,

Suite 301
641 West Lake Street
Chicago, IL 60661

Each lesson lasts about 40 minutes (one class period) unless otherwise noted.
Each lesson assumes the student has blank paper and a writing instrument.

Heredity and Environment

Knowledge: Can the student recall or remember main principles, ideas, or information?
(Students watch the video *Heredity and Environment* during this lesson)

_____

Comprehension: Can the student explain ideas or concepts?

_____

Application: Can the student use the information in a new way?

4. _____

Analysis: Can the student distinguish and relate the different parts of a statement?

_____

Synthesis: Can the student create and combine ideas into a new product?

_____

Evaluation: Can the student appraise?

In this program, we learn about the structure and chemistry of DNA molecules. Students see how genes are passed from parents to offspring and how they determine the traits of an individual. Discover how environmental factors, inside or outside of the womb, can affect a child's health later in life. Viewers also learn about genetic disorders and how counseling and screening can provide health information before or during pregnancy.

- Students will learn the structure and chemistry of DNA molecules.
- Students will understand how dominant and recessive traits are passed from parents to offspring.
- Students examine the role of both genetic and environmental factors in determining who we are.
- Students will learn about sex-linked and ethnic genetic disorders.
- Students will understand how and why people may seek genetic counseling.

These 5 question are used EACH DAY to wrap up your lessons.

1. What is the chemistry of a DNA molecule, and how is it structured?
2. Describe the difference between dominant and recessive genes.
3. Name some common genetic disorders and explain why they occur.
4. Which traits are determined by heredity and which may be developed due to environment?
5. Why might some people seek genetic counseling?

