AP BIOLOGY
Survival Guide
2026-2027

Student:_____

When life gives you mold, make Penicillin!

Mrs. Turney

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Task Verbs Used in Free-Response Questions

The following **task verbs** are commonly used in the free-response questions:

Calculate: Perform mathematical steps to arrive at a final answer, including algebraic expressions, properly substituted numbers, and correct labeling of units and significant figures.

Construct/Draw: Create a diagram, graph, representation, or model that illustrates or explains relationships or phenomena. Labels may or may not be required.

Describe: Provide relevant characteristics of a specified topic.

Determine: Decide or conclude after reasoning, observation, or applying mathematical routines (calculations).

Evaluate: Judge or determine the significance or importance of information, or the quality or accuracy of a claim.

Explain: Provide information about how or why a relationship, process, pattern, position, situation, or outcome occurs, using evidence and/or reasoning to support or qualfiy a claim. Explain "how" typically requires analyzing the relationship, process, pattern, position, situation, or outcome; whereas explain "why" typically requires analysis of motivations or reasons for the relationship, process, pattern, position, situation, or outcome.

Identify: Indicate or provide information about a specified topic, without elaboration or explanation.

Justify: Provide evidence to support, qualify, or defend a claim, and/or provide reasoning to explain how that evidence supports or qualifies the claim.

Make a claim: Make an assertion that is based on evidence or knowledge.

Predict/Make a prediction: Predict the causes or effects of a change in, or disruption to, one or more components in a relationship, pattern, process, or system.

Represent: Use appropriate graphs, symbols, words, illustrations, and/or tables of numerical values to describe biological concepts, characteristics, and/or relationships.

State (the null/alternative hypothesis): Indicate or provide a hypothesis to support or defend a claim about a scientifically testable question.

Support a claim: Provide reasoning to explain how evidence supports or qualifies a claim.

AP BIOLOGY EQUATIONS AND FORMULAS

Statistical Analysis and Probability

Mean

$$\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i$$

Standard Deviation

$$s = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n-1}}$$

Standard Error of the Mean

$$SE_{\bar{x}} = \frac{s}{\sqrt{n}}$$

Chi-Square

$$\chi^2 = \sum \frac{(o-e)^2}{e}$$

Chi-Square Table

p value	Degrees of Freedom							
	1	2	3	4	5	6	7	8
0.05	3.84	5.99	7.81	9.49	11.07	12.59	14.07	15.51
0.01	6.63	9.21	11.34	13.28	15.09	16.81	18.48	20.09

$\bar{x}$ = sample mean

n = sample size

s = sample standard deviation (i.e., the sample-based estimate of the standard deviation of the population)

o = observed results

e = expected results

Σ = sum of all

Degrees of freedom are equal to the number of distinct possible outcomes minus one.

Laws of Probability

If A and B are mutually exclusive, then:

$$P(\text{A or B}) = P(\text{A}) + P(\text{B})$$

If A and B are independent, then:

$$P(\text{A and B}) = P(\text{A}) \times P(\text{B})$$

Hardy-Weinberg Equations

$p^2 + 2pq + q^2 = 1$

$p + q = 1$

p = frequency of allele 1 in a population

q = frequency of allele 2 in a population

Metric Prefixes

Factor	Prefix	Symbol
10^9	giga	G
10^6	mega	M
10^3	kilo	k
10^{-1}	deci	d
10^{-2}	centi	c
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n
10^{-12}	pico	p

Mode = value that occurs most frequently in a data set

Median = middle value that separates the greater and lesser halves of a data set

Mean = sum of all data points divided by number of data points

Range = value obtained by subtracting the smallest observation (sample minimum) from the greatest (sample maximum)

Source: APCentral.Collegeboard.org

Rate and Growth

Rate

$$\frac{dY}{dt}$$

dY = amount of change

dt = change in time

Population Growth

$$\frac{dN}{dt} = B - D$$

B = birth rate

D = death rate

N = population size

Exponential Growth

$$\frac{dN}{dt} = r_{max}N$$

K = carrying capacity

r_{max} = maximum per capita growth rate of population

Logistic Growth

$$\frac{dN}{dt} = r_{max}N\left(\frac{K-N}{K}\right)$$

Simpson's Diversity Index

Diversity Index $= 1 - \sum\left(\frac{n}{N}\right)^2$

n = total number of organisms of a particular species

N = total number of organisms of all species

Water Potential (Ψ)

$\Psi = \Psi_P + \Psi_S$

Ψ_P = pressure potential

Ψ_S = solute potential

The water potential will be equal to the solute potential of a solution in an open container because the pressure potential of the solution in an open container is zero.

