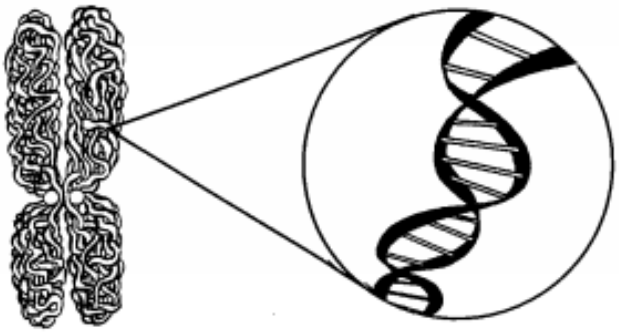
Name _____

# Day 2 ~ Biology EOC Panther Run

# The Cell's Control Center

*The diagram and caption below summarize the relationship between a chromosome, DNA, and genes. Use the diagram and your own knowledge to decide whether each statement is true or false. Write* true *or* false *before each statement.*



A chromosome contains protein and one long molecule of DNA, which is shaped like a twisted rope ladder. A gene is a segment of the DNA molecule. Most genes consist of thousands of rungs on the "ladder." A chromosome may have thousands of genes.

**Chromosome** **Part of DNA molecule**

_____ 1. A chromosome is highly coiled.

_____ 2. Genes are larger than chromosomes.

_____ 3. Genes determine what characteristics offspring inherit.

_____ 4. A human body cell has 23 pairs of chromosomes, or 46 total.

_____ 5. DNA directs the production of proteins in a cell.

_____ 6. Chromosomes only occur in egg and sperm cells.

_____ 7. Chromosomes are located within the cytoplasm of a cell.

_____ 8. Egg and sperm cells have half as many chromosomes as other human cells do.

_____ 9. The letters *DNA* stand for *diniate*.

_____ 10. The DNA molecule has a structure that allows it to duplicate easily.

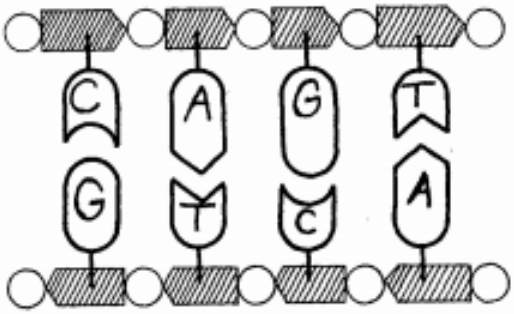
_____ 11. The shape of the DNA molecule is called a double helix.

_____ 12. Human beings have about 100 genes.

# DNA MOLECULE AND REPLICATION

Name _____

The building blocks of the DNA molecule are nucleotides, which consist of a phosphate, a deoxyribose sugar and a nitrogenous base. In the diagram, label these three substances on the nucleotide. The letters representing the four different nitrogeneous bases are shown in the nucleotides at the right. Place the name of the base next to its letter symbol in the appropriate space.




