

# HUMAN SCIENCE Lesson Plan

## Day 1 & 2: Talk to me, HIV



### Outcomes for Today

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- 4 Genes are a set of instructions encoded in the DNA sequence of each organism that specify the sequence of amino acids in proteins characteristic of that organism. As a basis for understanding this concept:
  - 4.a. Students know the general pathway by which ribosome's synthesize proteins, using tRNAs to translate information from mRNA.

### PREPARE

#### 1. Background Background knowledge to engage the content

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##### What is translation?

Translation is the process by which a protein is synthesized from the information contained in a molecule of messenger RNA (mRNA). During translation, an mRNA sequence is read using the genetic code, which is a set of rules that defines how an mRNA sequence is to be translated into the 20-letter code of amino acids, which are the building blocks of proteins. The genetic code is a set of three-letter combinations of nucleotides called codons, each of which corresponds with a specific amino acid or stop signal. Translation occurs in a structure called the ribosome, which is a factory for the synthesis of proteins

#### 2. Wordwall vocabulary words to teach and add to the Word Wall.

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<b>RNA</b>	A polymeric constituent of all living cells and many viruses, consisting of a long, usually single-stranded chain of alternating phosphate and ribose units with the bases adenine, guanine, cytosine, and uracil bonded to the ribose. RNA molecules are involved in protein synthesis and sometimes in the transmission of genetic information. Also called <i>ribonucleic acid</i> .
<b>(mRNA)</b>	Messenger RNA

### READ

#### 3. View

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##### Article/Video

Go to: <http://www.avert.org/hiv-virus.htm>

Search: History and Science

Locate: The Structure of HIV

Read: As a class

The article is very informative. The video clip (02:35) is very technical but informative.

### **Additional Resources:**

For additional DNA Resources with teacher support material  
<http://www.pbs.org/wnet/dna/teachers/index.html>

## **RESPOND**

### **4. Visual Process.**

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Create a timeline of the AIDS/HIV gene and disease.

## **EXPLORE**

### **5. Activity** Explore more deeply with a visual or oral language activity.

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#### Comic Strip—2 day activity

<http://www.mysciencebox.org/book/export/html/375>

- Review the idea of transcription and translation.
- Write down key concepts (see table below) in a column on the side of the board.

#### Protein synthesis key concepts:

- DNA is located in the nucleus of the cell.
  - The sequence of DNA nucleotides forms the genetic code.
  - RNA polymerase separates the 2 strands of DNA and then matches an RNA nucleotide to each DNA nucleotide.
  - This chain of RNA nucleotides forms a molecule of messenger RNA.
  - The messenger RNA leaves the nucleus.
  - A ribosome assembles around the messenger RNA
  - The ribosome reads the sequence of codons in the messenger RNA and matches a transfer RNA molecule to each codon.
  - The ribosome assembles the amino acids brought by the transfer RNA into a chain.
  - The finished chain of amino acids is a protein.
- Once you have elicited the major steps of transcription/translation, cross out or underline the vocabulary words. For example:
    - “~~DNA~~ is located in the ~~nucleus~~ of the ~~cell~~.”
    - “The sequence of ~~DNA nucleotides~~ forms the ~~genetic code~~.”

- Ask students to be creative and brainstorm other words or ideas that might fit in the place of the crossed out/underlined words. For example, instead of “DNA is located in the ~~nucleus~~ of the ~~cell~~” you might say
  - “The mayor is located in the town hall of the city.”
  - “A beautiful princess is located in the highest tower of the castle.”
  - “The Pirate King is located on his pirate ship in the middle of the Black Sea.”
- Use this brainstorming strategy for perhaps 2 or 3 key concepts then begin tying the ideas together to create a non-science storyline that parallels the protein synthesis process. Perhaps the princess is sending a secret message to her knight in shining armor to build a device to rescue her. Or maybe the Pirate King is sending secret orders to his henchmen on land to build a weapon.
- Once students get the idea, give them an overview of the project: Create a comic strip that is an **analogy** for the protein synthesis process. Below each panel of the comic strip, write down the translation of your story in science speak (the key concepts listed above). Begin by outlining the entire story side by side with the science speak key concepts.
- Only after the story is outlined should you begin illustrating.

**6. Discussion** Ask discussion questions that engage at many levels

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**Key Questions**

- How does HIV replicate?
- What does HIV need to survive?
- What is translation and transcription? How does that affect the spread of HIV/AIDS?

**EXTEND**

**7. Write, Draw or Speak.**

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In your own words describe how the HIV Gene is formed and how it affects the body?

**8. Close** Close by extending today’s lesson to what you can do in your life and the world.

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Students should complete the chart below based on their learning from the day. They should fill in the chart with one change and one habit per day.

- *Change I can make = decreasing bad habits and bad choices;*
- *Habit I can build = Increasing healthy habits and choices*

<i>Change I can make</i>	
<i>Habit I can build</i>	

# HUMAN SCIENCE Video Notes



Name:

Part I:

Note taking tips: (Cornell Notes)

- Write important details from the video, segment, article, or passage in the second column;
- After you write your notes, return to the first column and add phrases, words and questions related to the details. A sketch or picture may also be helpful.

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Column 1: Phrases, words, questions or a sketch related to the details in column 2.	Column 2: Important Details

Part II:

Note taking tips: (Cornell Notes)

- Summarize the video, article, or passage in the space below. Use your own words.

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# HUMAN SCIENCE Lesson Plan

## Day 1: Break the Code



### Outcomes for Today

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- 4 Genes are a set of instructions encoded in the DNA sequence of each organism that specify the sequence of amino acids in proteins characteristic of that organism. As a basis for understanding this concept:
- 4.b. Students know how to apply the genetic coding rules to predict the sequence of amino acids from sequence codons to RNA

### PREPARE

#### 1. Background Background knowledge to engage the content

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##### What is a code?

The basic definition of code is a systematic system of letters, numbers, or symbols that represent something else. In genetics code is—the amino acid sequence of a protein by the sequence of nucleotides comprising the gene for that protein: *a gene that codes for the production of insulin.*

Our cells, body functions, and genes have a code that transfers information throughout the system. This code is typically a system of letters (that have been assigned to the DNA) that is within our genes. Everyone has a unique genetic code that makes them similar in some ways but uniquely different in others.

#### 2. Wordwall vocabulary words to teach and add to the Word Wall.

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**Codon:** The basic unit of the genetic code. A sequence of three adjacent nucleotides in DNA or mRNA.

**mRNA:** Messenger RNA carries the DNA message from the nucleus to the ribosomes.

**tRNA:** Transfer RNA carries the amino acids to the ribosomes.

**RNA:** Ribonucleic Acid the heredity material of certain viruses and the material encoded by the DNA to carry out specific genetic functions.

