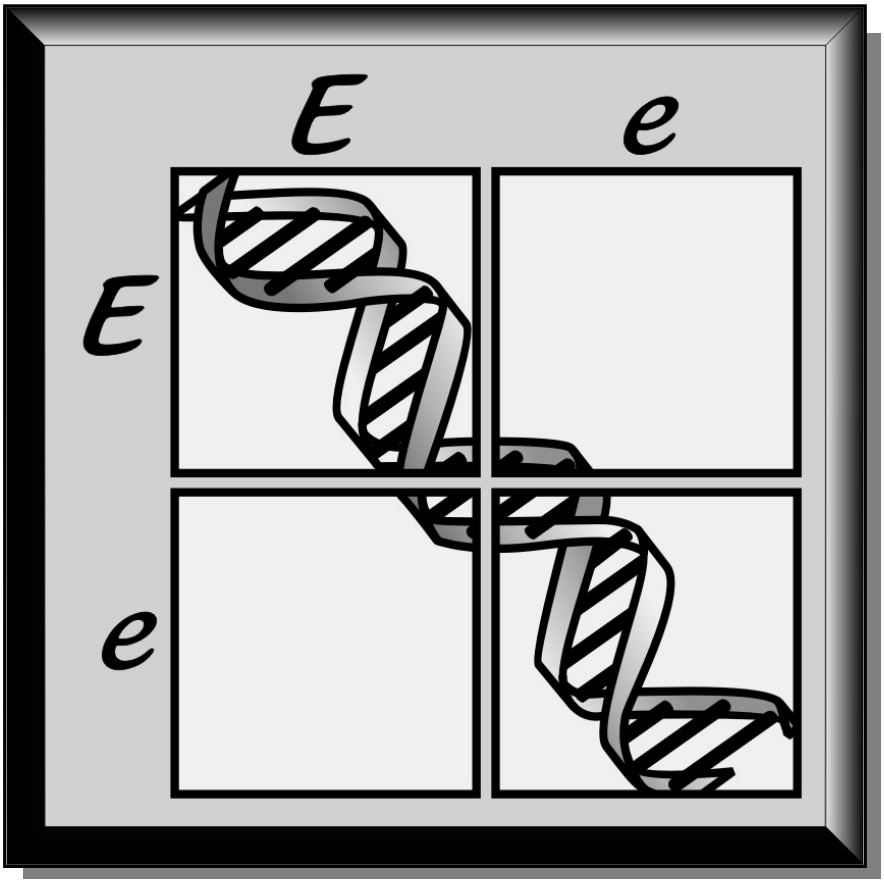
The Principles, Theories & Precepts of Biology

ACTIVITIES



Chapter 3

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The Principles, Theories & Precepts of Biology

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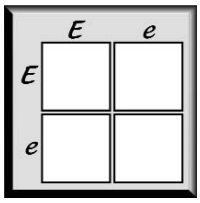
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ACTIVITIES
Lesson 1:

GREGOR MENDEL AND HIS WORK: THE HISTORY

You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. ***Genetics*** is the study of: _____.
   (a) immunity (b) development (c) heredity (d) metabolism

2. The study of genetics is based on the works of _____.

3. Johann Mendel finished his education with the money he received from:_____ _____.
   (a) his parents (c) his sister's dowry
   (b) one of his techers (d) working on his parent's farm

4. When Johann joined the Augustinian monastery of St. Thomas in Altburn, it had a great reputation for: _____.
   (a) musical achievement (c) mathematical achievement
   (b) literary achievement (d) scientific achievement

5. While at the University of Vienna, Mendel studied under Johann Christian Doppler, who taught him:_____.
   (a) the basic rules of genetics
   (b) how to observe the Doppler effect
   (c) how to be a teacher
   (d) how to conduct an experiement

6. For eight years, Mendel raised _____ and carefully documented the results of breeding and cross-breeding them.
   (a) squash plants (c) corn stalks
   (b) pea plants (d) tomato plants

7. Mendel's work was _____ by the scientific community.

8. Mendel urged the scientific community to value _____ more than _____ about hypotheses.

9. The scientific community of Mendel's time embraced a theory which had no evidence and ignored another theory with years of evidence.____ (a) True or (b) False

10. Darwin and Mendel were in agreement on the issue of genetics.
    ____ (a) True or (b) False

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11. Mendel felt that the government's decision to tax the monasteries was an attack on: _____.
    (a) his genetic research (c) religious freedom
    (b) scientific advancement (d) political freedom

12. Today, Mendel is known as the_____.

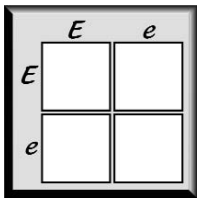
13. Mendel's life shows that:_____.
    (a) you can achieve great things if you have a desire to learn
    (b) sometimes you must sacrifice in order to achieve a goal
    (c) "failure" is not final
    (d) all of the above

14. Write the **Life Principle**:
    "_____
    _____
    _____."

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Name: _____

Date: _____ Grade: _____





GREGOR MENDEL AND HIS WORK: THE EXPERIMENTS

You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. A ***Gene*** is a segment of DNA that codes for a specific trait and transmits_____ _____.

2. A ***true-breeding*** stock always _____ to the next generation.

3. The pollen producing, male part of a flower is called the _____, and the egg-producing, female part of a flower is called the_____.
   (a) stalk, stamen (c) carpel, stalk
   (b) stamen, carpel (d) carpel, stamen

4. In self-pollination: _____.
   (a) pollen fertilizes egg cells on the same flower
   (b) pollen is carried by wind to another flower
   (c) resulting seeds have two plants as parents
   (d) resulting seeds have high genetic diversity

5. Mendel cut away the male parts of his flowers in order to:_____ _____.
   (a) prevent plants from producing pollen cells
   (b) increase self-pollination
   (c) control cross-pollination
   (d) prevent plants from producing egg cells

6. Mendel studied _____ traits in pea plants, each of which had two contrasting forms.

7. Mendel produced ***hybrid*** plants by crossing two parents that had _____ versions of a particular trait.
   (a) identical (b) similar (c) opposite (d) several

8. The first generation that results from the cross of two, true-breeding plants is called the _____.

9. The parental plants in Mendel's experiments are called the_____.

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10. The ***F1 generation*** appeared to be a blend of the traits of the parent plants. ____
(a) True or (b) False

11. Approximately _____ of the ***F2 generation*** in Mendel's experiments contained the forms of the traits that had seemingly disappeared in the F1 generation.
(a) all (b) one-half (c) two-thirds (d) one-fourth

12. The simplest pea plants to use in genetic research are those that normally cross-pollinate.
____ (a) True or (b) False

13. Mendel chose to study traits that had distinctly contrasting forms. ____
(a) True or (b) False

List in order the seven basic rules on which Mendel based his experiments.

14. _____
_____

15. _____
_____

16. _____
_____

17. _____
_____

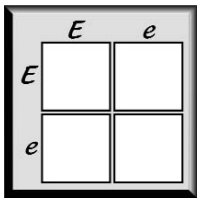
18. _____
_____

19. _____
_____

20. _____
_____

21. Write the **Life Principle**:
"_____
_____
_____."

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GREGOR MENDEL AND HIS WORK: THE CONCLUSIONS

You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. Mendel reasoned that some indivisible unit must determine each of the traits he investigated because:_____
_____.
   (a) the observable traits in his experiments blended
   (b) the traits in his experiments were not observable
   (c) the observable traits in his experiments did not blend
   (d) the observable traits in his experiments were consistent with the male parent

2. Mendel's "merkmal" that codes for a specific trait today is called a(n)_____.

3. Mendel concluded that for each trait that he investigated, every plant contained at least two genes or _____: one from each parent.

