Types of Data

Qualitative

(observations / descriptions)

ex: Plant has red flowers

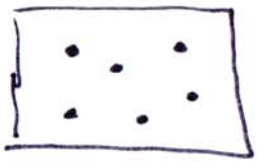
Quantitative

(numerical)

ex: Plant has 5 red flowers

Discrete

(count)



6 plants

Continuous

(measurement)

ex: time
length

Categorical

red
yellow
green

Scientific Notation

- 1 million = 1000000. 1.0×10^{6}
- 48900. 4.89×10^{4}
- 0.0001 1×10^{-4}
- 0.0000067 6.7×10^{-6}
- 3×10^{5} 300000
- 4×10^{-2} 0.04

The appropriate units to use when making measurements

SI Units

Measurement	Units
Length	meter (m)
Temperature	Kelvin K Celcius °C K = °C + 273
Mass	gram (g)
Volume (liquid)	liter (L)
Volume (solid)	meter^3 (m^3)
Time	second, days, mo, Yrs .....

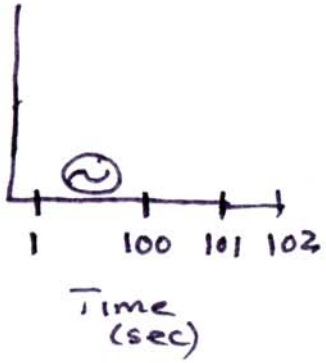
Prefixes: K Kilo: 1000 = 1×10^3 3000 grams ⇒ 3×10^3 grams = 3 Kg

c centi: 1/100 = 1×10^{-2} 5 cm ⇒ 5×10^{-2} meters = 0.05 meters

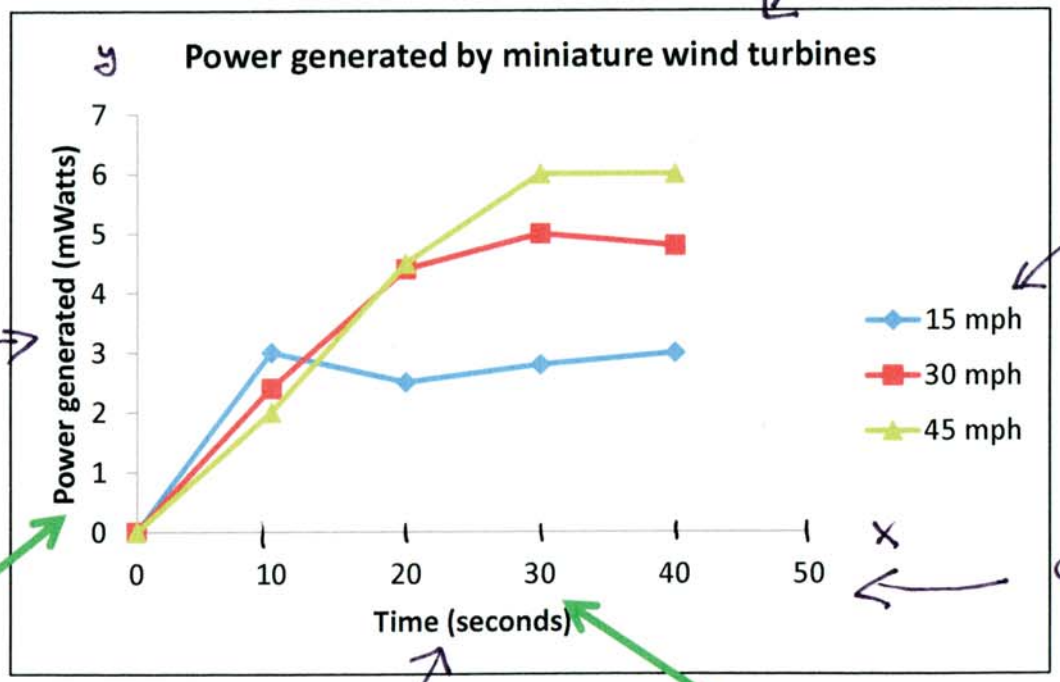
m milli: 1/1000 = 1×10^{-3} 15 mL ⇒ 15×10^{-3} liters = 0.015 liters

μ micro: 1/1000000 = 1×10^{-6} 7 μm = 7×10^{-6} meters = 0.000007 meters

Presenting data using graphs



TITLE (descriptive)



Legend (if you have more than 1 set of DATA).

