

Teacher Guide: Stem Cells in the Spotlight Web Quest

ACTIVITY OVERVIEW

Abstract:

Students navigate the *Stem Cells in the Spotlight* module to complete a web quest to learn about stem cells.

Module:

Stem Cells in the Spotlight

Prior Knowledge Needed:

None

Key Concepts:

Stem cells; stem cell therapies; cell differentiation

Materials:

Computers with Internet access, student handouts

Appropriate For:

Ages: 12 - 18

USA grades: 7 - 12

Prep Time:

15 minutes

Class Time:

30 minutes

Activity Overview Web Address:

<http://gslc.genetics.utah.edu/teachers/tindex/overview.cfm?id=stemcellsquest>

Other activities in the *Stem Cells in the Spotlight* module can be found at:
<http://gslc.genetics.utah.edu/teachers/tindex/>

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TABLE OF CONTENTS

	<u>Page</u>
Pedagogy	1
A. Learning Objectives	
B. Teaching Strategies	
Additional Resources	1
A. Activity Resources	
Materials	2
A. Detailed Materials List	
Standards	2-4
A. U.S. National Science Education Standards	
B. AAAS Benchmarks for Science Literacy	
C. Utah Secondary Science Core Curriculum	
Teacher References	5-6
A. Web Quest - Answer Key	
Student Pages	
• Web Quest	S-1 – S-2

Teacher Guide: Stem Cells in the Spotlight Web Quest

I. PEDAGOGY

A. Learning Objectives

- Students will learn about the different types of stem cells.
- Students will learn that cells differentiate.
- Students will learn about stem cell therapies and their associated risks and challenges.

B. Teaching Strategies

1. Timeline

- 2-3 weeks before activity:
 - Reserve a computer lab with Internet access
- 1 day before activity:
 - Make copies of the student pages (S-1 –S-2), one for each student
- Day of activity:
 - Take students to the computer lab and pass out student handouts for them to complete

2. Classroom Implementation

- Hand out the *Stem Cells in the Spotlight* webquest (student pages S-1 – S-2)
- Bring your class to the computer lab and have them log on to:
<http://gslc.genetics.utah.edu/> and click on the *Stem Cells in the Spotlight* module.
- Instruct your students to use this module to answer the questions on the *Stem Cells in the Spotlight* (pages S-1– S-2) web quest.

3. Assessment Suggestions

- Use the completed web quest as an assessment.

4. Extensions

- See Additional Resources for more activities covering stem cells.

II. ADDITIONAL RESOURCES

A. Activity Resources linked from the online Activity Overview at:

<http://gslc.genetics.utah.edu/teachers/tindex/overview.cfm?id=stemcellsquest>

- Website: Classroom Activities Index: *Stem Cells in the Spotlight* - Online and Print-and-Go™ activities covering stem cells, stem cell therapies, and bioethics.

Teacher Guide: Stem Cells in the Spotlight Web Quest

III. MATERIALS

A. Detailed Materials List

- Computers with Internet access
- Student handouts (S-1 – S-2)

IV. STANDARDS

A. U.S. National Science Education Standards

Grades 5-8:

- Content Standard C: Life Science - Structure and Function in Living Systems; specialized cells perform specialized functions in multicellular organisms.
- Content Standard F: Science in Personal and Social Perspectives - Science and Technology in Society; social needs, attitudes and values influence the direction of technological development.

Grades 9-12:

- Content Standard C: Life Science - The Cell; cells have particular structures that underlie their functions.
- Content Standard C: Life Science - The Cell; cells can differentiate, and complex, multicellular organisms are formed as a highly organized arrangement of differentiated cells. In the development of these multicellular organisms, the progeny from a single cell form an embryo in which the cells multiply and differentiate to form the many specialized cells, tissues and organs that comprise the final organism. This differentiation is regulated through the expression of different genes.
- Content Standard F: Science in Personal and Social Perspectives - Science and Technology on Local, National, and Global Challenges; science and technology are essential social enterprises, but alone they can only indicate what can happen, not what should happen. The latter involves human decisions about the use of knowledge.
- Content Standard F: Science in Personal and Social Perspectives - Science and Technology in Local, National, and Global Challenges; progress in science and technology can be affected by social issues and challenges.

B. AAAS Benchmarks for Science Literacy

Grades 6-8:

- The Nature of Technology: Issues in Technology - societies influence what aspects of technology are developed and how these are used. People control technology (as well as science) and are responsible for its effects.

Teacher Guide: Stem Cells in the Spotlight Web Quest

- The Living Environment: Cells - all living things are composed of cells, from just one to many millions, whose details usually are visible only through a microscope. Different body tissues and organs are made up of different kinds of cells.