### READ

#### 3. View

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##### Video

Go to: [www.discoveryeducation.com](http://www.discoveryeducation.com) (Subscription Based Website)

Search: Genetic Coding

Locate: The Power of Genes (approximate run time 11:00)

View: Segment 1—Twin Traits (04:28)

Segment 2—Understanding Fraternal Twins (01:28)

Segment 3—Understanding Identical Twins (02:39)

Segment 4—Unraveling the Mystery of Human Characteristics (05:08)

More DNA Coding Resources:

This website lists various different web based activity's, web sites, and lesson support materials.

<http://www.kumc.edu/gec/lessons.html>

## RESPOND

### 4. Visual Process.

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#### Venn Diagram

Create a Venn Diagram and compare and contrast the similarities and differences between identical and fraternal twins.

## EXPLORE

### 5. Activity

Explore more deeply with a visual or oral language activity.

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#### DNA Fingerprint

<http://www.pbs.org/wgbh/nova/sheppard/analyze.html>

This activity will help students create a DNA Fingerprint this activity is web based and can be done as a class, in small groups, or as an individual.

### 6. Discussion

Ask discussion questions that engage at many levels

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#### Key Questions

- How are personality traits inherited?
- How are identical traits formed compared to fraternal twins?
- What can DNA be used for?
- How has evolution affected genes?
- How does the DNA research on twins give insight on heredity and nature vs. nurture?

## EXTEND

### 7. Write, Draw or Speak.

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What was the result of your DNA fingerprint? Was the outcome what you expected? What new insight did you learn about DNA coding and imprints? How does this information impact you? What can you conclude about your personal DNA fingerprint based on this information?

### 8. Close

Close by extending today's lesson to what you can do in your life and the world.

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Students should complete the chart below based on their learning from the day. They should fill in the chart with one change and one habit per day.

- *Change I can make = decreasing bad habits and bad choices;*
- *Habit I can build = Increasing healthy habits and choices*

Change I can make	
Habit I can build	

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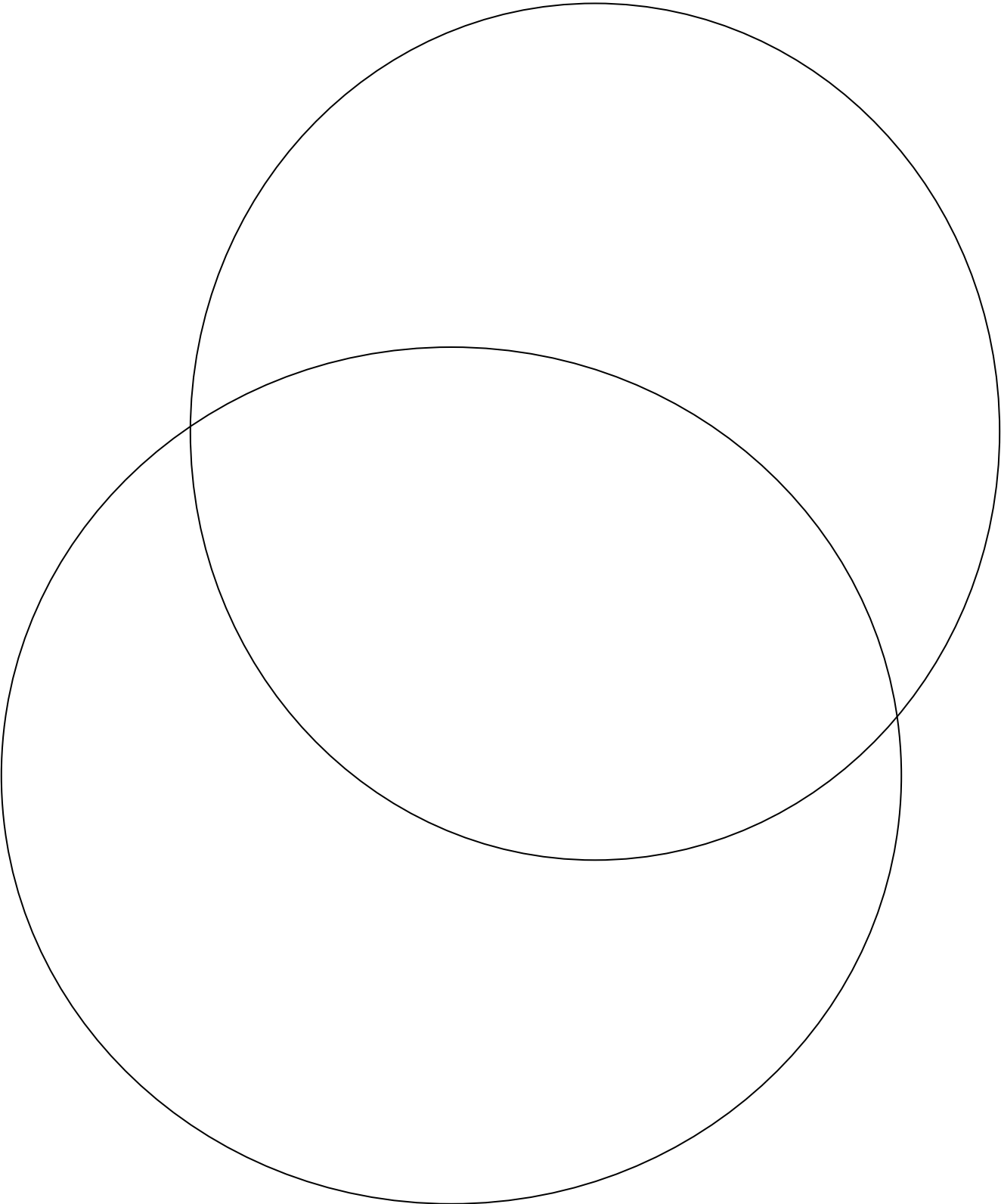
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# 6g6 Venn Diagram Chart



# HUMAN SCIENCE Lesson Plan

## Day 2: Break the Code



### Outcomes for Today

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- 4 Genes are a set of instructions encoded in the DNA sequence of each organism that specify the sequence of amino acids in proteins characteristic of that organism. As a basis for understanding this concept:
- 4.b. Students know how to apply the genetic coding rules to predict the sequence of amino acids from sequence codons to RNA.

### PREPARE

#### 1. Background Background knowledge to engage the content

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##### What does DNA coding mean?

DNA makes up the genes coming from one of four bases. This sequence of the bases is what creates your genetic make-up. The process is very simplistic. So much so, scientists were baffled by it for years.

#### 2. Wordwall vocabulary words to teach and add to the Word Wall.

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<b>Codon:</b>	The basic unit of the genetic code. A sequence of three adjacent nucleotides in DNA or mRNA.
<b>mRNA:</b>	Messenger RNA carries the DNA message from the nucleus to the ribosomes.
<b>tRNA:</b>	Transfer RNA carries the amino acids to the ribosomes.
<b>RNA:</b>	Ribonucleic Acid the heredity material of certain viruses and the material encoded by the DNA to carry out specific genetic functions.

