

ProQuest Standards-Based Learning Activity

GENETIC DISORDERS PAMPHLET—Teacher Guide

APPROPRIATE FOR: Science, Grades 9-12

TIMELINE: Two or three class periods

GEORGIA SCIENCE STANDARDS ADDRESSED THROUGH THIS LESSON

SB2. Students will analyze how biological traits are passed on to successive generations.

- a. Distinguish between DNA and RNA.
- b. Explain the role of DNA in storing and transmitting cellular information.
- c. Using Mendel's laws, explain the role of meiosis in reproductive variability.
- d. Describe the relationships between changes in DNA and potential appearance of new traits including
 - Alterations during replication.
 - Insertions
 - Deletions
 - Substitutions
 - Mutagenic factors that can alter DNA.
 - High energy radiation (x-rays and ultraviolet)
 - Chemical
- e. Compare the advantages of sexual reproduction and asexual reproduction in different situations.
- f. Examine the use of DNA technology in forensics, medicine, and agriculture.

LEARNING EXPECTATION/OBJECTIVES

- Students will solidify a general understanding of genetic disorders.
- Students will investigate a genetic disorder using SIRS Knowledge Source
- Students will design an informative pamphlet on a genetic disorder.

MATERIALS

- Paper
- Coloring pencils
- Example pamphlets taken from a health center, local hospital, or other source
- Computer with printer
- Printer paper

Description of Activity

Students will research a genetic or chromosomal disorder using SIRS Knowledge Source. Then, in groups of 3-4, they will design and ultimately construct an informative pamphlet regarding the disease that they have been researching.

Background Information/Scenario

Recent discoveries about the human genome have opened doors to understanding genetic disorders and their potential cures. Cystic Fibrosis, Fragile X-Syndrome, Huntington's Disease, and Sickle Cell Anemia are all genetic disorders that have received intense medical attention over the past two decades. In the beginning, the exact causes of these diseases baffled doctors. Luckily, we can now link the symptoms of these genetic disorders to specific patterns in the human genome. Treatments have been greatly improved, and possible cures are on the horizon.

Outline of Procedures -- DAY 1

Introduction:

Prior to beginning this project, hand out to the class a number of different informative brochures. (While health brochures are obviously preferable, brochures of almost any topic can still provide an effective demonstration of the concept.) Instruct your students to review each brochure, making note of factors such as: (a) intended use, (b) intended audience, (c) informational organization, (d) design layout, etc. Have students suggest what they like and dislike about each of the brochures; students should be pushed to justify their preferences in terms of a larger framework for the "ideal brochure" which is presumably described in terms of the factors listed above. It might help to directly probe various factors, e.g., "Does this brochure use or misuse pictures as part of its design layout?" or, "Is there too little or too much information for the intended audience?"

Student Prerequisites:

Prior to beginning this activity, students should have received an introduction to molecular biology and have an understanding of basic genetics. Ideally, students will also understand the connection between DNA and proteins and the role of proteins in the body. If students need to be refreshed on these topics, SIRS Knowledge Source provides a number of excellent introductions and summaries on these topics. Alternatively, students can be brought up-to-speed by tackling a topic in genetics that is relatively new to them but which builds on their existing knowledge. (This last tactic is not discussed further here; some suggested topics include Protein Synthesis and DNA Translation.)

GROUP PROJECT:

At the instructor's discretion, student groups will either be assigned a specific genetic disorder or else will be allowed to pick one on their own. (Suggested topics are listed following this introduction.) In groups of 3-4, your students will research six essential questions regarding the genetic disorder they are researching using SIRS Knowledge Source. The essential questions are:

- 1) What is the disorder?
- 2) What causes it?
- 3) How is it inherited?
- 4) How is it diagnosed?
- 5) What are its symptoms?
- 6) What are current and past treatments?

Ideally, each student can research one specific aspect of his or her group's selected genetic disorder. If there aren't enough computers, the available computers can be used to find and print specific articles for group members to read. Alternatively, the teacher may want to print out appropriate articles from SIRS Knowledge Source in advance of the class period for distribution.

Encourage students to divide the project up so that some members focus on research while other group members focus on pamphlet design. It might be worth mentioning that such divisions of labor were probably in place at the organizations that made the sample brochures. Note that all students should be involved with the research at first; however each should approach the research from the perspective of their role, e.g., the graphic designer might be especially interested in finding images. When searching, the following SIRS Knowledge Source tips may prove helpful:

Here are some sample starting points for finding articles regarding Cystic Fibrosis, Huntington's Disease, Fragile X-syndrome, and Hemophilia using the following SIRS Knowledge Source resources:

1. Type "Genetic Disorders" in the Subject Heading Search box
2. The following subjects will be listed for more specific searching

3. Behavior disorders in children, Genetic aspects
 - Eating disorders, Genetic aspects
 - Genetic disorders
 - Genetic disorders in children
 - Genetic disorders, Treatment

If there are enough computers so groups don't have to hurry, encourage students to browse through several different articles for ideas before printing any of them. It not only saves paper, but also builds perspective and thus helps the pitfall of flashy but time-consuming false leads. Students should print diagrams, charts, quotes or whatever they believe will prove helpful in making their brochures.