Label (unit)

consistent Scale

the dependent variable

(variable you are measuring during an expt)

Labels (units)

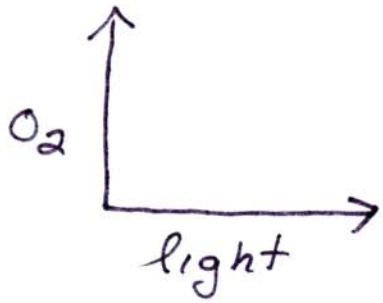
the independent variable

(variable you can control during an expt)

Labeling Graphs

Graph titles should be *descriptive* and explain the results.

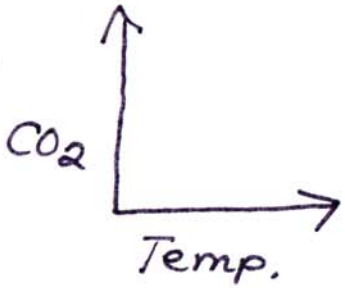
GRAPH TITLE FORMULAS:



The Effect of _____ on _____

The effect of light on O_2-production during photosynthesis

The Relationship between _____ and _____



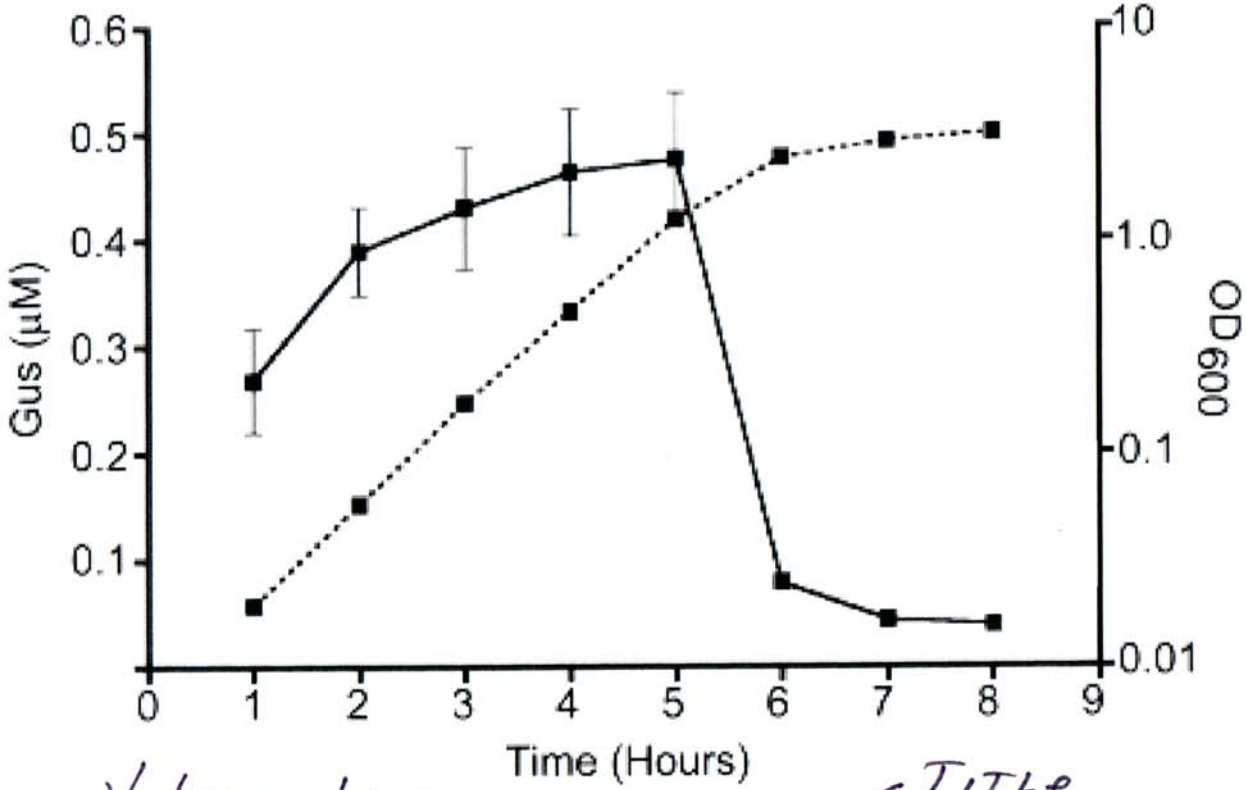
The relationship between temp. and CO_2-production during cellular respiration

" _____ vs _____" is not acceptable

~~O_2 vs. light~~

~~CO_2 vs. temp~~

Presenting data using graphs (publications)



