CALIFORNIA INSTITUTE FOR REGENERATIVE MEDICINE

Teacher Version

Microenvironment Microarray Design Exercise

Introduction: Through close observation of the activity of different stem cells, it has been determined that the fate of a cell may depend partly on signals received from components of its surrounding microenvironment. The Microenvironment Microarray (MEArray) allows researchers to place different microenvironment protein components in unique combinations on a small chip. They can then observe how cells act in the different environments to determine which factors cause stem cells to behave a certain way.

Goal: To learn how a scientist would go about setting up a MEArray in a laboratory in order to study the effects different combinations of proteins in a microenvironment (ME) will have on the cell fate.

Directions:

For Beginners

Step 1: In groups, draw a block of 4-16 big circles (each representing a single combinatory ME) on a piece of butcher paper.

Step 2: Represent several real or imagined ME "factors" as small symbols in different combinations within each of the larger circles (see Fig 1).

Step 3: Draw and cut out different shapes of cells on a colored paper and paste them on top of the ME's. Each shape will indicate a fate choice after exposure to each unique microenvironment. For example, different combinations of factors can cause a mammary gland progenitor cell to differentiate into a luminal epithelial cell (produces milk) or a myoepithelial cell (contracts the mammary gland).

Advanced Students

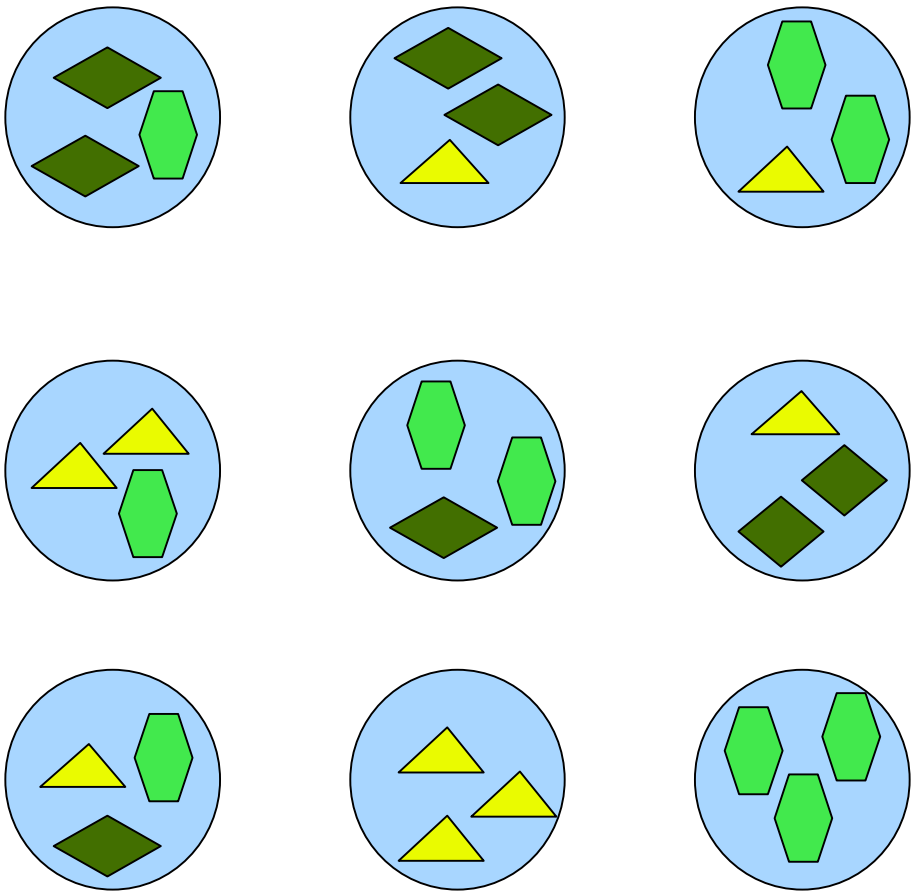
In groups, research a type of progenitor cell and set up a similar microenvironment experiment using factors you predict (or that have been shown to) influence fate decisions.

Hint: It helps to have a firm grasp of the properties of progenitor cells before you dive into researching a specific type.

Example research topics:

- neural progenitor cells
- muscle satellite cells
- pancreatic progenitor cells
- etc.

MEArray example (Fig 1):



= individual microenvironment

= protein that causes differentiation into myoepithelial cell

= protein that causes differentiation into luminal epithelial cell

= protein that causes proliferation of mammary gland progenitor cell

Note: Different combinations of the above proteins will determine the fate of the cell placed in each microenvironment.