Name_____

UNDERSTANDING GENETICS

Vocabulary

AMINO ACIDS: Chemical subunits that link-up with one another to form long molecular chains that are called proteins.

CHROMOSOMES: Wormlike cell structures that become visible before cells divide and that are the location of the genes that store genetic information for making proteins. In cells that are not undergoing cell division, the chromosomes cannot be seen and exist within the cell's nucleus in the form of threads or grains called CHROMATIN.

CROSS: In genetics, this is a shortened way of saying cross-pollination, or cross-fertilization.

CROSS-FERTILIZATION: A technique used by geneticists in which male sex cells from an organism possessing one set of traits are used to fertilize the female sex cells of an organism of the same species that can possess a different set of traits.

CROSS-POLLINATION: A technique used by geneticists in which pollen containing the male sex cells from the flowers of a plant possessing one set of traits is transferred to the pistils, containing the female sex organs, in the flowers of another plant of the same species that can possess a different set of traits.

CYSTIC FIBROSIS: A genetic disease that particularly affects the tissue of the lungs and pancreas.

DELETION MUTATION: A type of mutation that occurs when part of the DNA of a gene is deleted or lost.

DEOXYRIBONUCLEIC ACID: Commonly called DNA, this huge molecule is a major component of chromosomes. DNA functions to store information for making proteins. Distinct sections of DNA containing coded information for making particular proteins are called GENES.

DIPLOID: Possessing two complete sets of chromosomes. For example, humans have 23 different types of chromosomes, but since humans are diploid, each cell possesses 23 chromosome pairs for a total of 46 chromosomes.

DOMINANT GENE: A gene, such as the one for tallness in pea plants, that can overpower weaker recessive genes, like the pea's gene for shortness.

DNA: An abbreviation for DeoxyriboNucleic Acid.

ENZYME: A class of protein that controls the rate of chemical reactions.

FAVORABLE MUTATION: Wheras most genetic mutations cause living things to sicken or die, FAVORABLE MUTATIONS actually benefit organisms, improving their chances of survival.

FERTILIZATION: The fusion of a male sex cell (sperm) and female sex cell cell (egg) to produce a fertilized egg.

FIRST FILIAL GENERATION: The first generation of offspring resulting from a cross of two parent organisms, abbreviated the F1 generation.

GENE: The basic unit of inheritance. A distinct section of a DNA molecule that contains the instructions for building a particular protein.

Name_____

UNDERSTANDING GENETICS
Vocabulary (continued)

GENETICS: The study of heredity.

GENETIC DISEASES: Diseases such as Hemophilia, Downs Syndrome, Cystic Fibrosis and Sickle Cell Anemia that result when genetic instructions in the DNA become confused as a result of genetic mutations.

GENETIC MUTATION: A change in a gene or a chromosome that typically causes death or illness but can, in rare instances, be favorable and can result in new traits being passed on to offspring.

GENETIC CODE LANGUAGE: A language used by the cells of all living organisms. The instructions written in this language reside in the DNA library. Each sentence of instructions is called a GENE. Every genetic code word in a gene sentence is just three letters long and is almost always the name of an amino acid. The genetic code alphabet from which the genetic code words are written uses just four letters A, C, T, and G which represent the chemical subunits of DNA.

GENOTYPE: The actual genetic makeup of an organism; the genes that an organism possesses.

GERM CELL LINE: A unique class of cells that give rise to sperm and eggs that are found only in the ovaries of females and the testes of males. Germ cells are the only cells in the body that can undergo the process of MEOISIS OR REDUCTION DIVISION that causes their diploid number of chromosomes to be reduced by half.

HAPLOID: Half of the Diploid number of chromosomes. As a result of MEIOSIS, diploid germ cells are converted into haploid sex cells.

INHERITANCE: Heredity; traits that can be inherited. Genetics is the science of inheritance or heredity.

INHERITANCE FACTORS: The term used by Mendel to explain why the traits he studied in peas were inherited in pairs. Later, inheritance factors were re-named GENES.

INSERTION MUTATION: A class of genetic mutations that occur when extra DNA is inserted into a gene.

MENDEL, GREGOR: A monk who performed the first scientific experiments in genetics. Mendel is known as "The Father of Genetics."

MEIOSIS: Also known as REDUCTION DIVISION. Meiosis takes place when germ cells in the ovaries or testes undergo two cell divisions but the DNA is only replicated once. As a result of meiosis, diploid germ cells are converted into haploid sperm and eggs.

MITOSIS: The duplication and division of the nucleus and of the chromosomes before cell division.

OFFSPRING: This term can mean child, or children but also refers to the descendents of genetic crosses of both plants and animals.