4. ***Multiple alleles*** occur when:_____
_____.
   (a) more than two alleles exist in a population for a particular characteristic
   (b) an individual has more than two alleles for a specific trait
   (c) an individual inherits two alleles from each parent
   (d) two individuals have identical alleles for a specific characteristic

5. Mendel's P generation tall plants contained:_____
_____.
   (a) one allele for tallness and one for shortness
   (b) multiple alleles
   (c) two copies of the allele for tallness
   (d) two copies of the allele for shortness

6. ***Gametes*** from pea plants contain _____ copy(ies) of each gene.

7. Mendel observed from his F1 generation that the plants with one allele for tallness and one allele for shortness were:_____
_____.
   (a) just as tall as the plants with two alleles for tallness
   (b) slightly shorter than the plants with two alleles for tallness
   (c) one-half the height of the plants with two alleles for tallness
   (d) taller than the plants with two alleles for tallness

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8. In pea plants that have both alleles for a specific trait, only the ***dominant*** allele is expressed. This is the Law of _____.

9. In Mendel's experiments, the allele for tallness was the _____ allele, and the allele for shortness was the _____ allele.
   (a) recessive, dominant
   (b) multiple, recessive
   (c) dominant, recessive
   (d) dominant, multiple

Matching:

10. _____ ***phenotype***	(a) description of an organism that has a mixed pair of alleles for a trait (Tt)
11. _____ ***genotype***	(b) outward manifestation of a genetic trait displayed by an organism
12. _____ ***homozygous***	(c) genetic composition and description of an organism
13. _____ ***heterozygous***	(d) description of an organism that has an identical pair of alleles for a trait (TT)

14. Two organisms with different genotypes can have the same phenotype. _____
   (a) True or (b) False

15. In his F1 cross, Mendel crossed plants that were homozygous for tallness with plants that were _____ for shortness and produced offspring that were heterozygous for height.

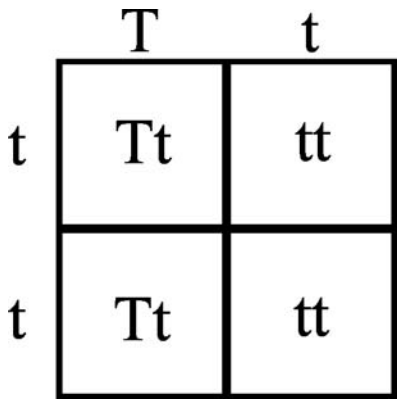
16. The principle that paired genes must separate from each other during meiosis is known as: _____.
   (a) the Law of Independent Assortment
   (b) the Law of Segregation
   (c) the Law of Dominance
   (d) the Meiotic Law

17. When a plant with the genotype Tt produces gametes:_____ _____.
   (a) all of the gametes will carry the T allele
   (b) all of the gametes will carry the t allele
   (c) one-half of the gametes will carry the T allele and one-half will carry the t allele
   (d) all of the gametes will be heterozygous

18. One fourth of the offspring in a cross between two heterozygotes for height (Tt) should be _____.
   (a) Tt (b) tt (c) tall (d) t

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19. Use the ***Punnet square*** below to predict the genotypes of the offspring from a heterozygous tall parent (Tt) and a homozygous short parent (tt)._____



(a) one-half Tt and one-half tt
(b) one-fourth tt and three fourths Tt
(c) one-fourth TT and three-fourths Tt
(d) one-half TT and one-half tt

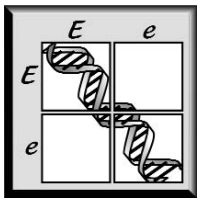
20. The principle of _____ states that different genes do not influence each other's segregation during gamete formation.

21. Write the **Life Principle**:
"_____
_____
_____."

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PRINCIPLES OF HEREDITY



You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. Genes can be inherited together due to their close proximity on the same chromosome. This condition is known as _____.

2. Genes that are close together on a chromosome tend to _____ during the ***crossing-over*** process.
   (a) separate (c) remain together
   (b) switch places (d) exchange information

3. The condition in which neither allele is completely dominant or recessive that results in a blending of the phenotypes is called: _____.
   (a) crossing-over (c) co-dominance
   (b) incomplete dominance (d) polygenic inheritance

4. A cross between a homozygous red snapdragon flower and a homozygous white snapdragon will produce _____ flowers.
   (a) red (b) white (c) spotted (d) pink

5. In ***incomplete dominance***, the genes themselves blend along with the phenotypes.
   _____ (a) True or (b) False

6. How does ***co-dominance*** differ from incomplete dominance?_____
   _____
   (a) In co-dominance, both heterozygous alleles are completely expressed.
   (b) In co-dominance, the heterozygous phenotype is a blend of the two homozygous phenotypes.
   (c) In co-dominance, heterozygous alleles are expressed in an alternating fashion.
   (d) In co-dominance, one allele is dominant over the other allele.

7. Coat color in rabbits is an example of _____.

8. ***Polygenic inheritance*** characteristics are always determined by:_____
   _____.
   (a) a single gene (c) more than one gene
   (b) multiple phenotypes (d) multiple alleles

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9. Skin color has a wide variety of phenotypes because it is controlled by:_____ _____.
   (a) incomplete dominance (c) polygenic inheritance
   (b) co-dominance (d) multiple alleles

10. The mathematical principles of _____ are used to predict the likelihood of certain events.

11. The ***probability*** of a single coin flip landing heads up is ¼. _____
    (a) True or (b) False

12. If you flip a coin three times and each time it lands on heads, the probability that it will land on heads a fourth time has increased. _____ (a) True or (b) False

13. What is the probability of a coin landing on tails five times in a row? _____
    (a) ½ (b) ¼ (c) 1/16 (d) 1/32

14. Use the Punnet square below to find the probability that a cross between a heterozygous purple flower (Pp) and a homozygous white flower (pp) will produce a phenotype for purple flowers._____
    (a) ¼ (b) ½ (c) ¾ (d) 1

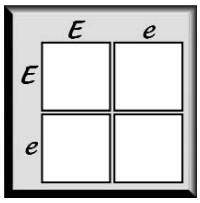
	P	p
p	Pp	pp
p	Pp	pp

15. Write the **Life Principle**:
    "_____
    _____
    _____."

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Name: _____

Date: _____ Grade: _____



HUMAN GENETICS



You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. Diploid human cells have a total of _____ chromosomes.
   (a) 23 (b) 46 (c) 48 (d) 52

2. What is the function of ***colchicines*** in making chromosomes visible?_____
   _____
   (a) It prevents cells from completing mitosis, keeping them in their condensed form.
   (b) It speeds the process of mitosis, making chromosome movement evident.
   (c) It causes the chromosomes to condense so they can be seen clearly.
   (d) It poisons the DNA and destroys it so that pieces can be easily distinguished.

3. A diagrammatic representation of individual chromosomes cut out from a photograph and grouped together is called a(n) _____.

4. Human ***autosomes*** represent:_____.
   (a) 22 pairs of homologous chromosomes
   (b) one pair of sex chromosomes
   (c) 22 pairs of alleles
   (d) a complete karyotype

5. Female cells contain _____ chromosomes, whereas male cells contain one ***X chromosome*** and one ***Y chromosome***.

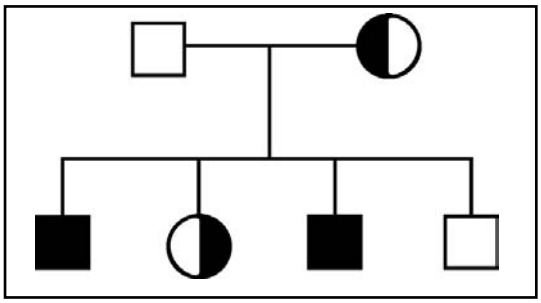
6. Sperm and egg cells contain _____
   _____.
   (a) a haploid number of chromosomes; double that of somatic cells
   (b) a haploid number of chromosomes; half that of somatic cells
   (c) a diploid number of chromosomes; double that of somatic cells
   (d) a diploid number of chromosomes; half that of somatic cells

7. Sperm cells carry _____ chromosomes.
   (a) X and Y (b) only X (c) only Y (d) neither X or Y

8. The female egg determines if an offspring will be male or female. _____
   (a) True or (b) False

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9. A diagram that tracks the inheritance of a single gene through several generations of a family is a(n) _____.