### READ

#### 3. View

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##### Video

Go to: [www.discoveryeducation.com](http://www.discoveryeducation.com) (Subscription Based Website)  
Search: Genetic Coding  
Locate: The Power of Genes  
View: Segment 5: Utilizing DNA to Solve Crimes (04:58)  
Segment 6: Developments in Genetic Coding; Using CODIS to Solve Crimes (02:11)  
Segment 7: Going Beyond Nature: Cloning through the Study of DNA (03:33)

## RESPOND

### 4. Visual Process.

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No visual process today.

## EXPLORE

### 5. Activity

Explore more deeply with a visual or oral language activity.

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#### Reading DNA Code

<http://www.dnai.org/a/index.html>

Review the above website with your students.

This is interactive. There are slides, short video clips, and articles on reading DNA.

### 6. Discussion

Ask discussion questions that engage at many levels

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#### Key Questions

- How is DNA read?
- Who were the scientist that contributed to the DNA code? What did they do?
- How does crossing over affect DNA?
- How does translation affect DNA?
- What impact did the ability to read DNA have on science and our lives?

## EXTEND

### 7. Write, Draw or Speak.

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Choose one scientist from today's lesson that contributed to breaking and reading the DNA code. Write a short biography on them. You can use the biographical cube to list your information if you choose. Be sure to include their contributions to science and DNA.

### 8. Close

Close by extending today's lesson to what you can do in your life and the world.

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Students should complete the chart below based on their learning from the day. They should fill in the chart with one change and one habit per day.

- *Change I can make = decreasing bad habits and bad choices;*
- *Habit I can build = Increasing healthy habits and choices*

<i>Change I can make</i>	
Habit I can build	

# HUMAN SCIENCE Video Notes



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## 10c12 Cubing Biography

	Who is person? Date of birth? Death?	
	Where did this person grow up?	
What relationships did this person have?	What did this person do?	What was this person like?
	Why is this person important?	

# HUMAN SCIENCE Lesson Plan

## Day 3: Break the Code



### Outcomes for Today

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- 4 Genes are a set of instructions encoded in the DNA sequence of each organism that specify the sequence of amino acids in proteins characteristic of that organism. As a basis for understanding this concept:
- 4.b. Students know how to apply the genetic coding rules to predict the sequence of amino acids from sequence codons to RNA.

### PREPARE

#### 1. Background Background knowledge to engage the content

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##### **What is gene alteration? Should it be allowed? (for review and discussion)**

Gene Alteration is a process scientist go through to change genes to “benefit” health and wellness. By changing the genetic code and make-up and obese persons genes could be altered to help them lose weight. People could be altered to be faster and stronger (a mega military). Genes could be altered so people could live longer. Plants can be altered to become disease and bug resistant and become super crops. Animals altered to be healthier or more cost effective to produce.

There are positives and negatives to this science. Think about the ramifications of genetically altering humans, plants, and animals.

For introduction review:

Gene Alteration Makes Super Mice:

<http://www.cbsnews.com/stories/2004/08/24/tech/main637939.shtml>

#### 2. Wordwall vocabulary words to teach and add to the Word Wall.

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<b>Codon:</b>	The basic unit of the genetic code. A sequence of three adjacent nucleotides in DNA or mRNA.
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<b>tRNA:</b>	Transfer RNA carries the amino acids to the ribosomes.
<b>RNA:</b>	Ribonucleic Acid the heredity material of certain viruses and the material encoded by the DNA to carry out specific genetic functions.



## READ

### 3. View

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Video:

Go to: [www.discoveryeducation.com](http://www.discoveryeducation.com) (**Subscription Based Website**)  
Search: Genetic Coding  
Locate: The Power of Genes  
Segment 8: Transgenic: Positive and Negative Effects of a New Gene (04:10)  
Segment 9: Developments in Reproduction: Cross Species Cloning (03:42)  
Segment 10: Identifying the Origin and Assignment of Character Traits (04:07)  
Segment 11: Understanding the Impact of Gene Alteration (04:45)  
Segment 12: Gene Therapy Transforming the Human Body through Genetic Drugs (07:28)

Article:

Go to: [www.discoveryeducation.com](http://www.discoveryeducation.com) (**Subscription Based Website**)  
Search: Gene Alteration  
Locate: Encyclopedia Article

Video/Article:

Go to: [www.PBS.org](http://www.PBS.org)  
Search: Genetic Alteration  
Locate: Point of View; In the Family  
There is additional support material and a lesson related to this film located at: [http://www.pbs.org/pov/inthefamily/lesson\\_plan.php](http://www.pbs.org/pov/inthefamily/lesson_plan.php)

## RESPOND

### 4. Visual Process.

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Gene Alteration Poster (pro's and con's)

There are many positives and negatives to genetic testing and alteration. Create a poster/T Chart that depicts both sides of the argument. Be as creative as possible. Include visual representations for each side.

## EXPLORE

### 5. Activity

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Genetics Experiment:

<http://school.discoveryeducation.com/lessonplans/programs/genetics/>

Students will write and create a experiment that relates to genetic testing. Directions and information can be located at the above link.

## 6. Discussion Ask discussion questions that engage at many levels

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### Key Questions

- What are the positive and negative impacts of Gene Alterations?
- Why is it important to know the gene structures of humans? How can that information help scientist?
- Who are gene hunters? What do they do? How can they help find cures for major diseases?
- Should cosmetic issues be addressed with genetic alteration?
- How can genetic drugs affect the human ability to heal itself?
- Why is it important to use genetics in breeding for service dogs?
- Is it more acceptable to alter animal genes versus human genes? Why or why not?
- How is gene alteration done?

### EXTEND

## 7. Write, Draw or Speak.

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### Class Debate:

Can genetic testing and alteration be done and no impact the future of your health care and food sources? How does genetic testing impact our society? What can happen if gene alteration is used for negative causes—to create a mega military? Would you want to be the person whose genes were altered so you could serve society in a certain way? What about the positives? Creating food sources that are disease and bug resistant? Do we risk altering the natural course of nature by drastically changing how we raise food? Working to service animals to genetically alter them so they have the strongest skill set to help people.

- As a class research the positive and negative impact genetic alteration has on our society.
- Have students break into two groups, one researching the positive impact and the other the negative impact.
- Set classroom debate and discussion rules.
- Once completed have students debate each other.

**8. Close** Close by extending today's lesson to what you can do in your life and the world.

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Students should complete the chart below based on their learning from the day. They should fill in the chart with one change and one habit per day.

- *Change I can make = decreasing bad habits and bad choices;*
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# HUMAN SCIENCE Lesson Plan

## Day 1: Mutant DNA



### Outcomes for Today

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- 4 Genes are a set of instructions encoded in the DNA sequence of each organism that specify the sequence of amino acids in proteins characteristic of that organism. As a basis for understanding this concept:
- 4.c. Students know how mutations in the DNA sequence of a gene may or may not affect the expression of the gene or the sequence of amino acids in the encoded protein.

