Intro to Biology
Disease and Immunity

Name_____
Period_____Date_____

Mega Multiples of Microbes Activity

Questions to Ponder:

- ✓ How are large numbers of microbe populations calculated?
- ✓ How long does it take for different microbes to multiply?
- ✓ Why is it important to determine growth rates of microbes?
- ✓ How can microbes be eliminated from surfaces even though they grow at rapid rates?
- ✓ What happens to older cells as the new cells continue to multiply?

Procedure:

1. Determine the number of grains of rice in a package of rice. Count the number of grains required to fill a tablespoon.

   _____ grains in 1 tablespoon

2. Using spoonfuls, determine the number of spoons of rice required to fill a small cup.

   _____ spoons in 1 cup

3. Now calculate the number of grains of rice in the cup.

   _____ grains of rice in a cup (multiply answer from #1 times answer from #2)

4. Finally, measure the rice from the package by filling and refilling the cup.

   Approximately how many grains of rice are in a package of rice? _____grains

   How many packages of rice would you need to have a million grains of rice?_____

   How many packages would you need for a billion grains of rice?_____

Now that you have calculated the grains of rice and can appreciate the value of a million or a billion grains of rice, you should be able to appreciate the numbers of microbes that may be present on your kitchen countertop, in your intestines, etc. Remember that microbes are microscopic organisms and include viruses, bacteria, and fungi and each of these organisms reproduce in various ways.

Concepts to Consider:

Microbes divide, forming new cells. That is, 1 cell forms 2 cells in a certain period of time that often is called a generation. Then the 2 cells divided, forming a total of 4 cells. These 4 cells can all divide, forming a total of 8 cells. Thus, in each generation the number of cells in the microbial population doubles.

Data Collection:

Now determine how many cells are formed from a single cell in 20 generations. Do this by beginning with 1 cell and doubling it (multiply 1 by 2). This is the first generation. Then the number 2 is multiplied by 2 for the number of cells at the second generation. This number is multiplied by 2 to determine the number for the 3rd generation, and so on to the 20th generation. Use your calculators or mental math to determine the values for each generation and record below:

Data Table:

Generation	# of cells
1 (1x2)	2
2 (2x2)	4
3 (4x2)	8
4 (8x2)	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	

_____ total number of cells in the 20th generation

Compare your numbers with those obtained by two other groups. Correct any mistakes in your data table above.

Data Display/Analysis:

Construct a graph on a separate sheet of graph paper for each value in the chart above.
Be sure to title your graph and label both the x and y axes.

What would happen if you were to calculate the number of individuals produced after 40 generations rather than 20?

How would you graph this information to keep it on a single page?

Could you make a graph to include time if you know a single generation takes one-half hour or some other time period to reproduce? How would you label your axes?

What conditions might affect the number of individuals in microbial populations?

From the information you have on this scenario, develop a **hypothesis** that could be tested in an experiment that gathers quantitative data. Be able to explain your hypothesis.

For example:

Organism A has a generation time of 20 minutes. Organism B has a generation time of 30 minutes. At the starting time, 100 individuals of Organism A and 400 individuals of Organism B are placed in optimum conditions and begin to reproduce. Can you determine when, or if, both populations will ever be the same size?

Your hypothesis:

Conclusions:

What Did You Find out By Doing This Activity?

Mega Multiples of Microbes Activity

As an introduction, the poem "Sarah Cynthia Sylvia Stout Would Not Take the Garbage Out" by Shel Silverstien may be used to generate discussions about garbage and microbe growth.

(from Where The Sidewalk Ends, Harper Collins Publishers)