http://www.genetics.org/

http://kidshealth.org/parent/system/medical/about_genetics.html

http://www.genome.gov/

http://learn.genetics.utah.edu/

Richard Walker and Steve Jones

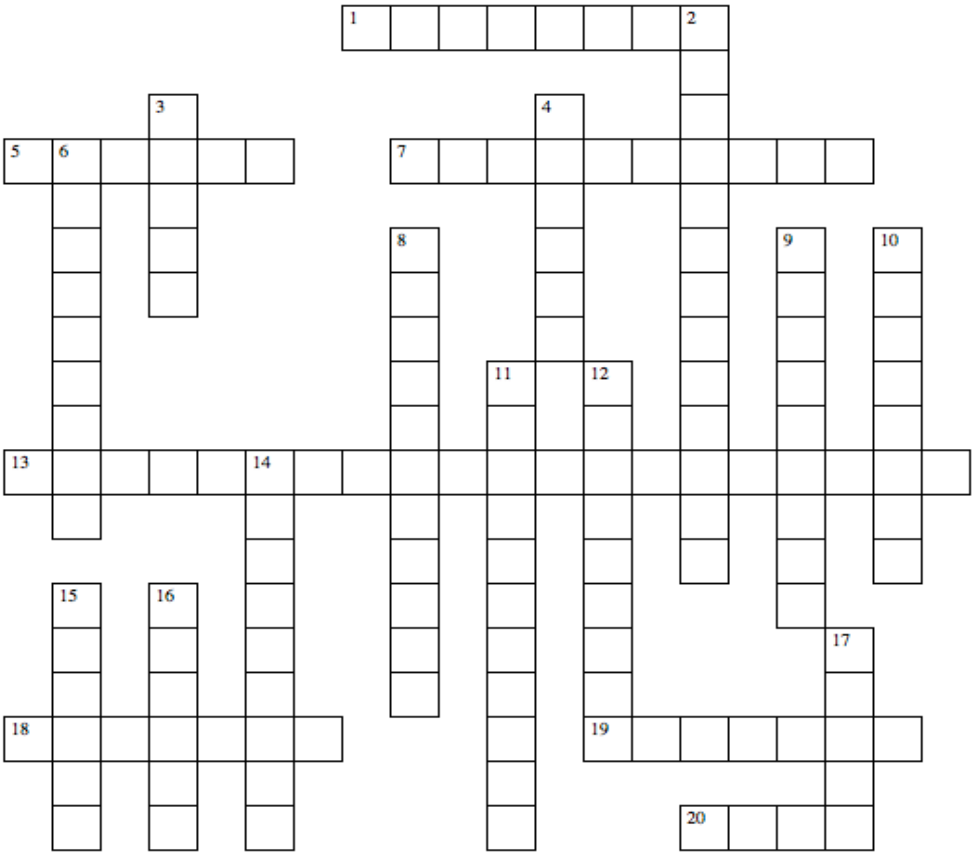
Victor K. McElheny

,

Susan Elrod

Fill in the crossword puzzle with the correct word from the word bank.

genes
carrier
codons
chromosomes
DeoxyriboNucleicAcid
dominant
ovum
sperm
recessive
translocation
zygote
meiosis
mutation
gamete
double helix
codominant
autosomes
allele
base pairs
polygenic



ACROSS

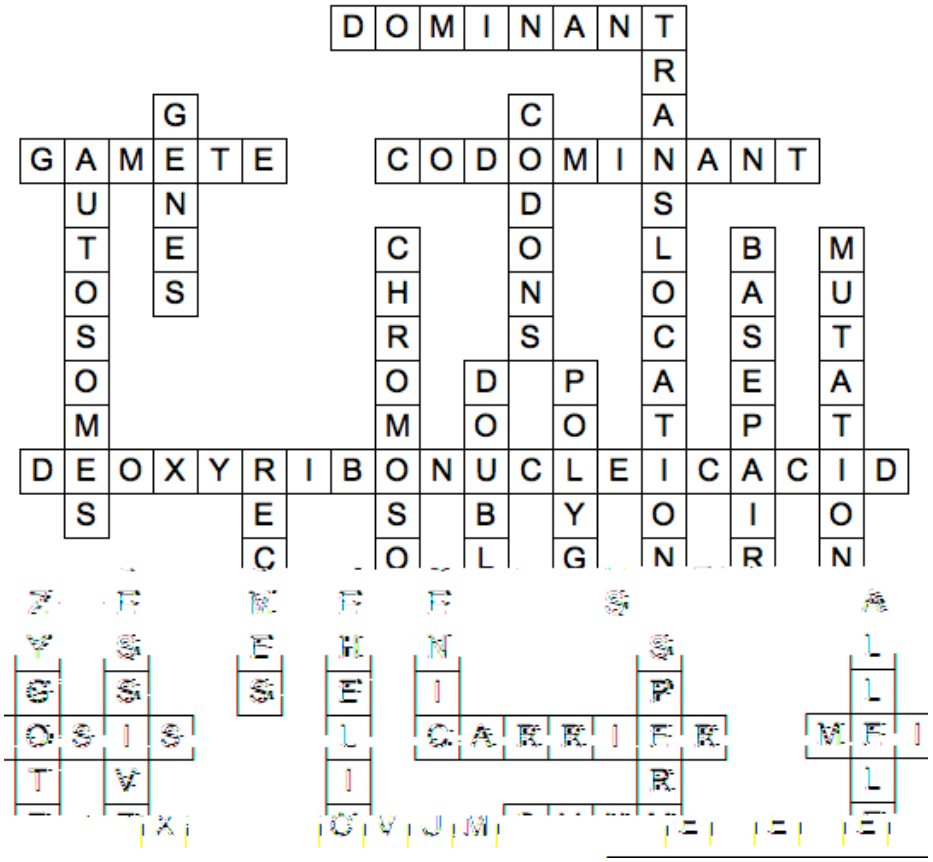
1) Gene that masks the effect of any other allele of the same gene.
5) A mature sex cell that is able to unite with one of the opposite sex to create a new individual.
7) When two dominant versions of a trait are expressed in an offspring.
13) Chemical name for the molecule that influences all living things.
18) When sex cell chromosomes are reduced to one half.
19) Someone who has a recessive allele for a trait.
20) A female gamete.