### PREPARE

#### 1. Background Background knowledge to engage the content

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##### What is Sickle Cell Anemia? What is it caused by?

Sickle cell anemia (uh-NEE-me-uh) is a serious disease in which the body makes sickle-shaped red blood cells. “Sickle-shaped” means that the red blood cells are shaped like a “C.”

Normal red blood cells are disc-shaped and look like doughnuts without holes in the center. They move easily through your blood vessels. Red blood cells contain the protein hemoglobin (HEE-muh-glow-bin). This iron-rich protein gives blood its red color and carries oxygen from the lungs to the rest of the body.

Sickle cells contain abnormal hemoglobin that causes the cells to have a sickle shape. Sickle-shaped cells don’t move easily through your blood vessels. They’re stiff and sticky and tend to form clumps and get stuck in the blood vessels. (Other cells also may play a role in this clumping process.)

The clumps of sickle cells block blood flow in the blood vessels that lead to the limbs and organs. Blocked blood vessels can cause pain, serious infections, and organ damage.

Sickle cell anemia is one type of anemia. Anemia is a condition in which your blood has a lower than normal number of red blood cells. This condition also can occur if your red blood cells don’t have enough hemoglobin.

Red blood cells are made in the spongy marrow inside the large bones of the body. Bone marrow is always making new red blood cells to replace old ones. Normal red blood cells last about 120 days in the bloodstream and then die. They carry oxygen and remove carbon dioxide (a waste product) from your body.

In sickle cell anemia, a lower-than-normal number of red blood cells occurs because sickle cells don’t last very long. Sickle cells usually die after only about 10 to 20 days. The bone marrow can’t make new red blood cells fast enough to replace the dying ones.

Sickle cell anemia is an inherited, lifelong disease. People who have the disease are born with it. They inherit two copies of the sickle cell gene—one from each parent.

People who inherit a sickle cell gene from one parent and a normal gene from the other parent have a condition called sickle cell trait. Sickle cell trait is different from sickle cell anemia. People who have sickle cell trait don’t have the disease, but they have one of the genes that cause it. Like people who have sickle cell anemia, people who have sickle cell trait can pass the gene to their children.

## 2. Wordwall vocabulary words to teach and add to the Word Wall.

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<b>Mutation:</b>	A chemical change in a gene, resulting in a new allele, or a change in the portion of the chromosome that regulates the gene, in either case the change is hereditary (coming from on or both parents).
<b>Allele:</b>	One of two or more possible forms of a gene. Each affecting hereditary traits somewhat differently.
<b>Sequence:</b>	An order of succession; an arrangement.
<b>Monogenic disorder:</b>	Single gene disorder

### READ

## 3. View

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### Video:

**Go to:** [www.discoveryeducation.com](http://www.discoveryeducation.com) (Subscription Based Website)

**Search:** Genetic Mutation

**Locate:** Understanding Genetics Part 2 (approximate run time 15:52)

### RESPOND

## 4. Visual Process.

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### Venn Diagram

Using a Venn Diagram chart compare a regular blood cell vs. a sickle cell.

- Draw/Illustrate the differences
- In the center write ways a person with sickle cell can adapt and live a more pain free life;

### EXPLORE

## 5. Activity Explore more deeply with a visual or oral language activity.

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### Your Genes Fit Me Funny:

There are certain ailments that are due to genetic mutations. This activity will show students what it feels like to live with a certain mutation. Look at the list of potential genetic below. Some of these mutations are due to birth defects others are due to environmental factors. Give one mutation to your students and let them “feel” what it would be like to have that particular disorder. You can give more than one disorder to the class at the time.

Partial Blindness: Using a pair of old sunglasses. Smear them thickly with Vaseline.

Sickle Cell Anemia: Tape students fingers together so they can not function or bend in full range of motion (do not do it too tight).

Loss of Muscle Function: Have students use their recessive arm or hand to do basic tasks—like spooning items into a bowl or drawing.

Once the mutation has been gifted to the student have them participate in basic activities—writing, reading, and eating. Have students and answer the following questions:

1. What did it feel like to have a mutation? If that disability or ability could be prevented through gene testing do you think it should be?
2. Do you think there is a reason for certain genetic mutations—can they be a positive? What would happen to certain species if mutations had not occurred?

## **6. Discussion** Ask discussion questions that engage at many levels

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### **Key Questions**

- What are three facts about the structure of genes?
- What other factors than development can cause a gene to mutate?
- Why is it important that genes are found in the exact same location on the DNA strand?
- What is the basic function of genes?
- What do enzymes do and why are they important?
- What happens to a gene if you insert or delete base pairs in an existing gene?

## **EXTEND**

### **7. Write, Draw or Speak.**

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Gene mutations are like spelling errors. In some circumstances they change the meaning of your intended message entirely and make it impossible to understand the message. In other cases you can still determine what is being said by the content of the message.

Write a letter to your friend telling them about your day. Your letter has been victim to a genetic mutation. You can not use any vowels (A, E, I, O, or U) in your writing.

Exchange the letter with your friend. Were they able to understand your message? What was lost or gained in the message that they received?



**8. Close** Close by extending today's lesson to what you can do in your life and the world.

---

Students should complete the chart below based on their learning from the day. They should fill in the chart with one change and one habit per day.

