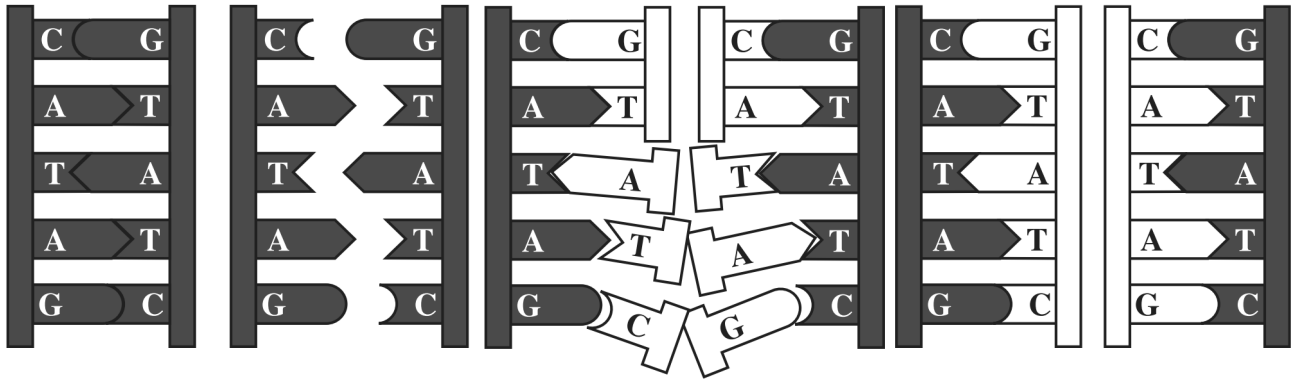
Scientists study DNA to understand heredity, disease, and the evolutionary history of organisms. During these studies, DNA must first be separated into two complementary strands. Next, the appropriate nucleotides are attached to the nucleotides in each original strand to produce two new complete DNA strands. The diagram below shows a simple model of this process. The letters A, T, C, and G represent the four nucleotides.

**Original DNA Molecule**

**Stage 1**  
Original molecule is separated into two complementary strands.

**Stage 2**  
Nucleotides are attached to original strands.

**Stage 3**  
The result is two complete DNA molecules.



15. A partial DNA sequence for normal hemoglobin and a partial DNA sequence for sickle-cell anemia are shown below.

G-G-A-C-T-T-C-T-T  
**Normal hemoglobin**

G-G-A-C-A-T-C-T-T  
**Sickle-cell anemia**

Based on the DNA sequences, sickle-cell anemia is caused by

- A. a sex-linked trait.
  - B. a dominant nucleotide.
  - C. a mutation in the genetic code.
  - D. an incomplete separation of chromosomes.
16. Which of these provides the *best* evidence of a close evolutionary relationship between two species?
- A. similar sequences of the nucleotides in the DNA molecules
  - B. similar processes of replicating DNA molecules during cell division
  - C. similar numbers of chromosomes formed by the DNA molecules
  - D. similar numbers of mutations that occur in DNA molecules over time

17. Portions of the DNA sequences from two different animal species are shown below. The DNA sequences of the two species are similar.

— AAA GGC TTG ATC  
— AAA GGC ATG TAC

Based on the similarity in the DNA sequences, which is *most* likely true?

- A. The two species have the same diet.
  - B. The two species live in the same environment.
  - C. The two species have a close evolutionary relationship.
  - D. The two species are able to mate and produce fertile offspring.
18. The discovery of which of the following has most directly led to advances in the identification of suspects in criminal investigations and in the identification of genetic diseases?
- A. antibiotics
  - B. cell structure
  - C. DNA structure
  - D. sterile procedures
19. Which of the following is the template for the production of RNA within a cell?
- A. DNA
  - B. ATP
  - C. protein
  - D. carbohydrate

20. Which sequence of DNA bases would pair with the ones shown in the partial strand below?

1      2      3  
ATG TGA CAG

A. 1      2      3  
ATG TGA CAG

B. 1      2      3  
TAC ACT GTC

C. 1      2      3  
GTA AGT GAC

D. 1      2      3  
CAT TCA CTG

21. What molecules do both DNA and RNA contain?

- A. uracil                      B. thymine  
C. nucleotides                D. deoxyribose

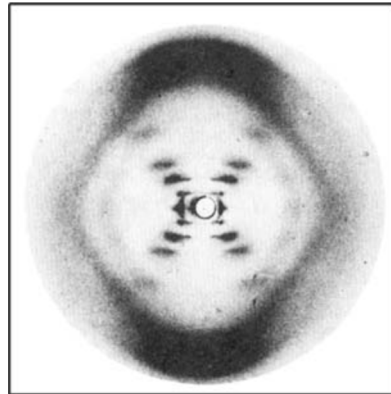
22. The genetic material of an organism is composed of

- A. lipids.  
B. proteins.  
C. deoxyribonucleic acids.  
D. complex carbohydrates.

23. Which of the following *best* describes how DNA and RNA are similar?

- A. They both contain the nitrogen bases thymine and adenine.  
B. They both are formed in a double-helix structure.  
C. They both are composed of five different nucleotides.  
D. They both contain the nitrogen bases cytosine and guanine.

24. The diagram below shows Rosalind Franklin's x-ray diffraction image of DNA.



How did this evidence affect the work of Watson and Crick?

- A. It was used to determine the physical structure of DNA.  
B. It was used to identify the four bases that make up DNA.  
C. It was used to develop the theory of independent assortment.  
D. It was used to show that DNA was the molecule of inheritance.

25. Which information was *most* important to the development of genetic engineering techniques?
- the observation of nondominant alleles
  - the discovery of lethal genes
  - the formulation of Punnett squares
  - the structure of a DNA molecule

26. **Codons Found in Messenger RNA**

		Second Base				
		U	C	A	G	
First Base	U	Phe	Ser	Tyr	Cys	Third Base
		Phe	Ser	Tyr	Cys	
		Leu	Ser	Stop	Stop	
		Leu	Ser	Stop	Trp	
C	Leu	Pro	His	Arg	U	
	Leu	Pro	His	Arg	C	
	Leu	Pro	Gln	Arg	A	
	Leu	Pro	Gln	Arg	G	
A	Ile	Thr	Asn	Ser	U	
	Ile	Thr	Asn	Ser	C	
	Ile	Thr	Lys	Arg	A	
	Met	Thr	Lys	Arg	G	
G	Val	Ala	Asp	Gly	U	
	Val	Ala	Asp	Gly	C	
	Val	Ala	Glu	Gly	A	
	Val	Ala	Glu	Gly	G	

A strand of mRNA containing the repeating sequence AAGAAGAAGAAG could code for which of the following amino acid sequences?