Forster et al. , 2011
J. Bacteriology

Figure legend/description

TITLE

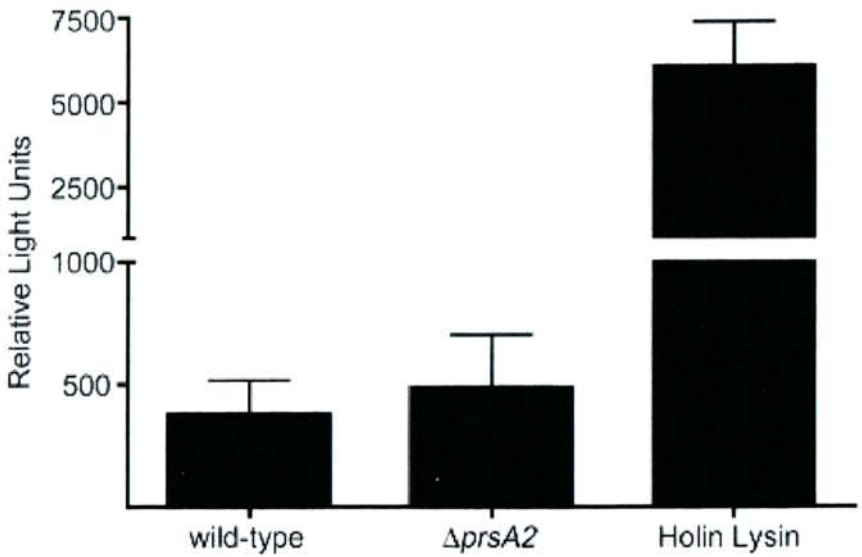
Describes expt and what the DATA is showing

***prsA2* is expressed during exponential growth in broth culture.** [*L. monocytogenes* strain 10403S carrying pJZ095 (strain DP-L5755) was grown for 8 h in BHI medium. Each hour, an OD_{600} measurement was taken, and the β-glucuronidase (Gus) level from 1 ml of culture was measured. The levels of Gus were normalized to the OD_{600} measurements of the culture at each time point. The error bars represent the standard errors of the means. Data were collected from duplicate samples from three independent experiments.] Solid line: Gus concentration; Dashed line: OD_{600}.

Legend box

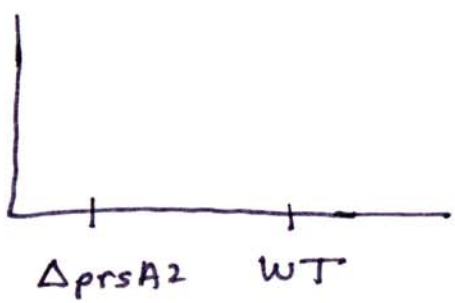
When to use a bar graph OR line graph

BAR

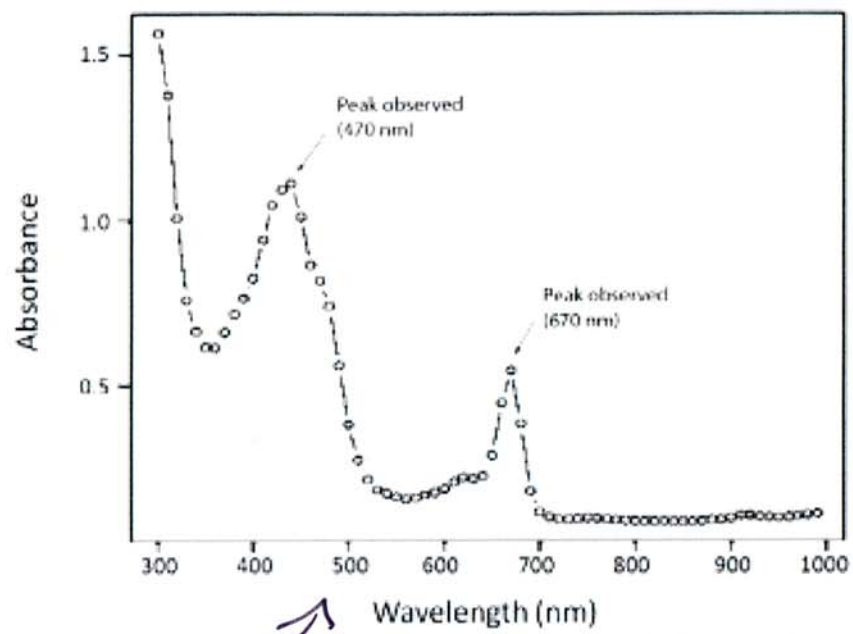


Forster et al. , 2011
J. Bacteriology

Categorical DATA
(discrete)