- *Change I can make = decreasing bad habits and bad choices;*
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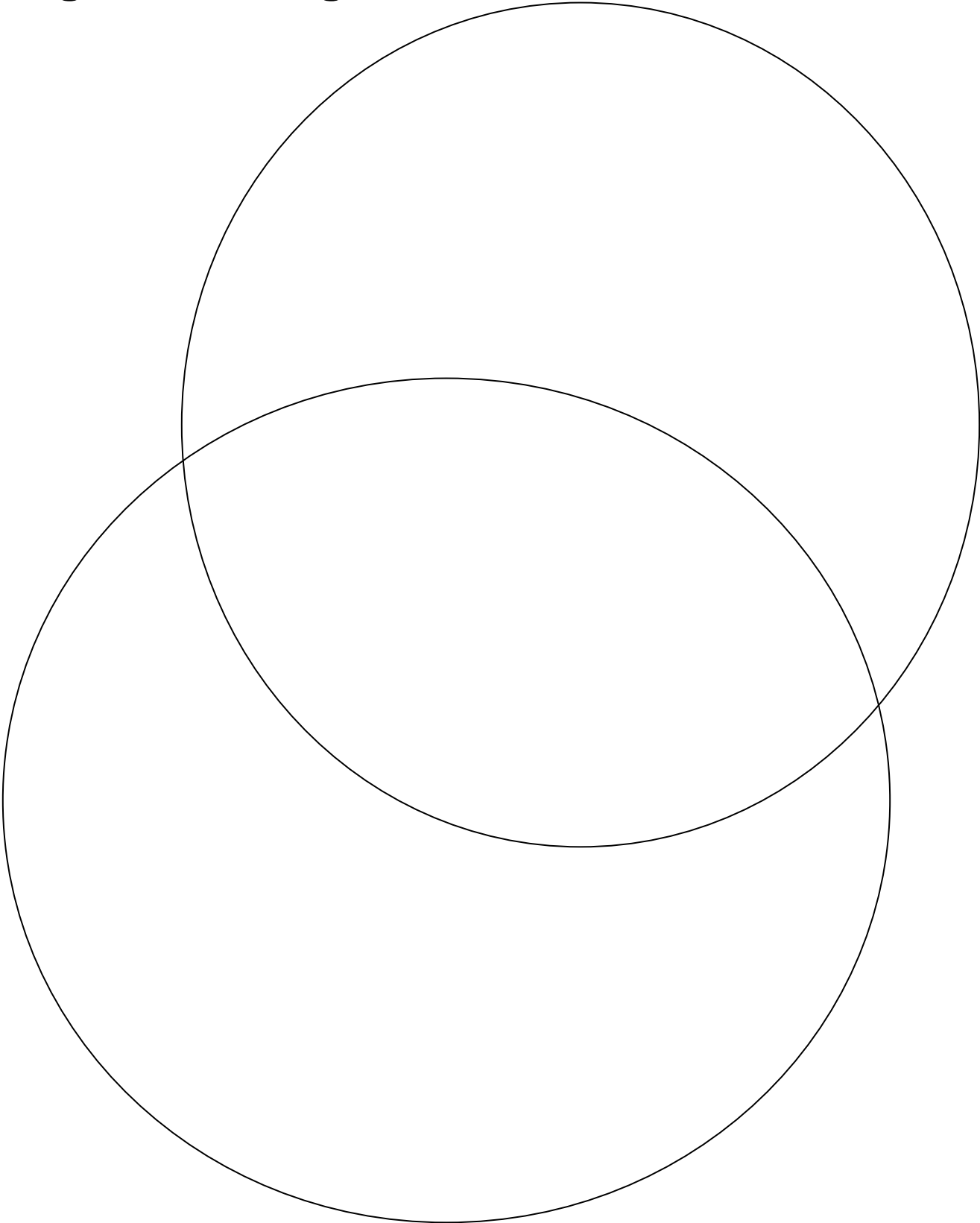
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# 6g6 Venn Diagram Chart



# HUMAN SCIENCE Lesson Plan

## Day 2: Mutant DNA



### Outcomes for Today

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- 4 Genes are a set of instructions encoded in the DNA sequence of each organism that specify the sequence of amino acids in proteins characteristic of that organism. As a basis for understanding this concept:
- 4.c. Students know how mutations in the DNA sequence of a gene may or may not affect the expression of the gene or the sequence of amino acids in the encoded protein.

### PREPARE

#### 1. Background Background knowledge to engage the content

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##### What is Tay-Sachs? What is it caused by?

Tay-Sachs disease is a fatal genetic lipid storage disorder in which harmful quantities of a fatty substance called *ganglioside G<sub>M2</sub>* build up in tissues and nerve cells in the brain. The condition is caused by insufficient activity of an enzyme called *beta-hexosaminidase A* that catalyzes the biodegradation of acidic fatty materials known as *gangliosides*. Gangliosides are made and biodegraded rapidly in early life as the brain develops. It is almost an overweight or fat nervous system.

Infants with Tay-Sachs disease appear to develop normally for the first few months of life. Then, as nerve cells become distended with fatty material, a relentless deterioration of mental and physical abilities occurs. The child becomes blind, deaf, and unable to swallow. Muscles begin to atrophy and paralysis sets in. Other neurological symptoms include dementia, seizures, and an increased startle reflex to noise.

A much rarer form of the disorder occurs in patients in their twenties and early thirties and is characterized by an unsteady gait and progressive neurological deterioration. Persons with Tay-Sachs also have "cherry-red" spots in their eyes. The incidence of Tay-Sachs is particularly high among people of Eastern European and Ashkenazi Jewish descent.

Patients and carriers of Tay-Sachs disease can be identified by a simple blood test that measures beta-hexosaminidase A activity. Both parents must carry the mutated gene in order to have an affected child. In these instances, there is a 25 percent chance with each pregnancy that the child will be affected with Tay-Sachs disease. Prenatal diagnosis is available if desired.

Most children born with the disease have a life span of approximately 4 years. Most times they lose their lives due to reoccurring infections.

## 2. Wordwall

vocabulary words to teach and add to the Word Wall.

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Review the words from the previous day's word wall.

<b>Mutation:</b>	A chemical change in a gene, resulting in a new allele, or a change in the portion of the chromosome that regulates the gene, in either case the change is hereditary (coming from on or both parents).
<b>Allele:</b>	One of two or more possible forms of a gene. Each affecting hereditary traits somewhat differently.
<b>Sequence:</b>	An order of succession; an arrangement.
<b>Monogenic disorder:</b>	Single gene disorder

## READ

### 3. View

---

Video/Article:

Go to: <http://www.pbs.org>

Search: Genetic Mutation

Locate: Switching Genes Off and On

This is a video/article combination. There are also links on this site to interactive gene sites that support the material.

## RESPOND

### 4. Visual Process.

---

Think of all of the genetic issues that affect the population today. Refer to the following link for a list: <http://www.ivf1.com/pgd-gentic-disease-list/>

Write down the 10-15 most common and familiar diseases to your students.

- Have students create a “super hero” gene that can cure that disease.
- Have students illustrate their character
- What are its 5 most valuable strengths
- How would your life change if that “super hero” gene existed

## EXPLORE

### 5. Activity

Explore more deeply with a visual or oral language activity.

---

Have students participate in the following writing activity.

- Students should choose and study one of the case studies below
- Read each of these three scenarios and then describe in a few lines each person's daily life.
- Describe how your life would be altered if you had the same or similar genetic mutation.

### **Scenario 1 - Ziad**

Ziad was born with poor eyesight: he is colour-blind. This disorder was genetically passed down to him by his mother, and yet she does not suffer from colour-blindness herself. How can that be? Well, Ziad's particular type of colour-blindness (the inability to distinguish between red and green) is the most common kind and is caused by a genetic defect on the x chromosome.

Since he can't rely on colour to help him go about his daily activities, Ziad has to find other ways of coping. How do you think he manages? To help you answer this question, try to imagine what Ziad has to do to dress himself properly, find the family car in a parking lot, identify insects for his collection or choose fresh fruit and vegetables at the grocery store.

### **Scenario 2 - Maria**

Maria suffers from diabetes. Because her pancreas doesn't produce insulin, Maria can't control the amount of sugar in her bloodstream. Insulin is very important because it helps our bodies efficiently use the energy in the food we eat and keeps our bodies in good working order.