A = _____

T = _____

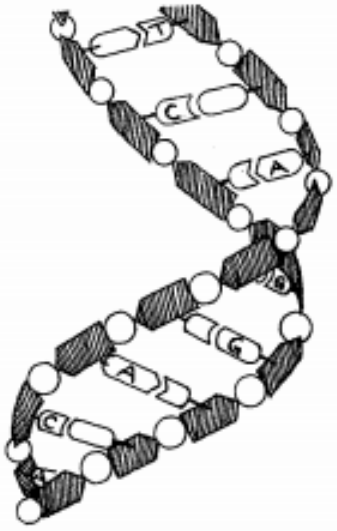
G = _____

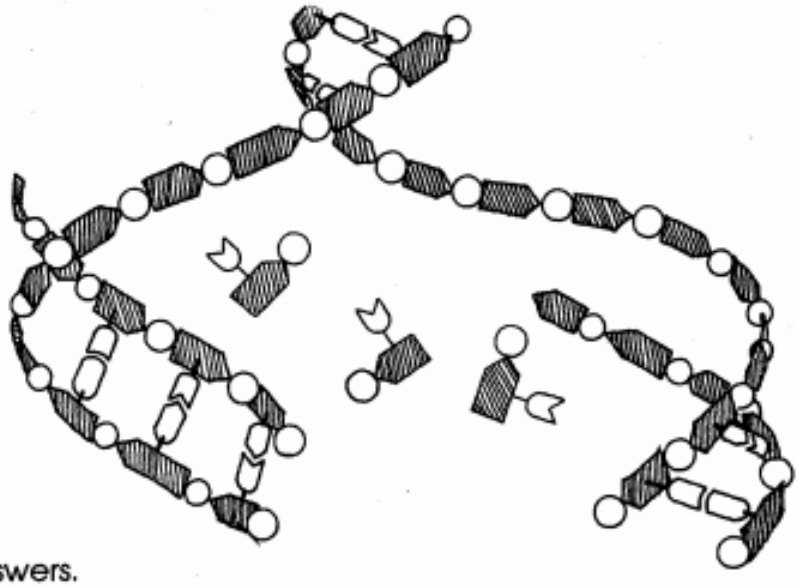
C = _____

The DNA molecule has a double helix shape. Two strands of DNA are coiled around each other and attached by bonds between the nitrogenous bases of each chain. Adenine always bonds with thymine, and cytosine bonds with guanine.

In the illustration at the left below, label a phosphate and a deoxyribose sugar. Fill in the symbol for each base depending on its complementary base in the opposite strand.

The diagram at the right shows the replication of DNA. Fill in the symbol for each base. Label the original strand, a new strand and a free-floating nucleotide.



Fill in the blanks with the correct answers.

The structure of DNA was determined by _____ and _____ .

They described the shape of the DNA molecule as a _____ .

After replication, _____ identical molecules of _____ are produced. A gene is a sequence of _____ in a DNA molecule.

# mRNA AND TRANSCRIPTION

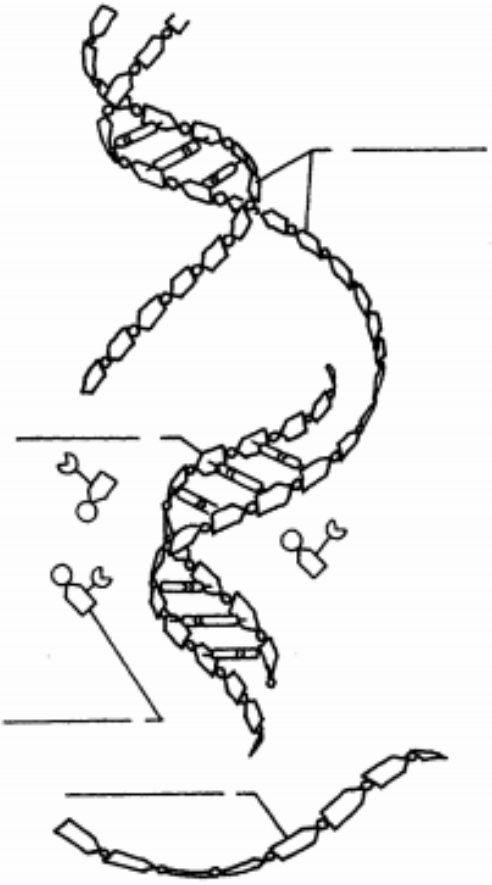
Name _____

## Transcription

Fill in the blanks below. On the illustration of transcription, label the DNA, the newly-forming mRNA, the completed strand of mRNA and a free nucleotide.

Messenger RNA (mRNA) carries the instructions to make a particular _____ from the DNA in the _____ to the ribosomes. The process of producing mRNA from instructions in the DNA is called _____.

During transcription, the DNA molecule unwinds and separates, exposing the nitrogenous bases. Free RNA _____ pair with the exposed bases. There is no _____ (T) in RNA. _____ (U) pairs with adenine (A) instead. RNA contains the sugar _____ instead of deoxyribose. The mRNA molecule is completed by the formation of _____ between the RNA _____, and it then separates from the DNA. The mRNA molecule is a _____ strand, unlike DNA.