10. The above ***pedigree*** indicates that:_____.
    (a) the mother carries one allele for a particular trait
    (b) two of three sons will express the trait
    (c) the trait is sex-linked
    (d) all of the above

11. Because males have just one X chromosome, they are _____ females to express a recessive gene on the X chromosome.
    (a) less likely than (c) more likely than
    (b) equally likely as (d) none of these

12. ***Colorblindness*** is rare in females because:_____ _____.
    (a) they usually have a dominant gene for vision on one of their X chromosomes
    (b) they cannot inherit the recessive allele on the X chromosome
    (c) the allele is carried on the Y chromosome
    (d) females are capable of suppressing the recessive gene from their X chromosome

13. In ***hemophilia***, blood does not _____ normally.

14. The gene for hemophilia occurs on the _____ chromosome and usually occurs in _____.
    (a) Y; males (c) X; males
    (b) Y; females (d) X; females

15. In order for individuals to be Rh-negative, they must have the alleles: _____.
    (a) Rh+/Rh+ (c) Rh-/Rh-
    (b) Rh+/Rh- (d) none of these

16. The *IA* and *IB* blood type alleles are _____ over the allele *i*.
    (a) incompletely dominant (c) co-dominant
    (b) incompletely recessive (d) completely recessive

17. Molecules that stimulate the production of antibodies are called_____.

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18. If a person has *AB*-negative blood, they have_____
_____.

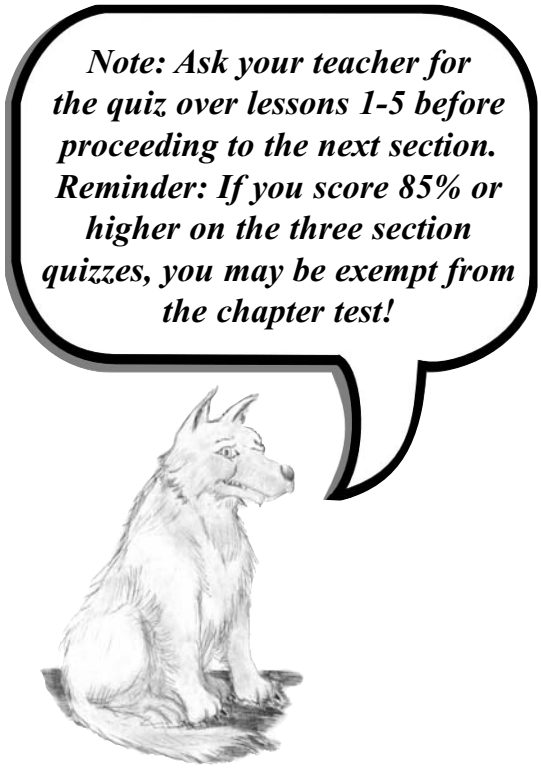
(a) both *A* and *B* antigens from the *ABO* gene and the negative allele from the Rh blood group
(b) O antigens from the *ABO* gene and the positive allele from the Rh blood group
(c) antibodies to A and B antigens
(d) antibodies to O antigens

19. A phlebotomist:_____
_____.

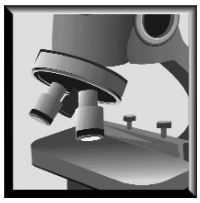
(a) draws blood from patients as a therapeutic or diagnostic measure
(b) prescribes antibiotics to patients with blood diseases
(c) works in a lab with blood samples to determine certain characteristics of a patient's health
(d) performs blood transfusions

20. Write the **Life Principle**: "_____
_____
_____."

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THE DISCOVERY OF DNA

You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. Chromosomes are composed of two substances:_____ and _____.

2. The science based on the activity of DNA and the role of DNA in the production of proteins is called _____.

3. Place an "X" in front of all of the following statements that correctly describe Fredrick Griffeth's experiment.
   _____ (a) Griffeth isolated two types of bacteria that are associated with pneumonia: smooth and rough.
   _____ (b) Mice injected with the rough bacteria alone developed pneumonia.
   _____ (c) Dead smooth bacteria were still virulent.
   _____ (d) Dead smooth bacteria mixed with rough bacteria caused pneumonia.
   _____ (e) Griffeth concluded that the rough bacteria in the presence of the dead smooth bacteria had transformed into smooth, virulent bacteria.

4. A ***virulent*** bacterium is a harmless bacterium. _____ (a) True or (b) False

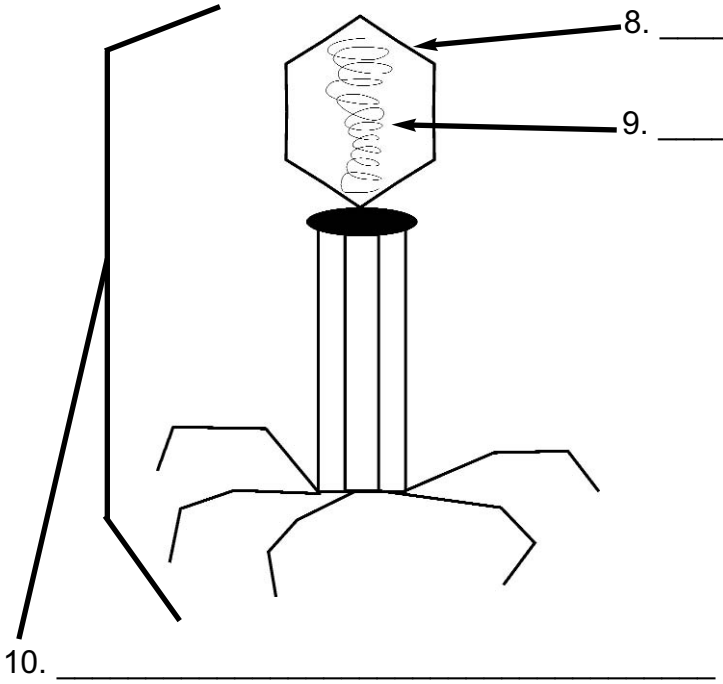
5. The process of reproduction in which genetic material is added to, or replaces portions of, a bacterium's DNA is called _____.

6. Place an "X" in front of all of the following statements that correctly describe the Avery experiments.
   _____ (a) Avery believed genetic material from smooth bacteria had been transferred to rough bacteria in Griffeth's experiment.
   _____ (b) Avery destroyed various molecules of heat-killed bacteria to determine which molecule was causing transformation.
   _____ (c) Transformation was blocked when proteins in the bacteria were destroyed.
   _____ (d) Avery concluded that proteins make up genes.

7. ***Bacteriophages*** are any _____ that infect _____.
   (a) bacteria; viruses (c) viruses, parasites
   (b) parasites, viruses (d) viruses, bacteria

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Label the diagram below according to the illustration in your text.



