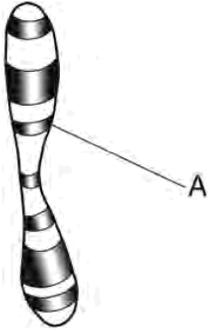


**Modern Genetics Review**

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1. Human genetic material is represented in the diagram below.



The region labeled A is made up of a section of

- A) a protein that becomes an enzyme
  - B) DNA that may direct protein synthesis**
  - C) a carbohydrate made from amino acids
  - D) glucose that may be copied to make DNA
2. The molecule DNA contains the four bases listed below.

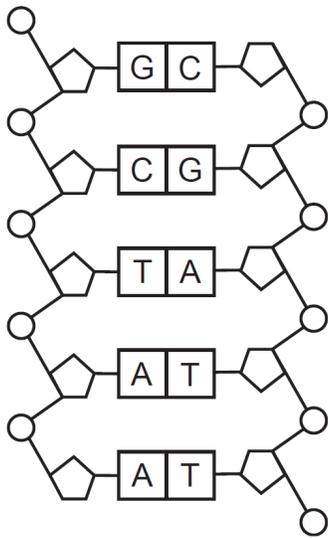
A – adenine  
C – cytosine  
G – guanine  
T – thymine

Which base pairings normally occur during DNA replication?

- A) Guanine pairs with cytosine. Thymine pairs with thymine.
  - B) Adenine pairs with thymine. Cytosine pairs with guanine.**
  - C) Thymine pairs with guanine. Cytosine pairs with adenine.
  - D) Cytosine pairs with cytosine. Thymine pairs with thymine.
-

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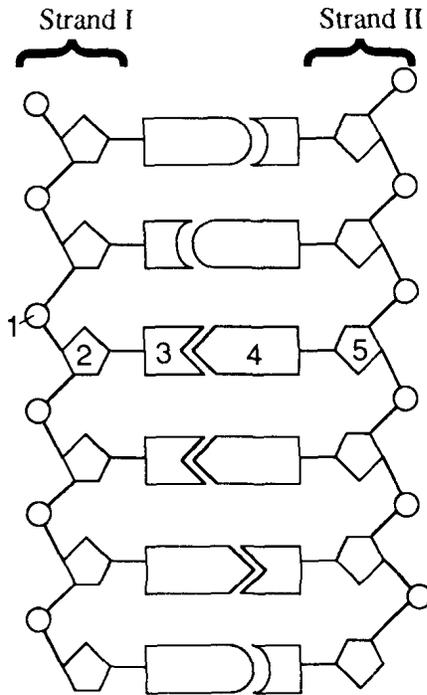
3. The diagram below represents a portion of a molecule found in cells of the human body.



Sequences represented by the letters in this molecule enable human cells to

- A) alter the method of absorption of material
  - B) carry out asexual reproduction by meiosis
  - C) **synthesize enzymes from organic molecules**
  - D) modify genetic recombination during mitosis
-

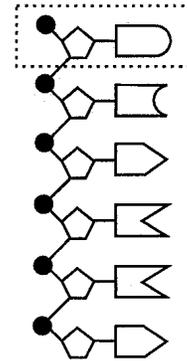
4. Base your answer to the following question on the diagram below and on your knowledge of biology.



Structures 1, 2, and 3 make up a

- A) nucleic acid                      B) ribosome  
 C) nucleolus                         D) **nucleotide**
5. In addition to a phosphate group, a DNA nucleotide could contain
- A) **thymine and deoxyribose**  
 B) uracil and deoxyribose  
 C) thymine and ribose  
 D) uracil and ribose

6. Base your answer to the following question on the diagram below and on your knowledge of biology. The diagram represents a portion of a strand of a DNA molecule.



The entire structure enclosed within the dotted line represents a

- A) deoxyribose molecule  
 B) nitrogenous base  
 C) phosphate  
 D) **nucleotide**
7. Which is the sugar component of a DNA nucleotide?
- A) adenine                             B) **deoxyribose**  
 C) glucose                             D) phosphate
8. The coded information of a DNA molecule is determined by the
- A) sequence of amino acids  
 B) number of ribose units  
 C) **sequence of the nitrogenous bases**  
 D) sequence of the sugar-phosphate units
9. Before they can pass from a parent cell to its offspring cells, the inherited instructions that a human cell carries must first be
- A) moved into the nucleus  
 B) broken down and made into DNA molecules  
 C) used to make specific protein molecules that form genes  
 D) **accurately replicated**
10. Which molecules are needed to cut and copy segments of DNA?
- A) reproductive hormones  
 B) carbohydrates  
 C) antibodies  
 D) **biological catalysts**