## Codons

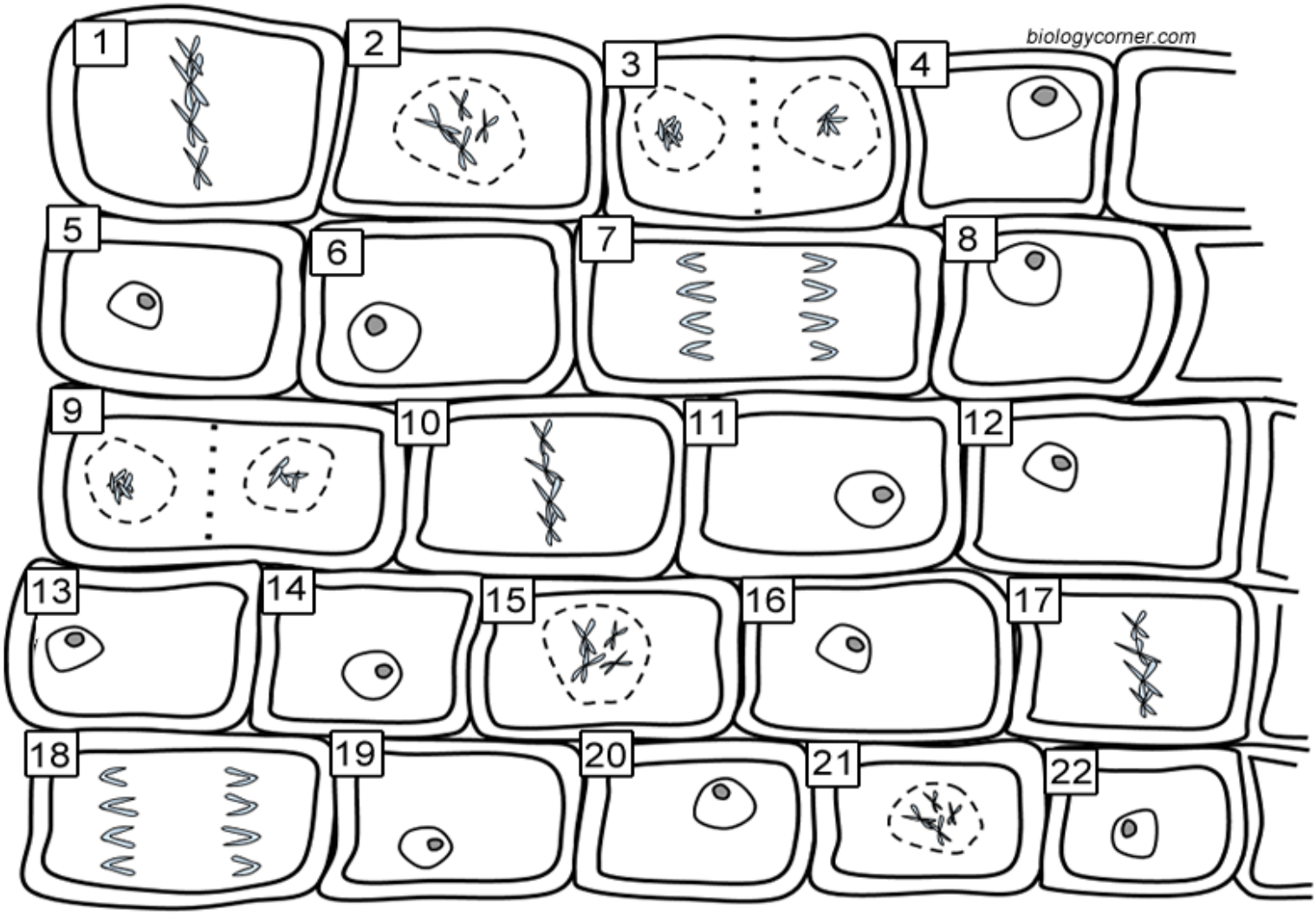
Each combination of three nitrogenous bases on the mRNA molecule is a codon, a three-letter code word for a specific amino acid. The table below shows the mRNA codon for each amino acid. Use the table to answer the questions below.