The Solute Potential of a Solution

$\Psi_S = -iCRT$

i = ionization constant (1.0 for sucrose because sucrose does not ionize in water)

C = molar concentration

R = pressure constant (R = 0.0831 liter bars/mole K)

T = temperature in Kelvin (°C + 273)

pH $= -\log[H^+]$

Surface Area and Volume

Surface Area of a Sphere

$SA = 4\pi r^2$

Volume of a Sphere

$V = \frac{4}{3}\pi r^3$

Surface Area of a Rectangular Solid

$SA = 2lh + 2lw + 2wh$

Volume of a Rectangular Solid

$V = lwh$

Surface Area of a Cylinder

$SA = 2\pi rh + 2\pi r^2$

Volume of a Cylinder

$V = \pi r^2 h$

Surface Area of a Cube

$SA = 6s^2$

Volume of a Cube

$V = s^3$

r = radius

l = length

h = height

w = width

s = length of one side of a cube

SA = surface area

V = volume

Source: APCentral.Collegeboard.org

The AP Biology Exam

FORMAT

Total Time: *Three hours duration and consisting of two sections (90 minutes each)*

Multiple Choice: *60 multiple choice questions (some individual & some in sets of 4-5)*

Free-Response Questions: *2 long questions and 4 short answer questions*

Distribution by section: *Multiple Choice= 50% of your total score*

Free Response= 50% of your total score

Calculators are allowed on the exam (be sure to check AP central for type)

The exam also assesses each of the eight units of the course with the following exam weightings on the multiple-choice section of the AP Exam:

Unit	Exam Weighting
1: Chemistry of Life	8–11%
2: Cell Structure and Function	10–13%
3: Cellular Energetics	12–16%
4: Cell Communication and Cell Cycle	10–15%
5: Heredity	8–11%
6: Gene Expression and Regulation	12–16%
7: Natural Selection	13–20%
8: Ecology	10–15%

About the Exam

The AP Biology Exam will test your understanding of the biological concepts covered in the course units, as well as your ability to utilize the scientific method and analyze data.

This is a hybrid digital exam. You'll complete multiple-choice questions and view free-response questions in the Bluebook testing app. You'll handwrite your free-response answers in paper exam booklets.

Calculators are permitted for this exam. See AP Exams Calculator Policy for the list of calculators approved for this course.

Reference materials, such as equations sheets and reference tables, are available for this course. Go to Reference Information for Specific AP Exams to find reference materials for AP Biology and exam day details.

https://apstudents.collegeboard.org/courses/ap-biology/assessment

TRENDS

Results in 2025: Earning a 3 or higher (pass rate)= 71.0% (Total # students= 287,232)
- Earning a 5= 19.0% of test takers.
- Earning a 4: 24.0% of test takers.
- Earning a 3: 28.0% of test takers.
- Earning a 1: 8.0% of test takers.

Results in 2024: Earning a 3 or higher (pass rate)= 68.0% (Total # students= 260,062)
- Earning a 5= 16.0% of test takers.
- Earning a 4: 23.0% of test takers.
- Earning a 3: 29.0% of test takers.
- Earning a 1: 10.0% of test takers.

Results in 2023: Earning a 3 or higher (pass rate)= 64% (Total # students=239,470)
- Earning a 5= 14.0% of test takers.
- Earning a 4: 23.0% of test takers.
- Earning a 3: 27.0% of test takers.
- Earning a 1: 12.0% of test takers.

While "passing" is a 3, a 4 or 5 is generally required to stand out or skip introductory college courses.

https://www.totalregistration.net/AP-Exam-Registration-Service/Compare-Score-Distributions.php?id=18&year=2021

UNIT CONVERSIONS:

Customary Units	Metric Units
1 inch	2.54 centimeters
1 foot	30.48 centimeters or 0.3048 meter
1 yard	0.914 meter
1 mile	1.609 kilometers
1 ounce	28.350 grams
1 pound	454 grams or 0.454 kilogram
1 fluid ounce	29.574 milliliters
1 quart	0.946 liter
1 gallon	3.785 liters

Metric Units	Customary Units
1 centimeter	0.394 inch
1 meter	3.281 feet or 1.093 yards
1 kilometer	0.621 mile
1 gram	0.035 ounce
1 kilogram	2.205 pounds
1 milliliter	0.034 fluid ounce
1 liter	1.057 quart or 0.264 gallon

Energy Units Conversion Table

Btu	kWh	Therm	Dkt
1	0.00029	0.00001	.000001
3,412	1	29.308	293.08
100,000	29.308	1	10
1,000,000	293.08	10	1
3,412,000	1,000	34.12	3.412

Power Units Conversion Table

Btu/hour	Watt	HP	kW
1	0.293	0.00039	0.00029
3.413	1	0.00134	0.001
2546.10	746	1	0.746
3413	1000	1.341	1