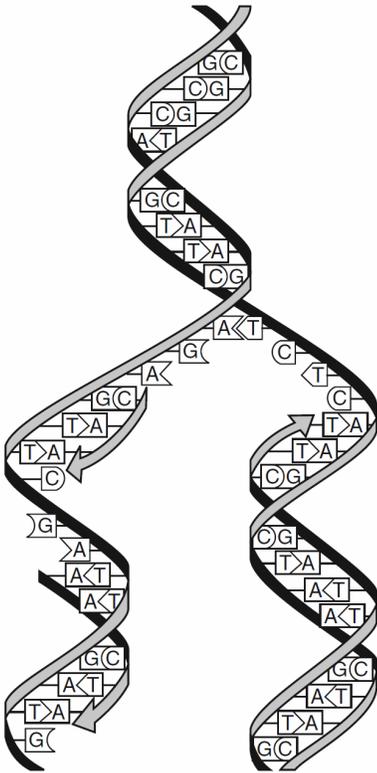
11. Before a cell divides, an exact copy of each chromosome is made by the process of

- A) genetic engineering
- B) replication**
- C) mutation
- D) recombination

12. DNA replication occurs in preparation for

- A) mitosis, only
- B) meiosis, only
- C) both mitosis and meiosis**
- D) neither mitosis nor meiosis

13. The process represented in the diagram below occurs in many cells.



The main function of this process is to

- A) provide an exact copy of the genetic code**
- B) ensure genetic variation in a species
- C) synthesize cellular proteins
- D) produce antibodies to combat disease

14. Which cellular change in an organism could be inherited by the next generation?

- A) a change in the ribosomes in the pancreas of a squirrel
- B) the deletion of a single DNA base in a sperm cell of a trout**
- C) a decrease in the size of a vacuole in a rose leaf cell
- D) the transfer of a piece of a chromosome in the skin cell of a raccoon

15. A mutation occurring in a human can be passed from parent to offspring when it occurs in a

- A) lung cell, due to exposure to a toxic gas
- B) gamete formed in the ovary**
- C) body cell undergoing mitosis
- D) heart cell with chromosome damage

16. Which event would most likely cause a change in a genetic sequence in an organism?

- A) eating certain foods high in saturated fats
- B) strenuous physical activity
- C) exposure to radiation**
- D) a sudden exposure to cooler temperatures

17. A change in the base subunit sequence during DNA replication can result in

- A) variation within an organism**
- B) rapid evolution of an organism
- C) synthesis of antigens to protect the cell
- D) recombination of genes within the cell

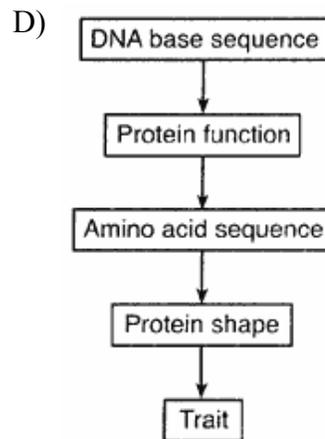
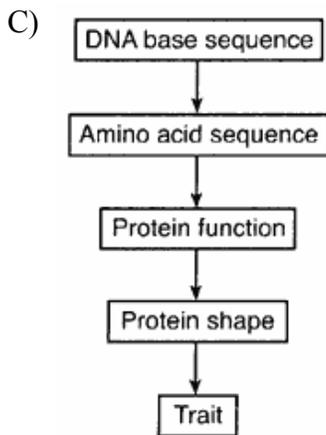
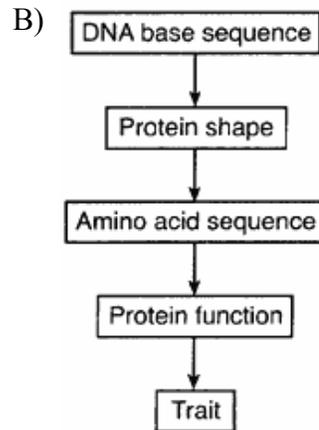
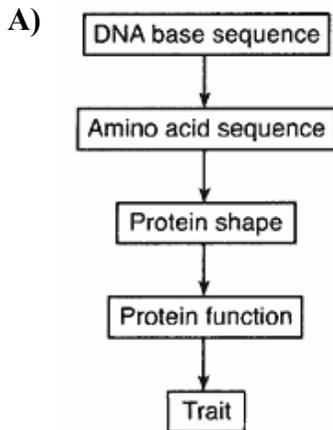
18. Synthesis of a defective protein may result from an alteration in