1. The codon for trytophan is _____.
2. For leucine, there are _____ different codons.
3. The codon GAU is for _____.
4. In a stop codon, if the second base is G, the first and third bases are _____ and _____.

Second Base in Code Word

| First Base in Code Word | A | G | U | C | Third Base in Code Word |
|---|---|---|---|---|---|
| A | Lysine | Arginine | Isoleucine | Threonine | A |
| | Lysine | Arginine | Methionine | Threonine | G |
| | Asparagine | Serine | Isoleucine | Threonine | U |
| | Asparagine | Serine | Isoleucine | Threonine | C |
| G | Glutamic Acid | Glycine | Valine | Alanine | A |
| | Glutamic Acid | Glycine | Valine | Alanine | G |
| | Aspartic Acid | Glycine | Valine | Alanine | U |
| | Aspartic Acid | Glycine | Valine | Alanine | C |
| U | "Stop" codon | "Stop" codon | Leucine | Serine | A |
| | "Stop" codon | Trytophan | Leucine | Serine | G |
| | Tyrosine | Cysteine | Phenylalanine | Serine | U |
| | Tyrosine | Cysteine | Phenylalanine | Serine | C |
| C | Glutamine | Arginine | Leucine | Proline | A |
| | Glutamine | Arginine | Leucine | Proline | G |
| | Histidine | Arginine | Leucine | Proline | U |
| | Histidine | Arginine | Leucine | Proline | C |

# Mitosis ~ Onion Cell




Name the stage in each cell.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____
14. _____
15. _____

16. _____
17. _____
18. _____
19. _____
20. _____
21. _____
22. _____

*Math Problems* (show work)

23. What percentage of the cells are in interphase?

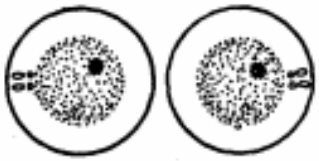
24. What percentage of the cells are in metaphase?

# STAGES OF MITOSIS

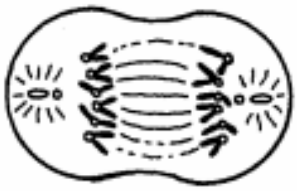
Name _____

Number the following six diagrams of the stages of mitosis in animal cells in the proper order. Label each stage with the proper name.

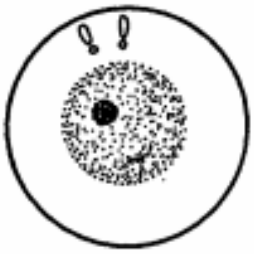
_____



_____

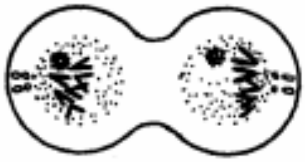


_____



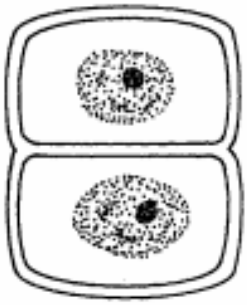
_____

_____



_____

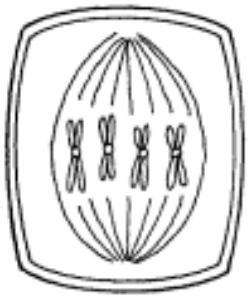
Do the same for the following diagrams of mitosis in plant cells.