Outline of Procedures -- Days Two & Three

1. Initial planning of the pamphlet begins, including rough penciled sketches. Each pamphlet should consist of a single piece of paper, either folded in half or in thirds. Students are encouraged to provide information on all sides.

2. Students should print or copy any diagrams, figures, or quotes that can be used for each project and explore layout possibilities.

3. Each group should come up with a peer review process so that any item intended for the final brochure is edited, revised and ultimately approved. Trying to be constructive is, of course, critical. Students are encouraged to review the initial questions, and whether each section of the pamphlet is relevant to the previous section.

Suggestion: Try running the first feedback session as a demo where a group volunteers to act as guinea pigs. While the group members will playact their selected roles, they will not discuss their own work or research; instead they will dissect and constructively critique one of the sample brochures brought in by the instructor.

4. Finally, each group will implement their design, incorporating all edits and group suggestions as best possible. Again, make sure the sample pamphlets are available throughout.

Warning: Students tend to put too much information into their pamphlets. Encourage students to be brief and concise. Remind them of the factors they brainstormed when initially discussing the sample brochures. Set aside time for students to quiz each other on how these initial factors are upheld in their brochures.

Conclusion/Finished Work

The teacher should collect and make copies of each group's brochure. Each group should present their brochure to the group, justifying some of their more difficult production decisions. Finally, a discussion of how the researched genetic disorders differ (or are similar) is recommended to help generalize each group's specific knowledge to the larger context of genetic disorders.

ASSESSMENT

Research

Students will be evaluated based these criteria:

- Did students use SIRS Knowledge Source effectively to collect information, quotes, diagrams, and figures about their genetic disorder?
- Did each group organize information based on the six essential questions?
- Did the group collaborate effectively, with each student taking responsibility for one portion of the research?

Pamphlet design

Students will be evaluated based largely on the factors that they themselves brainstormed the first day. In addition, the following are recommended criteria:

- Does the pamphlet address a specific audience?
- Does the pamphlet suggest a genetic basis for the disease?
- Does the pamphlet provide resources for more information?
- Does the pamphlet suggest symptoms that are recognizable for the disease?
- Does the pamphlet suggest treatments for the disease?
- Did the group collaborate effectively, with each student taking responsibility for one portion of the pamphlet production?

OPTIONAL EXTENDED ENRICHMENT ACTIVITIES

SIRS Knowledge Source provides **Leading Issues** which is an opportunity to follow up research on genetic diseases with a mini-debate on controversial issues that relate to genetic diseases:

- Abortion
- Genetic Engineering
- Stem Cells
- Health Care Reform

SIRS has created unique models that correlate mini-debates with the format of Leading Issues to provide teachers and students with support for extending these enriching and engaging learning activities.

1. Click the Educators' Resources link at the top of the Search page
2. Scroll down and click the following links to open and print the guides
3. Guide to Creating a Debate Outline - Student
4. Guide to Creating a Debate Outline - Teacher

GENETIC DISORDERS PAMPHLET—Student Version

Background:

Advanced techniques in DNA Science have allowed researchers to discover the genetic basis for many inherited disorders. Cystic Fibrosis, Fragile X-Syndrome, Huntington's Disease and Sickle Cell Anemia are all genetic disorders that have been the focus of medical research for the past couple of decades. Until recently, however, our understanding of the genetic basis for each disease was nonexistent -- even for medical professionals. Thankfully, today one can link the genetic basis to the symptoms of each of these genetic disorders. Treatments have been modified with the new data, and possible cures are on the horizon.

Task:

In groups of 3-4, you will be asked to develop an informative brochure for one specific genetic disorder. Imagine that this brochure will be used one day by patients to learn more about their genetic disorder. Sample brochures are available for ideas on content and layout. As a class, you will discuss the pros and cons of these sample brochures. Ultimately, it is the group's responsibility to determine what information is necessary. However, below is a list of potential questions that one might want to know about a specific genetic disorder.

- What is it?
- What causes it?
- How is it inherited?
- How is it diagnosed?
- What are its symptoms?
- How is it treated?

Procedure:

1. To make your group's efforts more productive, you'll want to discuss your interests and divide up the work. Begin by assigning the above questions for the research. Each member of the group should be responsible for thoroughly and accurately answering at least one of the above questions.

2. Use SIRS Knowledge Source to research the answers to your questions and gather resources to use in your pamphlet. To search in SIRS Knowledge Source:

- You will start at the main search screen; if you are not on the main search screen, click *Search* at the top of the page
- Type in the specific genetic disorder your group is studying.
- Decide on the media types you would like to include in your search and select/deselect as necessary.
- Press *Search*.

Be sure to note any charts, illustrations and quotes that accentuate one specific aspect of your topic. Also, it is highly suggested that you try to take notes in your own words from the start; your brochure must be primarily in your own words and it's much easier to use your own words gradually rather than waiting until the end of the project.

3. Pamphlet Content

Consider some of the following questions as you work together to create your pamphlet.

- Based on the class review of sample pamphlets, what did you like about some of the pamphlets more than others?
- Are you going to use a question-based outline or break your information into independent sections in some other way?
- Does the pamphlet address a specific audience?
- Does the pamphlet suggest a genetic basis for the disease?
- Does the pamphlet provide resources for more information?
- Does the pamphlet suggest symptoms that are recognizable for the disease?
- Does the pamphlet suggest treatments for the disease?