BIOCHEMISTRY IS ELEMENTARY

Your Name:_____

PROJECT SITE:

PROJECT SUPPORT: Tsao family gift to Colorado State University, & the National Science Foundation

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BIOCHEMISTRY IS ELEMENTARY

CLASS

PROJECT: Hurrah for Histograms!

Part 1: Peeking at pennies

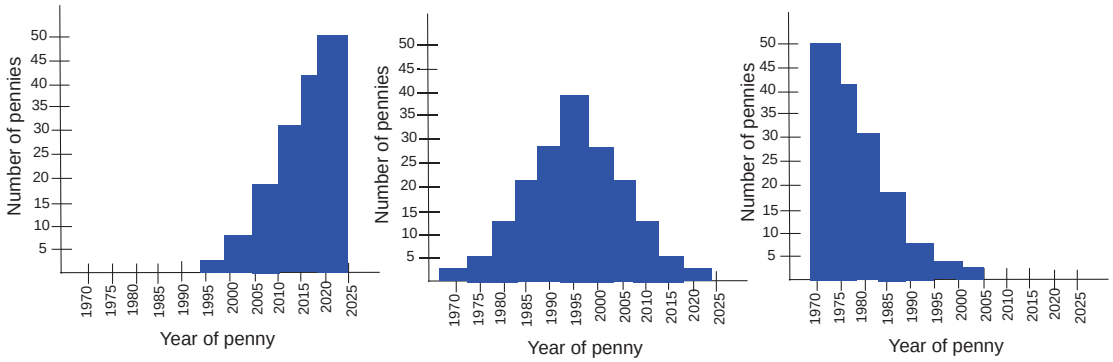
Experiment Materials and Equipment to be shared by a group of 4 students:

Please check off the following materials as you receive them.

_____ **10 pennies**
_____ **1 microscope**
_____ **1 garbage bag**
_____ **paper towels**
_____ **1 marker**
_____ **1 smart phone**

Objective: Use microscopes to report the year various pennies were made in and report the results in a histogram.

Hypothesis: What do you think the histogram will look like (circle one)?



Procedure for penny experiment:

1. First set up the microscope so you can visualize the pennies.
2. Use the microscope to determine the year each penny was made.
3. Use the graph (see below) to report the year the penny was made.
4. Report your results on the master histogram provided at front of the classroom.
5. Fill out the questions.