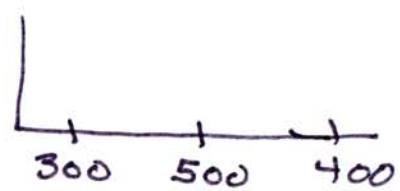


LINE



Ramirez et al.
JMBE (In Review)

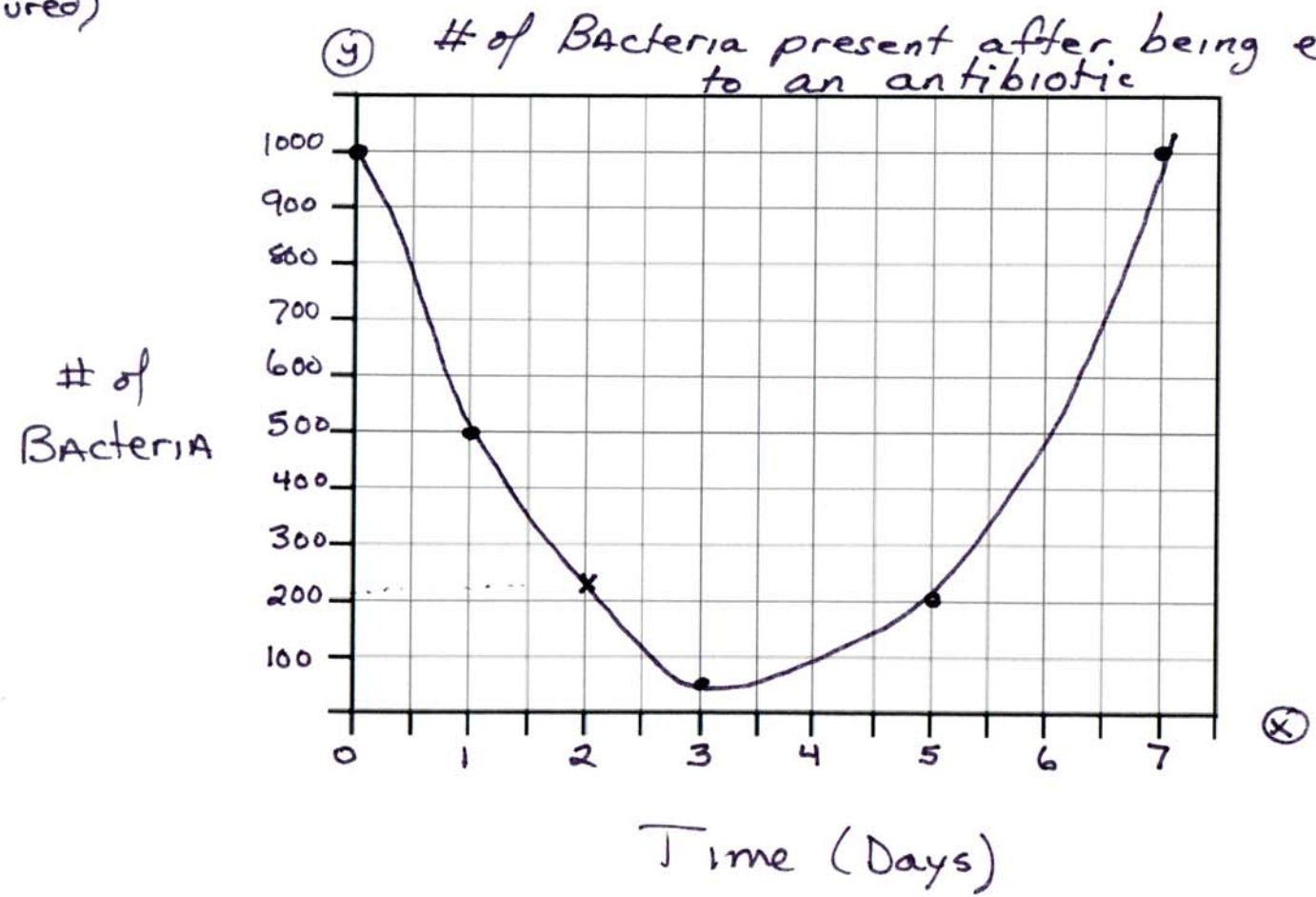
Continuous



Properly preparing a graph

In order to determine the effect of a certain antibiotic on a bacterium, an experiment was performed. The antibiotic was added to a culture of bacteria. Every couple of days, a sample of the culture was taken and the number of bacteria present was counted. The results are shown below.

Independent → Days incubated with antibiotic	0	1	3	5	6	7
Dependent (measured) → # of Bacteria Present in Culture	1000	500	50	200	500	1000



Inferences?

How many bacterial cells are present on day 2?

