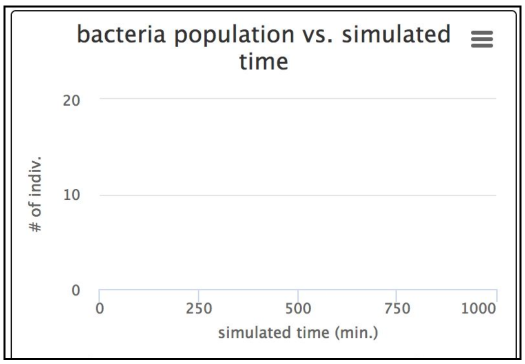
Name: ______________________________________________ Period: ________ Date: _________

# Lesson 6: How does a bacteria population grow in a simulated environment?

## Investigation 1: How does the size of a bacterial population change over time?

**Predict.** If four individual bacteria were introduced into a Petri dish, and no antibiotics were introduced, make a prediction showing what you think would happen to the total number of bacteria in that patient over time in the space below.




Sketch a graph showing your prediction to the left. Describe why this would this happen below.

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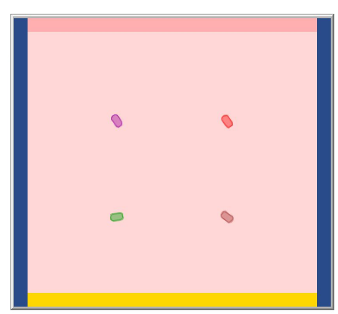
**Procedure for Investigation 1**: In this next investigation, you will start the model with different numbers bacteria. To start with you will start with 4 total bacteria, each one will be a different color. But each bacteria will reproduce at the same rate.

1. Go to [http://infection.inquiry-hub.net](http://infection.inquiry-hub.net)
2. Set these sliders all to 1.


3. Press the ***SETUP/RESET*** button to initialize the model.


4. Then press ***GO/PAUSE*** button to run the model.


5. Use your mouse cursor to drag and drop the bacteria to equally space them out. The image to the right shows how to distribute the bacteria ------->



*These materials were developed with funding through a grant from the Gordon and Betty Moore Foundation to Northwestern University and the University of Colorado Boulder.*

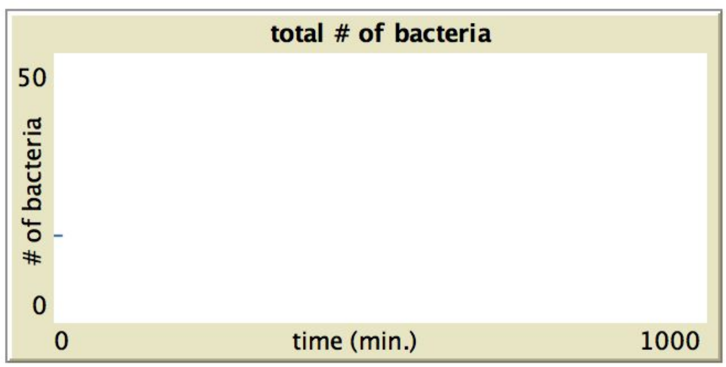
6. Next, click the checkmark box in the ***REPRODUCE?*** switch to turn it on:


7. The size of the population will start growing. When the population stops growing, press the ***GO/PAUSE*** button to pause the model.


8. Sketch the shape of the graph for each of the variations of bacteria in the space for the graph below.

9. Record the size of the population at the end of the simulation and the number of each variation of bacteria in the simulation at this point in the table below. Calculate the percentage of bacteria with each type of variation that are in the population as well.

**Observations**




| Variation | At the start of the simulation | | At the end of the simulation | |
|---|---|---|---|---|
| Color visualization for this variation | # of bacteria | The % of the population that is made up of this variation | # of bacteria | The % of the population that is made up of this variation |
| purple | 1 | 25% | | |
| green | 1 | 25% | | |
| brown | 1 | 25% | | |
| red | 1 | 25% | | |
| Total bacteria | 4 | 100% | | |

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## Making Sense

**Q1.** What caused the graph of total number of bacteria to end up having the shape it did?

**Q2.** How did your results compare to other group members?

**Q3.** What do you think caused the proportion of the bacteria with each variation to remain relatively stable (close to 25% of the population)?