- lys-arg-glu-lys
- ser-ser-glu-glu
- lys-arg-lys-arg
- lys-lys-lys-lys

27. 5' ATCAGCGCTGGC 3'

The above sequence of DNA is part of a gene. How many amino acids are coded for by this segment?

- 4
- 8
- 12
- 20

28. A scientist puts nucleotide chains of UUUUUU in a test tube under conditions allowing protein synthesis. Soon the test tube is full of polypeptide chains composed of only the amino acid phenylalanine. What does this experiment indicate?

- The amino acid phenylalanine is composed of uracil.
- UUU codes for the amino acid phenylalanine.
- Protein synthesis malfunctions in test tubes.
- Most proteins contain only one type of amino acid.

29. Which of the following base pair sequences could be produced in DNA replication?

- 5' AGTCUT 3' 3' TCUGTA 5'
- 5' AGTCAT 3' 3' TCAGTA 5'
- 5' AGTCAT 3' 3' CTGACG 5'
- 5' AGTCAT 3' 3' UCAGUA 5'



30. A base sequence is shown below.

ACAGTGC

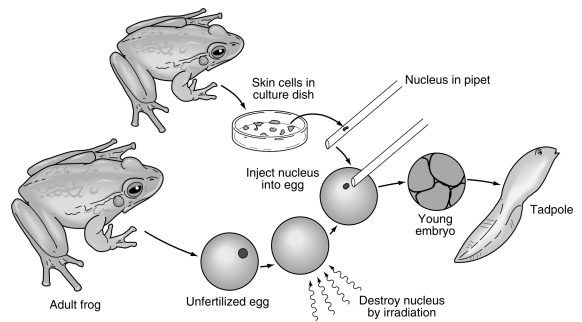
How would the base sequence be coded on mRNA?

- A. TGTCACG
- B. GUGACAU
- C. UGUCACG
- D. CACUGUA

31. Semi-conservative replication of DNA refers to the idea that

- A. DNA molecules need to unwind before duplication begins.
- B. each new DNA molecule contains two new single RNA strands.
- C. the two strands of DNA molecules run in opposite directions.
- D. each half of the original DNA molecule is joined with a new complementary DNA strand.

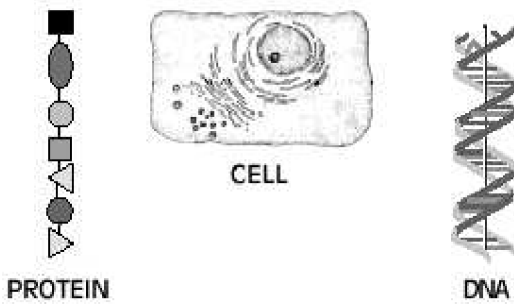
32. The diagram below shows the procedure scientists used to clone a frog from the nucleus of a skin cell.



This procedure is evidence that \_\_\_\_\_.

- A. the nuclei of the skin cells protect the frog
- B. only skin cells can be used to clone a frog
- C. the skin cells are the reproductive cells of the frog
- D. the nuclei of skin cells contain all the DNA needed for a new frog

33.



What is the relationship between the three structures in the diagram above?

- A. DNA is produced by protein which is produced in the cell.
- B. Protein is composed of DNA which is produced in the cell.
- C. DNA controls the production of protein in the cell.
- D. A cell is composed only of DNA and protein.

34. Which statement about DNA is correct?

- A. A child's DNA will be unrelated to the mother's or father's DNA.
- B. A child's DNA will show similarities to both the mother's and father's DNA.
- C. A female child's DNA will exactly match the mother's DNA.
- D. A male child's DNA will exactly match the father's DNA.

35. The table shows which mRNA codons code for various amino acids.

Which amino acid sequence will be produced by translation of the mRNA sequence UAC UCU ACC?

		Second Position				
		U	C	A	G	
First Position (5' end)	U	Phe Phe Leu Leu	Ser Ser Ser Ser	Tyr Tyr Stop Stop	Cys Cys Stop Trp	U C A G
	C	Leu Leu Leu Leu	Pro Pro Pro Pro	His His Gln Gln	Arg Arg Arg Arg	U C A G
	A	Ile Ile Ile Met	Thr Thr Thr Thr	Asn Asn Lys Lys	Ser Ser Arg Arg	U C A G
	G	Val Val Val Val	Ala Ala Ala Ala	Asp Asp Glu Glu	Gly Gly Gly Gly	U C A G
						Third Position (3' end)

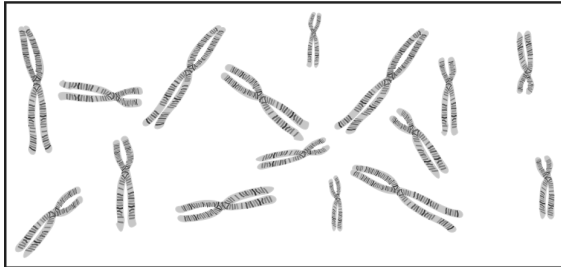
- A. Asn – Pro – Thr
- B. Thr – Pro – Asn
- C. Thr – Ser – Tyr
- D. Tyr – Ser – Thr

36. Which statement about DNA is correct?

- A. A child's DNA will be unrelated to the mother's or father's DNA.
- B. A child's DNA will show similarities to both the mother's and father's DNA.
- C. A female child's DNA will exactly match the mother's DNA.
- D. A male child's DNA will exactly match the father's DNA.

37. DNA contains the code for constructing which molecules?
- A. proteins                      B. fats  
C. starches                      D. sugars

38. The diagram below shows the chromosomes from a cell after they were photographed under a microscope.



Which of the following questions may *best be* answered by studying an organism's chromosomes?

- A. What sex is the organism?  
B. Is the organism endangered?  
C. Where is the organism's ecosystem?  
D. How does the organism obtain its food?