DOWN

2) When parts of chromosomes are rearranged with parts of other chromosomes.
3) Basic unit of genetic information.
4) Groups of three connected bases on a DNA molecule.
6) Any of the chromosomes except the sex chromosomes.
8) Rod-shaped portions of DNA that come in 23 pairs.
9) These interact to form the rungs of the DNA "ladder."
10) Change in genetic structure.
11) Shape of DN
12) Several different genes inherited from both parents, all to control a single trait.
14) Gene whose allele trait will only show up if it is inherited from both parents.
15) One member of gene that controls traits like hair and eye color.
16) Fertilized egg cell.
17) Male gamete.

Fill in the crossword puzzle with the correct word from the word bank.

Crossword Puzzle



ACROSS

1) Gene that masks the effect of any other allele of the same gene.
5) A mature sex cell that is able to unite with one of the opposite sex to create a new individual.
7) When two dominant versions of a trait are expressed in an offspring.
13) Chemical name for the molecule that influences all living things.
18) When sex cell chromosomes are reduced to one half.
19) Someone who has a recessive allele for a trait.
20) A female gamete.

DOWN

2) When parts of chromosomes are rearranged with parts of other chromosomes.
3) Basic unit of genetic information.
4) Groups of three connected bases on a DNA molecule.
6) Any of the chromosomes except the sex chromosomes.
8) Rod-shaped portions of DNA that come in 23 pairs.
9) These interact to form the rungs of the DNA "ladder."
10) Change in genetic structure.
11) Shape of DNA.
12) Several different genes inherited from both parents, all to control a single trait.
14) Gene whose allele trait will only show up if it is inherited from both parents.
15) One member of a gene that controls traits like hair and eye color.
16) Fertilized egg cell.
17) Male gamete.

Students watch the 38-minute video *Heredity and Environment* while completing a corresponding worksheet.

Learning Seed's video *Heredity and Environment*
A means of playing the video to students
Copies of Viewer's Worksheet (p. 9)
Worksheet Answer Key (p. 10)

Heredity and Environment

_____

Heredity and Environment

1. The DNA alphabet is made up of the letters: _____ _____ _____ _____.
2. A group of 3 bases is called a _____.
3. Genes combine into large rod-like structures called _____.
4. We have _____ pairs of chromosomes, _____ in total.

5. Meiosis creates sex cells called _____.
6. Germ cells divide into four _____ cells.
7. If a sperm with an X chromosome fertilizes an egg, the offspring will be a _____.

8. Some differences arise from _____ or when parts of chromosomes get rearranged with parts of other chromosomes.
9. Sometimes there are sections of the chromosomes that each other and create new genetic combinations in the new cells
10. _____ are the only two individuals who can share the same chromosomes.

11. _____ alleles mask the effect of any other allele of the same gene.
12. _____ alleles only show up if both parents pass them on to their child.
13. _____ alleles are both expressed in a child.

14. Genetic disorders can be dominant, recessive or _____.
15. Sometimes geographic and _____ backgrounds make people prone to certain genetic disorders.
16. Some disorders occur as a result of random errors involving an incorrect number of _____.

17. Genetic _____ can educate people about genetic disorders before or after a pregnancy.
18. Doctors may run a series of _____ to determine people's risk factors or current conditions.
19. A person's _____ describes all their dominant and recessive genes.
20. A person's _____ includes their location, diet, how they are treated by others, and other factors.
21. A person's _____ is the way in which all of a person's traits are expressed.

Heredity and Environment

_____

1. The DNA alphabet is made up of the letters: _____ _____ _____ _____.
2. A group of 3 bases is called a _____.
3. Genes combine into large rod-like structures called _____.
4. We have _____ pairs of chromosomes, _____ in total.

5. Meiosis creates sex cells called _____.
6. Germ cells divide into four _____ cells.
7. If a sperm with an X chromosome fertilizes an egg, the offspring will be a _____.