PHENOTYPE: The observable, physical traits of an organism.

PISTIL: The female reproductive organs of a flower consisting of the *stigma*, *style*, and *ovary*.

Distributed by United Learning

Name_____

UNDERSTANDING GENETICS
Vocabulary (continued)

POLLEN: Material produced by the stamens in the male part of a flower and that contains the male sex cells.

POLLINATION: The transfer of pollen from the male part of the flower to the pistil, the female part of the flower.

PROTEINS: Chemical substances found in living things made up of long chains of amino acids: Most proteins function as enzymes but they can also serve structural and transport functions as well. Nearly every gene functions to store instructions for building proteins.

PUNNETT SQUARE: A digrammatic representation of a genetic cross used to determine the characteristics of the offspring of the cross.

RECESSIVE GENE: A gene whose trait is masked by the presence of a dominant gene; a recessive gene can be thought of as a (weaker) gene.

REDUCTION DIVISION: Another term for meiosis.

SECOND FILIAL GENERATION: The offspring that grow from the seeds resulting from a cross of First Filial Generation parent organisms, abbreviated the F2 generation.

SEX CHROMOSOMES: Chromosomes that can be found in non-identical pairs and whose distribution in a fertilized egg determines the sex of the offspring. For example, human males possess an XY pair of sex chromosomes whereas human females possess an XX pair of sex chromosomes.

SEX CELLS: Special haploid cells that can fuse together to form a diploid fertilized egg and from which an embryo will develop. In humans the male sex cells are called sperm and the female sex cells are called ova or eggs.

STAMEN: The male reproductive organ of a flower. Pollen is produced by the stamen.

SICKLE-CELL ANEMIA: A genetic disease that causes the red blood cells to become sickle, or cresent shaped.

SPECIES: A group of organisms capable of interbreeding to produce fertile offspring.

SUBSTITUTION MUTATION: A common type of genetic mutation that occurs when an incorrect genetic code letter is substituted for the correct letter in a gene.

TRUE-BREEDER: In Genetics, an organism whose genotype for a particular trait is composed of purely dominant or purely recessive genes. For example, all short pea plants have a pair of "t" shortness genes and are true-breeders for shortness. Some tall plants possess a pair of "T" genes for tallness and likewise are true breeders for tallness. Whereas other tall plants, those with a "T" gene on one chromosome of a diploid pair and a "t" gene on the other chromosome of the pair, are not true breeding for the tallness trait.

Name_____

UNDERSTANDING GENETICS

Vocabulary Exercise

Directions: Match the correct definition in Column B with the word listed in Column A.

Column A	Column B
( ) cystic fibrosis	1. Male reproductive organ of a flower which produces pollen.
( ) proteins	2. Child or children; descendants of genetic crosses of both plants and animals.
( ) pistil	3. Another term for meiosis.
( ) Punnett Square	4. The transfer of pollen from the male part of the flower to the pistil, the female part of the flower.
( ) species	5. A diagrammatic representation of a genetic cross used to determine the characteristics of the offspring.
( ) offspring	6. A group of organisms capable of interbreeding to produce fertile offspring.
( ) mitosis	7. Duplication and division of the nucleus and chromosomes before cell division.
( ) pollination	8. A genetic disease that particularly affects the tissue of the lungs and pancreas.
( ) reduction division	9. Chemical substances made up of long chains of amino acids.
( ) stamen	10. The female reproduction organs of a flower consisting of the stigma, style, and ovary.

Distributed by United Learning

Name_____

UNDERSTANDING GENETICS

Video Quizzes

Directions: Answer the following questions immediately after viewing the video presentation.

PART ONE:

1. True or False: Mendel found that when he cross-pollinated short pea plants with one another, the offspring were sometimes a mixture of tall and short plants.

2. A gene such as the one for tallness in pea plants is said to be _____because it overpowers the recessive shortness gene.

3. An organism's physical traits make up it's phenotype but its actual genetic makeup is called its _____.

4. If a human cell is found to contain an X and a Y chromosome, that cell must have come from a person whose sex is _____.

5. The biological process that converts diploid germ cells into haploid sex cells is called _____.

PART TWO:

1. The English alphabet has 26 letters but the genetic code alphabet uses only _____ letters.

2. Genes are distinct regions of a very large information storage molecule known by the abbreviation _____.

3. Nearly all of the three letter genetic code words used to write gene sentences are actually the names of the protein components called _____ _____.

4. Most chemical reactions inside of cells, such as the joining of the growth factor subunits,will only occur if the type of proteins called _____ are present.