Temperature Conversions

$$°C = \frac{5}{9}(°F - 32)$$

$$°F = \frac{9}{5}°C + 32$$

C	F	C	F	C	F	C	F
27.0	80.6	30.5	86.9	32.8	91.0	34.2	93.6
27.5	81.5	31.0	87.8	32.9	91.2	34.3	93.7
28.0	82.4	31.5	88.7	33.0	91.4	34.4	93.9
28.5	83.3	31.6	88.9	33.0	91.4	34.5	94.1
29.0	84.2	31.7	89.1	33.1	91.6	34.6	94.3
29.5	85.1	31.8	89.2	33.2	91.8	34.7	94.5
30.0	86.0	31.9	89.4	33.3	91.9	34.8	94.6
		32.0	89.6	33.4	92.1	34.9	94.8
		32.1	89.8	33.5	92.3	35.0	95.0
		32.2	90.0	33.6	92.5	35.1	95.2
		32.3	90.1	33.7	92.7	35.2	95.4
		32.4	90.3	33.8	92.8	35.3	95.5
		32.5	90.5	33.9	93.0	35.4	95.7
		32.6	90.7	34.0	93.2	35.5	95.9
		32.7	90.9	34.1	93.4	35.6	96.1

STATISTICAL METHODS FOR AP BIOLOGY

The Independent T-test analyzes the difference between the means of two groups (the control and the experimental groups) and takes into account the standard deviations of those two groups. It basically asks: Is there more variance WITHIN a single group than there is BETWEEN the two groups? If so, then the variable being applied to the experimental group cannot be determined to have been the cause of the difference between the group. BUT…if the difference between the subjects of the control group and the subjects of the experimental group is GREATER than the difference within one group, a significant amount of that difference can be attributed to the independent variable in the experiment.

$$t = \frac{(X_1 - X_2)}{\sqrt{\frac{(S_1)^2}{n_1} + \frac{(S_2)^2}{n_2}}}$$

Where:

x_1 is the mean of sample 1

s_1 is the standard deviation of sample 1

n_1 is the sample size of sample 1

x_2 is the mean of sample 2

s_2 is the standard deviation of sample 2

n_2 is the sample size in sample 2

How to Calculate T:

1. Calculate the mean (X) of each sample
2. Find the *absolute value* of the difference between the means
3. Calculate the standard deviation for each sample
4. Square the standard deviation for each sample
5. Divide each squared standard deviation by the sample size of that group.
6. Add these two values
7. Take the square root of the number to find the "standard error of the difference. 8. Divide the difference in the means (step 2) by the standard error of the difference (step 7). The answer is your "calculated T-value."
9. Determine the degrees of freedom (df) for the test. In the t-test, the degrees of freedom is the sum of the sample sizes of both groups minus 2.
10. Determine the “Critical T-value” in a table by triangulating your DF and the “p value” of 0.05.

A p-value is the probability of concluding there is a significant difference between the group's result and the null hypothesis is true (meaning, the probability of making the WRONG conclusion). In Biology, we use a standard “p-value” of 0.05. This means that five times out of a hundred you would find a statistically significant difference between the means even if there was none.

Draw your conclusion:

• If your calculated t value is greater than the critical T-value from the table, you can conclude that the difference between the means for the two groups is significantly different. We reject the null hypothesis and conclude that the alternative hypothesis is correct.

• If your calculated t value is lower than the critical T-value from the table, you can conclude that the difference between the means for the two groups is NOT significantly different. We accept the null hypothesis.

	Confidence Interval						
	80%	90%	95%	98%	99%	99.8%	99.9%
	α level two-tailed test						
df	0.2	0.1	0.05	0.02	0.01	0.002	0.001
1	3.078	6.314	12.706	31.821	63.657	318.313	636.589
2	1.886	2.920	4.303	6.965	9.925	22.327	31.598
3	1.638	2.353	3.182	4.541	5.841	10.215	12.924
4	1.533	2.132	2.776	3.747	4.604	7.173	8.610
5	1.476	2.015	2.571	3.365	4.032	5.893	6.869
6	1.440	1.943	2.447	3.143	3.707	5.208	5.959
7	1.415	1.895	2.365	2.998	3.499	4.785	5.408
8	1.397	1.860	2.306	2.896	3.355	4.501	5.041
9	1.383	1.833	2.262	2.821	3.250	4.297	4.781
10	1.372	1.812	2.228	2.764	3.169	4.144	4.587

Chi-Square

A chi-square analysis looks at the observed results compared to the expected results. It is typically used when you are looking at distinct groups or outcomes that should have been selected equally if there was no other variable affecting the selection. For example, if you expect that hamsters randomly select which corner of a cage to sit in, then their locations in each of the four corners over several trials should be the same. Given 40 runs, the hamster should have gone to each of the 4 corners a total of 10 times.

$$\chi^2 = \sum \frac{(O-E)^2}{E}$$

Chi-Square Test (χ^2) $X^2 = \sum_{i=1}^{r} \sum_{j=1}^{c} \frac{(O_{i,j} - E_{i,j})^2}{E_{i,j}}$.