- A) vacuole shape
- B) the number of mitochondria
- C) a base sequence code**
- D) cellular fat concentration

19. The ozone layer of Earth's atmosphere helps to filter ultraviolet radiation. As the ozone layer is depleted, more ultraviolet radiation reaches Earth's surface. This increase in ultraviolet radiation may be harmful because it can directly cause
- A) photosynthesis to stop in all marine organisms
  - B) abnormal migration patterns in waterfowl
  - C) mutations in the DNA of organisms**
  - D) sterility in most species of mammals and birds
20. Which statement is true regarding an alteration or change in DNA?
- A) It is always known as a mutation.**
  - B) It is always advantageous to an individual.
  - C) It is always passed on to offspring.
  - D) It is always detected by the process of chromatography.
21. A sudden change in the DNA of a chromosome can usually be passed on to future generations if the change occurs in a
- A) skin cell
  - B) liver cell
  - C) sex cell**
  - D) brain cell
22. New inheritable characteristics would be *least* likely to result from
- A) mutations which occur in muscle cells and skin cells**
  - B) mutations which occur in male gametes
  - C) mutations which occur in female gametes
  - D) the sorting and recombination of existing genes during meiosis and fertilization
23. Which nucleic acid carries instructions from the nucleus to the ribosome?
- A) DNA, only
  - B) Messenger RNA, only**
  - C) Transfer RNA, only
  - D) DNA, messenger RNA, and transfer RNA
24. In the synthesis of proteins, what is the function of messenger-RNA molecules?
- A) They act as a template for the synthesis of DNA.
  - B) They carry information that determines the sequence of amino acids.**
  - C) They remove amino acids from the nucleus.
  - D) They carry specific enzymes for dehydration synthesis.
25. A sequence of three nitrogenous bases in a messenger-RNA molecule is known as a
- A) codon**
  - B) gene
  - C) polypeptide
  - D) nucleotide
26. Which base is normally used in the synthesis of RNA but *not* in the synthesis of DNA?
- A) adenine
  - B) uracil**
  - C) cytosine
  - D) guanine
27. If a portion of a messenger RNA molecule contains the base sequence A-A-U, the corresponding transfer RNA base sequence is
- A) A-A-U
  - B) G-G-T
  - C) T-T-C
  - D) U-U-A**
28. What is the complementary messenger-RNA sequence for the DNA sequence shown below?
- C A A G G T  
└──┬──┬──┬──┬──┘
- A) C-A-A-G-G-U
  - B) G-T-T-C-C-A
  - C) G-U-U-C-C-A**
  - D) C-A-A-G-G-T
29. Which of the following nucleic acids brings the amino acids to the ribosome?
- A) DNA, only
  - B) Messenger RNA, only
  - C) Transfer RNA, only**
  - D) DNA, messenger RNA, and transfer RNA
30. In a cell, protein synthesis is the primary function of
- A) ribosomes**
  - B) nuclei
  - C) nucleolus
  - D) mitochondria
31. DNA is able to control cellular activities most directly by regulating the process of
- A) meiotic division
  - B) protein synthesis**
  - C) active transport
  - D) selective breeding

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32. Which sequence best represents the relationship between DNA and the traits of an organism?

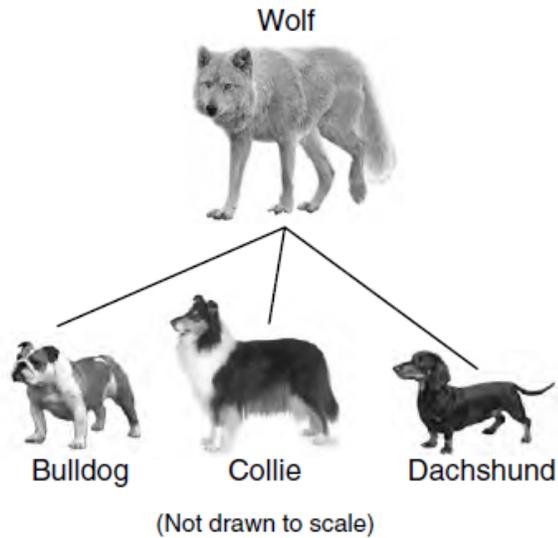


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33. A farmer grows beans that he sells to local markets. Over a period of 40 years, the farmer has identified the plants that produced the most beans and only used those beans to produce new plants. This procedure is part of the process of

- A) **selective breeding**
  - B) genetic engineering
  - C) replication
  - D) cloning
-

- 
34. The diagram below indicates a few of the many varieties of domestic dogs thought to have originated from wolves that were domesticated thousands of years ago.