8. Some differences arise from _____ or when parts of chromosomes get rearranged with parts of other chromosomes.
9. Sometimes there are sections of chromosomes that _____ each other and create new genetic combinations in the new cells.
10. _____ are the only two individuals who can share the same chromosomes.

11. _____ alleles mask the effect of any other allele of the same gene.
12. _____ alleles only show up if both parents pass them on to their child.
13. _____ alleles are both expressed in a child.

14. Genetic disorders can be dominant, recessive or _____ .
15. Sometimes geographic and _____ backgrounds make people prone to certain genetic disorders.
16. Some disorders occur as a result of random errors involving an incorrect number of _____.

17. Genetic _____ can educate people about genetic disorders before or after a pregnancy.
18. Doctors may run a series of _____ to determine people's risk factors or current conditions.

19. A person's _____ describes all their dominant and recessive genes.
20. A person's _____ includes their location, diet, how they are treated by others and other factors.
21. A person's _____ is the way in which all of a person's traits are expressed.

Teams of students play a game to answer questions about heredity.

Chart of questions (p. 12)

A board or overhead projector to keep score for the game.

None.

- Students will demonstrate knowledge of basic heredity concepts.
- Students will define key vocabulary terms related to heredity and environment.

Direct students to list as many possible hair/eye/skin color/body type combinations as they can in 5 minutes.

1. Explain that students will play a game similar to the television gameshow Jeopardy. Further explain that:
   1.1. Students will be divided into teams.
   1.2. The game will consist of 20 questions of varying point values.
   1.3. Teams may choose any question of any point value available on the board when it is their turn.
   1.4. The team with the highest score at the end is the winner.
2. Divide students into teams and determine the order in which they will choose questions.
3. Use a projector or whiteboard to show categories and point values for the class to see during the game.
4. Begin the game by asking the first team to choose a category and point value.
5. Continue the game, keeping score on a visible board or screen, and crossing off questions as they are answered, until all questions are answered correctly.

Should be the same each day of the unit to reinforce basic concepts. Suggested discussion questions are on page 4.

_____

(5 categories, 5 Levels of Point Value. Grey boxes are questions, and below each is its answer.)

points	_____	_____	_____	_____	_____
	What are the letters of the DNA alphabet?	When a sperm with an X chromosome unites with an ovum, what gender is the baby?	What are different variations of a gene called?	What is a person called who has a recessive allele for a carrier called?	Term referring to someone's genetic inheritance including all dominant and recessive genes?
	A, C, T, G	a girl	alleles	a carrier	genotype
	What is the shape of a DNA molecule?	How many chromosomes does a zygote have?	What kind of gene masks the effect of any other variation of the same gene?	What kind of recessive disorder is due to an abnormality found on the X chromosome?	What term refers to the extent to which traits of abilities change due to environmental factors?
	double helix	46	dominant	sex-linked inheritance	reaction range
	What is a group of 3 bases called?	Name the process that turns germ cells into sex cells.	Characteristics like blue eyes and red hair are a result of what type of gene?	People with Down syndrome have a third copy of what number chromosome?	What is it called when genes seem to influence the type of environment a person chooses?
	codon	meiosis	recessive	21	active correlation
	Genes combine into rod-like structures called what?	How many autosomes do sex cells have?	A child who inherits type A blood from one parent and type B blood from the other will have what blood type?	People with the polydactylism disorder have extras of these.	What is it called when the environment reacts differently to different genetic profiles?
	chromosomes	22	AB	fingers and toes	reactive correlation
	How may pairs of chromosomes do most human cells contain?	When a parent ovum cell divides, how many daughter cells result?	Name the type of trait that results form several different genes inherited from both parents.	Which genetic disorder is a defect of red blood cells found more often in African-Americans?	What is it called when genes influence both a child's environment and heredity?
	23	4	polygenic	sickle cell anemia	passive correlation

Students create a health history chart for themselves.