Number of pennies vs year of penny

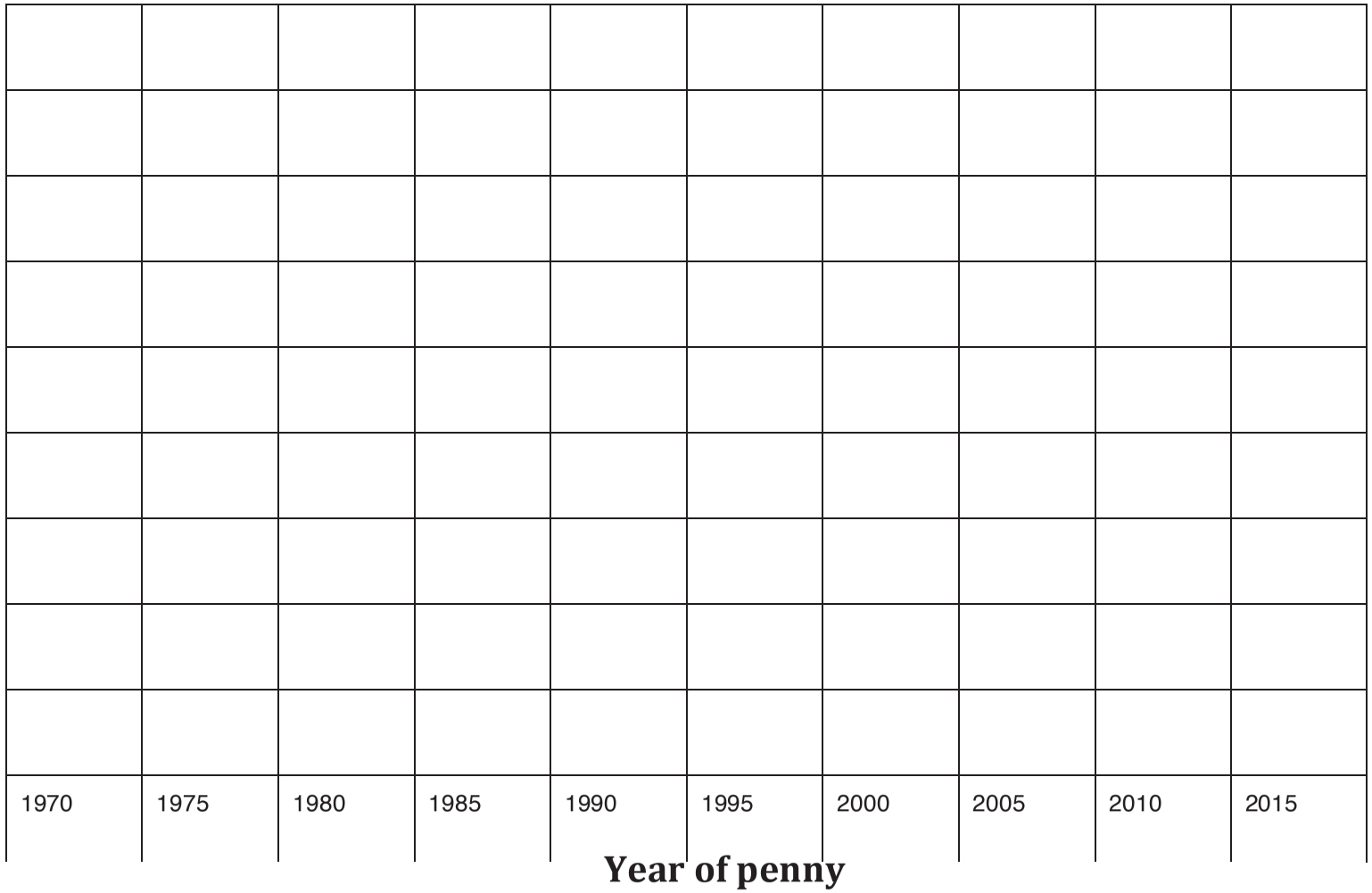
Group Reults:

Number of Pennies

1970	1975	1980	1985	1990	1995	2000	2005	2010	2015

Year of penny

Number of pennies vs year of penny



Class results:

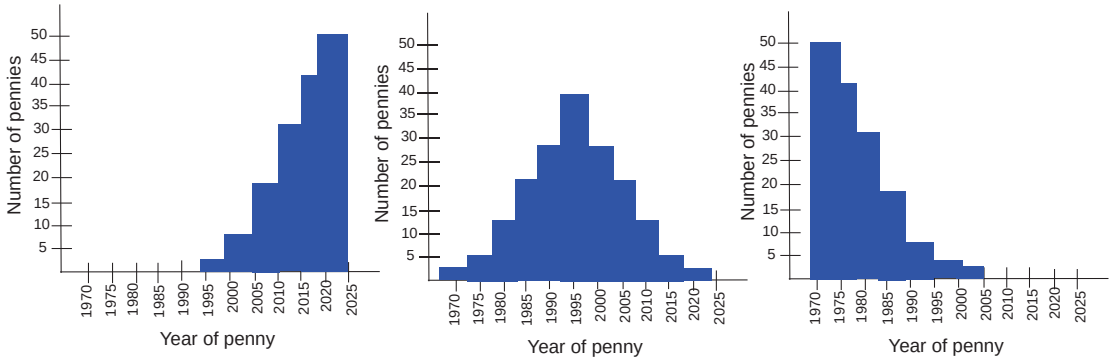
Results Table 1:

Number of students in your group: _____

Number of groups in your class:_____

Summary of the results from your penny experiment:

What did the classes histogram look like (circle one)?



