

# EMS Lesson 6: Genetic Mistakes

## (Post-Exhibit Visit)

### Objective:

By the end of the lesson, students will have a general understanding of the characteristics of various genetic disorders, whether they can be cured or treated, and how they are diagnosed.

### Curriculum Link:

After students have studied heredity from a cellular perspective, with depth of study having been determined by student abilities, this lesson relates genetic structure to physical manifestations of various disabilities.

### Exhibit Link:

#### *Understanding What It All Means; Genetic Testing; Mutation: A Recipe Change By Chance*

This part of the exhibit explains what happens when the DNA is not copied correctly during cell division. Mutations make us unique but can also cause genetic disorders and certain diseases.

### Time Required:

**Teacher Preparation:** 20 minutes    **Class Time:** Two to three 30-45 minute classes

### Materials Needed:

- Teacher and/or student resources on genetic disorders.
- 12x18-inch white construction paper, pencils, rulers for middle-schoolers to make a chart OR
- The following chart, including enough room to include answers, one for each elementary student

Genetic Disorder	Cause	Characteristics	Difficulties	Cure	Treatment
Cystic Fibrosis					
Sickle-cell Disease					
Hemophilia					
Down Syndrome					

### Lesson Steps/Activity:

1. According to student ability, review the genetic process of how traits are passed from parents to children. Explain that sometimes mistakes occur in the process, causing mutations or changes in the expected outcome. Discuss mutations and genetic disorders with the class. Pose questions to the class such as: What do you think a genetic disorder is? What are some genetic disorders you have heard about? What experience, if any, have you had with someone who has one of these disorders?
2. Ask students if they know the difference between a cure and a treatment. Work toward definitions of the two terms. Ask how genetic diseases are different from the flu or chicken pox.
3. Divide the class into pairs, and assign the following disorders so that several pairs will work independently on the same one:

- 1) Cystic Fibrosis
- 2) Sickle-cell Disease
- 3) Hemophilia
- 4) Down's Syndrome

None of these can be "cured" since even gene therapy would result in person who still has mutated gene in gamete. Watch difference between therapy (even gene therapy) and cure.

4. Have student groups use the comparative chart and the following questions to prepare a report and present it to the class:
  - A. What causes the disorder?
  - B. What are the characteristics of the disorder?

- C. What difficulties might a person with this disorder experience? Are there any situations where a person with this disorder may have an advantage over one who does not? (SC—heterozygote has resistance to malaria)
  - D. Can this disorder be cured?
  - E. What kind of medical treatment is available for a person with this disorder?
  - F. How is this disorder diagnosed?
  - G. How do you think this disorder could be effectively treated?
  - H. How would you draw a diagram or use a Punnett square that illustrates the mutation that causes this disorder?
5. Have a follow-up class discussion, comparing findings of the different groups.

### **Extensions & Modifications:**

Elementary:

- Assemble resource reading in classroom for students to browse in prior to this lesson.
- Omit questions F-H.

Middle:

- Guide students in a computer lab session to research the topics on the Internet using [http://www.accessexcellence.org/AB/IWT/Gene\\_Therapy\\_Overview.html](http://www.accessexcellence.org/AB/IWT/Gene_Therapy_Overview.html), and WebMD Web sites. <http://www.yourgenesyourhealth.org/ygyh/mason/ygyh.html?syndrome=hemo> [http://www.pbs.org/wgbh/evolution/library/01/2/1\\_012\\_02.html](http://www.pbs.org/wgbh/evolution/library/01/2/1_012_02.html)
- Give students a 12x18-inch piece of construction paper to make a chart using the key words from questions A through F as headings on columns (cause, characteristics, etc).
- Have students respond to questions G and H on the back of the chart.
- Have students look up hemophilia in relation to the royal families of Europe. Pose the question: Do you think this disease had any effect on history in Europe?

Important terms: genetic disorder, mutation, treatment, cure

Additional Middle School terms: DNA, amniocentesis, karyotype

### **Writing Prompts/Discussion Questions:**

1. Describe how you might know if one of your friends had cystic fibrosis.
2. If you had a friend whom you knew had hemophilia, how might it affect the kinds of activities you did together?
3. Do you think you should adjust your behavior around someone who has Down's syndrome? If so, how? Should you adjust your behavior around someone with cystic fibrosis?
4. Why do you think many people feel there will be a cure soon for some genetic disorders?

### **Additional Resources:**

Human Genetics, A Resource for Teachers

<http://www.usoe.k12.ut.us/curr/science/core/bio/genetics/home%20page.htm>

This site provides basic information on many genetic disorders.

### **National Standards Addressed:**

K-4 Content Standard C – Life Cycles of Organisms

- Many characteristics of an organism are inherited from the parents of the organism, but other characteristics result from an individual's interactions with the environment. Inherited characteristics include the color of flowers and the number of limbs of an animal. Other features, such as the ability to ride a bicycle, are learned through interactions with the environment and cannot be passed on to the next generation.

5-8 Content Standard C – The Molecular Basis of Heredity

- Every organism requires a set of instructions for specifying its traits. Heredity is the passage of these instructions from one generation to another.
- Hereditary information is contained in genes, located in the chromosomes of each cell. Each gene carries a single unit of information. An inherited trait of an individual can be determined by one or by many genes, and a single gene can influence more than one trait. A human cell contains many thousands of different genes.