Students need access to the U.S. Health and Human Services website

A printer

Before the lesson:

1. Ensure that this lesson complies with any privacy rules for your school, community, and district.
2. Fill out the form yourself to be better able to answer any student questions.

- The student will investigate their family's health history.
- The student will utilize an online tool to organize heath history information.
- The student will identify risk factors they should be aware of in their own health.

Journal activity: What was the most interesting thing you learned when you did your pre-lesson interviews with family members about their health?

1. Instruct your students to interview as many family members as possible (siblings, parents, aunts, uncles and grandparents) about all illnesses or diseases they have had, as well as their age of onset for the disease. (You may wish to set a minimum quote for number of interviews).

2. Direct students to the Family Health History Tool on the U.S. Department of Health & Human Services website: familyhistory.hhs.gov

3. Instruct students to start their own family history, follow directions on the website to input the information they collected from interviews with their family members.

4. Direct them to print out their health history chart and turn it in with a one-paragraph analysis of what he or she learned during the assignment.

Should be the same each day of the unit to reinforce basic concepts. Suggested discussion questions are on page 4.

Students will review the differences between meiosis and mitosis and then fill out a Venn diagram to show their understanding.

Teaching materials describing the meiosis and mitosis processes

Venn diagram worksheet (p. 15)

If your textbook or teaching materials do not cover the meiosis and mitosis processes, you (and/or your students) can visit the PBS.org website and search for “Mitosis.” You will find some excellent materials, including a flash video.

- The student will learn the differences between meiosis and mitosis.
- The student will recognize similarities and differences that relate to meiosis and mitosis.
- The student will compare and interpret various aspects of their topic.

Lead a class discussion to create a KWL (Know, Want to Know, Learned) chart on the board for the topic of meiosis and mitosis. You can complete the chart after the lesson.

1. After reviewing the processes of meiosis and mitosis, inform students they will be creating a Venn diagram on the topic.
2. Distribute the Venn Diagram template and read the instructions aloud with students, answering their questions.
3. Split students into pairs and allow time for them to complete the diagram together and then to review it as a class.

Should be the same each day of the unit to reinforce basic concepts. Suggested discussion questions are on page 4.

_____

,

_____ This Venn diagram has two circles, labeled meiosis and mitosis. In the areas of the circles that do *not* overlap, write facts that are <u>unique</u> to that process. In the areas that overlap, write facts that are true of <u>both</u> processes.

Below is a bank of possible entries. Use these and add any additional you can think of to complete the Venn Diagram.

_____

Dau/hter cells have same genetic make up

Dau/hter cells have different genetic make up

Dau/hter cells have same # of chromosomes

Parent cell produces 2 dau/hter cells

Parent cell produces 4 dau/hter cells ! ! !

