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**Survivorship Lab**

Within a population, some individuals die very young while others live into old age. To a large extent, the *pattern* of survivorship is species-dependent. Generally, three patterns of survivorship have been identified. These three have been summarized by *survivorship curves,* graphs that indicate the pattern of mortality (death) in a population.

Humans in highly-developed countries with good health-care services are characterized by a Type I curve, where there is high survivorship until some age, then high mortality. The insurance industry has generated information to determine "risk groups.” The premiums they charge are based upon the risk group to which an individual belongs.

While survivorship curves for humans are relatively easy to generate, information about other species is more difficult to determine. It can be quite a trick to simply determine the age of an individual plant or animal, not to mention watching an entire population over a period of years. However, the principle of determining survivorship can be demonstrated in the laboratory using nonliving objects.

In this exercise, we will study the populations of soap bubbles, using them as models of real populations to construct survivorship curves. We will subject these populations to different kinds of stress to determine the effects upon survivorship curves.

**Materials**

* bubbles
* stopwatch
* rulers
* calculator
* graph paper - logarithmic
* and arithmetic scale

**Procedure:**

**Soap Bubble Survivorship**

Work in groups of four for this experiment. One person will blow bubbles, a second member will serve as the timer, a third observes survivorship, and the fourth records data in your data tables. Three different populations of soap bubbles will be formed based upon actions of group member:

***Population 1***- once the bubble leaves the wand, group members wave, blow, or fan in an effort to keep the bubble in the air and prevent it from breaking (“dying”).

***Population 2***- group members do nothing to interfere with the bubbles or keep them in the air.

***Population 3* -** this group requires a line one meter from the bubble blower. The group member blowing the bubbles tries to blow the bubbles through the opening in the frame. Bubbles that don’t cross the line “die” at 1 second. Bubbles that cross the line are timed until they pop/die. Group members cannot do anything to influence the bubbles survival.

Fill out the three data tables, one for each population

1. Practice blowing bubbles for a few minutes until they can be generated with the single end of the wand.
2. Once the bubble is free of the wand, the timer should start the watch. When the bubble bursts, the timer should note the time and puts a check mark next to the appropriate “age at death” in the data table for the appropriate population.
3. Obtain data on 50 bubbles.
4. Repeat the entire procedure above for each of the three soap bubble populations, making the modifications necessary that are described earlier.

PUT DATA INTO EXCEL: Download the “survivorship. xls” spreadsheet from the syllabus page. Then summarize your data as follows: USE EXCEL!!

1. Count the number of checks at each age. Record the number in the column headed “Total Number Dying at This Age” on the Excel spreadsheet.
2. Determine and record the surviving at each age by inserting a formula into the column Titled “Total Number Surviving at this age.”

3. Calculate the percentage surviving at each age by using the formula:

**Percentage surviving to this age = (number surviving)/(50) x 100%**

**To do this:** insert the formula “=C3/50 \* 100.”

Since at “birth” (moment the bubble left the wand) all bubbles were “alive”, 100% were alive at age 0.

Repeat formula in all cells in the column (as described above).

1. Repeat with 2nd and 3rd populations

**C. Plotting Survivorship Curves**

We plot survivorship curves on semi-log graphs because lx is a proportion: the proportion of the original cohort surviving to age x. The distance between points on a logarithmic axis reflects their proportional relationship, and so a logarithmic scale is appropriate. It is easier to see details for very small and very large values of y.

This kind of graph also makes clear important differences between the three types of survivorship curve. Note that on the linear graph, type II and type III curves have

qualitatively similar shapes, whereas on the semi-log graph they look quite different.

**Using excel,** plot the Plot the “Percentage Surviving” columns from your data tables on the grid for the three soap bubble populations. You will add a series for each and label each “population 1, 2, or 3,” accordingly.

After plotting the values using the traditional arithmetic plots, change to semi-log by clicking on the Y axis values (this puts a box around them) and then control-click and chose “format axis.” Select scale in the pop-up box and then check “logarithmic scale.”