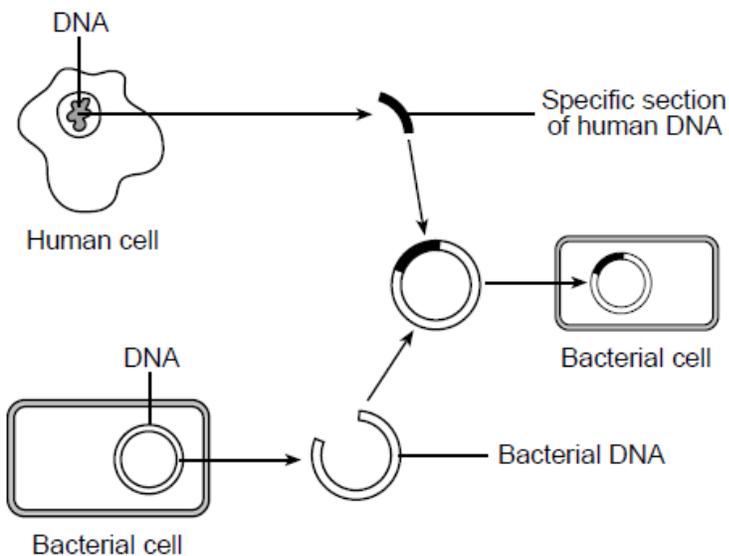
Adapted from: <http://evolution.berkeley.edu/evolibrary/article>

The many varieties of domesticated dogs were most likely produced as a result of

- A) mutating the body cells of the dogs
  - B) selective breeding over many generations**
  - C) genetic engineering with specific enzymes
  - D) cloning dogs with desirable traits
35. The organic compounds that scientists use to cut, copy, and move segments of DNA are
- A) carbohydrates
  - B) enzymes**
  - C) hormones
  - D) starches
-

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36. The diagram below represents an important biological technique scientists rely on to produce replacement hormones.



Which two processes are required for the technique to successfully produce hormones?

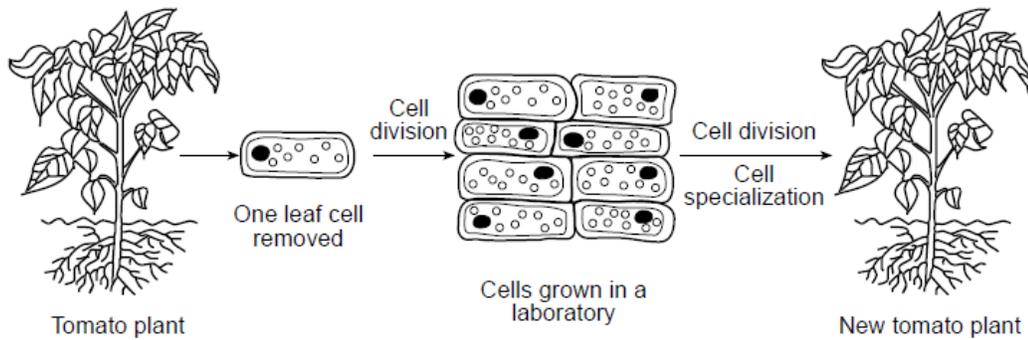
- A) **replication of DNA in bacterial cells and cell division**
- B) replication of DNA in bacterial cells and gamete formation
- C) meiosis and development
- D) mitosis and fertilization

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37. Scientists have developed the ability to manufacture hormones, such as human growth hormone, using bacteria. One benefit of this new technology is that

- A) scientists can use only one type of bacteria
  - B) **bacteria are relatively inexpensive and reproduce quickly**
  - C) patients can spend more money on their medications
  - D) scientists produce drugs that cause more immune reactions
-

38. A standard laboratory technique used to produce a new plant is represented in the diagram below.



This technique is best identified as

- A) gene alteration
- B) selective breeding
- C) replication
- D) **cloning**

39. Farmers may someday clone their best milk-producing cow into a whole herd. What potential disadvantage might be important to consider in having such a large group of clones on one farm?