Controls growth in living things

DNA molecules replicate

Cells divide

Cells divide twice

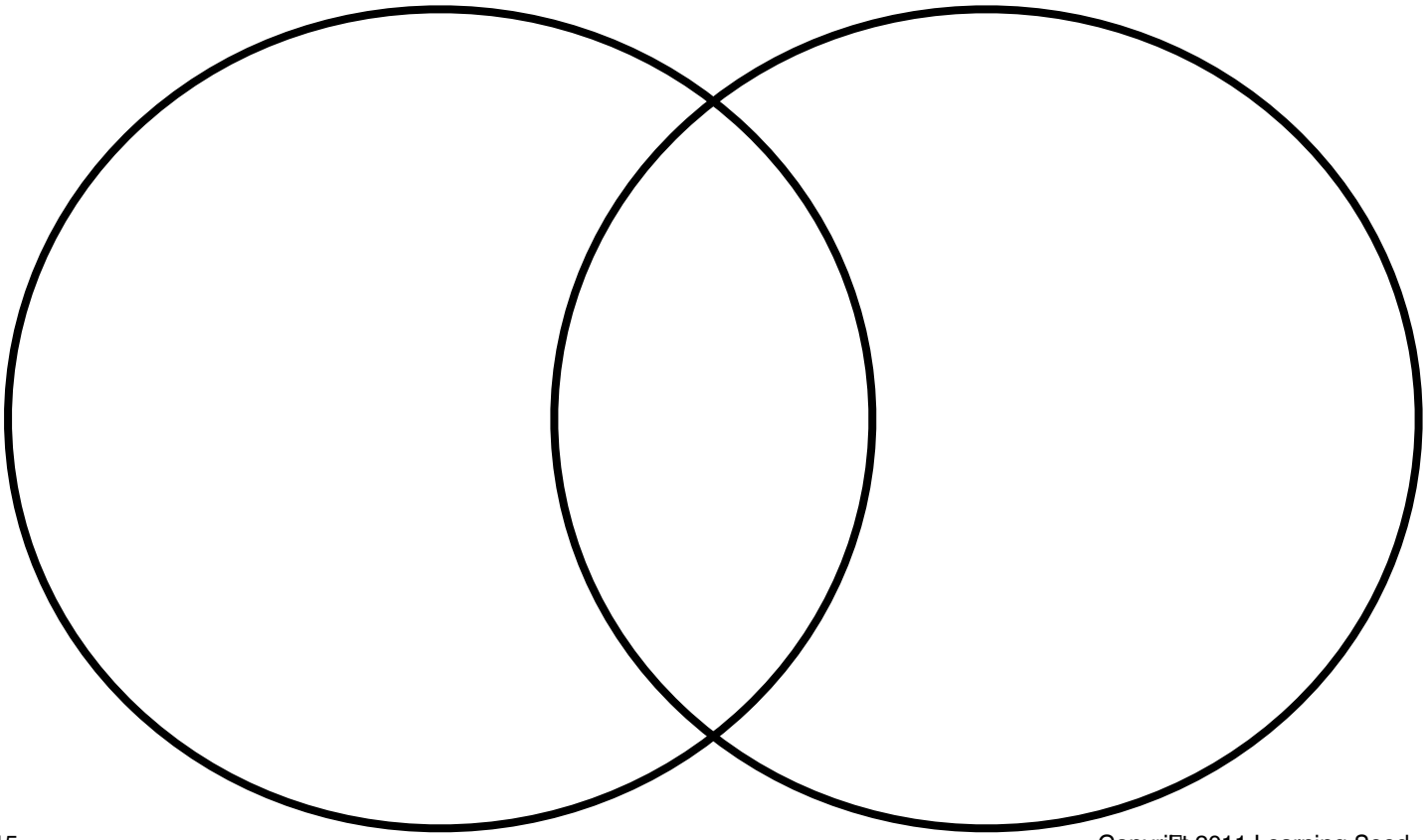
Starts with somatic cells

Forms gametes

Cells divide once

Starts with sex cells

Begins with parent cells



Students should also include accurate, original responses of their own.

_____

Starts with sex cells

Cells divide twice

Parent cell produces 4 daughter cells

Daughter cells have different genetic make up

Forms gametes

_____

Starts with somatic cells

Cells divide once

Parent cell produces two daughter cells

Daughter cells have same genetic make up

Daughter cells have same # of chromosomes

_____

Begins with parent cells

Cells divide

Controls growth in living things

DNA molecules replicate

Students will work with a partner to write and perform a 3 to 5 minute news report about a current topic in the field of genetics.

Computer with online access to the following Genome.gov web page: http://www.genome.gov/10000475.

This lesson will span three class periods (Day 1 - choose and research topic, Day 2 - write and rehearse presentation, and Day 3 - perform news reports for the class).

- The student will identify a current issue involving genetics.
- The student will recognize the significance of the findings written in a news article on genetics.
- The student will organize the salient points of a news article to share with the class.
- The student will perform a news report with a partner that teaches key information they learned from a news article.

Class Discussion: What details make for a good television news report? Who are some good news anchors, and what makes them stand out from the rest?