39. Which of the following *best* describes the number of chromosomes in a normal human liver cell?
- A. 23 pairs of chromosomes  
B. 46 different types of chromosomes  
C. 46 male chromosomes and 46 female chromosomes  
D. 23 original chromosomes and 23 duplicate chromosomes

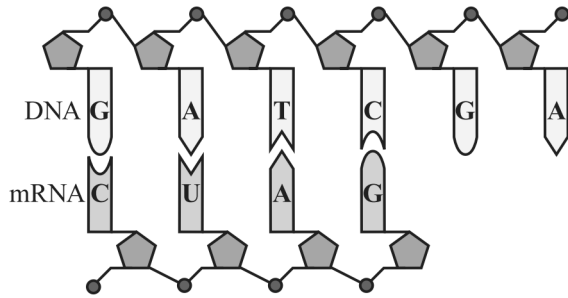
40. Genetic information usually flows in one specific direction. Which of the following *best* represents this flow?

- A. DNA → Protein → RNA  
B. Protein → RNA → DNA  
C. RNA → Protein → DNA  
D. DNA → RNA → Protein

41. DNA and RNA are similar because they both contain

- A. deoxyribose.                      B. nucleotides.  
C. thymine.                              D. double helices.

42. The diagram below shows a strand of DNA matched to a strand of messenger RNA.



What process does this diagram represent?

- A. mutation                      B. respiration  
C. transcription                D. translation
43. Why is the particular sequence of bases in a segment of DNA important to cells?
- A. Some base sequences code for protein production.  
B. Some base sequences cause the release of lipids from the nucleus.  
C. Some base sequences contain the order of sugars in polysaccharides.  
D. Some base sequences produce electrical signals sent to the cytoplasm.

44. Which of the following statements *best* describes a DNA molecule?

- A. It is a double helix.  
B. It contains the sugar ribose.  
C. It is composed of amino acids.  
D. It contains the nitrogenous base uracil.

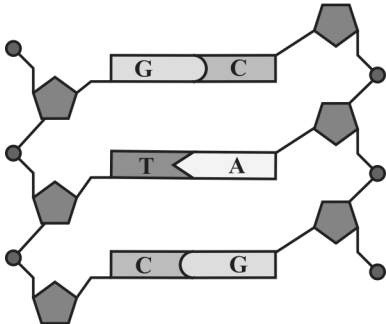
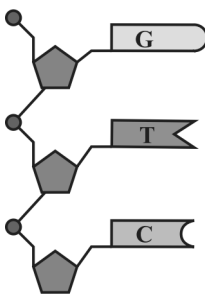
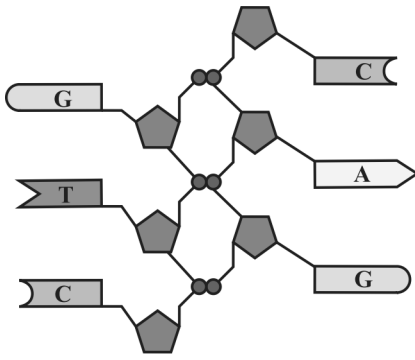
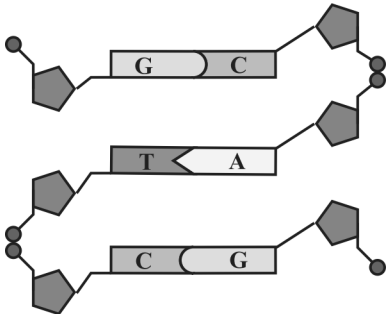
45. Which of the following units are repeatedly joined together to form a strand of DNA?

- A. amino acids                      B. fatty acids  
C. nucleotides                      D. polysaccharides

46. In a molecule of double-stranded DNA, the amount of adenine present is always equal to the amount of

- A. cytosine.                      B. guanine.  
C. thymine.                      D. uracil.

47. Which of the following models *most* accurately represents the structure of DNA?

- A. 
- B. 
- C. 
- D. 

48. Look at the illustration below.



This illustration is a model of

- A. RNA                      B. DNA  
C. a lipid                  D. a protein

49. DNA from four organisms was examined using gel electrophoresis. The results are shown in the diagram below.

DNA GEL ELECTROPHORESIS RESULTS

1	2	3	4
—	—	—	—
	—		—
—	—	—	—
	—	—	—

According to the data, which of these pairs of organisms are *most closely* related?

- A. 1 and 2                      B. 2 and 3  
C. 2 and 4                      D. 3 and 4

50. Look at the DNA sequence below.

GAA TTC GCA

What do the G and A represent in the DNA sequence?

- A. sugars
- B. amino acids
- C. phosphates
- D. nitrogen bases

51. How many nucleotides are needed to code for one amino acid?

- A. 1
- B. 3
- C. 4
- D. 6

52. Which RNA sequence is produced using the DNA sequence AGC-TAC-ACT?

- A. UCG-AUG-UGA
- B. UCG-UAC-ACU
- C. TCG-ATG-TGA
- D. AGC-UAC-ACU

53. Which of these are the repeating units that form a DNA molecule?

- A. fatty acids
- B. nucleotides
- C. amino acids
- D. chromosomes

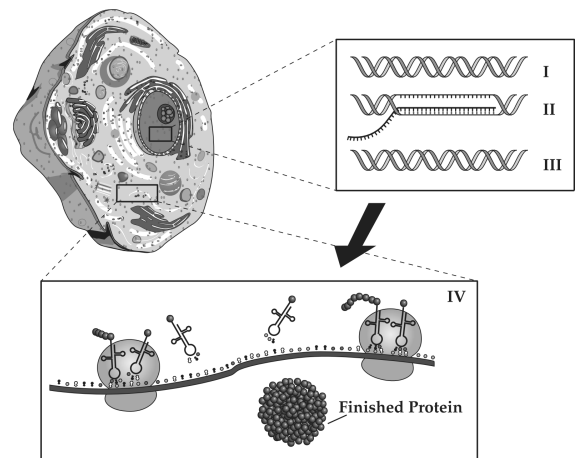
54. Hemoglobin is an important protein in red blood cells. The DNA code for hemoglobin contains the following segment:

TGC-GGA-CTC-CTC

Which of these is the messenger RNA code for this segment of DNA?