Do your results support your hypothesis? (circle one)

Yes No

Did you enjoy performing this scientific experiment? (circle one)

Not sure Yes No

Did you learn something about humans during this scientific experiment? (circle one)

Not sure Yes No

PART 2: Sleepy or speedy?

Today's Project:

What does caffeine do to the body? What does alcohol do to the body? Do worms move faster or slower with caffeine? How about with alcohol?

Let's answer these questions!

In this part of today's project, we will give worms a dose of either caffeine, alcohol, or neither (which is called the negative control). Then, we will watch how the worms react. Worms swim in a pretty thrashing motion. With caffeine, will the worms swim **faster or slower**? With alcohol, will the worms swim **faster or slower**?

In Part 1, we used a **histogram** to look at the **trend** of years on pennies. If we just picked one penny out of a pile of pennies, and the year was 2016, how could we tell if that was normal? How could we tell if we could probably pick another penny from 2016 in the pile? We made a histogram to answer this question.

In Part 2, we will look at how **lots of worms** react to caffeine or alcohol. If you look at ten worms, and they all swim fast, what speed do you think your 11th worm will swim?

_____
_____

If you look at 10 worms, and they all swim slowly, what speed do you think your 11th worm will swim?

_____
_____

If you look at two worms, and one swims quickly and one swims slowly, what speed do you think the next worm will swim?

_____
_____

Is that a harder question to answer?

_____
_____

Would you rather test 2 worms, 10 worms, or 100 worms? Why?

_____
_____

Now, we will see how worms react to different stimuli.

A **stimulus** is something that stimulates the worm, or makes the worm have a reaction. There are many different types of stimuli. **Caffeine** and **alcohol** are both stimuli.

Can you think of a drink that has caffeine in it?

_____
_____

Can you think of a drink that has alcohol in it?

_____
_____

Think about how those drinks (or, the caffeine and alcohol in them) affect someone drinking them.

Giving a worm a stimulus can change how it swims. Some stimuli make worms swim faster, and some make worms swim slower. Do you think caffeine or alcohol will stimulate worms? Let's make a hypothesis about how quickly or slowly a worm will swim.

Hypothesis:
If caffeine is added, then the worms will…..

_____
_____

If alcohol is added, then the worm will….

_____
_____

Instead of looking at just one worm, we will look at many worms. Each student will look at one worm, and we will put all our results together into a **big histogram**.

Procedure:

1. One microscope at the front of the class will be projected for the whole class.
2. Have a grid on the bottom of the slide. Put suspended worms on the top of the slide. Image.
3. Give students different boxes. Ask them to pick one worm in the box.
4. The teacher will say “start” “stop” and time 30 seconds, while the students watch the worm movement.
5. Have students count the number of thrashes of the worm

QUESTIONS:

Is your worm an egg, baby, or adult?

How is your worm swimming?

How many thrashes did you count in 30 seconds?

How many thrashes per minute?

_____ x 2 = _____

(Thrashes in 30 seconds) (Thrashes in 1 minute)

6. Draw a graph on the smart board at the front of class. Have each student come up and put their worm on the histogram.
7. Have a volunteer dose the worms with caffeine (NEW slide of worms)
8. Repeat worm monitoring

QUESTIONS:

Is your worm an egg, baby, or adult?

How is your worm swimming?

How many thrashes did you count in 30 seconds?

How many thrashes per minute?

_____ x 2 = _____
(Thrashes in 30 seconds) (Thrashes in 1 minute)

9. Have a volunteer dose the worms with alcohol (NEW slide of worms)
10. Repeat worm monitoring

QUESTIONS:

Is your worm an **egg**, **baby**, or **adult**?

How is your worm swimming?