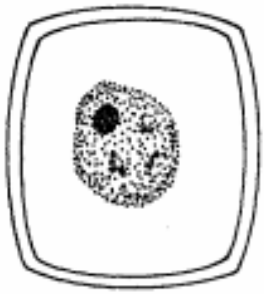
_____

_____

_____



_____



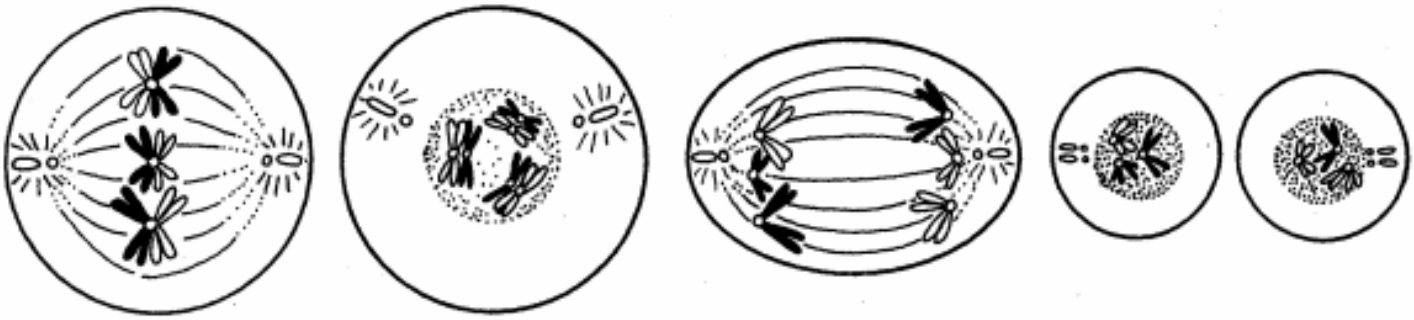
_____

_____

# STAGES OF MEIOSIS

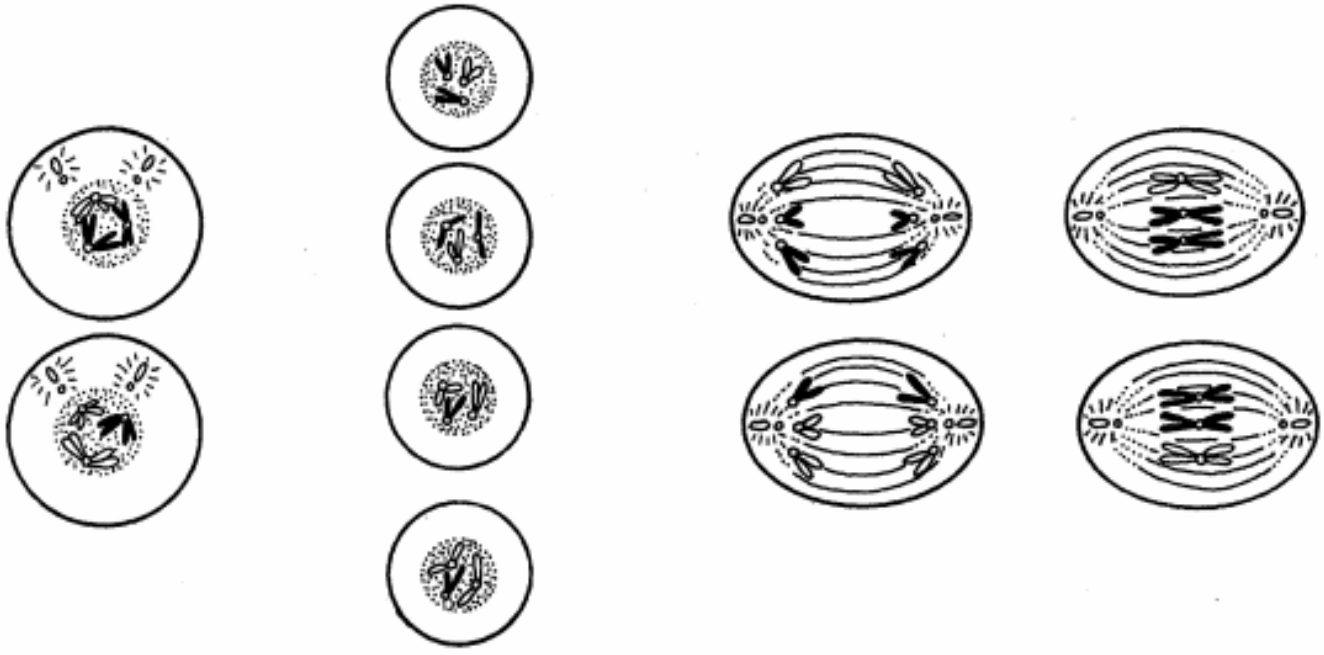
Name _____

Number the following diagrams of a first meiotic division in the proper order. Label each phase correctly as prophase I, metaphase I, anaphase I or telophase I.



_____ _____ _____ _____

Do the same for the diagrams of the second meiotic division. Label each phase correctly as prophase II, metaphase II, anaphase II, telophase II .



_____ _____ _____ _____

# COMPARING MITOSIS AND MEIOSIS

Name _____

Determine whether the following characteristics apply to mitosis, meiosis or both by putting a check in the appropriate column(s).

| | Mitosis | Meiosis |
|---|---|---|
| 1. no pairing of homologs occurs | | |
| 2. two divisions | | |
| 3. four daughter cells produced | | |
| 4. associated with growth and asexual reproduction | | |
| 5. associated with sexual reproduction | | |
| 6. one division | | |
| 7. two daughter cells produced | | |
| 8. involves duplication of chromosomes | | |
| 9. chromosome number is maintained | | |
| 10. chromosome number is halved | | |
| 11. crossing over between homologous chromosomes may occur | | |
| 12. daughter cells are identical to parent cell | | |
| 13. daughter cells are not identical to parent cell | | |
| 14. produces gametes | | |
| 15. synapsis occurs in prophase | | |