- A. ACG-CCT-GAA-GAA
- B. TCC-GGT-CTC-CTC
- C. ACG-CCU-GAG-GAG
- D. UGC-GGA-CUC-CUC

55. The diagram below shows the key steps for making proteins. Use the diagram to answer the following question(s).



According to the diagram, in which step is messenger RNA being constructed?

- A. I
- B. II
- C. III
- D. IV

56. Which step involves transfer RNA?
- A. I      B. II      C. III      D. IV

57. Which step involves ribosomes?
- A. I      B. II      C. III      D. IV

58. A researcher recently discovered a species of bacteria. DNA sequences were obtained from it and from several other species of bacteria. The DNA sequences came from the same part of the bacterial chromosome of each species.

	DNA Sequence		
Unknown Species	ACT	GCA	GCC
Species I	ACA	GCG	CCG
Species II	ACT	GCT	GGC
Species III	ACA	GCC	GGG
Species IV	ACT	GCA	GCG

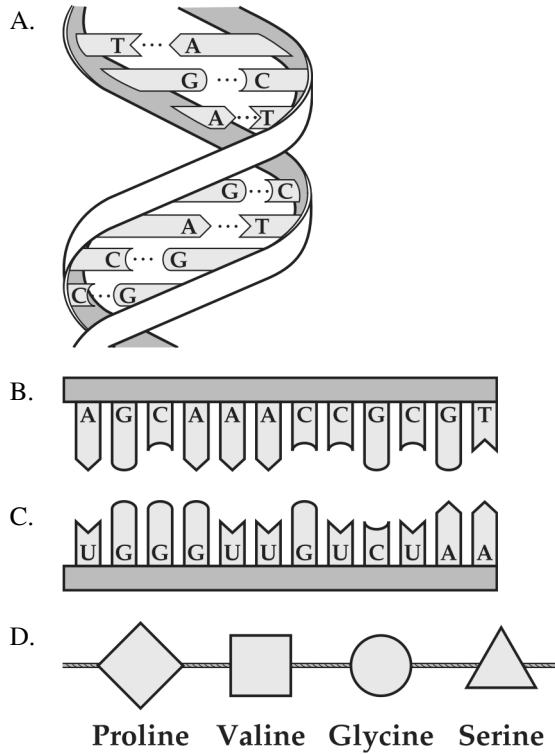
According to the data above, the unknown bacteria are *most closely* related to which species?

- A. Species I                      B. Species II  
 C. Species III                     D. Species IV

59. Which of the following is correctly matched with its function?
- A. rRNA – contains codes to make new ribosomes  
 B. DNA – carries the amino acids to the ribosomes  
 C. tRNA – combines with proteins to make up ribosomes  
 D. mRNA – carries genetic codes from nucleus to the ribosomes

60. Scientists can insert and remove nucleotides from a DNA strand. Which of these identifies this process?
- A. base pairing                      B. gene splicing  
 C. DNA synthesis                    D. DNA transcription

61. Which of these represents the structure of messenger RNA?



62. A strand of DNA has a nucleotide base sequence of TAC-CGG-AGT. Which of the following is the complementary mRNA nucleotide sequence produced from the strand of DNA?

- A. UAC-CGG-AGU      B. ACU-GAA-CGA  
 C. AGU-UCC-UAC      D. AUG-GCC-UCA

63. A cellular process uses a strand of genetic material to produce a new strand. Parts of the strands are shown below.

Original strand ATT CAG

New strand UAA GUC

This new strand will *most likely* be used for

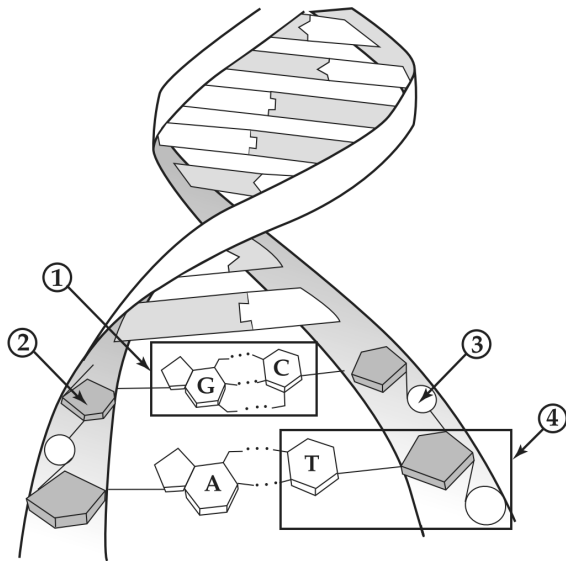
- A. gene splicing      B. DNA synthesis  
 C. crossing-over      D. protein synthesis

64. The genetic information for making a protein must move from the nucleus to the cytoplasm. Which of these moves this information to the cytoplasm?

- A. a ribosome      B. DNA  
 C. RNA      D. an amino acid

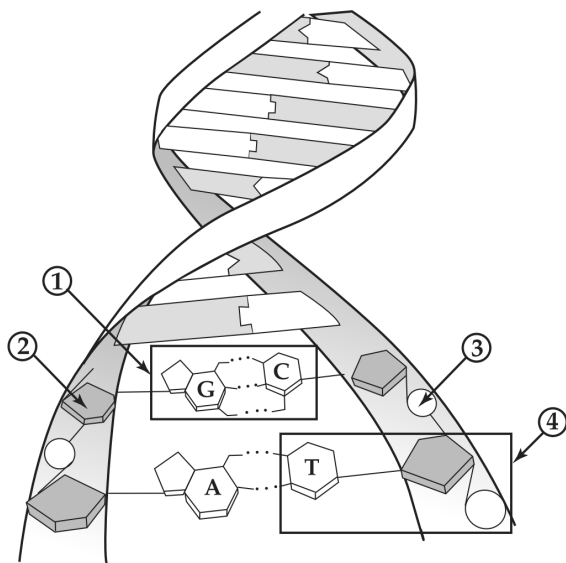


65. Which of these is a nucleotide?



- A. 1      B. 2      C. 3      D. 4

66. Which of these is a sugar?



- A. 1      B. 2      C. 3      D. 4

67. The nucleotide base sequence of a strand of DNA is TAC-CGG-AGT. What is the sequence of the complementary DNA strand?