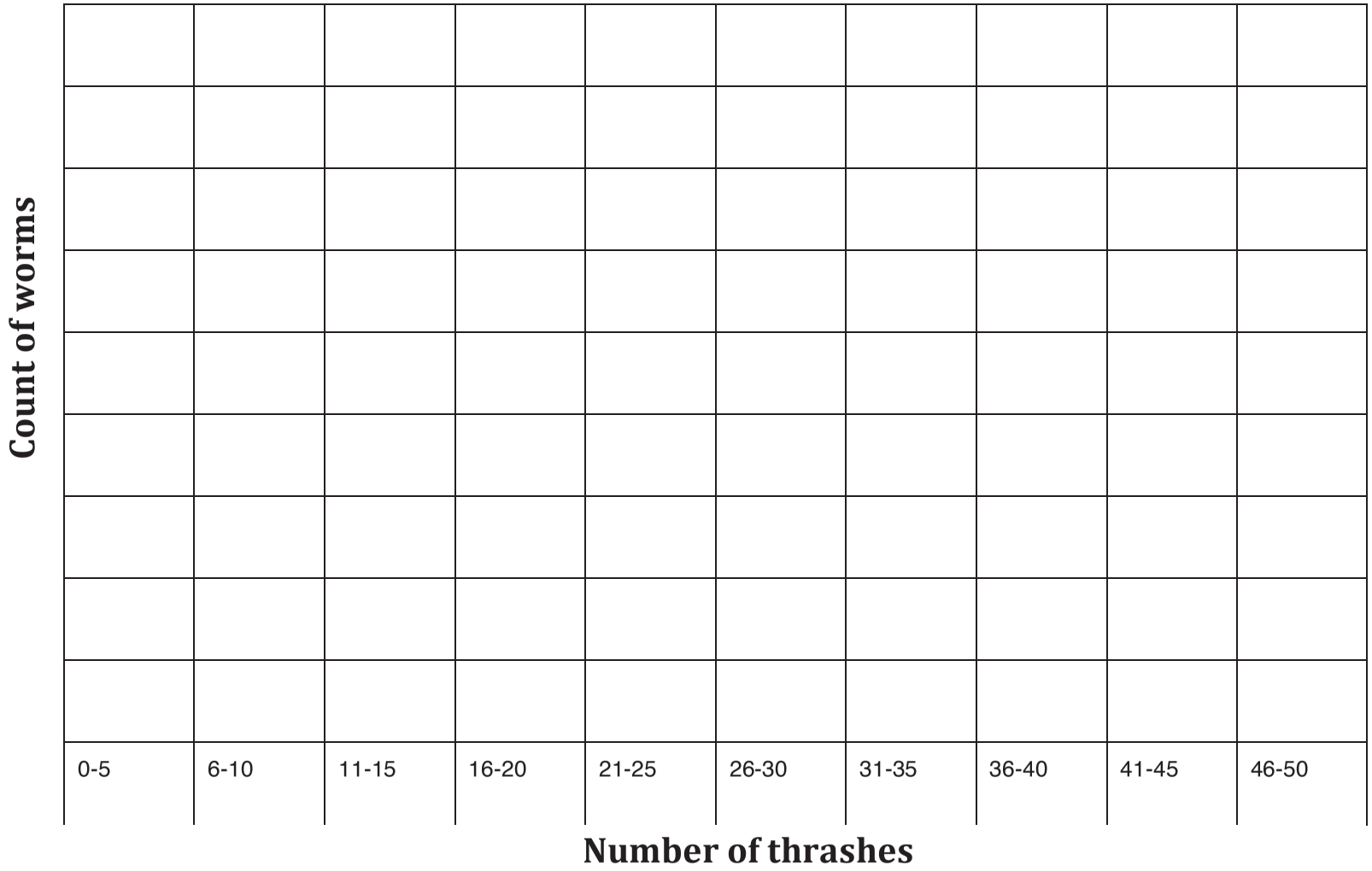
How many thrashes did you count in **30 seconds?**

How many **thrashes per minute**?

_____ x 2 = _____
(Thrashes in 30 seconds) (Thrashes in 1 minute)

Now that we have our numbers, let's make histograms.