11. A phage attacks a bacterium by:_____
_____.
(a) injecting its genetic material into the bacterial cell
(b) destroying the cell wall of the bacterial cell
(c) injecting toxins into the bacterial cell
(d) engulfing the bacterial cell

12. Ultimately, a phage causes a bacterium to:_____
_____.
(a) begin killing other bacteria (c) reproduce bacteria rapidly
(b) become a single phage (d) make and release hundreds of viruses

13. A form of an element having a nucleus that gives off particles and energy is a(n) _____.

14. Hershey and Chase labeled phage protein with ***radioactive*** _____ and phage DNA with radioactive _____.
(a) sulfur; phosphorous (c) phosphorous; nitrogen
(b) sulfur; nitrogen (d) phosphorous; sulfur

15. Hershey and Chase found that when a bacterium was infected with a phage, _____ from the phage entered the bacterium while sulfur did not, indicating that only the phage's DNA entered the bacterium.

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16. Hershey and Chase's experiment convinced biologists around the world that genes were made of _____.

17. Isotopes of elements have the same number of _____ but different numbers of _____ in their nuclei.
    (a) protons; neutrons (c) protons, electrons
    (b) electrons; neutrons (d) neutrons, protons

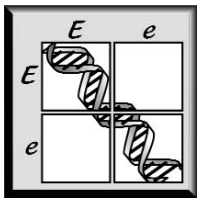
18. Only unstable isotopes are radioactive. _____ (a) True or (b) False

19. Write the **Life Principle**: "_____
    _____
    _____."

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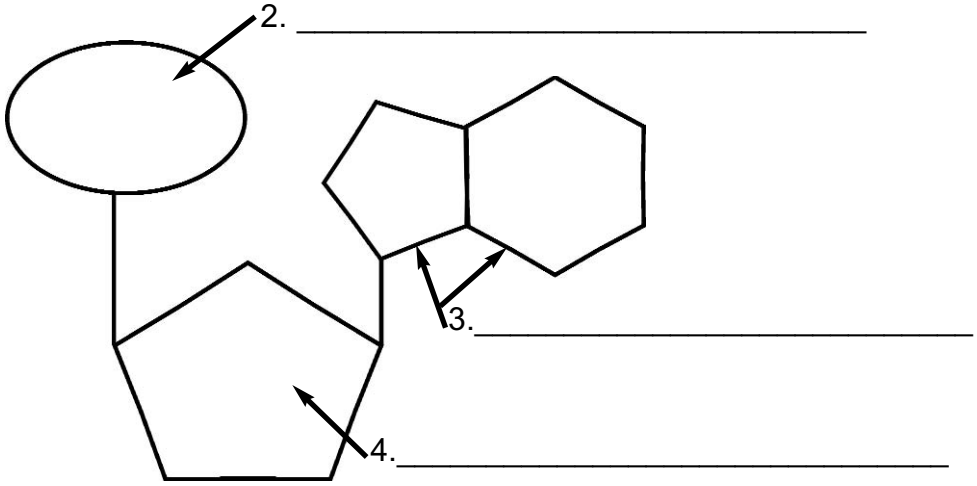


DNA STRUCTURE AND REPLICATION

You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. A(n) _____ is a compound made of a phosphate group, a nitrogenous base, and a 5-carbon sugar.

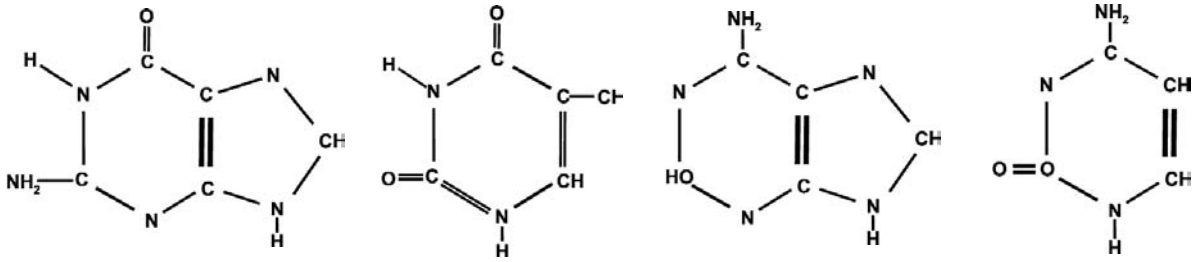
Label the nucleotide according to the diagram in your text.



5. The ***nucleotides*** that make up DNA include all of the following, **except**:_____ _____.

(a) adenine (b) cytosine (c) uracil (d) thymine

Label the following nucleotides as Adenine, Guanine, Thymine, or Cytosine.



6._____ 7._____ 8._____ 9._____

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10. What does ***Chargaff's Rule*** state?_____
_____
(a) DNA contains equal amounts of all of the four nucleotides.
(b) DNA contains equal amounts of cytosine and adenine as well as guanine and thymine.
(c) DNA contains equal amounts of cytosine and guanine as well as adenine and thymine.
(d) DNA contains different amounts of all of the four nucleotides.

11. A technique in which a powerful X-ray beam is aimed at a sample, then the scattering pattern of the X-rays is recorded on film is called_____
_____.

12. Watson and Crick gained important information about the structure of DNA from the work of: _____.
(a) Hershey and Chase (c) Erwin Chargaff
(b) Franklin and Wilkins (d) Fredrick Griffeth

13. Watson and Crick worked out a model DNA structure and called it a:_____
_____.
(a) ladder model (c) double-helix
(b) spiral staircase (d) pleated-sheet

14. Which of the following nucleotides make up a DNA base pair? _____
(a) A and T (b) A and C (c) T and C (d) T and G

15. DNA base pairs are held together by _____ bonds.
(a) covalent (b) ionic (c) peptide (d) hydrogen

16. In 1962 for their DNA model, Watson and Crick received the_____
_____— the highest award that the international community can give for scientific discovery.

17. The process by which DNA is copied is called: _____.
(a) DNA translation (c) DNA regeneration
(b) DNA replication (d) DNA duplication

18. DNA is copied during which phase of the cell cycle? _____
(a) M phase (b) G1 phase (c) S phase (d) G2 phase

19. Place the following events in chronological order.
_____ (a) New complementary strands are synthesized to match exposed bases.
_____ (b) A cell begins cell division.
_____ (c) Enzymens separate the DNA complementary strands.

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Matching:

20. _____ ***chromatin*** (a) proteins attached to chromosomes that may play a role in protecting and organizing DNA

21. _____ ***histones*** (b) tiny particles formed by histones that help to fold and package DNA

22. _____ ***nucleosomes*** (c) material of chromosomes that consists of DNA and proteins

23. One human cell contains about _____ feet of DNA.

Review Question: Match the following people with their scientific discoveries.

24. _____ Hershey and Chase (a) provided clues to the structure of DNA by X-ray diffraction

25. _____ Erwin Chargaff (b) determined the structure of DNA

26. _____ Franklin and Wilkins (c) determined that genes are made of DNA

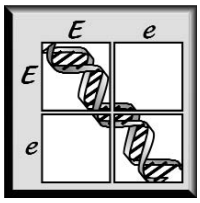
27. _____ Watson and Crick (d) determined the proportions of DNA nucleotides present in a DNA molecule

28. Write the **Life Principle**: "_____
_____
_____."

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THE DNA REPLICATION PROCESS



You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. In 1958, Matthew Meselson and Franklin Stahl developed some experiments to show the process by which: _____.
   (a) cells divide (c) DNA duplicates
   (b) life originated (d) proteins are assembled

2. The hypothesis of conservative replication suggests all of the following, **except**:_____
   _____
   _____.
   (a) the two strands of the parent DNA molecule act as templates for a completely new double-stranded molecule
   (b) the parent DNA is preserved in tact and merges into one daughter cell
   (c) the new double-stranded molecule merges into one daughter cell
   (d) the two strands of the parent DNA molecule separate and each acts as a template for a new strand

3. According to the hypothesis of ***semi-conservative replication***, each daughter cell inherits a DNA molecule that consists of _____.
   (a) one new and one parental strand (c) two parental strands
   (b) two new strands (d) one new strand only

4. The hypothesis of dispersive replication suggests that the parental DNA is_____
   _____ and used as templates for the formation of two, new double helixes.

