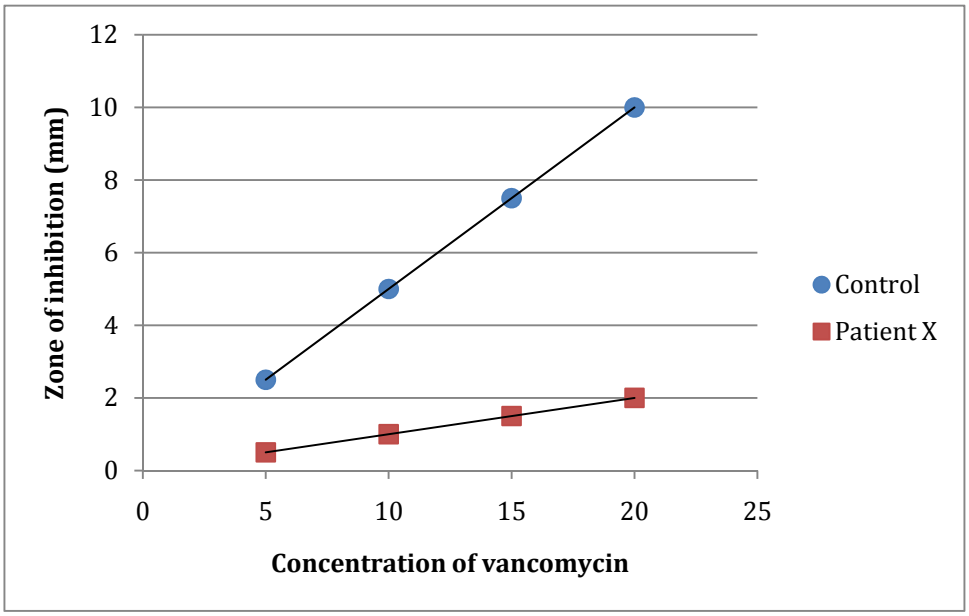
MiSP Evolution / Bacterial Resistance Assessment L3

Name _____ Date _____

EVOLUTION BY NATURAL SELECTION / BACTERIAL RESISTANCE

At a large urban hospital, a number of patients developed staph (*Staphylococcus aureus*) infections. The bacteria were found to be resistant to vancomycin, the antibiotic of choice for this particular bacterial infection. A microbiologist who was investigating the extent of this resistance decided to test the response to vancomycin in bacteria from cultures isolated from infected patients and in control bacteria from her research stocks. The microbiologist used the disk-diffusion method in her experiment. The bacteria were spread on plates, and disks soaked in vancomycin ranging in concentration from 5 to 20 micrograms vancomycin/milliliter were placed in the center of the plates. The zone of inhibition was measured in mm. The graph from one comparison is shown below.



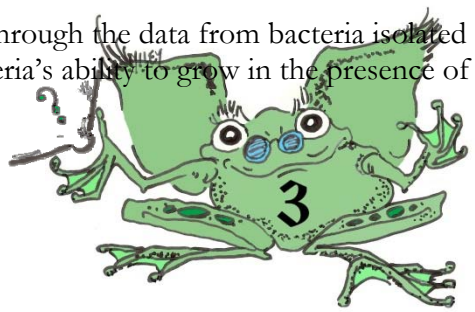
1. Explain and interpret the data represented by the graph. Compare the data from the control bacteria and the bacteria isolated from patient X.

_____

_____

_____

2. The line through the control data is steeper than the line through the data from bacteria isolated from patient X. What does this mean in terms of the bacteria's ability to grow in the presence of vancomycin?



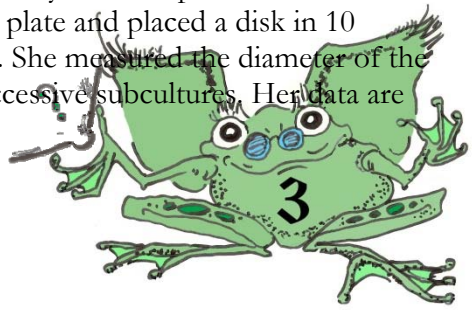
3. Draw a line on the graph that would represent the response of bacteria that were less resistant to vancomycin than the bacteria isolated from patient X, but more resistant than the control bacteria.