1. Inform students that they will be writing and performing a mock news report about a topic involving genetics.
2. Divide students into partners and distribute and discuss the presentation rubric.

   Required elements can include: Both partners should have equal number of lines, a minimum of 5 facts are required in the report, report must include the Who? What? Where? When? Why? and How? of the story.
3. Direct students to access the webpage http://www.genome.gov/10000475
4. Allow one class period to read articles and make their choice.
5. Allow one class period for students to write and rehearse the presentation.
6. Allow one class period for students to perform their news reports.

Should be the same each day of the unit to reinforce basic concepts. Suggested discussion questions are on page 4.

_____

	There were 2 or more inaccuracies in the news report.	There was 1 inaccuracy in the news report.	All of the information was accurate.		
	Group showed a severe lack of cooperation with each other.	Cooperation was somewhat lacking in the group.	The group showed cooperation with each other.		
	The group was severely unprepared and needed prompts and reminders during more than half of the news report.	The group needed prompts and reminders more than twice during the news report.	The group was prepared and needed 1 reminder or prompt during the news report.		
	The group did not express knowledge about the topic.	The group expressed little knowledge about the topic.	The group expressed adequate knowledge of the topic.		
	The news report is missing 2 or more of the required	The news report is missing 1 of the required elements.	The news report has all of the required elements.		

Students will write a research paper about a genetic disorder.

Learning Seed's video *Heredity and Environment* chapter on genetic disorders

A means of playing the video to students

Copies of Research Paper handout (p. 20)

You may want to recommend students visit the MedicinePlus web page:

- http://www.nlm.nih.gov/medlineplus/geneticdisorders.html

- The student will research a genetic disease.
- The student will learn the history, symptoms, prevalence and treatment of a genetic disease.
- The student will identify important aspects of a genetic disease.
- The student will write a one-page paper describing what they have learned.
- The student will gain a better understanding of a genetic disease.

Write the following diseases for the entire class to see: Celiac Disease, Cleft Lip and Palate, Cystic Fibrosis, Down syndrome, Dwarfism, Fragile X Syndrome, Genetic Brain Disorders, Leukodystrophy, Prader Willi Syndrome, Sickle Cell Anemia, Tay-Sachs, Huntington's Disease.

Have a class discussion about any of the diseases with which the students might be familiar.

1. Replay the chapter in *Heredity and Environment.*
2. Inform students they will be writing a one-page informational paper on one genetic disease or disorder.
3. Inform students of your expectations and due date for the paper.
4. Direct the students to the webpage: http://www.nlm.nih.gov/medlineplus/geneticdisorders.html
5. Allow time for students to explore the site in order to choose a disease or disorder.
6. Allow time for students to take notes on the disease or disorder of their choosing and begin writing their paper.

Should be the same each day of the unit to reinforce basic concepts. Suggested discussion questions are on page 4.

A genetic disorder is a disease caused by a mutation in one or more genes, by a combination of gene mutations and environmental factors, or by damage to chromosomes. Scientists have discovered 1,800 different dominant disorders and at least 700 recessive disorders. A special kind of recessive disorder is called sex-linked inheritance. These disorders reside on genes in the X chromosome.

For this research paper, you should choose a disorder from the list below. Do independent research in order to write a one-page paper in which you describe:

- The type of disorder it is (dominant, recessive, or sex-linked)
- Symptoms of the disorder and how it affects a person's life
- Treatment and other unique information related to the disorder

See attached Rubric for more criteria.