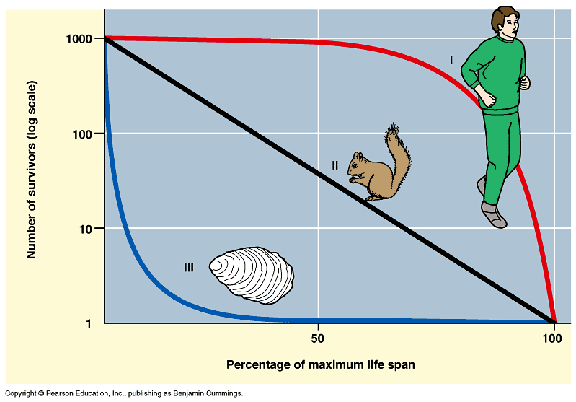
*You should notice that the plot lines change when you switch from arithmetic to semi-log grid.*

Using a semi-log grid, the spacing automatically takes into account the effect of a log on the graph and “calculates” the logarithm of the percentage surviving for you.

**D. Interpretation of the Survivorship Curves**

A straight line on the logarithmic plot indicates the death rate is constant. In the arithmetic plot it is easier to see that more individuals die at a young age than at older ages. In natural populations, three basic trends of survivorship affecting population size have been identified. These are represented in the table and semi-log graph below. NOTE- In analyzing a population survivorship trend, the semi-log plot must be used.

**Survivorship Curves**



I Low mortality early in life, most deaths occurring in a narrow time span at maturity

II Rate of mortality fairly constant at all ages

III High mortality early in life

**Questions**

1. Examine the survivorship curves for the three soap bubble populations. How do they correlate with the Type I, II, and III survivorship trends? Explain.
2. Do any of the bubble populations show constant death rate for at least part of their lifespan? If so, which?
3. How did the treatments that bubble populations 1, 2, and 3 were subjected to affect the shape of their curves?
4. Which type of survivorship curve describes a population of organisms that produces a very large number of offspring, most of which die at a very early age, only a few surviving to old age? Give an example of a population of this type.
5. What reproductive strategy (R or K) would you expect each population to have. Explain each of these strategies.
6. Would you expect a population in which most members survive for a long time to produce few or many offspring? Which would be most advantageous to the population as a whole? Explain.
7. Suppose a human population exhibits a Type III survival curve. What would you expect to happen to the curve over time if a dramatic improvement in medical technology takes place? Explain.
8. What would you expect to happen to a population where the birth rate is about equal to the death rate? Explain.
9. How many humans presently occupy our planet? [look it up]
10. Is our population increasing, decreasing, or remaining stable? Explain with evidence.

**MINI LAB REPORT for Bubble Lab:**

Title: Survivorship Lab, your name, date, bell, partners

Data: Put borders around each of the 3 tables, copy and paste into word doc. Be sure to title each table.

Data Analysis: Copy and paste the graph into word doc. Be sure to title each graph, label axes, and leave the legend with each population labeled.

Questions: Answer the lab questions in complete sentences.

Completed lab is due : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Soap Bubble Population Data Population #:**

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| Soap Bubble Population Data: Population One | | | | |
| Age at Death (seconds) | Tally each Bubble that Dies | Total Number Dying at this Age | Total Number Surviving at this Age | Percent Surviving to this Age |
| 0 |  |  |  |  |
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| Soap Bubble Population Data: Population Two | | | | |
| Age at Death (seconds) | Tally each Bubble that Dies | Total Number Dying at this Age | Total Number Surviving at this Age | Percent Surviving to this Age |
| 0 |  |  |  |  |
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| Soap Bubble Population Data: Population Three | | | | |
| Age at Death (seconds) | Tally each Bubble that Dies | Total Number Dying at this Age | Total Number Surviving at this Age | Percent Surviving to this Age |
| 0 |  |  |  |  |
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