~ 225 cells

Writing a valid conclusion from a graph

State the relationship between the independent and dependent variable.

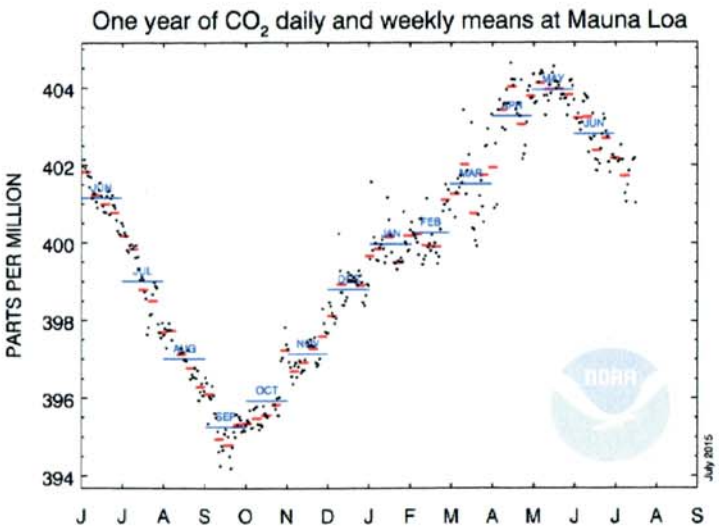
TREND

*Give a scientifically valid **reason** as to why you see this trend in the data.*

Reason

_____. This may be due to _____.

Example:



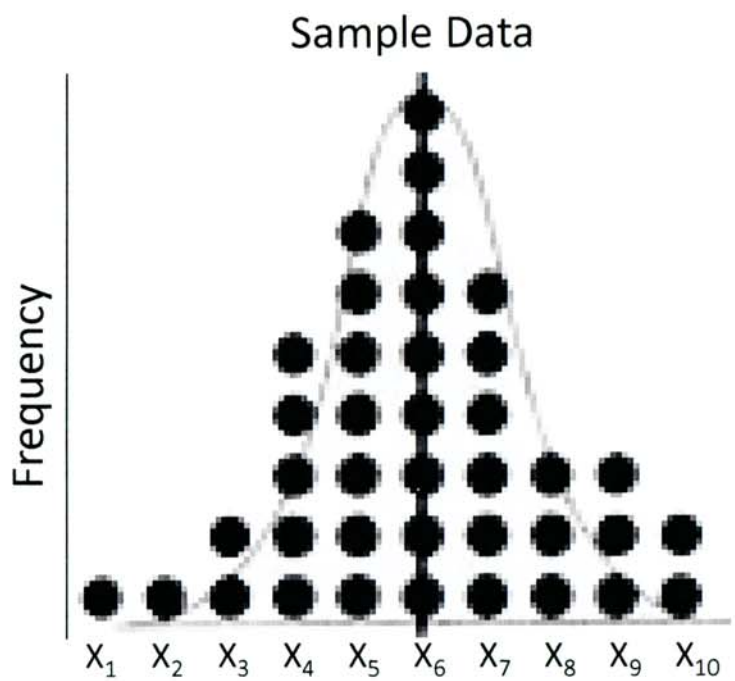
Time (months)

Amt. of CO_2 decreases in warmer months (May → Sept) and increases in cooler months (Sept → May). This may be due to the fact that plants perform more photosynthesis in warmer mo. as compared to cooler mo.

$$CO_2 + H_2O \xrightarrow{light} C_6H_{12}O_6 + O_2$$

Measures of Central Tendency

When looking at your data, you may notice that the majority of the numbers focus around the center of your data set or distribution. Three measures of central tendency include:



Mean: (Average) $\frac{\text{Sum of DATA pts}}{\text{Total \# of DATA pts}}$

Median: middle # of your data set after arranging the data lowest → highest

Mode: # that appears the most

(mode does not necessarily have to exist)

Measures of Central Tendency

The table below shows the temperature outside Connelly Hall at 11:00am for 5 consecutive days.

Monday	Tuesday	Wednesday	Thursday	Friday
20°C	13.4°C	22.8°C	19.5°C	13.4°C

Mean: $\frac{\text{Sum of data}}{\text{\# data pts}}$

$= \frac{20 + 13.4 + 22.8 + 19.5 + 13.4}{5}$

$= \frac{89.1}{5}$

$= 17.8°C$

Median: middle # after low → high

13.4, 13.4, 19.5, 20, 22.8

if even # data pts

13.4, 13.4, 19.5, 20, 20, 22.8

average

19.75°C

Mode: # most often

13.4°C