- A. TAC-CGG-AGT      B. ACT-GAA-CGA  
C. AGT-TCC-TAC      D. ATG-GCC-TCA

68. Which of these make up the primary link between a gene and the expression of a trait?

- A. proteins              B. sugars  
C. lipids                 D. vitamins

69. Scientists have determined the sequence of most of the human genome. Which of these fields of science will probably benefit the most from this knowledge?

- A. chemistry              B. geology  
C. physics                 D. medicine

70. Use the information below to answer the following question(s).

Scientists genetically modified a variety of corn to protect it against pests like the corn borer. The corn borer is an insect caterpillar that feeds on the corn stalk, which weakens the stalk and makes it fall over. A new gene in the genetically modified corn causes the plant to produce a chemical that is toxic to the corn borer. Some people are concerned that the genetically modified corn could harm other insects such as the monarch butterfly caterpillar. The monarch caterpillar eats leaves of milkweed plants that might be coated with toxic corn pollen. However, not all researchers agree with the concerns regarding the monarch butterfly caterpillar. They state that it is unusual for large amounts of harmful corn pollen to be found on milkweed leaves. Also, only a small percentage of caterpillars feed on the milkweed plants near corn fields.

Which was *most likely* introduced into corn that made it pest-resistant?

- A. gene
- B. lipid
- C. toxin
- D. protein

71. Both DNA and RNA

- A. contain phosphate
- B. contain amino acids
- C. are a double helix
- D. are inorganic

72. Below are parts of the mitochondrial DNA codes for the American black bear, the giant panda, the red panda, and the raccoon.

**MITOCHONDRIAL DNA CODES**

Organism	DNA Codes
American black bear	ATT GGA GCA GAC TTA
Giant panda	ATT GGC ACT AAT CTA
Red panda	ATT GGA ACT AAC CTT
Raccoon	ATC GGA TCT AAC CTT

Based on this information, which two species are *most closely* related?

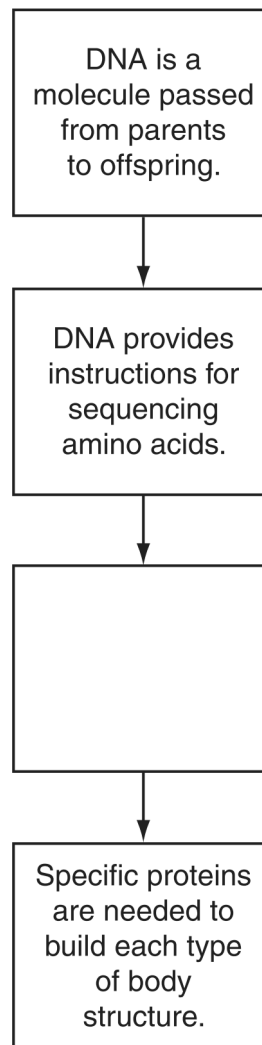
- A. the American black bear and the giant panda
- B. the American black bear and the raccoon
- C. the red panda and the raccoon
- D. the red panda and the giant panda

73. What does DNA sequencing *most* help taxonomists learn about an organism?

- A. how the organism reproduces
- B. how the organism interacts with its environment
- C. how the organism is related to other species
- D. how the organism fits into the food chain

74. Which statement *best* describes a gene?
- A. A gene contains a code for building a carbohydrate.
  - B. A gene contains chromosomes inherited during sexual reproduction.
  - C. A gene is a segment of protein in the nucleus.
  - D. A gene contains a code for building a protein.

75. The diagram below explains why offspring are more similar to their parents than to other organisms, even though all organisms are made of the same basic substances.



Which statement is the *best* information to include in the third box in the diagram?

- A. RNA is a substance that forms a copy of the DNA.
- B. Every different sequence of amino acids makes a unique protein.
- C. Proteins vary in structure more than any other type of organic molecule.
- D. DNA consists of carbon, hydrogen, oxygen, nitrogen, and phosphorus atoms.

76.



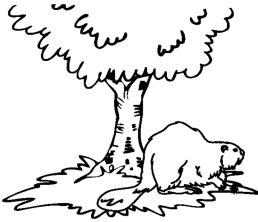
Which trait will the offspring get from the parent beaver?

A.



Eating bark from a tree

B.



Sitting under a tree

C.



Having a flat tail

77. A strand of DNA is exposed to intense heat. Which of these *best* describes what will happen to the strand of DNA?

- A. The chemical bonds of the DNA molecule will be broken.
- B. More nitrogen base pairs will add on to the DNA molecule.
- C. The chemical bonds of the DNA molecule will be strengthened.
- D. The nitrogen base pairs in the DNA molecule will switch places.

78. What is the role of hydrogen bonds in the structure of DNA?

- A. to code for proteins
- B. to synthesize proteins
- C. to separate the strands
- D. to connect the base pairs

79. Which of these *best* describes the initial change caused by a DNA mutation?

- A. a change in the sequence of base pairs
- B. a change in the production of enzymes
- C. a change in the number of nucleosomes within a cell
- D. a change in the number of hydrogen bonds between the bases

80. Which of these shows the steps by which proteins are coded and synthesized?
- A. RNA → DNA → protein
  - B. DNA → RNA → protein
  - C. protein → RNA → DNA
  - D. protein → DNA → RNA

81. The chromosome structure in a cell accounts for genetic variation based on the order of its
- A. sugar groups
  - B. nitrogen bases
  - C. hydrogen bonds
  - D. phosphate groups

82. Which of the following is related to a chromosome in a way similar to how a bone is related to a skeleton?
- A. A nucleus
  - B. A gamete
  - C. A gene
  - D. A cell

83. Scientists can genetically alter corn so that it makes a protein that will harm a certain caterpillar that feeds on it. Which of the following is an advantage of producing this type of corn?
- A. The corn will have a better color.
  - B. The corn will be able to resist insects.
  - C. The insects will reproduce more quickly.
  - D. The insects will become immune to the poison.

84. CCGTAC
- What would the mRNA complement of the above DNA strand be?
- A. AATGCA
  - B. GGCAUG
  - C. TTACUT
  - D. UUACGU

85. In what part of DNA is genetic information located?
- A. Hydrogen bonds
  - B. Nucleotide sequence
  - C. Sugar molecules
  - D. Enzymes

86. Watson and Crick's model of DNA resembles—

- A. interlocking gears.
- B. a boat on a calm lake.
- C. a twisted ladder.
- D. electrical wires.