Worm's movement in water



Summary of the results from your experiments with water, alcohol, and caffeine:

How do you think these results are similar to humans? How do you think they're different?

Did all the groups in your class get the same answer with their worms? (circle one)

Yes No

Do your results support your hypothesis? (circle one)

Yes No

Did you enjoy performing this scientific experiment? (circle one)

Not sure Yes No

Did you learn something about stimuli during this scientific experiment? (circle one)

Not sure Yes No

Checklist:
When undertaking a study using the scientific method, it is important to make sure you performed all the necessary steps.

The following is a checklist to help you do this.

Checklist item	Answers should be “yes”, if not go back and complete the steps.
1. Have you recorded the hypothesis you are testing?	
2. Have you worded the hypothesis so that it can be tested in your experiment?	
3. Did you make a list of the materials you used?	
4. Do you think another individual can repeat your experiment based on the experimental procedure?	
5. Did you collect your data using a table?	
6. Did you fill out 2 graphs for the Pennies experiment and 3 graphs for the Worm experiment?	
7. Were you consistent, careful and accurate when you made your observations?	
8. Did you summarize and evaluate your experimental procedure, making comments about its success?	
9. Did you record if your hypothesis was true or false?	

"Hurrah for Histograms!"
Instructor Guidelines

Introduction

Today, we're going to talk about information that you can collect from a scientific observation or experiment and how scientists organize that information so they read it.

How many of you have heard the word "data"? Can anyone tell me what data is? That's right, **data** is the information that we collect from an observation. Data can be **qualitative**. This means that the information we collect describes a characteristic or trait of the thing we're observing. One example would be to look at the height. Some people are short and some are tall. Short or tall is an example of qualitative data. Who can give me some more examples of qualitative data?

Data can also be **quantitative**. Quantitative data uses numbers to tell us something about our observation. For example, height can also be described using quantitative data. Some people are 4'5" and some are 5'11". Can anyone tell me another example of quantitative data?

Does anyone know some ways in which we can organize quantitative data? (Examples may include tables, bar charts, line graphs, etc). **Graphs** are an import tool that scientists use to look at their data visually. Why would we want to organize data into something that we can see? (This allows us to see patterns in the data that might tells us something about our observation). Today we're going to learn about a special kind of graph called a histogram.

When you count something, what do you normally count with? (Examples may include fingers, tally marks, etc). What if you need to count the number of objects in different groups? How would you do that? What would be an easy way to see which group had more objects?

When scientists want to compare the number of objects in different groups, they use what is called a histogram. The **histogram** can tell us how many objects are in each group, or the **frequency** with which we see certain objects. For example, we can make a histogram of ages in our classroom. How many of you are 9? 10? 11? (Draw a quick histogram on the board with the class values). Looking at this histogram, who can tell me which age group has the most people?

Now we're going to make our own histograms. Please break into groups of 4 (variable depending on class size). I will give each group a set of 10 pennies and I want you to take turns looking at the pennies. Look at the year of the penny. Color a box in the correct year range for each penny. What do you think the histogram will look like (options are provided in the workbook)? What is your

hypothesis? Do you think more pennies will have recent years on them like 2015 or 2016? Or will more be old such as 1970 or 1980? What would your hypothesized histogram look like?

Next, we will learn how to use a histogram with a real experiment. How many of you have had pop with caffeine? How does it make you feel? (Excited, energized, etc). We call this a reaction, and when something makes you react, we call that a **stimulus**. We have worms here that like to move around. If we give them caffeine, what do you think will happen to them? (speed up) We're going to look at the worms under the microscope as a class. Each student will pick one worm and count how many times the worm moves in 30 seconds. Then we will give the worms caffeine and count again. On the big histogram, we have number ranges here that represent how many times the worm moved. Color in a box for each worm that had that number thrashes. In blue, we will color boxes for the normal worms, and in red, we will color boxes for the caffeine worms. What do you think the chart will look like? What is your hypothesis?

Vocabulary
data
qualitative
quantitative
graph
histogram
frequency
stimulus