Celiac Disease

Cleft Lip and Palate

Cystic Fibrosis

Down syndrome

Dwarfism

Fragile X Syndrome

Genetic Brain Disorders

Leukodystrophy

Prader Willi Syndrome

Sickle Cell Anemia

Tay-Sachs

Huntington's Disease

_____

	There were 2 or more inaccuracies in the paper.	There was 1 inaccuracy in the paper.	All of the information was accurate.	All of the information was accurate and showed a deep understanding of all elements of the topic.	
	There are 5 or more grammatical or spelling errors in the paper.	There are 3-4 grammatical or spelling errors in the paper.	There is 1-2 grammatical or spelling error in the paper.	There are no grammatical or spelling errors in the paper.	
	The paper is disorganized and had no discernible structure.	The paper is somewhat disorganized showed little structure	The paper was organized and had a clear structure.	The paper extremely organized with a clear and effective structure.	
	The student did not express knowledge about the topic.	The student expressed little knowledge about the topic.	The student expressed adequate knowledge of both topic.	The student expressed deep knowledge of the topic.	
	The paper completely lacked a clear focus.	The paper was somewhat lacking in focus.	The paper's focus is mostly clear but veers of topic slightly.	The paper has very clear focus and stays on topic throughout.	

one member of a pair of genes that occupies a specific spot on a chromosome that controls the same trait (hair color, eye color, etc.) some alleles are dominant and some are recessive.

any of the chromosomes except the sex chromosomes.

pairs of complementary bases that interact to form the rungs of the DNA double helix.

a person with a recessive allele for a trait.

rod-shaped portions of DNA that are organized into 23 pairs.

condition whereby two dominant versions of a trait are both expressed in an offspring.

groups of three connected bases on a DNA molecule which combine to form genes.

chromosomes that overlap other chromosomes to create new combinations in new cells.

the chemical name for the molecule that carries the instructions for all living things.

(

twins who are produced when two separate ova are fertilized by two separate sperm at approximately the same time; they will not be genetically identical.

the letters A, C, T, and G which stand for the first letters of the base types that make up DNA: Adenine, Cytosine, Thymine, and Guanine.

gene that masks the effect of any other allele of the same gene.

the shape of DNA that resembles a twisted ladder with the sides made up of the sugar and phosphate units of the two nucleotide strands and the rungs made up of the bases extending into the center and joined by hydrogen bonds.

a disorder produced by the presence of an extra chromosome on the 21st pair.

a disorder produced by an injury to a gene on the X chromosome which can result in mild to moderate mental retardation.

a mature sex cell that usually has half of the normal number of chromosomes and is capable of uniting with a gamete of the opposite sex to begin the formation of a new individual.

the basic unit of genetic information.

discipline that focuses on helping people deal with issues that relate to inherited disorders.

a disease caused by a mutation in one or more genes, by a combination of gene mutations and environmental factors, or by damage to chromosomes.

any event that changes genetic structure.

human cells that specialized for reproduction.

the process by which the number of chromosomes in a cell that produces sex cells is reduced to one half and that involves a division of each pair of chromosomes.

when a trait is controlled by a dominant/recessive pair.

twins that are genetically identical who are produced when an fertilized egg divides in half.

a female gamete.

several different genes inherited from both parents, all to control a single trait.

gene whose allele trait will only show up if a child inherits the same alleles of the same gene from both parents.

disorders that occur when a child inherits an allele for the trait from both parents.

a special kind of recessive disorder that occurs when the allele for the disorder resides on genes on the X chromosome.

a genetic blood disorder that is named for the shape of the red blood cells of the people who have it.

a male gamete.

a disorder that causes blindness and muscle degeneration prior to death.

process whereby parts of chromosomes get rearranged with parts of other chromosomes.

genes that are recessive and located only on the X chromosome.

fertilized egg cell.

12.1 Analyze principles of human growth and development across the life span.
12.2 Analyze conditions that influence human growth and development
12.3 Analyze strategies that promote growth and development across the lifespan.

15.1 Analyze roles and responsibilities of parenting.
15.2 Evaluate parenting practices that maximize human growth and development
15.4 Analyze physical and emotional factors related to beginning the parenting process.

6.2 Evaluate the effects of diverse perspectives, needs, and characteristics of individual and families.

13.2 Analyze personal needs and characteristic and their effects on interpersonal relationships.