

Name: _____

CELL DIFFERENTIATION

SUMMARY:

In this activity, students will explore how epigenetic signals cause the differentiation of stem cells into specialized cells. Students will simulate cell differentiation by using a model.

OBJECTIVE:

Introduce how epigenetics leads to specialized cells in a developing embryo.

BACKGROUND INFORMATION:

Every human begins as a single-celled zygote. So how do we become multi-cellular? If you examined the DNA inside every diploid cell, you find it to be identical. However, each cell expresses different genes. This is because of epigenetic signals. Upon division of the original zygote, different signals are given to each cell, which causes them to be sent on different fates. The original embryonic stem cells are totipotent, which means they can become any cell type. However, when epigenetic signals change gene expression in these cells, they become multi-potent, which means they can only become certain types of cells. Over time, as their fate is determined, these cells become highly specialized. In this activity, you will explore the ways in which a cell differentiates. All cells will start as stem cells but as they receive different signals, they will differentiate into different tissue types.

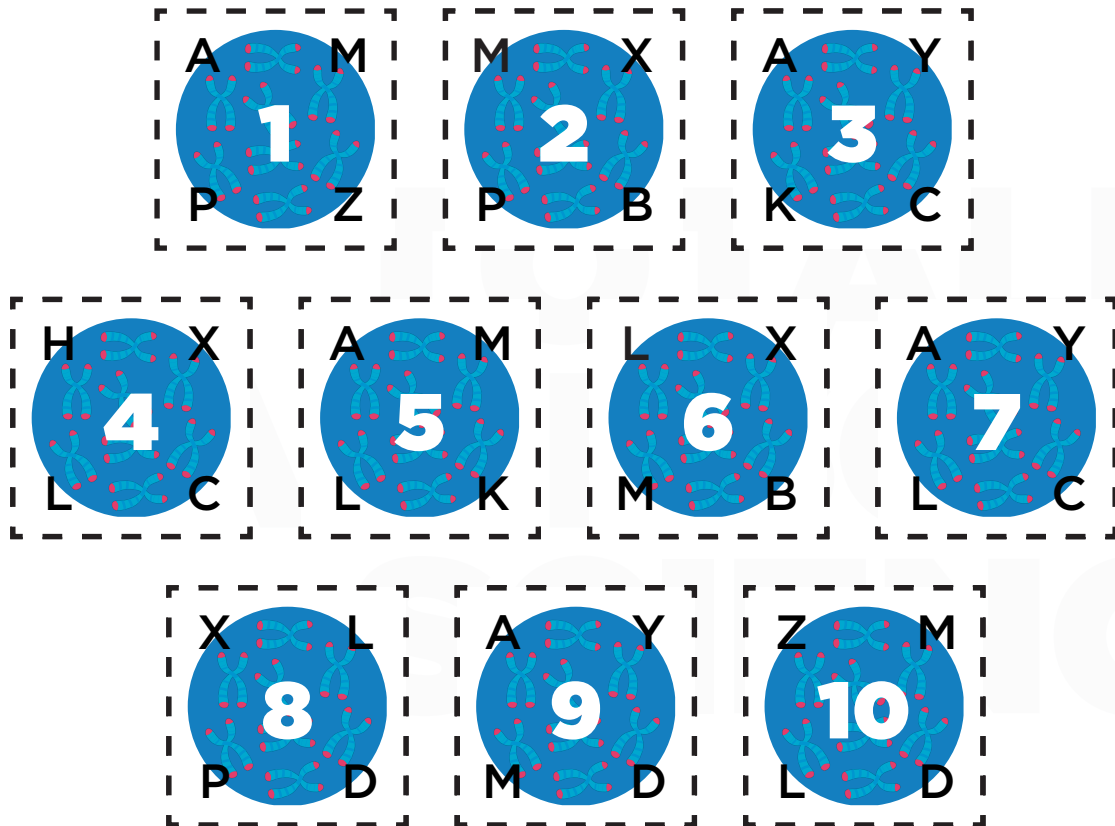
INTRODUCTION QUESTIONS:

1. What does it mean for a cell to be totipotent?

2. What causes embryonic stem cells to differentiate into specialized cells?

GAME DIRECTIONS:

1. Cut out the cell pieces below.
2. Line up each of the 10 cells along the embryonic stem cell line in the center of the activity board. The order does not matter.
3. Use the differentiation commands below to move the cells around the board.



DIFFERENTIATION COMMANDS:

1. If the cell has an A on it, move forward 1 space.
2. If the cell has a B on it, move backward 1 space.
3. If the cell has a C on it, move forward 1 space.
4. If the cell has a D on it, move forward 1 space.
5. If the cell has an X on it, move backward 1 space.
6. If the cell has a Y on it, move forward 1 space.
7. If the cell has a Z on it, move backward 1 space.
8. If the cell has an H on it, move forward 1 space.
9. If the cell has a P on it, move backward 1 space.

ECTODERM

MESODERM

STEM CELLS

START HERE

GERM CELLS

ENDODERM



FORWARD



BACKWARD

DISCUSSION:

After a zygote divides multiple times, it becomes a blastocyst. This bundle of cells begins to fold in order to form three layers. The endoderm cells become internal organs such as the liver, pancreas, and lungs. The mesoderm cells become tissues such as cartilage, muscles, blood cells, and bones. The ectoderm cells become skin cells, eye cells, and neurons. Some stem cells become germ cells, which are sperm or egg cells. Stem cells also replicate to make more stem cells, which help to replenish tissues throughout life.

RECORD THE OUTCOME:

Using the identification number on each cell, record which cells ended up in each layer. Each row can have more than one cell.

Ectoderm	
Mesoderm	
Stem Cells	
Germ Cells	
Endoderm Cells	

REFLECTION QUESTIONS:

1. What do the letters on the cell cards represent?
2. Do all the cells have the same DNA inside their nucleus? Explain your reasoning.
3. What can be said about the potency of the cells in the ectoderm layer versus the cells in the stem cell layer? Which ones have more potency?