5. Through their experiments, Meselson and Stahl provided strong support for the theory of:
   _____.
   (a) conservative replication (c) dispersive replication
   (b) semi-conservative replication (d) complementary base pairing

6. A hypothesis can never be proven. _____ (a) True or (b) False

7. DNA replication begins with the separation of the two complementary strands along the hydrogen bonds linking the paired bases. _____ (a) True or (b) False

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8. The function of ***DNA polymerase*** is to:_____
_____.

(a) separate the two complementary strands
(b) hold the two complementary strands apart
(c) join nucleotides together during DNA replication
(d) prevent DNA replication from progressing to completion

9. What are ***Okazaki fragments***?_____
_____

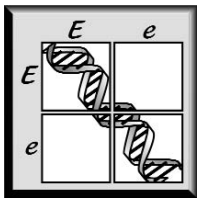
(a) pieces of DNA that have been cut out of the parent strand
(b) pieces of DNA that are joined together to form a DNA strand
(c) fragments of the DNA ligase enzyme
(d) single nucleotides that do not fit in the DNA sequence

10. The enzyme that joins Okazaki fragments together is called:_____
_____.

(a) DNA polymerase (c) DNA lipase
(b) DNA dismutase (d) DNA ligase

11. Write the **Life Principle**: "_____
_____
_____."

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PROTEIN SYNTHESIS



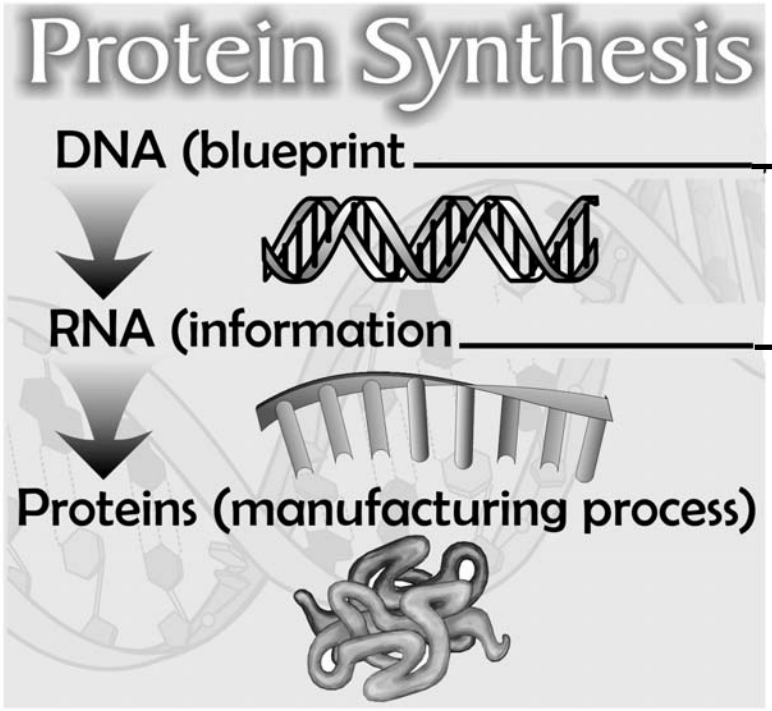
You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. During the 1950's and 1960's, biologists concluded that _____ is essential in the synthesis of proteins.

2. Which of the following are made of proteins? _____
   (a) enzymes (c) hair, skin, and nails
   (b) filaments of muscle cells (d) all of these

3. Place an "X" in front of all of the following elements that must be present for protein synthesis to occur.
   _____ (a) twenty amino acids
   _____ (b) enzymes
   _____ (c) RNA
   _____ (d) DNA
   _____ (e) insulin

Fill in the blanks with the correct labels for protein synthesis.



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6. The principal type of nucleic acid that carries out the instructions coded in DNA is called: _____.
(a) an amino acid (b) an enzyme (c) RNA (d) a protein

7. The sugar in ***RNA*** is _____, whereas the sugar in DNA is_____.
(a) glucose; ribose
(b) ribose; deoxyribose
(c) deoxyribose; glucose
(d) deoxyribose, ribose

8. RNA is a double-stranded helix. _____ (a) True or (b) False

9. RNA contains _____ instead of _____.
(a) uracil; thymine
(b) adenine; guanine
(c) thymine; adenine
(d) uracil; adenine

10. Place an "X" in front of each of the following statements that correctly describe ***messenger RNA***.
_____ (a) It is synthesized in the cytoplasm.
_____ (b) It receives genetic information from the DNA molecule.
_____ (c) It carries copies of genetic information to the rest of the cell.
_____ (d) It carries a precise message.

11. The form of RNA molecule that carries out the instructions coded in DNA is known as: _____.
(a) *mRNA* (b) *rRNA* (c) *tRNA* (d) *nRNA*

12. ***Ribosomes*** are the sites of: _____.
(a) lipid synthesis
(b) aerobic respiration
(c) protein synthesis
(d) carbohydrate metabolism

13. The form of RNA that carries amino acids to the ribosomes is: _____.
(a) *tRNA* (b) *mRNA* (c) *nRNA* (d) *rRNA*

14. The nucleotide sequence of a DNA molecule is copied into an RNA molecule during: _____.
(a) translation
(b) DNA replication
(c) dispersive replication
(d) transcription

15. ***RNA polymerase*** is responsible for "reading" the nucleotides of a DNA strand and positioning nucleotides in an RNA molecule according to complementary base pairing.
_____ (a) True or (b) False

16. RNA and DNA each contain four nucleotides; however RNA contains _____ instead of the _____ found in DNA.

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17. Refer to the Nucleotide Base Pairing chart in your text. A nucleotide sequence of AAGC in DNA would be copied as _____ in RNA; the nucleotide sequence of TACG in DNA would be copied as _____ in RNA.
    (a) UUGA; AGGC (c) UGAA; TAGG
    (b) TTCG; TTGA (d) UUCG; AUGC

18. The instructions coded in DNA specify the order in which the twenty different _____ are put together to form a specific protein.

19. The ***genetic code*** consists of a sequence of nitrogenous bases in a DNA molecule.
    _____ (a) True or (b) False

20. A sequence of three nucleotides that codes for an amino acid is known as a(n):_____ _____.
    (a) polypeptide (b) protein (c) codon (d) anticodon

21. Only one code exists for each amino acid. _____ (a) True or (b) False

22. When a polypeptide chain is assembled, methionine is usually the first amino acid used. Why is this true?_____
    _____
    _____
    (a) The AUG codon is the start codon for translation and it also codes for the amino acid methionine.
    (b) The AUG codon is the most frequently used codon, so methionine is more likely to be first in a polypeptide chain.
    (c) Methionine is the strongest amino acid, so it is reliable in forming a polypeptide chain.
    (d) all of the above

23. Which of the following ***codons*** serves as a stop signal for the end of a polypeptide?
    _____
    (a) AAG (b) UAG (c) UCA (d) AAA

24. The process by which the nucleotides of ***mRNA*** are decoded into an amino acid sequence to form a protein is known as: _____.
    (a) transcription (c) translation
    (b) protein expression (d) decoding

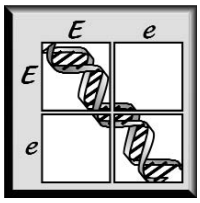
25. Place the following events of protein synthesis in chronological order.
    _____ (a) An *mRNA* arrives at ribosomes.
    _____ (b) A ribosome reaches a stop codon.
    _____ (c) An *mRNA* molecule exposes its codons.
    _____ (d) *tRNA* deposits the appropriate amino acid.
    _____ (e) A *tRNA* molecule unites with a specific amino acid.
    _____ (f) Sequential amino acids are linked and amino acids are released from *tRNA*.
    _____ (g) *tRNA* returns to cytoplasm for more amino acids.
    _____ (h) *tRNA* molecules match their ***anticodons*** with *mRNA* codons.