Grades 9-12:

- The Nature of Technology: Issues in Technology - social and economic forces strongly influence which technologies will be developed and used. Which will prevail is affected by many factors, such as personal values, consumer acceptance, patent laws, the availability of risk capital, the federal budget, local and national regulations, media attention, economic competition, and tax incentives.
- The Living Environment: Heredity - the many body cells in an individual can be very different from one another, even though they are all descended from a single cell and thus have essentially identical genetic instructions. Different parts of the instructions are used in different types of cells, influenced by the cell's environment and past history.
- The Human Organism: Human Development - the development and use of technologies to maintain, prolong, sustain, or terminate life raise social, moral, ethical, and legal issues.
- The Designed World: Health Technology - biotechnology has contributed to health improvement in many ways, but its cost and application have led to a variety of controversial social and ethical issues.
- The Designed World: Health Technology - knowledge of genetics is opening whole new fields of health care. In diagnosis, mapping of genetic instructions in cells makes it possible to detect defective genes that may lead to poor health. In treatment, substances from genetically engineered organisms may reduce the cost and side effects of replacing missing body chemicals.

C. Utah Secondary Science Core Curriculum

Intended Learning Outcomes for Ninth to Twelfth Grade Science

Students will:

5. Demonstrate Awareness of Social and Historical Aspects of Science
 - a. Cite examples of how science affects human life.
6. Demonstrate Understanding of the Nature of Science
 - i. Understand that science and technology may raise ethical issues for which science, by itself, does not provide solutions.

Teacher Guide: Stem Cells in the Spotlight Web Quest

Biology (9-12)

STANDARD IV: Students will understand that genetic information coded in DNA is passed from parents to offspring by sexual and asexual reproduction. The basic structure of DNA is the same in all living things. Changes in DNA may alter genetic expression.

Objective 3: Explain how the structure and replication of DNA are essential to heredity and protein synthesis.

- Research, report, and debate genetic technologies that may improve the quality of life (e.g., genetic engineering, cloning, gene splicing).

V. CREDITS

Activity created by:

Molly Malone, Genetic Science Learning Center

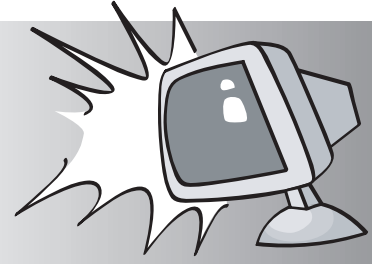
Pete Anderson, Genetic Science Learning Center (illustrations)

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Stem Cells in the Spotlight- Answer Key



Log on to: <http://gslc.genetics.utah.edu/units/stemcells> and explore this module to find the answers to the questions below.

1. What is a stem cell?

A stem cell is a cell whose job in the body has not yet been determined.

2. What does it mean to differentiate?

To differentiate is to gradually change into a specific cell type.

3. A stem cell differentiates by making new _____.

Lipids

Carbohydrates

Proteins

4. Drag Stem Cell Guy into the Differentiation Booth and dial #5 for Skeletal Muscle Cell. What is the scientific name of the cell type Stem Cell Guy will become?

Myoblast

5. Return to the Differentiation Booth and choose another type of cell. Create a quiz question from the information given. Write the cell type you chose, the question, and its answer below.

Answers will vary

6. Fill out the table below

	Definition	Example cell type
Totipotent	<i>can become any type of cell</i>	<i>embryonic</i>
Pluripotent	<i>can become almost any type of cell</i>	<i>blastocyst embryonic, fetal</i>
Multipotent	<i>can become a limited range of cells</i>	<i>umbilical cord, adult</i>

7. What is the primary goal of stem cell research?

To repair damaged tissue that can't heal itself.

8. Examine the steps in “What is the Recipe for Success?”

What type of cells were researchers hoping to replace in patients with Parkinson’s disease?

Dopamine neurons

What type of cells did researchers use and what made them a good choice?

Fetal stem cells were used because they are pluripotent and the natural source for dopamine neurons.

Why is tissue typing necessary in stem cell therapies?

Transplanted stem cells can trigger an immune response in recipients.

How did surgeons deliver the stem cells to Parkinson’s patients?

Surgeons drilled small holes in the skull and used a needle to inject stem cells into the holes.

9. What types of stem cell therapies are in use today?

Bone marrow transplants, peripheral blood cell transplants, and umbilical cord blood stem cell transplants.

10. How might therapeutic cloning aid stem cell therapies in the future?

Embryonic stem cells can be created by cloning. This approach minimizes the risk of transplant rejection.

11. What are some potential sources of embryonic stem cells for use in research and stem cell treatments?

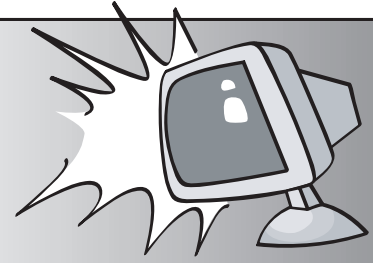
Embryos created as part of in vitro fertilization procedures, and cloned embryos.

12. “What Do You Think?” Vote in the online survey. How do your opinions compare to those of others?

Answers will vary.



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Multipotent		

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