Name: Kendra Huff  
Lesson Title: Stem Cell Study  
SSI Topic: Stem Cells  
Lesson Length (class periods): 2 blocks  
Grade Level(s): 10-12  

Appropriateness for Middle/High School Students  
Teaching strategies used:  
- Hands-on laboratory activity  
- Cooperative learning  
- 5 E’s  
- Differentiated instruction  
- Culturally responsive  

Background  
This lesson will cover introductory laboratory concepts of pipetting and following basic laboratory rules. It will also introduce stem cells, misconceptions associated with them, and how they are used in the laboratory and research setting. Stem cells differ from other kinds of cells in the body. When a stem cell divides by mitosis, each new cell has the potential to either remain a stem cell or become another type of cell with a more specialized function. All stem cells—regardless of their source—have three special properties: 1. Stem cells are unspecialized. 2. Stem cells are capable of dividing and self-renewing continually. 3. Stem cells differentiate into specialized cells.  

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Florida State Standards (NGSSS)  
List the Florida Sunshine State Standards (SSS) that directly applies to your objectives, as well as the NGSSS for relevant grade level(s) that you will connect the lesson content to.  

SC.912.N.1.1 Use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs), (Collect data or evidence in an organized way. Properly use instruments, equipment, and materials (e.g., scales, probeware, meter sticks, microscopes, computers) including set-up, calibration, technique, maintenance, and storage).  

SC.912.N.4.1 Explain how scientific knowledge and reasoning provide an empirically-based perspective to inform society's decision making.  

S.C. 912.L.16.14 Describe the cell cycle, including the process of mitosis. Explain the role of mitosis in the formation of new cells and its importance in maintaining chromosome number during asexual reproduction.  

Performance Objectives  
SWBAT:  
1. Follow laboratory rules and procedures using laboratory tools  
2. Distinguish between embryonic and adult stem cells  
3. Understand how stem cells are used in modern day research  
4. Discuss the ethical considerations involving stem cell research  

Adapted from UTeach
Materials List and Student Handouts
- 1 Stem Cell Locker per group
- 1-200 micro liter pipette per group
- 1 stem cell lab handout per student

5E Lesson Template
In the left column, list all activities you are planning. Also include information on how the class will be organized (grouping; individual work). The right column contains only probing questions you intend to ask of your students to guide their learning. For each phase, complete a brief (2-3 sentence) overview of what will occur in the space provided.

Consider the following during the Engage:
- Include an interesting attention grabber that focuses students’ interest and attention on the lesson content and activities.
- Introduce a guiding question that students should be able to answer at the end of the lesson.

Probing Questions:
- Elicit prior knowledge and students’ experiences.

| Engage | Overview: Students will participate in “Design by Plate”.

<table>
<thead>
<tr>
<th>Activities (Teacher or Student Actions)</th>
<th>Probing Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Students will pipette different volumes of colored water specified by the protocol into a 96 well plate to make a design.</td>
<td>• What would be the consequence of not removing the tip between the various colored solutions?</td>
</tr>
<tr>
<td>2. Teacher will circulate the classroom observing students’ proper lab skills and safety. Teacher will assist students and ask probing questions.</td>
<td>• What would happen if you set the micropipette with the incorrect amount stated in the protocol?</td>
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<tr>
<td></td>
<td>• (1/2 way through the design) Can you predict what the design will look like?</td>
</tr>
</tbody>
</table>

Consider the following during the Explore:
- Explain how your students will explore the concept(s), relating specifically to SSI-LPAI elements when appropriate, including students’ interests shared during the Engage.

Probing Questions:
- Design questions that guide student explorations, evaluate student understanding, and facilitate student interaction and group collaboration.
### EXPLORE

**Overview:** Students will complete simulation on stem cell lab using micropipettes.

<table>
<thead>
<tr>
<th>Activities (Teacher or Student Actions)</th>
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<tbody>
<tr>
<td>1. Students will complete stem cell lab according to the lab protocol.</td>
<td>• Discuss why a variety of colors were noted and what they may mean</td>
</tr>
<tr>
<td>2. Students will work in partners of two.</td>
<td>• Discuss the role of the growth factors in laboratory procedure</td>
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<tr>
<td>3. Students will read the lab protocols individually then discuss the difference between embryonic and adult stem cells.</td>
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**Consider the following during the Explain:**
- Have students share and explain the results of their investigation. Connect to relevant SSI-LPAI elements.
- Add additional content, including definitions, explanations, and new vocabulary in the context of concepts explored.

**Probing Questions:**
- Ask probing questions to deepen students’ conceptual understanding and skills of the concepts that the lesson is based upon.

### EXPLAIN

**Overview**
Students will participate in an interactive teacher guided power point lesson on stem cells

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<tr>
<td>1. Introduction of new vocabulary to include:</td>
<td>• Predict what differentiation might mean based on your background knowledge</td>
</tr>
<tr>
<td>Differentiation</td>
<td>• Predict what unspecialized might mean based on what it sounds like</td>
</tr>
<tr>
<td>Unspecialized</td>
<td>• What is the significance of unspecialized cells during the embryonic stage of development?</td>
</tr>
<tr>
<td>Self-Renew</td>
<td>• What would be the effect if all cells in our body were to be totipotent?</td>
</tr>
<tr>
<td>Embryonic stem cell</td>
<td></td>
</tr>
<tr>
<td>Adult Stem cell</td>
<td></td>
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<tr>
<td>Blastula</td>
<td></td>
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<tr>
<td>Growth Factors</td>
<td></td>
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<tr>
<td>2. Teacher will interact with students during power point presentation</td>
<td></td>
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</table>
Consider the following during the Elaborate:

- Opportunity to provide students with the chance to transfer and extend (apply) the concepts and skills they have just learned to their interests and new situations.

Probing Questions:

- Connect and apply the lesson to students’ interests outside the classroom.

### ELABORATE

**Overview**

Students will engage in a discussion about bioethics and the potential of stem cell research on society.

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| 1. Teachers will present a TED talk/power point describing current research being done on stem cells  
2. Split students into groups of 4 and give them a PRO/CON stance on embryonic stem cell research. Provide students with 30 minute research time to develop an argument in favor of their position. Students must write a letter defending their position and outlining their scientific research that supports their stance to send to congress about the benefits or detrimental effects of embryonic stem cell research. | • Explain why opponents of stem cells research think that scientists should NOT be allowed to do research using embryonic stem cells  
• Explain why supporters of stem cell research think that scientists SHOULD be allowed to do research using embryonic stem cells |

Consider the following during the Evaluate:

- Utilize the grading rubric you designed for the formative assessment tool (during session 4) to assess the students’ mastery of all benchmarks.

### EVALUATE

**Overview**

Students will complete a lab report on the stem cell lab

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<td>1. Students will complete an lab report in their interactive science notebook (ISN) for a grade</td>
<td>Students should combine all components of the lab and previous probing questions as part of their conclusion.</td>
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</tbody>
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