Computing D_f (degrees of freedom)

Degrees of freedom for chi square test of independence is equal to:

(rows-1)*(columns-1) = D_f

(2-1) = 1 * (2-1) = 1 * 1 = D_f

D_f = 1

We then get our chi critical value by getting Chi table and locating significance level 0.05 and D_f of 1.

Critical Values of Chi Square

df	0.05	0.01
1	3.84	6.64
2	5.99	9.21
3	7.82	11.34
4	9.49	13.28
5	11.07	15.09
6	12.59	16.81
7	14.07	18.48
8	15.51	20.09
9	16.92	21.67
10	18.31	23.21
11	19.68	24.72
12	21.03	26.22
13	22.36	27.69
14	23.68	29.14
15	25.00	30.58

df	0.05	0.01
16	26.30	32.00
17	27.59	33.41
18	28.87	34.80
19	30.14	36.19
20	31.41	37.57
21	32.67	38.93
22	33.92	40.29
23	35.17	41.64
24	36.42	42.98
25	37.65	44.31
26	38.88	45.64
27	40.11	46.96
28	41.34	48.28
29	42.56	49.59
30	43.77	50.89

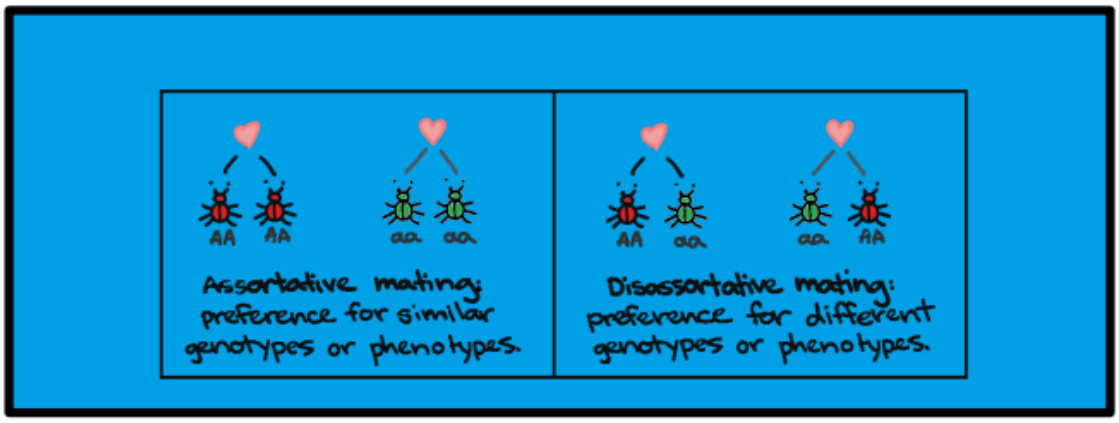
Degrees of Freedom = # Possible Observations – 1

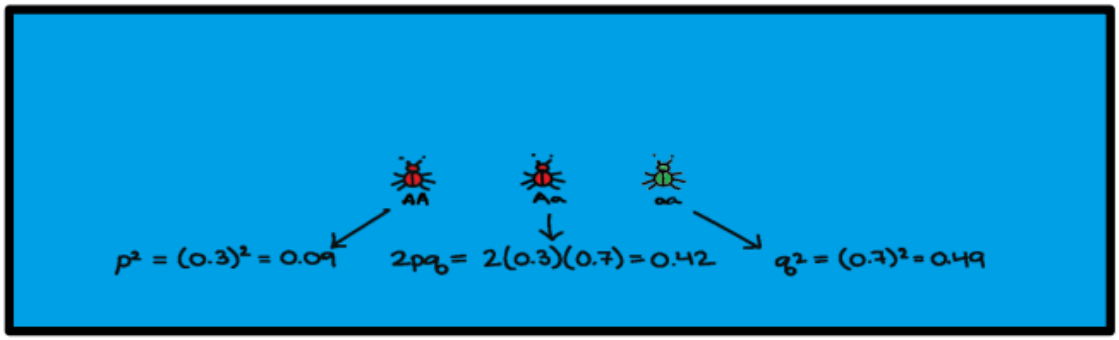
Level of Significance (alpha) in Science is set at 0.05.