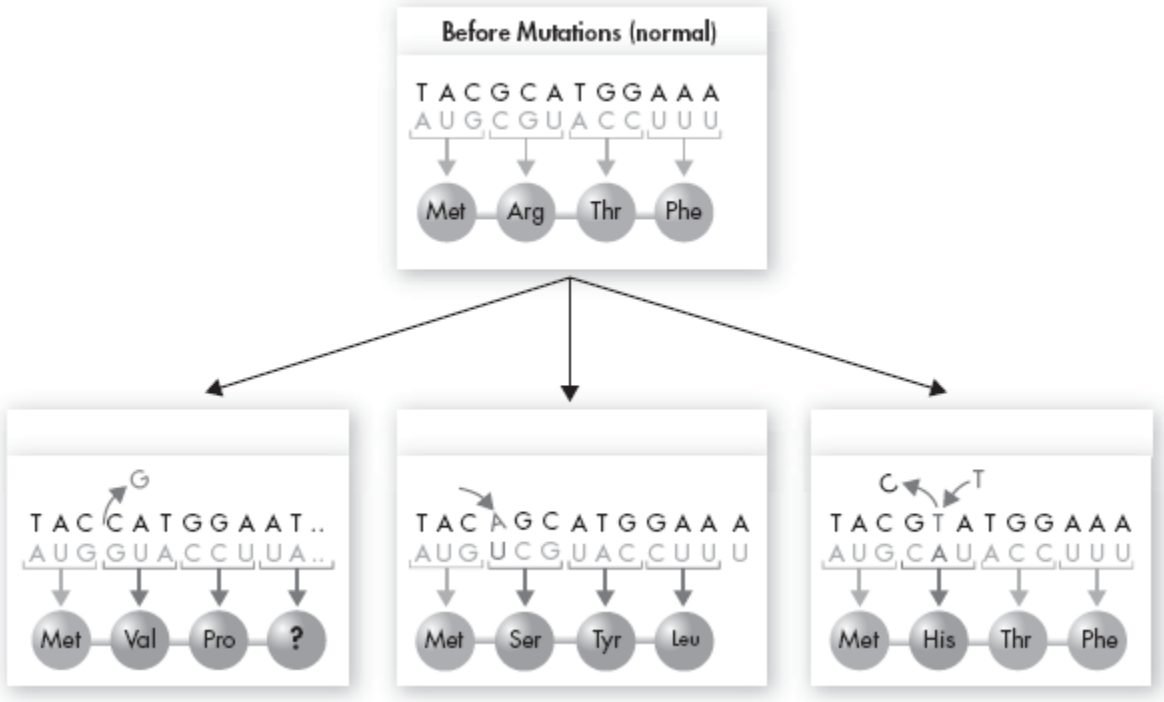
# Types of Mutations

Gene mutations produce a change in one gene. Point mutations produce gene mutations that involve a change in one or more nucleotides. Point mutations also occur at only one point in the DNA sequence. The diagram below shows an original chromosome and three possible point mutations.

*Follow the directions.*

**1.** Use the words in the box to add headings to the three lower parts of the diagram.

| insertion | deletion | substitution |
|---|---|---|




*Complete the sentences. Use the terms from the box above.*

**2.** In a(n) _____, one base is changed to a different base.

**3.** In a(n) _____, a base is inserted into the DNA sequence.

**4.** In a(n) _____, one base is removed from the DNA sequence.

*Answer the questions.*

**5.** Which of the following can result in a frameshift mutation? Circle each correct answer.

**A.** deletion

**B.** substitution

**C.** insertion

**6.** Why is a frameshift mutation more damaging than a substitution? _____

_____

_____

# Types of Mutations

Mutations that change whole chromosomes are called chromosomal mutations. The diagrams below show chromosomal mutations. Each diagram represents an original chromosome and a possible mutation of the chromosome.

**Original Chromosome**


**Deletion**


**Original Chromosome**


**Inversion**


**Original Chromosome**


**Translocation**


**Original Chromosome**


**Duplication**


*Follow the directions.*

**1.** Use the diagrams to help you complete the table.

| Mutation | Description |
|---|---|
| deletion | Part of the chromosome is lost. |
| | Extra copies of a part of a chromosome are made. |
| | Part of a chromosome breaks off and attaches to another chromosome. |
| | Sections of a chromosome are reversed. |

*Answer the questions.*