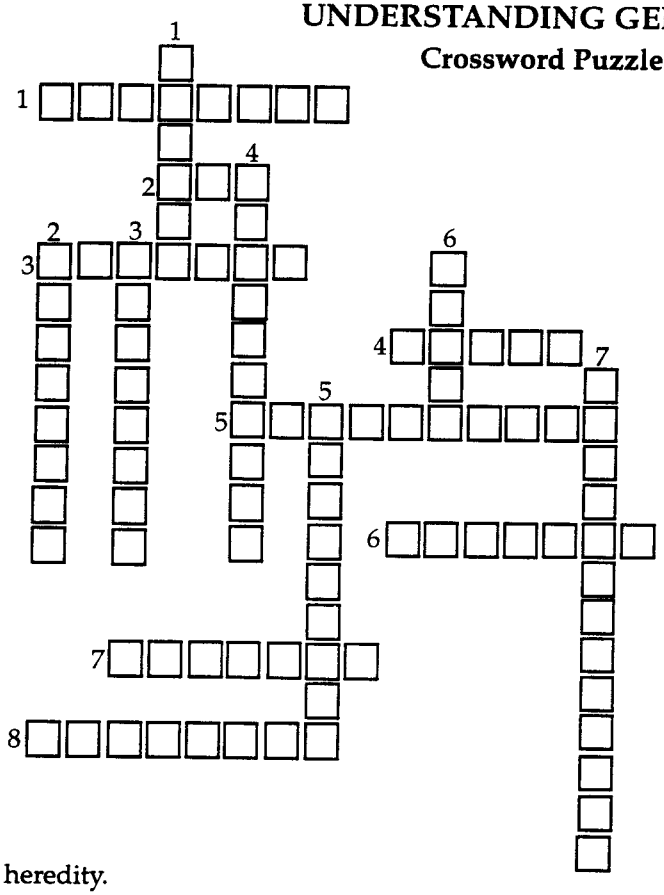
5. Errors in genes that result in the production of defective proteins are called _____.

Distributed by United Learning

Name_____

UNDERSTANDING GENETICS

Crossword Puzzle



ACROSS:

1. The science of heredity.
2. Abbreviation for Deoxyribonucleic Acid.
3. A cell condition in which each chromosome is doubled.
4. They contain the instructions for building proteins.
5. Genes are found on these cell structures that become visible when cells divide.
6. Sex cells are created by this biological process that is also known as reduction division.
7. Half the diploid number of cells.
8. The actual genetic makeup or genes that an organism possesses.

DOWN:

1. Gregor _____ carried out the first scientific experiments on heredity using pea plants.
2. The most powerful genes are said to be _____
3. Enzymes are a class of _____ that make it possible for chemical reactions to take place in cells.
4. Enzymes are made up of long chains of these components.
5. Weaker genes are said to be _____.
6. A organism's physical traits make up its _____type.
7. The fusion of the male and female sex cells is called_____

Distributed by United Learning

Name_____

UNDERSTANDING GENETICS

A Summary of Mendel's Experiments on Height in Pea Plants

SHORT X SHORT PLANTS= ALL SHORT OFFSPRING

	t	t
t	tt	tt
t	tt	tt

* All short plants are "true-breeding" for the shortness trait,
this means it is impossible for a short plant to exist unless the recessive gene is present on each chromosome of a diploid pair.

TALL X TALL PLANTS = A MIXTURE OF TALL AND SHORT PLANTS
This result is explained by the fact that Tall plants can be either the "true breeders" that have only the Tallness genes on each of the diploid pair of chromosomes (TT genotype). Other tall plants will not be true breeders because they possess one dominant T gene and one recessive shortness gene t (Tt genotype). These results are summarized in the Punnett Squares below.

True breeding Tall X True breeding Tall

	T	T
T	TT	TT
T	TT	TT

Only tall offspring will grow from the seeds of this cross.

True breeding tall X Non-True breeding tall

	T	t
T	TT	Tt
T	TT	Tt

Only tall offspring will grow from the seeds of this cross, because the T tallness gene is always dominant over the recessive shortness gene t

Non-True breeding tall X Non-True breeding tall

	T	t
T	TT	Tt
t	Tt	tt

A mixture of three-quarters tall and one-quarter short plants will grow from the seeds produced by this cross.

TRUE BREEDING TALL X SHORT PLANTS =ALL TALL 1st GENERATION OFFSPRING

	t	t
T	Tt	Tt
T	Tt	Tt

All of the offspring that grow from the First Filial Generation seeds will be Tall and all will be of the Tt genotype.

CROSSING THE FIRST GENERATION PLANTS FROM ABOVE= 1/4 SHORT 3/4 TALL OFFSPRING

	T	t
T	TT	Tt
t	Tt	tt

Three-quarters of the offspring that grow from the Second Filial Generation seeds will be tall and one-quarter will be short.