<u>Below Critical Value = Accept. Above Critical Value = Reject</u>

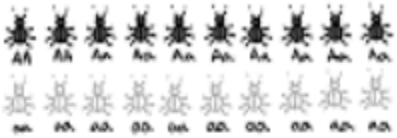
If the null hypothesis is accepted, then there probably is no relationship between the two variables and the experimental results were probably due to chance alone. If the null hypothesis is rejected, then there probably is a relationship between the two variables, and the experimental results are probably not due to chance.

The Hardy-Weinberg Theorem





Small population of 20 beetles:



ALLELE FREQUENCIES:

Freq. of allele A = p = 12/40 = 0.3

Freq. of allele a = q = 28/40 = 0.7

GENOTYPE FREQUENCIES:

Freq. of AA = 2/20 = 0.1

Freq. of Aa = 8/20 = 0.4

Freq. of aa = 10/20 = 0.5

The Four Main Ideas in AP Biology from AP Central and the College Board:

Big Idea 1: The process of evolution drives the diversity & unity of life.

Big Idea 2: Biological systems use energy and molecular building blocks to grow, reproduce, and maintain dynamic homeostasis.

Big Idea 3: Living systems store, retrieve, transmit, and respond to information essential to life processes.

Big Idea 4: Biological systems interact, and these systems and their interactions possess complex properties.

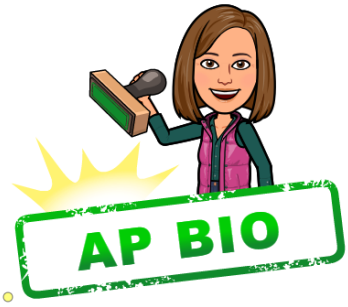
The application of each of these "big ideas" is paramount to understanding Biology at a depth that is at the introductory college level. As such, each one of these ideas is based on a core principle on which science is founded, and thus are found in each and every one of the units we cover in AP Biology. In addition, many of the test items (not only within this class, but also on the national AP Biology Exam) address these ideas, including free-response items.

Lab Report Scoring Template

Student Name:				
Title of Experiment:				
Scientific Method	Categories	Point Value	Notes	Earned Points
Title		2		
Introduction	Background	4		
	Problem Statement	2		
	Hypothesis	4		
	Null hypothesis	2		
Materials and Methods	Materials	4		
	Independent Variable	2		
	Dependant Variable	2		
	Confounding Variable	2		
	Sample Size	2		
	Controls	2		
	Methods/ Procedure	12		
	Statistical Methods	2		
Results	Data Organization	8		
	Data Analysis	10		
Conclusions		5		
Bibliography		5		
		70 possible points	Total points earned:	

Confounding Variable: is a third variable that influences both the independent and dependent variables. How to control them: You can decrease the impact of confounding variables on your research through: **restriction, matching, statistical control and randomization**. In restriction, you restrict your sample by only including certain subjects that have the same values of potential confounding variables.

Experimental Design Tips



What variable will you manipulate? _____
(independent variable)IV- what you are changing

What variable is responding to the one you are manipulating?_____
(dependent variable)DV- what you are measuring- be specific

Write a title for your experiment using the following as a guide.

Title: The effect of _____IV_____ on the _____DV_____.

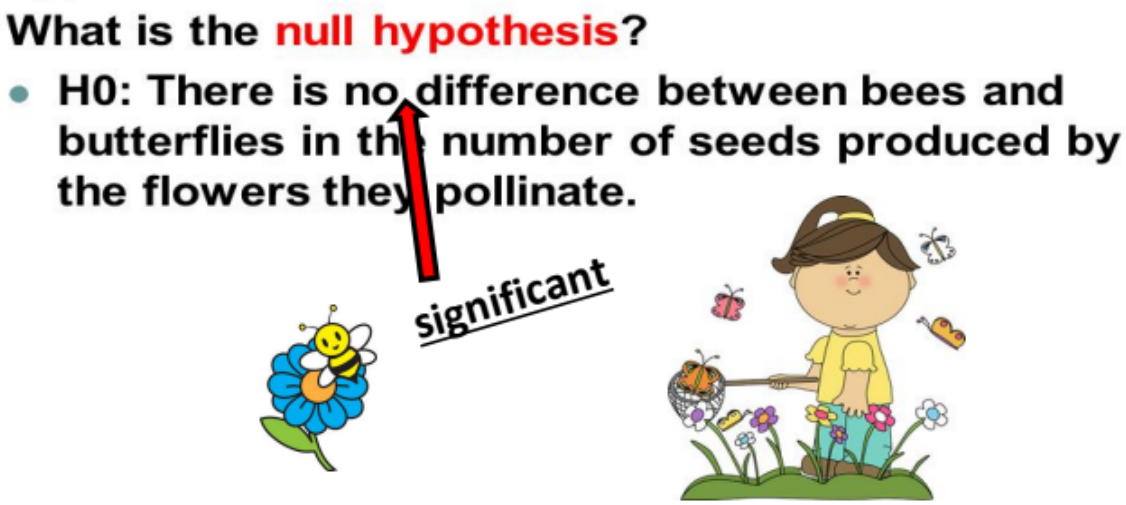
Write a hypothesis- What are you changing and how will that affect your results? Use the following as a guide.

