Modeling Controlled and Uncontrolled Cell Growth

Overview: Students construct a population of clay or play dough spheres to represent cells. Students model developing healthy cell populations and the impacts of multiple changes in cell growth patterns using clay.

Developed by Madelene Loftin, The HudsonAlpha Institute for Biotechnology

Provide students/pairs of students with a sheet of wax paper and two colors of modeling clay or play dough. Direct students to make 10 small clay spheres approximately ½ in diameter of each color.
Instructions will refer to red and blue cells, but any two easily distinguishable colors can be used.

1. Create a single layer of clay spheres of blue cells. The sheet should be 4-6 cells across. Place a red cell in the center of the sheet. This will represent the target cell.
2. Prompt students to list, from prior knowledge, the factors that impact how often the spheres divide and make new cells. Prompt students to model healthy cell growth by 'reproducing' each cell in the sheet. (The sheet should double in size as each cell divides into 2 new cells)
3. Prompt students to model what would happen if one of the red cells lost Contact Inhibition. Have students repeat the process in step 1 with the red cell reproducing more rapidly than the surrounding blue cells. Student models should show a clump of red cells. Students may make additional cells of either color as needed.
4. Return to the original layout of cells; 4-6 cells across with a single red cell in the middle.
5. Cells have a set life span and undergo only a certain number of cell divisions before they cease dividing and die. This is called apoptosis. Simulate apoptosis by removing 1 of every 4 blue cells. In this round, the red cells will ignore apoptotic signals and continue dividing. Complete a round of cell division for all cells. Repeat apoptosis by removing 1 out of every 4 blue cells, but no red cells. Complete a round of division for all cells. How does the number of blue cells compare to the number of red cells? Student models should show an increase in the number of red cells when compared to blue cells.
6. Cells have a variety of mechanisms that control how rapidly they divide. For this round, the red cells will show unregulated growth and divide twice as fast as the blue cells. Prompt students to model this. Student models should show a clump of unregulated red cell growth when compared to the orderly blue cell growth. Remind students that this uncontrolled growth may cause spatial distortions as red cells take up more and more space. This simulates tumor formation.