Name_____

UNDERSTANDING GENETICS

Mutations and Biodiversity: Fact Sheet

FACT #1: Genetic mutations are constantly occurring in populations of living things, usually as mistakes that occur when DNA is copied prior to cell reproduction.

FACT #2: If a mutation occurs in simple, single-celled organisms that are not dipliod, such as bacteria or protozoa, the mutation will be immediately passed on to the two daughter cells after the cell divides (unless the mutation is lethal, in which case the mutated organism will die).

FACT #3: The only new genetic mutations that can be passed on to offspring of complex, diploid, multicelled animals are those that take place in the GERM cells of the ovaries or testes of a parent. Mutations that occur in NON-GERM cells are not passed on to offspring.

FACT #4: Most new genetic mutations are recessive and therefore most new mutations will not be "expressed" or made visible until the mutated gene appears on each chromosome of the offspring. But, in order for this to occur, breeding must take place between parents who have had common ancestors and who are each gene carriers of the mutated gene.

FACT #5: If breeding between genetic relatives takes place, and each parent contributes an identical mutated gene to the fertilized egg, usually the egg wll fail to develop properly and will die due to the presence of a non-functional enzyme. However, death will not occur if the mutation merely results in the production of an enzyme whose ability to carry out its functions is only impaired.

FACT #6: In the case of a mutation that results in impaired enzyme function, a fertilized egg containing the two mutated genes will usually develop into an adult that is unhealthy, i.e. exhibits the characteristics of a genetic disease.

FACT #7: In very rare instances, some genetic mutations are favorable and result in physical changes that enhance an offspring's ability to survive under certain environmental conditions.

Distributed by United Learning

Name_____

UNDERSTANDING GENETICS

The Origin of a New Species: A Hypothetical Example

Let us image that in a large population of grazing animals, a single genetic mutation has occurred and the end result of this mutation is that one male animal has been born with a slightly longer neck than the other animals of his species. Furthermore, this mutation is dominant over the short neck trait (even though it is not essential that this gene be dominant for this example to work).

If the grazing land of this herd of animals becomes afflicted by a period of prolonged drought and grass supplies become scarce, most animals will die due to lack of food. However, the mutated male animal with the long neck has an advantage over the others of his herd because his long neck makes an entirely new source of food available to him, for he can eat the low-hanging leaves of trees, whereas his shorter cousins cannot, and, as a result, he is able to survive. In other words, his mutation has been favorable mutation.

Because he has lived to breed with surviving female animals, perhaps females with slightly longer legs, his mutated gene for "long-neckedness" will begin to appear in many offspring in the herd. Each period of drought will favor the survival of his long-necked children, grand-children, and great-grandchildren over their short-necked relatives. Over many thousands of years of cross-breeding, these long-necked animals will have the potential of developing into a distinct new species...and the critical event that set this whole, long chain reaction into effect was simply a random mutation coupled with certain harsh environmental conditions.

Distributed by United Learning

Name_____

UNDERSTANDING GENETICS

Lesson Quiz

1. Using a Punnett square, perform the following genetic cross between parental pea plants whose cells have the following genotypes:

•PARENT ONE: This plant's cells have a diploid pair of chromosomes with a pair of recessive "y" genes for green seeds.

•PARENT TWO: This plant's cells have a diploid pair of chromosomes and one has a recessive "y" gene for green seeds wheras the other chromosome has a dominant "Y" gene for yellow seeds.

2. What percentage of the plants that develop from the seeds produced by the cross above will have yellow seeds? What percentage will have green seeds?

3. Using a Punnett Square, perform the following genetic cross between parental pea plants that have the following genotypes:

• PARENT ONE: This plant's cells have a diploid pair of chromosomes that each have dominant "P" genes for green pod color.
• PARENT TWO: This plant's cells have a diploid pair of chromosomes and one chromosome has a recessive gene "p" for yellow pod color whereas it's other chromosome has a dominant "P" gene for green pod color.

4. What percentage of the plants that develop from the seeds of the cross above will have yellow pods? What percentage will have green pods?

5. When a mutation occurs in a GENE, the instructions for making a particular_____will usually become confused or disrupted.

6. TRUE OR FALSE: Mutations are always damaging to organisms.

7. TRUE OR FALSE: As a result of meiosis, diploid sex cells are produced from the haploid germ cells of the ovaries and the testes.

8. TRUE OR FALSE: Human females have one pair of X sex chromosomes.

9. TRUE OR FALSE: The genetic code employs a five letter alphabet that represents the chemical subunits of DNA.

10. TRUE OR FALSE: Proteins are made up of long chains of amino acids.

Distributed by United Learning