4. What is the unit rate of change in the zone of inhibition for the control? Show the formula for the unit rate of change, your substitutions, and the answer.

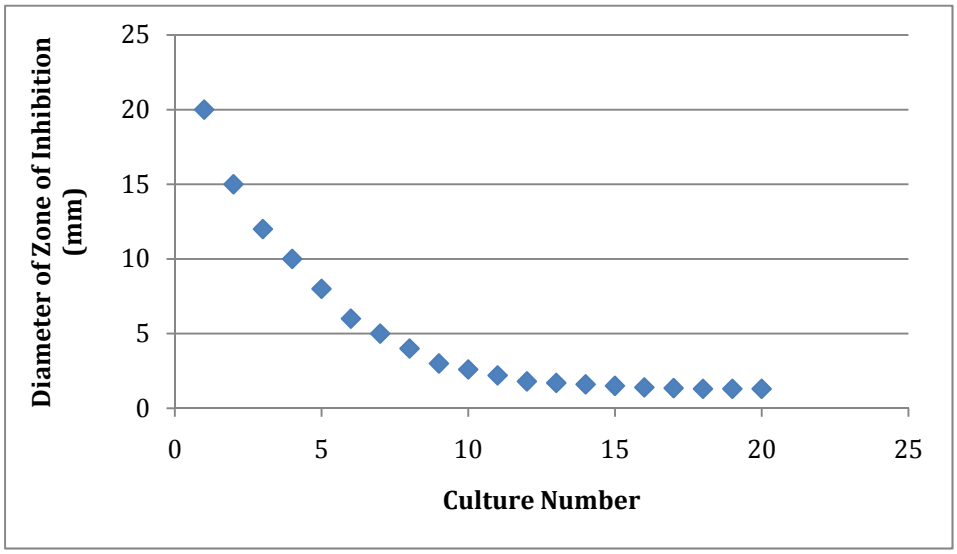
5. Write an equation for the line representing the response of the control bacteria. You will first need to determine the *y*-intercept.

6. Use your equation to determine the concentration of vancomycin at which there will be no zone of inhibition. Show your work.

The microbiologist noticed isolated colonies at the margin of the zone of inhibition in the control plate. She wondered how quickly the control bacteria would become resistant if they were repeatedly exposed to a moderate (10 micrograms/milliliter) dose of vancomycin. She spread the bacteria from a colony at the margin of the zone of inhibition on a new agar plate and placed a disk in 10 micrograms per milliliter vancomycin in the center of the dish. She measured the diameter of the zone of inhibition and then repeated this procedure for 20 successive subcultures. Her data are



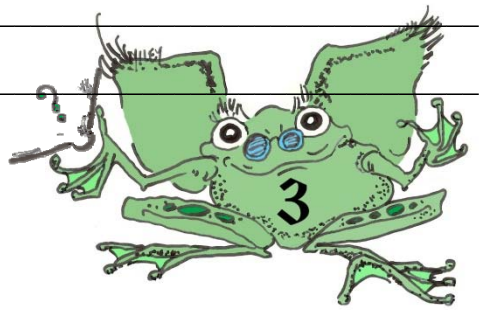
graphed below.



7. Why were some bacteria able to grow in the margin of the zone of inhibition of culture 1?

8. The bacteria's sensitivity to vancomycin changes with successive cultures. Between which set of five cultures (0-5, 5-10, 10-15, 15-20) does the bacteria's sensitivity to vancomycin change the most?

9. What causes the sensitivity to vancomycin to change over time?



10. On the basis of the graph, will the bacteria ever have a zone of inhibition = 0 mm? Explain your answer.

_____

_____

_____