87. What structures carry the *most* genetic information for a leaf cell?

- A. Chromosomes                      B. Ribosomes
- C. Centrioles                         D. Chloroplasts

88. One way RNA is different from DNA is that RNA contains—

- A. phosphate groups.                B. hydrogen bonds.
- C. ribose.                                D. bases.

89. What is photographed to create a karyotype?

- A. Mutations                          B. Genes
- C. Gametes                              D. Chromosomes

90. Which of the following statements *best* explains the relationship between the parts of genetic materials?

- A. Each DNA molecule contains genes.
- B. Each gene contains many DNA molecules.
- C. Each DNA molecule contains many chromosomes.
- D. Each chromosome contains DNA molecules.

91. 

UACUGA
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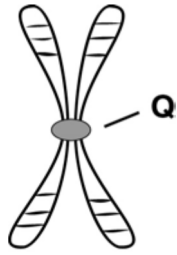
Which of the following represents a tRNA complement to the codons above?

- A. UAGTGA                              B. ATCACT
- C. AUGACU                              D. TACTCA

92. Which of the following best describes the order of events that leads to genetic expression?

- A. DNA → RNA → amino acid → protein → genetic expression
- B. RNA → amino acid → DNA → protein → genetic expression
- C. DNA → amino acid → protein → RNA → genetic expression
- D. RNA → protein → DNA → amino acid → genetic expression

93.



What is the region on the chromosome shown above marked by the letter "Q"?

- A. Chromatin
- B. Centromere
- C. Centriole
- D. Centrosome

94. Which of these models *best* represents a DNA molecule?

- A. A diagram of a DNA double helix, showing two strands twisted around each other with horizontal rungs representing base pairs.
- B. A diagram of a DNA molecule represented as a string of beads. The beads are arranged in two parallel vertical columns, with wavy lines extending from each bead to represent the sugar-phosphate backbone.
- C. A diagram showing three nucleosomes. Each nucleosome is represented as a rectangular block with a vertical line passing through its center, representing the DNA fiber passing through the nucleosome core.
- D. A diagram showing a DNA molecule with beads on a string. The beads are arranged in a zig-zag pattern, and dashed lines connect the beads, representing the DNA backbone.

95. DNA that has been cut by enzymes can separate into segments of different lengths during the process of—

- A. mitosis.
- B. electrophoresis.
- C. gene amplification.
- D. cytokinesis.

96. Which of the following would correctly represent the complementary strand of DNA to the DNA strand listed below?

A T A G C C A T G

- A. U A U C G G U A C  
B. A T A G C C A T C  
C. T A T C G G T A C  
D. G A T C A T T C A
97. The number of chromosomes can be studied by looking at a—
- A. karyotype.                      B. pedigree chart.  
C. genotype.                        D. punnet square.
98. The genotype of an organism describes the—
- A. codons that make up the genes of the organisms.  
B. number of genes on the organism's chromosomes.  
C. genetic make up of a trait.  
D. type of chromosomes present in the nucleus.

99. Which of the following carries amino acids to the site of protein synthesis?

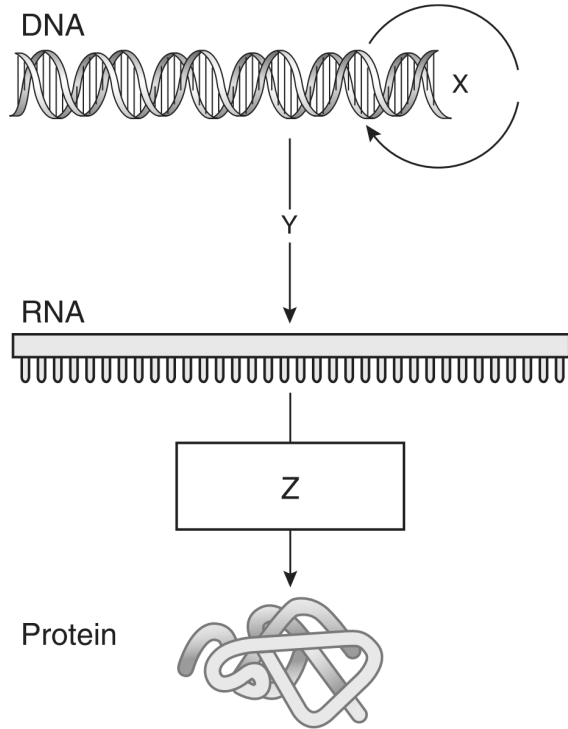
A. mRNA                              B. rRNA  
C. tRNA                                D. nRNA

100. Which molecule directs the synthesis of a polypeptide at a ribosome?

A. ADP    B. ATP    C. DNA    D. RNA



101. A diagram of a cellular process is shown below.



Which of the following identifies the process shown at point Z?

- A. Translation
- B. Translocation
- C. Replication
- D. Transcription

102. Genes provide the instructions for protein synthesis. Which molecule serves as a link between a gene and a protein?

- A. ATP
- B. DNA
- C. NAD
- D. RNA

103. This sequence of nucleotides represents one side of a double-stranded DNA molecule.

–ATTGC–

What is the correct sequence for the opposite side?

- A. ATTGC
- B. TAACG
- C. UAACG
- D. TAACU

104. James Watson and Francis Crick are credited with discovering the structure of DNA. Which of the following characteristics of DNA did this discovery help explain?