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26. A(n) _____ on a ***tRNA*** molecule matches a codon on an *mRNA* molecule, allowing the *tRNA* molecule to deposit a specific amino acid in a polypeptide chain.

27. Write the **Life Principle**: "_____
_____
_____."

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GENE EXPRESSION



You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. By coding for all the _____ of life, DNA is the molecular key to all life.

2. Only a small fraction of a cell's genes is active at any given time. _____
   (a) True or (b) False

3. A cell transcribes its genes:_____
   _____.
   (a) only as specific proteins are needed (c) in order to have an excess of proteins
   (b) all at the same time (d) none of these

4. A gene that is transcribed into *mRNA* is said to be _____, and a gene that is not being transcribed is said to be _____.
   (a) unexpressed; elite (c) elite; unexpressed
   (b) expressed; unexpressed (d) unexpressed, expressed

5. Escherichia coli uses three enzymes to digest _____, the primary sugar found in milk products.
   (a) galactose (b) fructose (c) maltose (d) lactose

6. Escherichia coli produces its digestive enzymes only when needed. _____
   (a) True or (b) False

Matching:

7. _____ ***operon*** (a) region of DNA to which the repressor binds

8. _____ ***repressor*** (b) codes for repressor protein that blocks a gene's transcription

9. _____ ***operator*** (c) region of DNA that controls the gene regulation process

10. In Escherichia coli, the repressor protein can:_____
    _____.
    (a) activate transcription (c) sense the presence or absence of lactose
    (b) digest lactose (d) synthesize lactose

11. In Escherichia coli, an operator prevents transcription for the synthesis of lactose-digesting enzymes. _____ (a) True or (b) False

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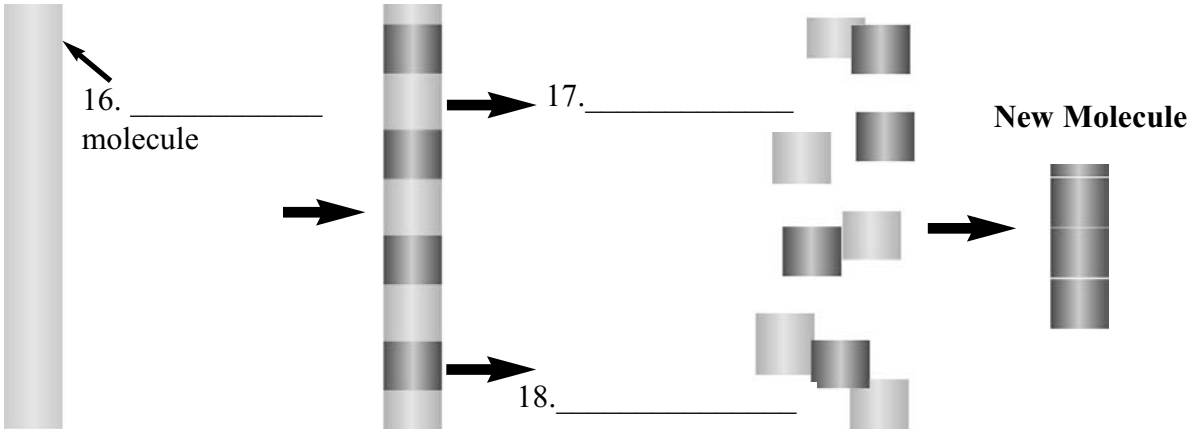
12. When lactose is present, it binds to the repressor protein, and:_____
_____.
(a) the repressor protein blocks the expression of the *lac* genes
(b) the repressor protein falls off the DNA so *lac* genes can be transcribed
(c) the repressor protein blocks RNA polymerase from reaching the *lac* genes
(d) the repressor protein binds with the operator gene on the DNA

13. Philip Sharp and Susan Berget discovered which of the following characteristics of gene expression in eukaryotes?_____
_____
(a) DNA sequences and *mRNA* base sequences of a gene are perfectly complementary.
(b) Parts of an *mRNA* molecule are often removed and discarded, changing the protein sequence.
(c) The cell has no control over gene expression.
(d) none of the above

14. _____ are intervening sequences that are removed from *mRNA* and therefore not expressed.

15. _____ are expressed sequences of *mRNA* that remain after the intervening sequences are removed.

Label the following diagram from your text.



19. Cells originating from a single zygote gradually specialize to become part of various tissues. _____ (a) True or (b) False

20. Write the **Life Principle**: "_____
_____
_____."

Note: Ask your teacher for the quiz over lessons 6-10 before proceeding to the next section. Reminder: If you score 85% or higher on the three section quizzes, you may be exempt from the chapter test!

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ACTIVITIES
Lesson 11:

MUTATIONS AND HUMAN GENETIC DISORDERS

You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. An inheritable alteration in the genetic information in a cell is known as a(n) _____.

2. A ***mutation*** can be caused by which of the following?_____ _____.
   (a) alteration of a DNA nucleotide (c) deletion of a DNA nucleotide
   (b) insertion of a DNA nucleotide (d) all of the above

3. Mutations are usually beneficial. _____ (a) True or (b) False

4. The majority of genetic mutations are carried on the:_____.
   (a) X chromosome (c) Y chromosome
   (b) autosomes (d) X and Y chromosomes

5. Place an "X" in front of all of the following statements that correctly describe albinism.
   _____ (a) It is caused by a dominant allele on chromosome 11.
   _____ (b) Individuals with two copies of the recessive allele for albinism are unable to produce melanin.
   _____ (c) It causes very dark skin pigmentation, helping people to tan evenly.
   _____ (d) It causes sensitivity to bright sunlight.

6. ***Melanin*** is the dark-brown pigment that gives skin its: _____.
   (a) color (b) elasticity (c) texture (d) scent

7. The most common fatal genetic disease in the United States is:_____ _____.
   (a) albinism (b) cystic fibrosis (c) Tay-Sachs disease (d) sickle cell anemia

8. Place an "X" in front of all of the following statements that correctly describe cystic fibrosis.
   _____ (a) It is caused by a recessive allele on chromosome 7.
   _____ (b) One copy of the cystic fibrosis allele will cause the disease.
   _____ (c) It causes a defect in a cell membrane protein that interferes with the movement of chloride ions in and out of cells.
   _____ (d) It causes secretion of a thick mucus that clogs lungs and ducts of the pancreas and liver.
   _____ (e) It usually does not cause death until about age 50.

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9. All of the following statements are true concerning Tay-Sachs disease, **except:**_____
_____.
(a) It is caused by two recessive alleles.
(b) It is most common in Jewish families of Eastern European ancestry.
(c) It prevents the nervous system from fully developing in embryos.
(d) It causes a breakdown of the nervous system beginning at age 2 or 3.

10. The iron-containing protein found in red blood cells that helps to transport oxygen to all parts of the body is called: _____.
(a) melanin (b) myoglobin (c) hemoglobin (d) insulin

11. Place an "X" in front of all of the following statements that correctly describe sickle cell anemia.
_____ (a) It is characterized by crescent or sickle-shaped white blood cells.
_____ (b) It is caused by a recessive allele.
_____ (c) It produces a mutated form of the red blood cell protein.
_____ (d) It is caused by a mutation of several amino acids.
_____ (e) It is most common among people of English ancestry.

12. Huntington disease is caused by a(n) _____ allele located on chromosome number four.

13. Which of the following statements is false concerning Huntington disease?_____
_____
(a) Symptoms are noticeable from birth.
(b) It causes loss of muscle control and degradation of the nervous system.
(c) Most people with the disorder have children before they are aware they carry the defective allele.
(d) A parent that is heterozygous for the disease has a fifty percent chance of passing the disorder to one of his or her children.