Unfortunately, there is no cure for diabetes, but the disease can be controlled. To do so, Maria has to inject herself with insulin before each meal. She can never skip meals and she must always keep a few healthy snacks on hand, especially before and after strenuous physical activity. Maria is a very active teenager. She plays soccer twice a week after school and she also sings with the school choir twice a week.

At the moment she is planning a two-week family vacation to South America to visit her grandparents. What precautions do you think Maria has to take if she wants to do all these activities without any difficulty?

### **Scenario 3 - Nicholas**

Nicholas has been a heroin addict for several years now. Despite his doctor's frequent warnings, Nicholas still shares needles with other heroin addicts. This is dangerous because when needles are shared, the contaminated blood of a person infected with the HIV virus, or other diseases, can be transmitted to another person. The HIV virus can eventually cause AIDS, where a person's immune system breaks down and they become highly susceptible to a range of illnesses, including some that can cause death. Currently there is no cure for HIV or AIDS.

One day, a friend Nicholas had shared needles with told him he had AIDS. Worried and convinced that he was infected too, Nicholas decided to get tested. He and his doctor learned that he had in fact contracted the HIV virus. Several years went by and Nicholas still did not develop AIDS, so he and his doctor decided to do some more medical tests. The HIV virus can stay in the human body for several years without any signs of illness: this is the HIV-positive period. The disease can show itself as early as two years after being infected by the HIV virus or as late as ten years. They discovered that Nicholas' genetic code contained two mutant copies of a certain gene. Luckily, this mutation protects the cells against attacks by the HIV virus. Less than 1% of Caucasian, or white, males have this mutation. Thanks to this mutation, Nicholas will spend the rest of his life without ever developing AIDS, although he will still be a carrier of the HIV virus and he could infect others.

In this case, the mutation had a positive effect on someone's health. Use your imagination to think up beneficial genetic mutations that would make humans even better. You can use super-heroes like Superman as your inspiration.

**6. Discussion** Ask discussion questions that engage at many levels

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**Key Questions**

- How can genes positively affect you?
- <http://www.genome.gov/10001740> look at the previous website. What are five of the largest ethical issues that surround genetic testing?
- What is genetic discrimination? How can it affect you or your family?
- What are other issues that surround genetic testing and study?
- Why isn't there a standard of care as it relates to the study of genetics?

**EXTEND**

**7. Write, Draw or Speak.**

---

Look at the case studies which were used in the activity today. If you had to choose one of the genetic mutations listed above that you would have to live with—which one would you choose? Why?

**8. Close** Close by extending today's lesson to what you can do in your life and the world.

---

Students should complete the chart below based on their learning from the day. They should fill in the chart with one change and one habit per day.

- *Change I can make = decreasing bad habits and bad choices;*
- *Habit I can build = Increasing healthy habits and choices*

<i>Change I can make</i>	
Habit I can build	



# HUMAN SCIENCE Video Notes



Name:

Part I:

Note taking tips: (Cornell Notes)

- Write important details from the video, segment, article, or passage in the second column;
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Part II:

Note taking tips: (Cornell Notes)

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# HUMAN SCIENCE Lesson Plan

## Day 1: What is Your Specialty?



### Outcomes for Today

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- 4 Genes are a set of instructions encoded in the DNA sequence of each organism that specify the sequence of amino acids in proteins characteristic of that organism. As a basis for understanding this concept:
- 4.d. Students know specialization of cells in a multicellular organism is usually due to the different patterns of gene expression rather than to differences of the genes themselves.

### PREPARE

#### 1. Background Background knowledge to engage the content

---

##### What is Tourette Syndrome?

Gilles de la Tourette syndrome (Tourette Syndrome or TS) is a neurological disorder which becomes evident in early childhood or adolescence before the age of 18 years. Tourette syndrome is defined by multiple motor and vocal tics lasting for more than one year. The first symptoms usually are involuntary movements (tics) of the face, arms, limbs or trunk. These tics are frequent, repetitive and rapid. The most common first symptom is a facial tic (eye blink, nose twitch, grimace), and is replaced or added to by other tics of the neck, trunk, and limbs.

These involuntary (outside the patient's control) tics may also be complicated, involving the entire body, such as kicking and stamping. Many persons report what are described as premonitory urges -- the urge to perform a motor activity. Other symptoms such as touching, repetitive thoughts and movements and compulsions can occur.

Verbal tics can also occur. These verbal tics (vocalizations) usually occur with the movements. These vocalizations include grunting, throat clearing, shouting and barking. The verbal tics may also be expressed as coprolalia (the involuntary use of obscene words or socially inappropriate words and phrases) or copropraxia (obscene gestures). Despite widespread publicity, coprolalia/copropraxia is uncommon with tic disorders.

Symptoms of TS vary from person to person and range from very mild to severe, the majority of cases fall into the mild category. Associated conditions can include attention problems (ADHD/ADD, impulsiveness (and oppositional defiant disorder), obsessional compulsive behavior, and learning disabilities. There is usually a family history of tics, Tourette Syndrome, ADHD, OCD. Tourette Syndrome and other tic disorders occur in all ethnic groups. Males are affected 3 to 4 times more often than females.

Most people with TS and other tic disorders will lead productive lives. There are no barriers to achievement in their personal and professional lives. Persons with TS can be found in all professions. A goal of TSA is to educate both patients and the public of the many facets of tic disorders. Increased public understanding and tolerance of TS symptoms are of paramount importance to people with Tourette Syndrome.

Tourette Syndrome is caused by a slight difference in the genetic pattern.

## 2. Wordwall

vocabulary words to teach and add to the Word Wall.

---

<b>Genetic Expression:</b>	Use of a gene to create the corresponding protein.
<b>Protein Sequence:</b>	The process of determining a protein's order of amino acids
<b>Protein Molecules:</b>	Any of a group of complex organic macromolecules that contain carbon, hydrogen, oxygen, nitrogen, and usually sulfur and are composed of one or more chains of amino acids. Proteins are fundamental components of all living cells and include many substances, such as enzymes, hormones, and antibodies, that are necessary for the proper functioning of an organism. They are essential in the diet of animals for the growth and repair of tissue and can be obtained from foods such as meat, fish, eggs, milk, and legumes.

## READ

### 3. View

---

**Video:**

**Go to:** [www.discoveryeducation.com](http://www.discoveryeducation.com) (Subscription Based Website)

**Search:** Difference of Proteins in Amino Acids

**Locate:** The Language of Life; Understanding the Genetic Code (approximate run time 27:39)

## RESPOND

### 4. Visual Process.

---

Start and Stop

The genetic sequence reads like an English sentence. There is a definite start and stop place. Look at the genetic codes in the article below.

<http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/C/Codons.html>

Create a stop sign or signal that illustrates the symbols for start and stop in the genetic sequence.

## EXPLORE

### 5. Activity

Explore more deeply with a visual or oral language activity.

---

There is no activity in today's lesson.