- A. Why DNA exists in all living cells
- B. The amount of DNA in a chromosome
- C. How DNA passes on genetic information
- D. The number of base pairs in a DNA molecule

105. Which diagram correctly models the process of protein synthesis?

- A. **Replication**                      **Transcription**  
DNA → RNA → Protein
- B. **Transcription**                      **Translation**  
DNA → RNA → Protein
- C. **Translation**                      **Transcription**  
DNA → RNA → Protein
- D. **Transcription**                      **Replication**  
DNA → RNA → Protein

106. The table below is a codon chart.

First Letter	Second Letter				Third Letter
	U	C	A	G	
U	phenylalanine	serine	tyrosine	cysteine	U
	phenylalanine	serine	tyrosine	cysteine	C
	leucine	serine	stop	stop	A
	leucine	serine	stop	tryptophan	G
C	leucine	proline	histidine	arginine	U
	leucine	proline	histidine	arginine	C
	leucine	proline	glutamine	arginine	A
	leucine	proline	glutamine	arginine	G
A	isoleucine	threonine	asparagine	serine	U
	isoleucine	threonine	asparagine	serine	C
	isoleucine	threonine	lysine	arginine	A
	<sup>(start)</sup> methionine	threonine	lysine	arginine	G
G	valine	alanine	aspartate	glycine	U
	valine	alanine	aspartate	glycine	C
	valine	alanine	glutamate	glycine	A
	valine	alanine	glutamate	glycine	G

What is the likely effect of a mutation that causes the sequence CGC to become CCG?

- A. The reading frame will be shifted.
- B. The protein formed will be unchanged.
- C. The protein will be translated incorrectly.
- D. The translation process will stop prematurely.

107. The order of bases on a segment of DNA is represented by C-A-C-T-G-A.

What would be the end result of transcription for this sequence?

- A. G-T-G-A-C-T
- B. C-U-C-A-G-U
- C. G-U-G-A-C-U
- D. C-A-C-T-G-A

108. RNA structure is different from DNA structure because only RNA has which of the following?

- A. Phosphate groups
- B. Thymine bases
- C. Adenine bases
- D. Ribose sugars

109. A segment of a DNA strand has the following bases:

TAC GAT

What is the complementary strand of DNA?

- A. UAG CAU
- B. TAG CAT
- C. ATG CTA
- D. AUG CUA

110. If a portion of a DNA strand has the base sequence TACGCA, what will be the base sequence of the mRNA strand transcribed?

- A. TACGCA
- B. UACGCA
- C. AUGCGU
- D. ATGCGT

111. Scientists can use the amino acid sequence in proteins to determine the evolutionary relationships of primates. Of the following, which primate is least closely related to humans?

Human: SER THR ALA GLY ASP

- A. Gorilla: SER THR ALA GLY ASP
- B. Baboon: ASN THR THR GLY ASP
- C. Chimp: SER THR ALA GLY ASP
- D. Lemur: ALA THR SER GLY GLU

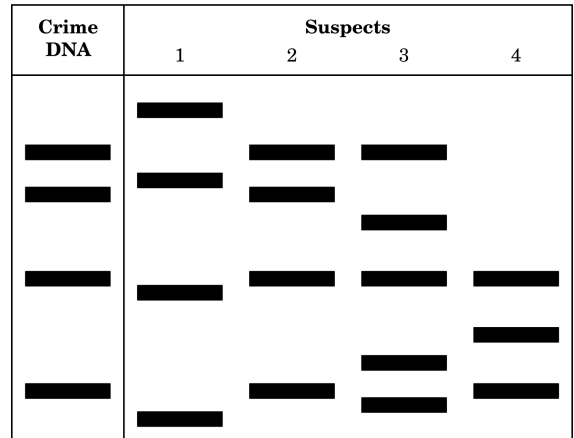
112. This chart represents amino acids that are coded from different combinations of mRNA codons.

Codons in mRNA								
First Base	Second Base						Third Base	
	U	C	A	G				
	UUU Phenylalanine	UCU Serine	UAU Tyrosine	UGU Cysteine	U			
U	UUC Phenylalanine	UCC Serine	UAC Tyrosine	UGC Cysteine	C			
	UUA Leucine	UCA Serine	UAA Stop	UGA Stop	A			
	UUG Leucine	UCG Serine	UAG Stop	UGG Tryptophan	G			
	CUU Leucine	CCU Proline	CAU Histidine	CGU Arginine	U			
C	CUC Leucine	CCC Proline	CAC Histidine	CGC Arginine	C			
	CUA Leucine	CCA Proline	CAA Glutamine	CGA Arginine	A			
	CUG Leucine	CCG Proline	CAG Glutamine	CGG Arginine	G			
	AUU Isoleucine	ACU Threonine	AAU Asparagine	AGU Serine	U			
A	AUC Isoleucine	ACC Threonine	AAC Asparagine	AGC Serine	C			
	AUA Isoleucine	ACA Threonine	AAA Lysine	AGA Arginine	A			
	AUG Methionine or start	ACG Threonine	AAG Lysine	AGG Arginine	G			
	GUU Valine	GCU Alanine	GAU Aspartic Acid	GGU Glycine	U			
G	GUC Valine	GCC Alanine	GAC Aspartic Acid	GCC Glycine	C			
	GUA Valine	GCA Alanine	GAA Glutamic Acid	GGA Glycine	A			
	GUG Valine	GCG Alanine	GAG Glutamic Acid	GGG Glycine	G			

Which amino acid sequence can be coded from the DNA sequence CAG TAG CGA?

- A. Valine — Isoleucine — Glycine
- B. Valine — Aspartic Acid — Alanine
- C. Valine — Isoleucine — Alanine
- D. Valine — Phenylalanine — Alanine

113. This diagram represents samples of DNA that were cut with a restriction enzyme during DNA fingerprinting in a crime lab.



Which technique was used to produce these bands?

- A. cloning
- B. gel electrophoresis
- C. gene splicing
- D. genetic engineering

114. This chart shows a list of messenger RNA codons.

Codons in mRNA									
First Base	Second Base						Third Base		
	U	C	A	G					
	UUU	Phenylalanine	UCU	Serine	UAU	Tyrosine	UGU	Cysteine	U
U	UUC	Phenylalanine	UCC	Serine	UAC	Tyrosine	UGC	Cysteine	C
	UUA	Leucine	UCA	Serine	UAA	Stop	UGA	Stop	A
	UUG	Leucine	UCG	Serine	UAG	Stop	UGG	Tryptophan	G
	CUU	Leucine	CCU	Proline	CAU	Histidine	CGU	Arginine	U
C	CUC	Leucine	CCC	Proline	CAC	Histidine	CGC	Arginine	C
	CUA	Leucine	CCA	Proline	CAA	Glutamine	CGA	Arginine	A
	CUG	Leucine	CCG	Proline	CAG	Glutamine	CGG	Arginine	G
	AUU	Isoleucine	ACU	Threonine	AAU	Asparagine	AGU	Serine	U
A	AUC	Isoleucine	ACC	Threonine	AAC	Asparagine	AGC	Serine	C
	AUA	Isoleucine	ACA	Threonine	AAA	Lysine	AGA	Arginine	A
	AUG	Methionine or start	ACG	Threonine	AAG	Lysine	AGG	Arginine	G
	GUU	Valine	GCU	Alanine	GAU	Aspartic Acid	GGU	Glycine	U
G	GUC	Valine	GCC	Alanine	GAC	Aspartic Acid	GGC	Glycine	C
	GUA	Valine	GCA	Alanine	GAA	Glutamic Acid	GGA	Glycine	A
	GUG	Valine	GCG	Alanine	GAG	Glutamic Acid	GGG	Glycine	G

A strand of DNA with the sequence AAC AAG CCC undergoes a mutation, and the first A is changed to a C. How will this mutation affect the amino acid sequence?

