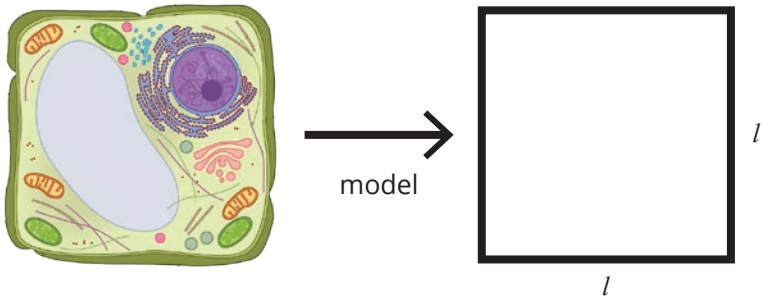
Chapter 5 Project

Small but Mighty

An activity to investigate the use of polynomials in biology.

In biology, we define a cell as the basic unit that contains the essential molecules of life and that all living things are composed of. In this activity, we will investigate why cells are usually very small.

Using a very simplified model, we can consider a cell as a small square. The sides of the square model the cell's membrane, which is the way the cell interacts with the environment, and the inside of the square models the cell's cytoplasm and nucleus, which are the parts that make the cell function.



1. What is the perimeter of a cell whose side length is equal to 10 μm (micrometers)?
2. What is the area of this same cell?
3. Compute the perimeter and the area for cells whose side lengths are 20 μm, 40 μm, and 80 μm. Summarize your findings in the table below

Side Length (μm)	Perimeter (μm)	Area (μm^2)
10		
20		
40		
80		

4. If a cell has a side length given by l, write a polynomial that represents its perimeter using the variable l. What is the degree of the polynomial you found?
5. If a cell has a side length given by l, write a polynomial that represents its area using the variable l. What is the degree of the polynomial you found?

We know that the ability of a cell to obtain its nutrients is proportional to its perimeter. That is, when a cell doubles the length of its side, it will be able to obtain twice as many nutrients. We also know that the amount of nutrients needed by a cell to function is proportional to its area. If a cell doubles in area, its need for nutrients also doubles.

6. Looking at the table you completed in Problem 3, determine how many times the need for nutrients increases every time the length of the side of the cell doubled.
7. Use your answer from Problem 6 to explain why there might be a limit to a cell's size. Explain why the need for nutrients grows much faster than the growth in the ability to obtain these nutrients.
8. Do a quick internet search and find out what the smallest and largest cells found in nature are. Does the answer surprise you? Why?