**2.** Which types of mutations can add genes to a chromosome? _____

**3.** Which type of mutation can take genes away from a chromosome? _____

**4.** Which type of mutation changes the order of the genes, but not the number of genes in a chromosome? _____

## Effects of Mutations

*For Questions 10–17, write the letter of the correct answer on the line at the left.*

_____ **10.** The cellular machinery that replicates DNA inserts an incorrect base

**A.** most of the time.

**B.** about half the time.

**C.** roughly once in every million bases.

**D.** roughly once in every 10 million bases.

_____ **11.** Small changes in genes

**A.** disappear quickly.

**B.** gradually accumulate over time.

**C.** prevent the next generation from developing.

**D.** do not affect future generations.

_____ **12.** A possible mutagen is

**A.** an anticodon.

**B.** translocation.

**C.** hemoglobin.

**D.** ultraviolet light.

_____ **13.** What happens when cells cannot repair the damage caused by a mutagen?

**A.** The DNA base sequence changes permanently.

**B.** The DNA base sequence is not affected.

**C.** The organism is not affected.

**D.** The organism is affected temporarily.

_____ **14.** Which of the following most accurately summarizes the effects of mutations on living things?

**A.** Most mutations are harmful, but some have little effect.

**B.** Many mutations have little or no effect, but some can be harmful or beneficial.

**C.** Most mutations are beneficial and a few are harmful.

**D.** About half of mutations are beneficial and half are harmful.

_____ **15.** Mutations are important to the evolution of a species because they

**A.** happen over the long period of time that evolution requires.

**B.** cut out and replace damaged or useless genes.

**C.** are a source of genetic variability.

**D.** accelerate the transcription rate of DNA.

_____ **16.** Cancer is the product of a mutation that

**A.** causes the uncontrolled growth of cells.

**B.** changes the structure of hemoglobin in the blood.

**C.** brings about stunted growth and severe pain.

**D.** causes a translocation in a pair of chromosomes.