- A. One amino acid will change.
- B. Two amino acids will change.
- C. All of the amino acids will change.
- D. The amino acids will remain the same.

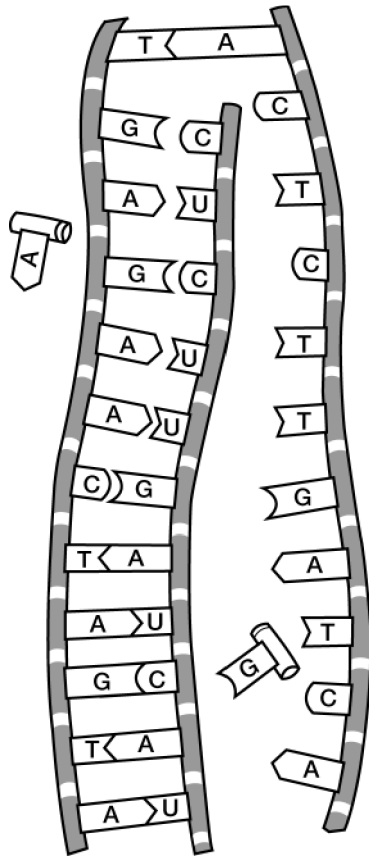
115. Which deals with the transmission of inherited traits from one generation to another?

- A. anatomy
- B. genetics
- C. ecology
- D. forensics

116. In the nucleus of a cell, the DNA molecule functions most like

- A. a pair of scissors.
- B. a computer memory chip.
- C. a ballpoint pen.
- D. a zipper.

117. Use the diagram below to answer the following question.



Key	
T = thymine	A = adenine
G = guanine	U = uracil
C = cytosine	

Which statement describes the diagram?

- A. DNA transcription is producing messenger RNA.
- B. DNA transcription is producing ribosomal RNA.
- C. DNA translation is producing messenger RNA.
- D. DNA translation is producing ribosomal RNA.

DNA/RNA and Gene Expression      4/22/2019

- |                       |                       |
|-----------------------|-----------------------|
| 1.<br>Answer:      C  | 21.<br>Answer:      C |
| 2.<br>Answer:      B  | 22.<br>Answer:      C |
| 3.<br>Answer:      D  | 23.<br>Answer:      D |
| 4.<br>Answer:      B  | 24.<br>Answer:      A |
| 5.<br>Answer:      A  | 25.<br>Answer:      D |
| 6.<br>Answer:         | 26.<br>Answer:      D |
| 7.<br>Answer:         | 27.<br>Answer:      A |
| 8.<br>Answer:      B  | 28.<br>Answer:      B |
| 9.<br>Answer:      C  | 29.<br>Answer:      B |
| 10.<br>Answer:      C | 30.<br>Answer:      C |
| 11.<br>Answer:      D | 31.<br>Answer:      D |
| 12.<br>Answer:      A | 32.<br>Answer:      D |
| 13.<br>Answer:      B | 33.<br>Answer:        |
| 14.<br>Answer:      C | 34.<br>Answer:      B |
| 15.<br>Answer:      C | 35.<br>Answer:      D |
| 16.<br>Answer:      A | 36.<br>Answer:      B |
| 17.<br>Answer:      C | 37.<br>Answer:      A |
| 18.<br>Answer:      C | 38.<br>Answer:      A |
| 19.<br>Answer:      A | 39.<br>Answer:      A |
| 20.<br>Answer:      B | 40.<br>Answer:      D |

41.  
Answer: B

42.  
Answer: C

43.  
Answer: A

44.  
Answer: A

45.  
Answer: C

46.  
Answer: C

47.  
Answer: A

48.  
Answer:

49.  
Answer:

50.  
Answer: D

51.  
Answer: B

52.  
Answer: A

53.  
Answer: B

54.  
Answer: C

55.  
Answer: B

56.  
Answer: D

57.  
Answer: D

58.  
Answer: D

59.  
Answer: D

60.  
Answer: B

61.  
Answer: C

62.  
Answer: D

63.  
Answer: D

64.  
Answer: C

65.  
Answer: D

66.  
Answer: B

67.  
Answer: D

68.  
Answer: A

69.  
Answer: D

70.  
Answer: A

71.  
Answer: A

72.  
Answer: C

73.  
Answer: C

74.  
Answer: D

75.  
Answer: B

76.  
Answer: C

77.  
Answer: A

78.  
Answer: D

79.  
Answer: A

80.  
Answer: B

81.  
Answer: B

82.  
Answer: C

83.  
Answer: B

84.  
Answer: B

85.  
Answer: B

86.  
Answer: C

87.  
Answer: A

88.  
Answer: C

89.  
Answer: D

90.  
Answer: D

91.  
Answer: C

92.  
Answer: A

93.  
Answer: B

94.  
Answer: A

95.  
Answer: B

96.  
Answer: C

97.  
Answer: A

98.  
Answer: C

99.  
Answer: C

100.  
Answer: D

101.  
Answer: A

102.  
Answer: D

103.  
Answer: B

104.  
Answer: C

105.  
Answer: B

106.  
Answer: B

107.  
Answer: C

108.  
Answer: D

109.  
Answer: C

110.  
Answer: C

111.  
Answer: D  
Objective: B.07A

112.  
Answer: C  
Objective: B.06C

113.  
Answer: B

114.  
Answer: A

115.  
Answer: B

116.  
Answer:

117.  
Answer: A