Hypothesis: If the _____IV_____ is _____

(describe how you changed it)

Then the _____DV_____ will _____ because _____.

(describe the effect-what you are measuring) (give detail)



Graphing for Labs

Mean: average of the data set

Median: the middle number in an ordered data set.

Mode: the most frequent number in your data set

Range= Largest - smallest

Setting up a graph don't forget:
Independent Variable goes on the X axis
Dependent Variable goes on the Y axis

What are the 7 steps to drawing a line graph in science?

1. Step 1: Identify the variables. … Independent and dependent
2. Step 2: Determine the variable range. …
3. Step 3: Determine the scale of the graph. ...
4. Step 4: Number and label each axis and title the graph.
5. Step 5: Determine the data points and plot on the graph. ...
6. Step 6: Draw the graph.
7. Step 7: Label the axis and title the graph (describes the experiment)

Elements of a good graph:

1. Title that describes the experiment
2. Uses the space provided.
3. Axis should be labeled with quantity being measured and the units of measurement
4. Create a consistent scale
5. Each point should be plotted accurately
6. Use a line of best fit if needed.

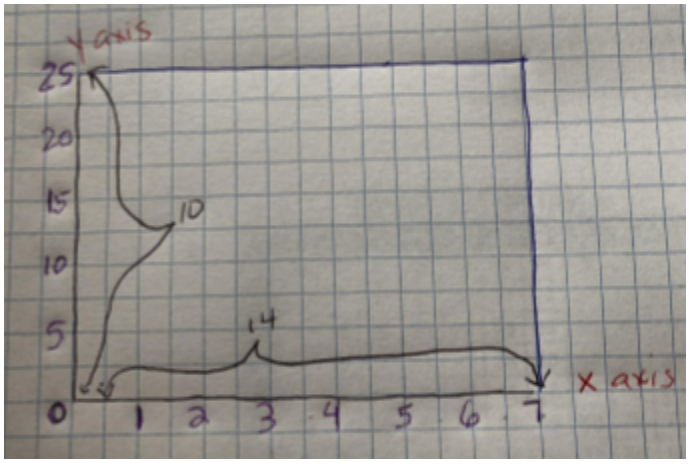
How to create a consistent scale:
Calculate the range (Largest # minus the smallest #)
Count the number of items (or number of boxes/lines) you have on the axis
Divide the calculated range by the number of items (Range/# of items)
Use the answer as a guide, but be consistent. Another helpful tip take your answer and multiple by 2, choose a number between the first calculated # and the multiplied by 2 answer for your grid (be sure it is divisible by 10)

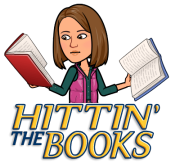
A graphing example

Data to be graphed:

X Axis	Y Axis
0	0
1.0	3.4
2.0	6.9
2.9	10.5
3.9	13.3
4.9	16.9
5.9	20.8

Y axis: Range= 20.8-0=20.8, 20.8/10= 2.1
Multiply by 2= 4.2
-choose a # between 2.1 and 4.2 that is divisible by 10
Best choice= 2.5
X axis: Range= 5.9-0=5.9, 5.9/14= .42
Multiply by 2= .84
-choose a # between .42 and .84 that is divisible by 10
Best choice= 0.5





AP Biology Reading by Units

SEMESTER ONE

Summer Assignment: Jump Start & Ecology (Quiz upon returning) Packet due 1st day of class

Unit Zero: Basics of AP Science (2 weeks)

Unit One: Biochemistry (3 weeks)

Textbook readings from chapters 1, 2, 3, 4, 5 and **Sections** 8.1, 8.2, 8.4, 8.5.

Unit Two: Cell Biology (3 weeks)

Textbook readings from chapters 6, 7 and 11.

Unit Three: Cellular Energetics (4 weeks)

Textbook readings from chapters 8, 9,10.

Unit Four: Cell Communication and Cell Cycle(2 weeks)

Textbook readings from chapter 11-12

SEMESTER TWO

Unit Five: Mendelian and Human Genetics (4 weeks)

Textbook readings from chapters (sections on 12 and 13)14, 15, 16 and 17.

Unit Six: Molecular Genetics and DNA Technology (4 weeks)

Textbook readings from chapters 18, 19, 20 and 21.

Unit Seven: Natural Selection & Evolution (4 weeks)

Textbook readings from chapters 22, 23, 24, 25 and 26.