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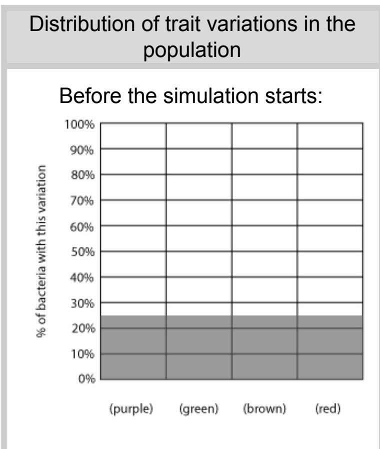
## Investigation 2: How Does the Initial Placement of Bacteria in a Petri Dish Affect Their Growth?

**Predict Q4.** You observed bacteria reproduce (divide) in the simulation, forming two separate new bacteria from one old bacteria.

If a green bacterium, how many new cells will it form? _____________
What will the color of each new cell be? ____________________

The graph below shows the distribution of trait variations in the population to start with (1 out of 4 bacteria of each variation




**Q5.** If you ran the simulation again, but let each one of these four bacteria start in random location, how do you think the proportion of each of these variations of bacteria at the end of the simulation will compare. Will they each remain close to 25%? Why?

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### Procedure for Investigation 2

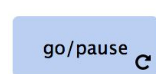
10. Set all of these sliders to 1.


11. Press the ***SETUP/RESET*** button to initialize the model.


12. Then press ***GO/PAUSE*** button to run the model.


13. Turn the REPRODUCE? switch on:


14. The size of the population will start growing. When the population stops growing, press the GO/PAUSE button to pause the model.




15. Record the size of the population at the end of the simulation and the number of each variation of bacteria in the simulation at this point in the table on the next page. Calculate the percentage of bacteria with each type of variation that are in the population as well.

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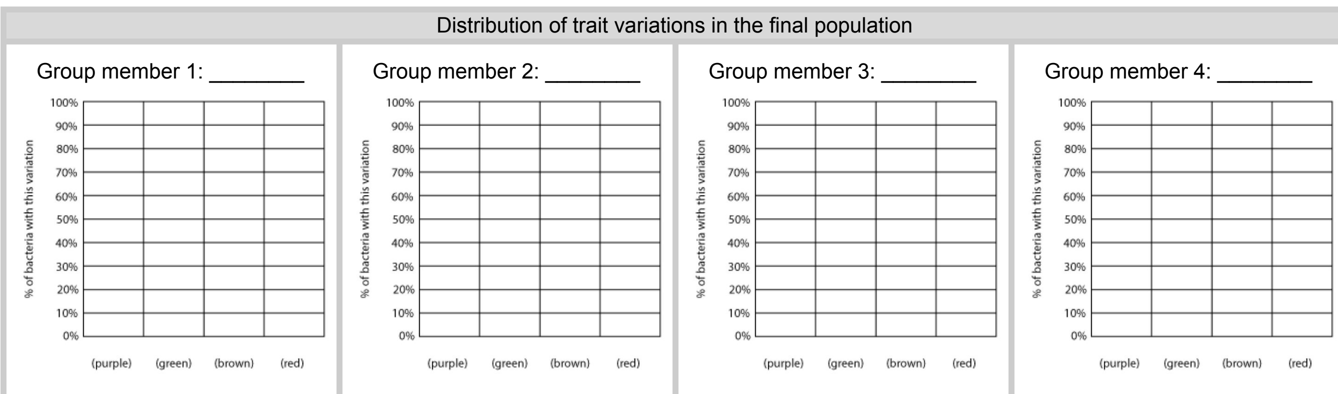
## Observations

| Variation | At the start of the simulation | | At the end of the simulation | |
|---|---|---|---|---|
| Color visualization for this variation | # of bacteria | the % of the population that is made up of this variation | # of bacteria | the % of the population that is made up of this variation |
| purple | 1 | 25% | | |
| green | 1 | 25% | | |
| brown | 1 | 25% | | |
| red | 1 | 25% | | |
| Total bacteria | 4 | 100% | | |

## Making Sense

**Q6.** How did your results compare to other group members? Fill in the four bar graphs below to representing the results of each of your group members.




**Q7.** Why is there more variation in the distribution of trait variations in the final populations between your group members than there was in the first investigation?

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## Conclusions

**Q8.** In the simulation:

- Every bacteria reproduces at the same rate if it has unoccupied space next to it.
- If there is more than one space next to a bacteria available, then the space it reproduces will be randomly selected.
- Bacteria only reproduce bacteria that have identical variations in pores/color as the parent cell that they descended from.

What did your class decide is causing some variations of bacteria to outcompete other variations of bacteria from one simulation run to the next?

## Connections

**Q9.** Would you expect the bacteria that are growing in the petri dishes in your classroom to follow a similar pattern of growth? Explain.

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