**6. Discussion** Ask discussion questions that engage at many levels

---

**Key Questions**

- What are proteins made of? How many cells make up amino acids?
- How many sets of genetic instructions are there?
- Why is it important for the gene to have a starting and stopping place for the cell to read?
- What do proteins do?
- If most cells contain the same DNA how does the body know to use only specific information from the gene?

**EXTEND**

**7. Write, Draw or Speak.**

---

Science Journal:

(based on the video)

Re-state in your own words how cells communicate their information. You can use a comic strip format to support your information with illustrations.

**8. Close** Close by extending today's lesson to what you can do in your life and the world.

---

Students should complete the chart below based on their learning from the day. They should fill in the chart with one change and one habit per day.

- *Change I can make = decreasing bad habits and bad choices;*
- *Habit I can build = Increasing healthy habits and choices*

<i>Change I can make</i>	
Habit I can build	

# HUMAN SCIENCE Video Notes



Name:

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# HUMAN SCIENCE Lesson Plan

## Day 2: What is Your Specialty?



### Outcomes for Today

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- 4 Genes are a set of instructions encoded in the DNA sequence of each organism that specify the sequence of amino acids in proteins characteristic of that organism. As a basis for understanding this concept:
- 4.d. Students know specialization of cells in a multicellular organism is usually due to the different patterns of gene expression rather than to differences of the genes themselves.

### PREPARE

#### 1. Background Background knowledge to engage the content

---

##### **What is Tourette Syndrome?** (review from day one lesson)

Gilles de la Tourette syndrome (Tourette Syndrome or TS) is a neurological disorder which becomes evident in early childhood or adolescence before the age of 18 years. Tourette syndrome is defined by multiple motor and vocal tics lasting for more than one year. The first symptoms usually are involuntary movements (tics) of the face, arms, limbs or trunk. These tics are frequent, repetitive and rapid. The most common first symptom is a facial tic (eye blink, nose twitch, grimace), and is replaced or added to by other tics of the neck, trunk, and limbs.

These involuntary (outside the patient's control) tics may also be complicated, involving the entire body, such as kicking and stamping. Many persons report what are described as premonitory urges -- the urge to perform a motor activity. Other symptoms such as touching, repetitive thoughts and movements and compulsions can occur.

Verbal tics can also occur. These verbal tics (vocalizations) usually occur with the movements. These vocalizations include grunting, throat clearing, shouting and barking. The verbal tics may also be expressed as coprolalia (the involuntary use of obscene words or socially inappropriate words and phrases) or copropraxia (obscene gestures). Despite widespread publicity, coprolalia/copropraxia is uncommon with tic disorders.

Symptoms of TS vary from person to person and range from very mild to severe, the majority of cases fall into the mild category. Associated conditions can include attention problems (ADHD/ADD, impulsiveness (and oppositional defiant disorder), obsessional compulsive behavior, and learning disabilities. There is usually a family history of tics, Tourette Syndrome, ADHD, OCD. Tourette Syndrome and other tic disorders occur in all ethnic groups. Males are affected 3 to 4 times more often than females.

Most people with TS and other tic disorders will lead productive lives. There are no barriers to achievement in their personal and professional lives. Persons with TS can be found in all professions. A goal of TSA is to educate both patients and the public of the many facets of tic disorders. Increased public understanding and tolerance of TS symptoms are of paramount importance to people with Tourette Syndrome.

Tourette Syndrome is caused by a slight difference in the genetic pattern.



## 2. Wordwall

vocabulary words to teach and add to the Word Wall.

---

Review from day one lesson.

<b>Genetic Expression:</b>	Use of a gene to create the corresponding protein.
<b>Protein Sequence:</b>	The process of determining a protein's order of amino acids
<b>Protein Molecules:</b>	Any of a group of complex organic macromolecules that contain carbon, hydrogen, oxygen, nitrogen, and usually sulfur and are composed of one or more chains of amino acids. Proteins are fundamental components of all living cells and include many substances, such as enzymes, hormones, and antibodies, that are necessary for the proper functioning of an organism. They are essential in the diet of animals for the growth and repair of tissue and can be obtained from foods such as meat, fish, eggs, milk, and legumes.

### READ

#### 3. View

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Article:

Go to: <http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/C/Codons.html>

Search: The Genetic Code

Locate: Article and codes

### RESPOND

#### 4. Visual Process.

---

No visual activity today

### EXPLORE

#### 5. Activity

Explore more deeply with a visual or oral language activity.

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History, Hieroglyphs, and DNA: Cracking an unknown code

<http://www.accessexcellence.org/AE/ATG/data/released/0173-janbarbee/index.php>

Use the above link to support student's ability to understand and decipher codes. This exercise simulates what it would be like to crack an unknown code—much like DNA.

**6. Discussion** Ask discussion questions that engage at many levels

---

**Key Questions**

- Do you think there are times that your body does not recognize the DNA code or can not read it? What happens then?
- If most cells contain the same DNA how does the body know to use only specific information from the gene?
- What are the benefits of cell specialization?
- What are the negatives of cell specialization?
- What happens if a cell mutates?
- What happens if a specialized cell does not communicate the correct information?

**EXTEND**

**7. Write, Draw or Speak.**

---

Science Journal:

There are benefits and negatives to cell specialization.

- Create a “T” chart listing at least three of each
- Choose one and expand on it in paragraph form

**8. Close** Close by extending today’s lesson to what you can do in your life and the world.

---

Students should complete the chart below based on their learning from the day. They should fill in the chart with one change and one habit per day.

- *Change I can make = decreasing bad habits and bad choices;*
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# HUMAN SCIENCE Lesson Plan

Day 1: We're All Made the Same—But Different

Day 2: Second activity—Bird Brains (optional)



## Outcomes for Today

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- 4 Genes are a set of instructions encoded in the DNA sequence of each organism that specify the sequence of amino acids in proteins characteristic of that organism. As a basis for understanding this concept:
  - 4.e. Students know proteins can differ from one another in the number and sequence of amino acids.
  - 4.f. Students know why proteins having different amino acid sequences typically have different shapes and chemical properties.

## PREPARE

### 1. Background Background knowledge to engage the content

---

#### **How has the study of DNA helped create drugs for common illnesses and diseases?**

##### **Case Study: Drugs developed for leukemia1950**

Gertrude Elion (b. 1918) found out about the Burroughs Wellcome drug company through her father, a dentist; the company had sent a drug sample to his office. Elion had graduated at the top of her class at Hunter College in 1937, but due to the Depression and the fact that she was female, she had trouble finding a job where she could apply her chemistry training. She had temporary and part-time jobs and took courses toward a master's degree, but kept hoping for a real research opportunity. In 1944, on her father's suggestion, she went to Burroughs Wellcome for an interview. George Hitchings (b. 1905) hired her on the spot for \$50 a week.