- A) It may be difficult to tell the animals apart.
- B) **Lack of variation may limit survival in the herd.**
- C) The cows could be fertilized by only one type of bull.
- D) The cows could be mated only with each other.

40. Sheep were the first species of mammals to be cloned. Which statement about cloned sheep is correct?

- A) Different kinds of body cells in a cloned sheep contain different DNA.
- B) Cloned sheep cannot produce offspring if they are mated with noncloned sheep.
- C) **Two sheep cloned from the same parent cannot mate and have offspring.**
- D) Many cells in cloned sheep have two identical nuclei, instead of a single nucleus.

Base your answers to questions 41 through 44 on the information and diagram below and on your knowledge of biology.

A human gene contains the following DNA base sequence: ACGCCCACCTTA

The gene mutated. It then contained the following DNA base sequence: ACGCGCACCTTA

**Universal Genetic Code Chart**  
**Messenger RNA Codons and the Amino Acids for Which They Code**

		SECOND BASE				
		U	C	A	G	
FIRST BASE	U	UUU } PHE UUC } UUA } LEU UUG }	UCU } UCC } SER UCA } UCG }	UAU } TYR UAC } UAA } STOP UAG }	UGU } CYS UGC } UGA } STOP UGG } TRP	U C A G
	C	CUU } CUC } LEU CUA } CUG }	CCU } CCC } PRO CCA } CCG }	CAU } HIS CAC } CAA } GLN CAG }	CGU } CGC } ARG CGA } CGG }	U C A G
	A	AUU } AUC } ILE AUA } AUG } MET or START	ACU } ACC } THR ACA } ACG }	AAU } ASN AAC } AAA } LYS AAG }	AGU } SER AGC } AGA } ARG AGG }	U C A G
	G	GUU } GUC } VAL GUA } GUG }	GCU } GCC } ALA GCA } GCG }	GAU } ASP GAC } GAA } GLU GAG }	GGU } GGC } GLY GGA } GGG }	U C A G

41. The amino acids bond together to form which type of complex molecule?  
**A) protein**      B) starch      C) fat      D) sugar
42. Which type of mutation is represented in the new gene?  
 A) addition      B) deletion      C) inversion      **D) substitution**
43. Then, using the Universal Genetic Code Chart, record the amino acid sequence that is coded for by the mRNA codons you placed in the table.

Mutated Gene DNA Base Sequence	ACG	CGC	ACC	TTA
mRNA codons	_____	_____	_____	_____
Amino acid sequence	_____	_____	_____	_____

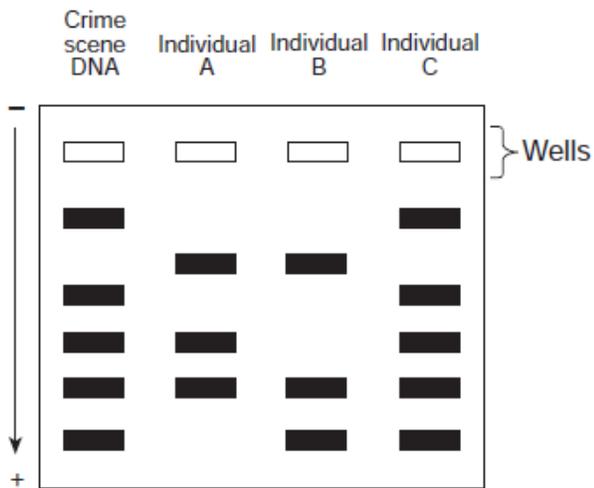
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44. In the table below, record the mRNA codons coded for by the DNA base sequence of the mutated gene ACGCGCACCTTA.

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45. Base your answer to question on the information and diagram below and on your knowledge of biology.

An unknown sample of DNA found at a crime scene was compared to DNA samples taken from three individuals. The results of the technique used to compare the samples are represented below.



What factor causes the DNA fragments to move in this technique?

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Base your answers to questions 46 and 47 on the information below and on your knowledge of biology.

Caretakers at a zoo are trying to determine which of two male tigers fathered the newest cub. They obtained DNA from the tiger cub, the mother tiger, and the two male tigers. The DNA was analyzed. The results of the analysis are shown below.

Male 1	Male 2	Cub	Female
		████	████
████	████	████	████
████	████	████	████
	████		
████	████		
		████	████
████			

46. Which male tiger is the father of the newborn cub? Support your answer.

Male tiger: \_\_\_\_\_

47. The technique used to separate the DNA for analysis is

- A) genetic engineering
- B) **electrophoresis**
- C) chromatography
- D) protein synthesis

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48. Using the DNA base sequences below, identify which *two* species are more closely related. Support your answer.