Unit Eight: Ecology (2 Weeks Review only) -Part Self Study: Begin over Summer

Textbook readings from chapters 52, 53, 54 and 55, 56 if time.

**** Schedule is subject to change**

Statistics and Graphing Choice Charts and Guidelines

		Normally Distributed Data (Parametric)	Nonparametric	Frequency counts
Descriptive Statistics		Mean, Standard Deviation, Standard Error, 95% CI	Median, Quartiles, Interquartile Range	Percent
Comparative Statistics	**Graph Type**	Bar Graph	Box and Whiskers Plot	Stacked Bar Graph or Pie Chart
	Test Types	*T-Test & *ANOVA		Chi-Square (Goodness of Fit)
Association Statistics	**Graph Type**	Scatter Plot Line Graph—Linear Time	Scatter Plot Line Graph—Linear Time	*Mosaic Chart
	Test for Association	*Pearson Correlation		*Chi Square Test for Association
	Linear Relationship	*Linear Regression		

**These are tests or graph types that you do NOT need to be able to calculate or draw but you might need to be able to interpret them.*

Graphing

One of the best ways to **communicate the results** of a scientific investigation is graphing or creating an effective **visual representation** of the data. Investigators often can easily see **patterns** in a carefully crafted visual display that may not be readily apparent in a data table of numbers. Visual displays also can clarify how two measured variables **affect** each other.

In a scientific investigation one of the first steps in data analysis is to create graphs. Effective graphs convey **summary or descriptive statistics** as part of the display. This means that a certain amount of data analysis is required to produce appropriate graphical representations of experimental results.

When you collect data in AP Biology, it will usually fall into three categories:

1. **Normal or Parametric data**
   a. Measurement data that fit a normal curve or distribution
   b. Usually data are in decimal form
   c. Examples include plant height, body temperature, skin color etc.
2. **Nonparametric data**
   a. Data do not fit normal distribution
   b. May include large outliers
   c. May be count data that can be ordered
3. **Frequency or count data**
   a. Usually generated by counting how many items fit into a category.
   b. Examples: results of a genetic cross; data collected as percentages.

The typical questions asked in an AP Biology Lab can be divided into two groups:

1. Questions that compare phenomena, events or populations.
    a. Is A different from B?
2. Questions that look for associations between variables.
    a. How are A and B correlated?

You should take time to think through **what kind of question is being asked** and **what kind of data will be required** to answer that question **prior** to starting an investigation and during the design process.

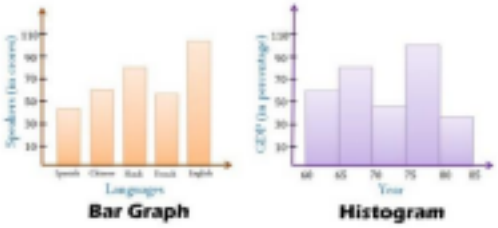
General Graphing Guidelines

1. Use the information provided here to select the appropriate graph type **PRIOR** to collecting data. 2. Every graph presented should have a **good title** that tells what the graph is about. A good title tells exactly what information the author is trying to present with the graph and usually includes both the ***dependent and independent*** variable.

3. Axes should be carefully **labeled** with numbers, labels and **units**. Intervals marked on line graphs should be equal in size and the scale should appropriately fit data.

4. Only plot points that have been measured. Plot points accurately!

Histograms vs. Bar Graphs

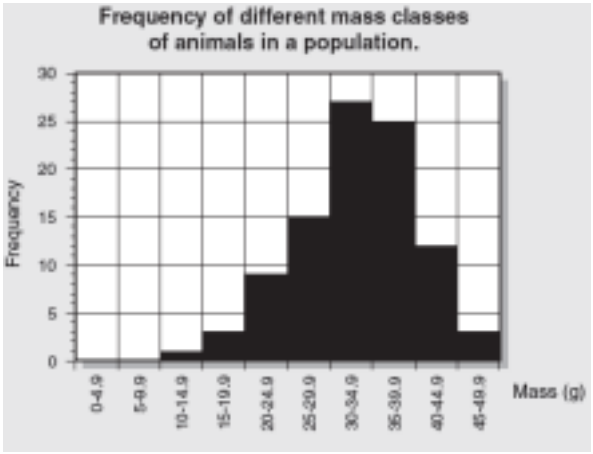


- In order to determine whether data is parametric or nonparametric you should initially make a **histogram** to look at the distribution of quantitative data.
- A histogram is different than a bar graph and is typically used for the purpose of determining distribution of data. A bar graph shows categories of data while a histogram shows a grouping of data on the x axis.