Hitchings' research team was launching an investigation of nucleic acids. At that time, little was known about them. Oswald Avery had recently discovered that they were part of DNA, and carried genetic information. But the structure of DNA and the nucleic acids' exact function would not be known for another decade. Hitchings split the nucleic acids up among his assistants. Elion was assigned a subgroup called purines. (Two of the four bases in DNA are purines -- adenine and guanine.) Hitchings reasoned that since bacteria, tumors, and certain parasites need large amounts of nucleic acid to reproduce, you could interrupt their life cycles by interfering with the nucleic acid. With that goal, he gave his researchers freedom to pursue the problem.

Elion created hundreds of purine compounds and investigated how they worked. Within two years, she was publishing papers on her findings. The breakthrough year was 1950. She created a purine chemical that disrupted the formation of leukemia cells. It was tested on animals successfully and then on humans. It brought about complete remission, but patients all eventually relapsed and died.

Elion was now riveted by cancer chemotherapy. She found that by minutely altering one of the compounds, it stopped tumor growth in mice. This was 6-mercaptopurine, or 6-MP for short. It was rapidly approved for use in childhood leukemia. Again it caused remission, but did not cure the disease. Eventually doctors would learn to use 6-MP in combination with other drugs and reach a cure rate of about 80 percent.

Meanwhile, in 1958, other researchers had found that 6-MP could also interfere with the immune system. That was a good thing when it came to organ transplants. Elion and Hitchings gave one of these researchers a chemical that they had synthesized -- a close relative of 6-MP that was later called azathioprine (trade name Imuran). When the British researcher told them the results were "not uninteresting," Hitchings was delighted. He knew that, "translated from the British, he had a very exciting result." Imuran worked in organ transplants with dogs. By 1961, kidney transplants on humans were attempted, and soon, with the help of Imuran, patients were surviving.

Looking further into the purine chemicals, and refining those she had made, Elion also developed drugs to treat gout and a few South American parasitic diseases. After Hitchings' retirement in 1967, Elion became head of the Department of Experimental Therapy, and turned back to an idea from 20 years before: a drug to treat viral infection. People thought it couldn't be done, but in the early 1970s Elion's team developed acyclovir (trade name Zovirax), effective against herpes, shingles, and Epstein-Barr virus. Elion retired in 1983 and within a year her former unit used her methods to develop AZT, the first drug licensed in the United States to treat HIV. In 1988 Elion, Hitchings, and Sir James Black of London received the Nobel Prize in physiology/medicine. The Nobel committee said of the recipients, "While drug development had earlier mainly been built on chemical modification of natural products, they introduced a more rational approach based on the understanding of basic biochemical and physiological processes."

## **2. Wordwall** vocabulary words to teach and add to the Word Wall.

---

<b>Protein:</b>	Any of a group of complex organic macromolecules that contain carbon, hydrogen, oxygen, nitrogen, and usually sulfur and are composed of one or more chains of amino acids. Proteins are fundamental components of all living cells and include many substances, such as enzymes, hormones, and antibodies, that are necessary for the proper functioning of an organism.
<b>Molecules:</b>	The smallest particle of a substance that retains the chemical and physical properties of the substance and is composed of two or more atoms; a group of like or different atoms held together by chemical forces
<b>Amino Acid:</b>	An organic compound containing an amino group (NH <sub>2</sub> ), a carboxylic acid group (COOH), and any of various side groups, especially any of the 20 compounds that have the basic formula NH <sub>2</sub> CHR <sub>1</sub> COOH, and that link together by peptide bonds to form proteins or that function as chemical messengers and as intermediates in metabolism

## READ

### 3. View

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Article:

Go to: [www.pbs.org](http://www.pbs.org)  
Search: Amino Acid Sequence  
Locate: The Brain Eater  
Read: As a class

Video:

Go to: [www.discoveryeducation.com](http://www.discoveryeducation.com) (Subscription Based Website)  
Search: Amino Acid Shapes/Properties  
Locate: Biologix: Gene Mutations and Viruses (approximate run time 29:00)  
Focus on segment 4  
Role of Genetic Code in the Synthesis of Proteins and Effects of Mutations in the Genetic Code (approximate run time 08:02)

## RESPOND

### 4. Visual Process.

---

Activity Name:

Give a brief description of the activity.

- Bullet specific steps that need to be used.

## EXPLORE

### 5. Activity

---

Explore more deeply with a visual or oral language activity.

DNA Workshop:

Go to: <http://www.pbs.org/wgbh/aso/tryit/dna/glossary.html>

Review the following:

- Glossary
- DNA Replication
- Protein Synthesis

Return to the first page of the activity

- Click on DNA Workshop Activity
  - Click on DNA Reproduction
  - Un-zip the DNA (Click help if needed)
  - Click on Protein Synthesis
  - Click un-zip DNA

**Bird Brains** (this activity will take one class period if you choose to add it to the lesson)

Go to: [www.pbs.org](http://www.pbs.org) or  
[http://www.pbs.org/wgbh/nova/teachers/activities/0304\\_01\\_nsn.html](http://www.pbs.org/wgbh/nova/teachers/activities/0304_01_nsn.html)

Search: Protein Structure

Locate: Nova Science Now; Bird Brains

### Activity Summary

Students will compare the sequence of amino acids in a gene shared between humans and six other organisms and infer evolutionary relationships among the species.

Character Education at the Markkula Center for Applied Ethics  
[www.scu.edu/character](http://www.scu.edu/character)

## 6. Discussion Ask discussion questions that engage at many levels

---

### Key Questions

- What does DNA do when it divides? Why?
- How did the research in 1950 alter treatments for Leukemia? Why is the ability to disrupt DNA important?
- In the case study, in background information, discusses procedures that were tested on dogs. Do you think it is moral and ethical to try medical procedures and testing on animals prior to humans? What are the benefits? What are the negatives? Would you want a procedure done on you that was not tested first? Explain your answers.
- What would be considered a desirable genetic mutation? Why?
- What is the shape of an amino acid important? What does it do?
- How can a gene mutation affect you?

### EXTEND

## 7. Write, Draw or Speak.

---

### Science Journal:

Take time to locate information on Animal Testing.

<http://www.pbs.org/wnet/religionandethics/episodes/august-15-2008/animal-testing-ethics/18/>

<http://www.aboutmyplanet.com/science-technology/animal-testing/>

Based on what you know and what you have learned do you think that animal testing is ethical? Are there certain things or items that should be tested and others banned?

Explain your answer in paragraph form. What are alternatives to animal testing? (list at least 3)

- Create a collage depicting products that are tested on animals.
- Cluster items that should be allowed to be tested on animals together (if you agree with that)
- Cluster items that should not be tested on animals together.



**8. Close** Close by extending today's lesson to what you can do in your life and the world.

---

Students should complete the chart below based on their learning from the day. They should fill in the chart with one change and one habit per day.

- *Change I can make = decreasing bad habits and bad choices;*
- *Habit I can build = Increasing healthy habits and choices*

<i>Change I can make</i>	
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- Summarize the video, article, or passage in the space below. Use your own words.

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