Lab 3, Biol-1, C. Briggs, revised Spring 2018

Name: _____
Lab day of week: _____

Experimental design

Objectives
Be able to identify dependent and independent variables in experimental designs.

Instructions
Imagine you ask the question, "Does amount of sleep affect test performance?"
Your experiment involves several groups of test subjects, each sleeping a different length of time. They all take the same test and their performance is measured.

Independent variable (what you have control over) = ?
Dependent variable (what you measure to detect any effect) = ?
What are some variables you would want to "control," or keep constant among your groups?

Some practice

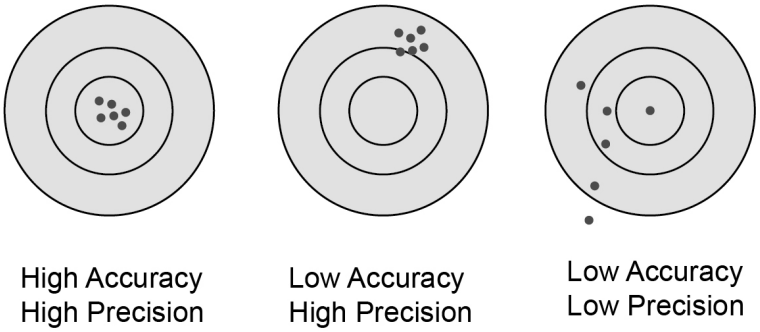
Question: Does salt consumption increase blood pressure?
Independent variable:
Dependent variable:
Other variables to control:

Question: Does sunlight exposure increase the risk of developing skin cancer?
Independent variable:
Dependent variable:
Other variables to control:

Measurements

Figure from online.science.psu.edu

Objectives
Learn to distinguish between precision and accuracy.
Get practice using the full capabilities of various measuring devices.



Instructions: Measure a length (ex: your height, tile width, etc.). Measure and record at least three times.

Metric system

Objectives
Learn metric prefixes.
Get comfortable converting between metric units.

Instructions
Please complete these tables, and solve the conversion problems that follow.

Unit	Abbreviation
Length	
Mass	
Volume	

		Power of 10	Prefix	Abbrev.	Length	Mass	Volume
1,000,000,000,000	one trillion	10^{12}		T			
1,000,000,000	one billion			G			
1,000,000	one million			M			
1,000	one thousand			k			
100	one hundred	10^2		h			
1	one.	10^0	---	---	m	g	L
1/100	one hundredth	$1/10^2 = 10^{-2}$		c			
1/1,000	one thousandth			m			
1/1,000,000	one millionth			µ			
1/1,000,000,000	one billionth			n			
1/1,000,000,000,000	one trillionth	$1/10^{12} = 10^{-12}$		p			

Conversion practice

8 km = ? m

17 m = ? mm

61 mm = ? cm

3.9 cm = ? mm

1 L = ? µL

10,000 mg = ? g

343 g = ? mg

0.05 kg = ? g

46 mm = ? m

Scientific notation and logarithms

Objectives
Get comfortable using scientific notation to work with very large and very small values.
Learn to use logarithms to work with large ranges of values.

Scientific Notation

Scientific notation uses “powers of 10” to simplify numbers containing lots of zeros.

1,000 = 10^3 = 10^3
100,000 = 10^5 = 10^5
0.001 = 10^-3 = 10^{-3}

2,000 = 2 x 10^3
0.005 = 5 x 10^-3

Practice
Try converting these out of scientific notation:

4 x 10^4

7 x 10^-5

Try converting these into scientific notation:

500,000,000

0.000008

Logarithms

Logarithms are used to work with large ranges of numbers.

$\log_{10} N = x$ means $10^x = N$ (Say, “Log base ten of N equals x.” “Ten to the x equals N.”)

For example, $\log_{10} 1000 = 3$ because $10^3 = 1000$

Practice

$\log_{10} 100 = ?$

$\log_{10} 10{,}000 = ?$

$\log_{10} ? = 6$

$\log_{10} ? = -3$

$\log_{10} 0.00001 = ?$

Microscopes

Objectives
Learn to use and care for a compound microscope.

Instructions
1. Please match each part to its function.

Stage	Closes down the amount of light, and sharpens image.
Stage adjustment knobs	Lifts or lowers the condenser; the closer to the specimen the better.
Light intensity knob	Should be set so that both eyepieces are the same length.
Interpupillary adjustment	Moves a slide side-to-side and front-to-back.
Coarse focus knob	Changes lamp brightness.
Fine focus knob	Should only be detached by holding the plug.
Iris diaphragm	Aligns light waves before they pass through specimen.
Condenser	Provides flat surface for specimens.
Condenser adjustment lever	Allows both eyes to see an image simultaneously.
Specimen holder	Holds a slide in place on the stage.
Eyepiece length adjustment (find the white ring)	Moves the stage up and down in tiny amounts.
Electrical cord	Moves the stage up and down rapidly.

2. Please number these steps, in the order they should be completed when using a microscope.

Remove specimen, lower stage, wrap cord, and return covered microscope to numbered shelf.

Move to other objective lenses to increase magnification.

Rotate lowest-magnification objective lens into position (probably 4x or 10x).

Clean all lenses with lens paper.

Place specimen on stage.

Adjust chair to a comfortable height.

Use coarse focus knob to adjust stage until an image is visible.

Be careful to use only the fine focus knob with the longest objective lenses.

Cells and cell movement

Objectives
Observe several different types of cells under a microscope.
Practice recording observations from qualitatively-variable specimens.
Observe how several single-celled organisms move themselves.

Instructions

1. Start by viewing the letter "e" slide.
2. Observe the onion skin on a wet mount, stained. Try to find the nucleus, nucleolus, cytoplasm, and cell wall.
3. Observe cells from your cheek on a wet mount, stained. Try to find the cell membrane, cytoplasm, and nucleus.
4. Observe *Elodea* cells on a wet mount, in distilled water. Try to find the cell wall, cell membrane, and chloroplasts.

5. Observe pond water organisms on a wet mount.
6. Observe *Amoeba* on a depression slide. Try to find a pseudopod.
7. Observe *Paramecium* on a wet mount, with slowing fluid and cotton fibers. Try to find cilia, contractile vacuoles, and food vacuoles.
8. Observe *Vorticella* on a wet mount. Notice the cilia and contractile stalk.
9. Witness the *Trichonympha* slide preparation. Notice the flagella.

Lab 3 Assignment

Regarding Lab 3:

1. Turn in this completed lab, and attach your responses to the items below.
2. Attach your original drawings of the onion skin, cheek cells, *Elodea*, and at least one of the single-celled animals (*Amoeba, Paramecium, Vorticella, or Trichonympha*). Excellent drawings will be labeled with the total magnification (such as 100x) and any observations you made (colors, textures, movements, etc.).

Preparing for Lab 4:

3. What is diffusion?
4. How is osmosis different from diffusion?
5. What is dialysis?

6. Imagine or draw a cube with each side 10 mm long.
    a. What is the surface area of this cube?
    b. What is the volume?
    c. What number do you get when you calculate “surface area / volume”? (This is the surface-area-to-volume ratio.)
7. Repeat parts a – c for a cube with each side 1 mm long.