14. A fertilized egg is called a(n) _____

15. ***Nondisjunction*** occurs when:_____
_____.
(a) a mutation occurs in the amino acid sequence of a protein
(b) a chromosome pair fails to separate during meiosis
(c) a zygote receives two recessive alleles causing a genetic disorder
(d) a cell does not undergo meiosis

16. Place an "X" in front of all of the following statements that are true concerning Turner syndrome.
_____ (a) It results from nondisjunction in autosomes.
_____ (b) A sperm or egg is produced lacking a sex chromosome.
_____ (c) Zygotes are designated XO.
_____ (d) It only affects males.
_____ (e) It causes infertility.

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17. In Klinefelter syndrome:_____
_____.
(a) males have an extra sex chromosome, often resulting in mental retardation
(b) males have only one sex chromosome, often resulting in mental retardation
(c) females have an extra sex chromosome, often resulting in infertility
(d) none of the above

18. If the two copies of an autosome do not separate correctly during meiosis, an individual can be born with cells that contain three copies of a chromosome.
_____ (a) True or (b) False

19. The most common form of ***trisomy*** is: _____.
(a) Turner syndrome (c) Down syndrome
(b) Klinefelter syndrome (d) Tay-Sachs disease

20. Down syndrome results in: _____.
(a) heart and circulatory problems (c) mental retardation
(b) a weakened immune system (d) all of these

21. Write the **Life Principle**: "_____
_____
_____."

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ACTIVITIES
Lesson 12:

MUTATION MECHANICS

You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. An agent that causes mutations is called a(n) _____.

2. Agents that cause mutations can be naturally occurring or introduced by the actions of humans. _____ (a) True or (b) False

3. A change in the number or structure of a cell's chromosomes is called a(n): _____.
   (a) chromosomal mutation (c) point mutation
   (b) gene mutation (d) frameshift mutation

4. ***Polyploids*** are produced when:_____ _____.
   (a) a nucleotide is missing from the DNA sequence
   (b) a nucleotide is added to the DNA sequence
   (c) a whole set of chromosomes fail to separate during meiosis
   (d) gametes are not formed from meiosis

5. ***Polyploidy*** in plants is usually: _____.
   (a) fatal (b) harmful (c) advantageous (d) very uncommon

6. Polyploidy in animals is usually: _____.
   (a) fatal (b) harmful (c) advantageous (d) in diploid form

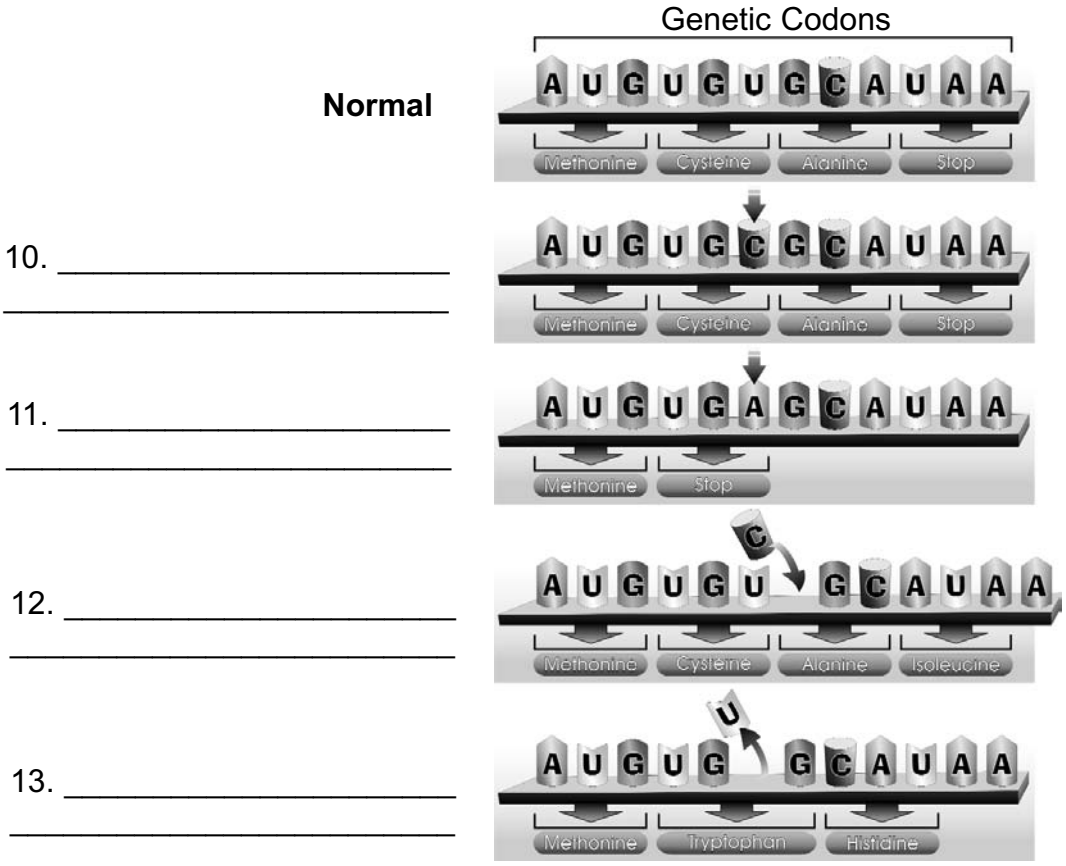
7. A mutation that involves only a single gene is called a(n)_____ _____.

8. When a single nucleotide is substituted for another in the DNA sequence, it is called a(n): _____.
   (a) chromosomal mutation (c) frameshift mutation
   (b) point mutation (d) transpositioning

9. Adding or subtracting a nucleotide from a normal sequence shifts the entire code, changes the codons, and produces an amino acid sequence that results in a useless or harmful protein. This type of mutation is called a(n): _____.
   (a) chromosomal mutation (c) frameshift mutation
   (b) point mutation (d) codon mutation

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Label the following as point mutations or frameshift mutations.



14. _____ mutations have the greatest negative effects.

15. A ***gene mutation*** in which long stretches of DNA move from one chromosome to another is called a(n): _____.
(a) frameshift mutation (c) point mutation
(b) transposition (d) transcription

16. The genes involved in transposition that can disrupt transcrition and change the amino acids of a protein are called _____.

17. The cell contains some fifty specialized enzymes that locate faulty sequences in the DNA and clip them out. _____ (a) True or (b) False

18. The probability of obtaining beneficial mutations is greater when working with _____ numbers of organisms.

19. The technology contained in the cell is unequaled in any factory on Earth.
_____ (a) True or (b) False

20. Write the **Life Principle**: "_____
_____
_____."

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ACTIVITIES
Lesson 13:

GENETIC ENGINEERING: PART I

You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. The science of altering an organism's genetic material to eliminate undesirable characteristics and/or to produce desirable new ones is called_____ _____.

2. Place an "X" in front of all of the following statements that are true concerning ***selective breeding***.
   _____ (a) It produces a new generation by mating individuals with desired characteristics.
   _____ (b) It is used in corn to increase kernel size and number.
   _____ (c) It is used in wheat and rice to produce higher yields.
   _____ (d) It originally produced nearly all wild animals.

3. The mating of two organisms with dissimilar genetic characteristics is known as: _____.
   (a) selective breeding (c) hybridization
   (b) inbreeding (d) domestication

4. The technique often used to combine the best characteristics of two organisms is_____ _____.

5. The technique often used to maintain an established breed is called_____, or the mating of individuals with similar characteristics.

