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Topic: Stem Cell Lab

Summary: Students will practice designing their own experiment. Students will experience pluripotent stem cells by watching a stem grow roots. Students should also recognize that plants grow by cell division.

Goals & Objectives: Students will be able to how many processes are involved for plants to grow. Students will be able to design a guided inquiry experiment.

NGSS Standards: *HS-LS1-4*. Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.
Common Core: RST 9.10.3, 9.10.7
Common Core: WST 9.10.1e, 9.10.2f, 9.10.7

Time Length: (3 to 4 weeks) 1 period to make the cutting and design the experiment. Half day to finish the lab report.

Procedures:
1. Place your plant into soil in a seedling starter tray. This will be the class's control group.
2. Students have to modify one variable. For example: use rooting hormone, change the type of plant, place in water in flask (not soil), cover plant with Tupperware (greenhouse).
3. Spray the cuttings daily with mist bottle to keep cuttings cool and moist. Many plants will die if lose too much water or start decomposing.
4. You can choose to have students take an initial root length, 0 mm, and a final average root length. You can also choose to have students pull out the plant to record the daily average root length. *If students do a daily measurement, there is a higher chance of the plant dying.*

Prerequisite Knowledge: Students should have already been introduced to the following concepts: cell division, cell differentiation, and the scientific method.

Materials:
- pots for soil
- light source
- soil
- rooting hormone
- metric ruler
- herbaceous plants (Coleus, Geranium)
- water and graduated cylinder
- 250 mL flasks or water bottles
- seedling start trays
- sharp scissor or scalpel with mat

Accommodations: Students with an IEP should work in a group with strong experimental design skills. Notes about the main concepts can be provided.

Editable DOCX File and Answer Key:
Available at www.ngsslifescience.com

Name: _____ Row: _____

Date:_____ Period:_____

Stem Cell Lab

Driving Question:
Do plants grow and repair itself in similar ways as animals do? Design an experiment to test to see if a plant can repair itself by growing new roots.

Materials:

- pots for soil
- light source
- soil
- rooting hormone
- metric ruler
- herbaceous plants (Coleus, Geranium)
- water and graduated cylinder
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Background:
Plant stem cells are undifferentiated cells located in the meristems of plant. Many herbaceous plants (not woody stem) and even many woody stemmed plants can be cloned if the cutting (a stem or a branch that is cut off) is put into the right conditions. This cutting will sprout roots and become a new plant that is an exact genetic clone of the plant the cutting was taken from. Use the following website as a guide to designing your experiment.
http://deepgreenpermaculture.com/diy-instructions/propagating-herbaceous-plants-from-cuttings/

Hypothesis:

_____

_____

Procedures: *use a numbered list of detailed procedures; lab must be reproducible*

_____

_____

_____

_____

_____

_____

_____

_____

_____

Variables:
Independent: _____ Dependent: _____

Constants: _____

Control Group: _____

Data Table: Record the number of roots per date measured. Include labels and units. Record average root length.

Analysis:

1. What process did the plant use to grow new roots? _____
2. What type of cells located in the stem / roots did the plant are used to grow new roots?

   _____
3. What process did the cells in question 2 use to become root cells? _____

Experimental Errors:

_____

_____

Conclusion:

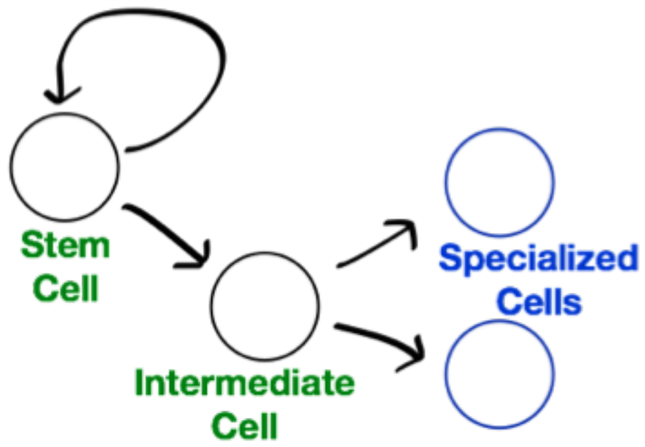
Do you confirm or reject your hypothesis? _____

What *evidence* supports why you confirmed or rejected your hypothesis?

_____

_____

Challenge Question:



4. Using stem cell diagram above, **make a prediction** on how rooting hormones cause cell differentiation.

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