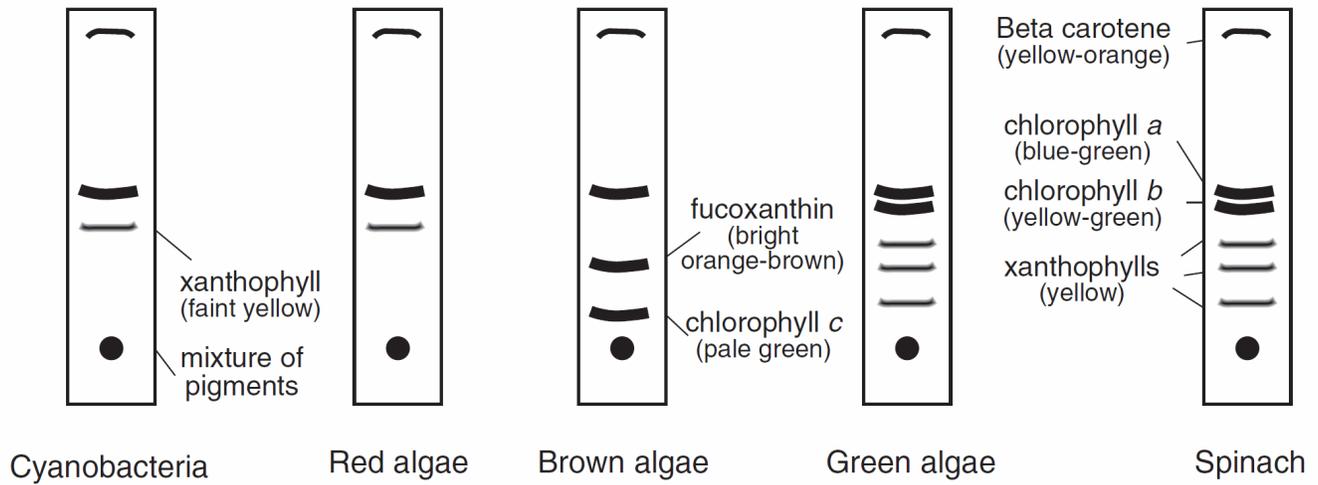
*Species A*: CAC GTG GAC AGA GGA CAC CTC

*Species B*: CAT GTG GAC AGA GGA CAC CTC

*Species C*: CAC GTA GAC TGA GGA CTT CTC

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Base your answers to questions 49 and 50 on the diagram below and on your knowledge of biology. The diagram represents the results of paper chromatography performed on extracts from five organisms.



49. Which two organisms are most closely related?

- A) cyanobacteria and green algae
- B) red algae and spinach
- C) brown algae and red algae
- D) red algae and cyanobacteria**

50. Identify *one* pigment molecule common to all five organisms.

## Answer Key DNA Review

1. **B**
2. **B**
3. **C**
4. **D**
5. **A**
6. **D**
7. **B**
8. **C**
9. **D**
10. **D**
11. **B**
12. **C**
13. **A**
14. **B**
15. **B**
16. **C**
17. **A**
18. **C**
19. **C**
20. **A**
21. **C**
22. **A**
23. **B**
24. **B**
25. **A**
26. **B**
27. **D**
28. **C**
29. **C**
30. **A**
31. **B**
32. **A**
33. **A**
34. **B**
35. **B**
36. **A**

37. **B**
38. **D**
39. **B**
40. **C**
41. **A**
42. **D**
- 43.

Mutated Gene DNA Base Sequence	ACG	CGC	ACC	TTA
mRNA codons	UGC	GCG	UGG	AAU
Amino acid sequence	CYS	ALA	TRP	ASN

44. recording in the table the mRNA codons coded for by the mutated DNA sequence as shown in the table below.
45. — electricity, — electrical charge, — attraction between opposite electrical charges
46. – All of the cub's DNA fragments match fragments found in either the female or male 1. – Half of the cub's DNA fragments matched DNA fragments from male 1. – The cub's DNA has two matches with male 1 and only one match with male 2.
47. **B**
48. A and B  
— They have more bases in common.  
— Their DNA sequences are more similar. — They have only one difference.
49. **D**

50. — beta carotene — chlorophyll *a* — the pigment molecule that causes the yellow-orange band