6. Mating individuals of the same breed increases the probability of genetic defects because: _____ _____.
   (a) most members of a breed are genetically similar, increasing the likelihood that two recessive alleles will be brought together
   (b) most members of a breed are genetically similar, increasing the likelihood that a dominant allele will cause a disorder
   (c) most breeds are genetically dissimilar, making it impossible to produce normal offspring
   (d) genetic defects in one breed cannot be passed to another breed

7. Proteins that cut DNA at a specific sequence of nucleotides are called_____ _____.

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8. ***Restriction enzymes*** are used by scientists to:_____
_____.
(a) splice DNA fragments together
(b) prevent DNA from being cut and separated
(c) restrict the activity of DNA nucleotides
(d) cut DNA molecules into smaller, precisely sized fragments for study

9. In _____, electric fields are used to separate biological material.

10. Which of the following statements is false concerning ***electrophoresis***?_____
_____
(a) DNA fragments are placed in a gel and the gel is placed in an electric field.
(b) Negatively charged DNA fragments move toward the positively charged electrode.
(c) Larger fragments move more quickly than smaller fragments.
(d) It is a technique used to separate DNA fragments.

11. Scientists now have computerized automated machines that can detemine the sequence of the nucleotides in an electrophoresis gel. _____ (a) True or (b) False

12. When two DNA fragments that were cut with the same enzyme are mixed:_____
_____.
(a) they repel each other
(b) they replicate
(c) they form a single DNA molecule
(d) they form two complete DNA molecules

13. Pieces of DNA from two or more sources that are reassembled to act as a single DNA molecule are called _____.

14. Scientists can design DNA molecules for many different and special purposes by:
_____.
(a) separating DNA fragments by electrophoresis
(b) combining DNA from two different sources
(c) using restriction enzymes to cut DNA into fragments
(d) all of the above

15. Write the **Life Principle**: "_____
_____
_____."

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GENETIC ENGINEERING: PART II

You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. _____ occurs when a cell's genetic makeup is changed by the insertion of DNA.

2. Small, circular DNA molecules in some bacteria that can be used in ***cell transformation*** are called: _____.
   (a) yeasts (b) spores (c) vacuoles (d) plasmids

3. Under the right conditions, recombinant ***plasmids*** mixed with non-plasmid containing bacteria will: _____.
   (a) be taken up by the culture bacteria (c) destroy the culture bacteria
   (b) be destroyed by the culture bacteria (d) be transformed by the culture bacteria

4. It is much easier to make eukaryotic cells accept new DNA than it is to make prokaryotic cells accept new DNA. _____ (a) True or (b) False

5. When DNA is injected into a plant or animal cell, the cell may do all of the following, **except:** _____.
   (a) destroy new pieces of DNA
   (b) take new DNA into the nucleus
   (c) insert new DNA into the chromosomes
   (d) form plasmids from new DNA

6. ***Transgenic*** organisms: _____
   _____.
   (a) have been produced from a genetically identical organism
   (b) have been transformed with genes from another organism
   (c) only contain genes that originate within themselves
   (d) are produced by mating organisms with similar genetic characteristics

7. Large amounts of a protein such as ***insulin*** can be produced by bacteria if:_____
   _____.
   (a) the gene that codes for insulin is properly inserted into the bacteria
   (b) the bacteria need insulin for their metabolic activity
   (c) insulin is inserted into the cytoplasm of the bacteria
   (d) the bacteria are infected with diabetes

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8. Insulin is a hormone that:_____
_____.
(a) is produced in excess in diabetics
(b) regulates heart rate
(c) removes sugars from the bloodstream
(d) carries oxygen to the systemic tissues and organs

9. _____ is a chemical produced in the body in tiny amounts and is an anti-viral agent.

10. Transgenic cells are used to produce pharmaceuticals, proteins, and vaccines.
_____ (a) True or (b) False

11. To produce a transgenic animal, researchers first transform the animal's:_____.
(a) sperm cell (b) egg cell (c) zygote (d) autosome

12. The process of artificially producing a genetically identical organism is called_____
_____.

13. Some genetically altered bacteria have been used to break down petroleum products after oil spills. _____ (a) True or (b) False

14. In _____, a healthy gene is directly inserted into a person with a malfunctioning gene to produce the lacking protein.
(a) cloning (c) chemotherapy
(b) hybridization (d) gene therapy

15. Place an "X" in front of the following statements that describe problems that could result from genetic engineering.
_____ (a) Pathogenic organisms used in recombinant DNA experiments could develop into infectious forms, causing large epidemics.
_____ (b) Genetically engineered bovine somatotropin may cause health problems in cows and humans.
_____ (c) Weeds could breed with transgenic plants, becoming resistant to herbicides.
_____ (d) Genetically modified crops could pose health and environmental risks.

16. Write the **Life Principle**: "_____
_____
_____."

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DNA FINGERPRINTING

You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. What is the difference between Medelian genetics and the genetics used today?_____
   _____
   (a) Today, biologists can look at the actual genes and not just their effects.
   (b) Today, biologists are restricted to indirect clues concerning genes.
   (c) Today, biologists no longer consider the effects of genes.
   (d) none of the above

2. The technique used to identify an individual from its unique pattern of DNA is called DNA: _____.
   (a) scanning (b) fingerprinting (c) sequencing (d) recognition

3. ***DNA fingerprinting*** focuses on:_____.
   (a) DNA units that code for specific proteins
   (b) repeating units of DNA that do not code for protein synthesis
   (c) specific restriction enzymes
   (d) radioactivity of nucleotides

4. Dark bands that are revealed when pieces of DNA are separated and identified by electrophoresis that can be used to identify and classify an individual's DNA are called: _____.

5. Place the following steps of DNA fingerprinting in chronological order.
   _____ (a) DNA is extracted from the cell.
   _____ (b) Radioactivity is detected to allow the number of repeat units to be detected.
   _____ (c) DNA fragments injected into a gel.
   _____ (d) DNA fragments separated by electrophoresis.
   _____ (e) Separated DNA fragments are identified and used to develop a fingerprint.
   _____ (f) DNA is obtained from an individual.
   _____ (g) DNA is split into fragments by restriction enzymes.
   _____ (h) Radioactive probes match up to repeat units and adhere to them.

6. ***Forensic medical science*** constitutes an overlapping of _____ and _____ fields regarding criminal/legal matters.

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7. Huntington disease slowly damages the: _____.
   (a) digestive system (c) nervous system
   (b) endocrine system (d) respiratory system

8. Genetic testing now enables children of people with Huntington disease to:_____
   _____.
   (a) cut the Huntington allele out of their DNA
   (b) determine if they carry the allele for Huntington disease
   (c) prevent the full expression of the allele for Huntington disease
   (d) delay Huntington disease symptoms for up to twenty years

9. Tests for genetic disorders may be used by:_____
   _____.
   (a) children of parents with genetic disorders
   (b) couples considering having children
   (c) children who do not know if their parents have genetic disorders
   (d) all of the above

10. The most controversial uses of DNA fingerprinting are in the _____
    _____.

11. Although DNA evidence is now used to identify crime suspects, it is still not always accepted by juries. _____ (a) True or (b) False

12. DNA information is currently incorporated into ID cards and small computer chips inside human bodies. _____ (a) True or (b) False

13. The human Genome Project is an effort to:_____
    _____.
    (a) sequence all the nitrogenous bases in the human genome
    (b) identify each individual in a society with DNA fingerprinting
    (c) observe the effects of all of the human genes
    (d) perfect the use of radioactive probes in DNA fingerprinting

14. Write the **Life Principle**: "_____
    _____
    _____."

Note: Ask your teacher for the quiz over lessons 11-15 before proceeding to the next section. Reminder: If you score 85% or higher on the three section quizzes, you may be exempt from the chapter test!

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