Basis for Comparison	Histogram	Bar Graph
Meaning	A graphical representation that displays data by way of bars to show the frequency of numerical data. Can be used to determine whether data is parametric or nonparametric.	A pictorial representation of data that uses bars to compare different categories of data.
Indicates	Distribution of non-discrete variables	Comparison of discrete variables
Presents	Quantitative data	Categorical data
Spaces	Bars touch	Bars do not touch
Elements	Elements are grouped together in “bins” that represent ranges of data	Elements are taken as individual entities
Can bars be reordered?	No	Yes

Guidelines for Histograms

- When an investigation involves **measurement data**, one of the first steps is to construct a histogram to represent the data's distribution to see if it approximates a **normal distribution**.
- Plots of **continuous data** and are often used to represent frequency distributions
- The data are numerical and continuous (i.e. height or weight) so the **bars touch.**
- The x axis usually records the class interval. The y axis usually records the number of individuals in each class interval (frequency).
- Requires setting up of **bins**—uniform range intervals that cover the entire range of the data.



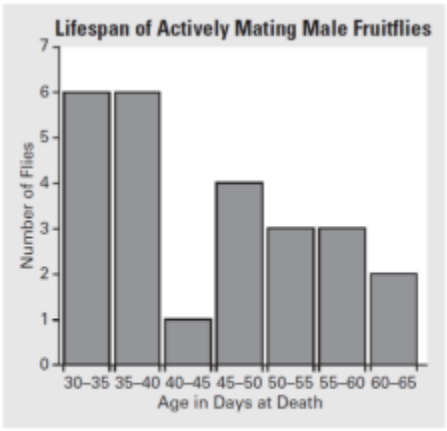


Figure 5. Histogram Showing Nonparametric Data [*Source: Hanley, James A., and Stanley H. Shapiro. "Sexual Activity and the Lifespan of Male Fruitflies: A Dataset That Gets Attention." Journal of Statistics Education 2, no. 1 (1994).*]

Guidelines for Bar Graphs

Bar graphs are appropriate for data that are **non-numerical and discrete** for at least one variable, i.e. they are grouped into separate categories.

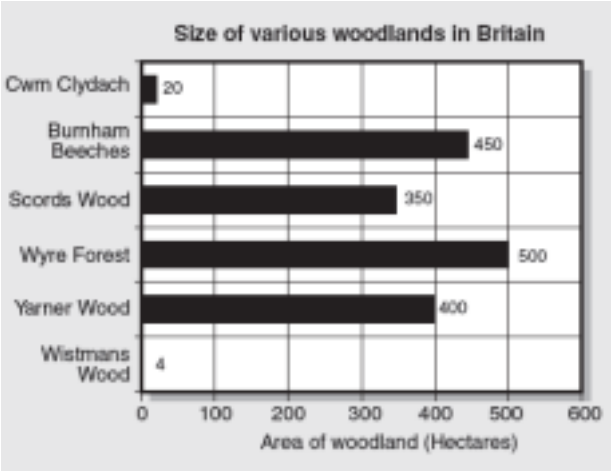
- Data is **discontinuous**, non-numerical categories (i.e. place, color and species)--**bars do not touch** •

Data values may be entered on or above bars

- Multiple sets of data can be displayed side by side for direct comparison *(i.e. males and females in the same age group).*
- Axes may be reversed so that the categories are on the x axis, i.e. the bars can be vertical or horizontal. • **Examples**

of situations when using a bar graph is appropriate: *Are the spines on fish in one lake without predators shorter than the spines on fish in another lake with predators*

- **Sample standard error bars** (or sample error of the sample mean) is a notation at the top of each shaded bar that shows the sample standard error. Most of the time, bar graphs should include standard error rather than standard deviation. The SEM bars provide more information about how different the two means may be from each other.



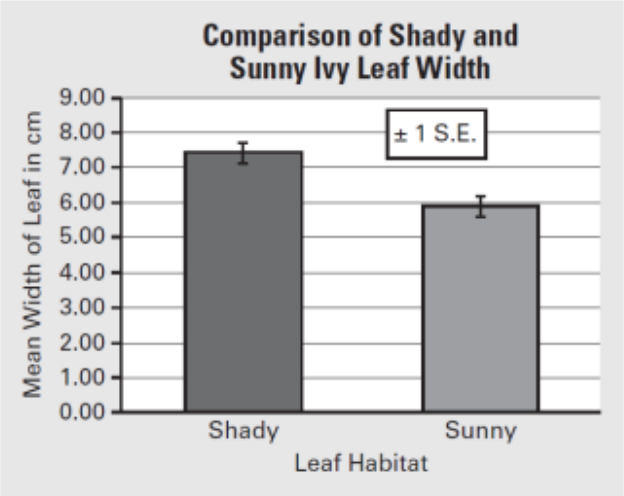
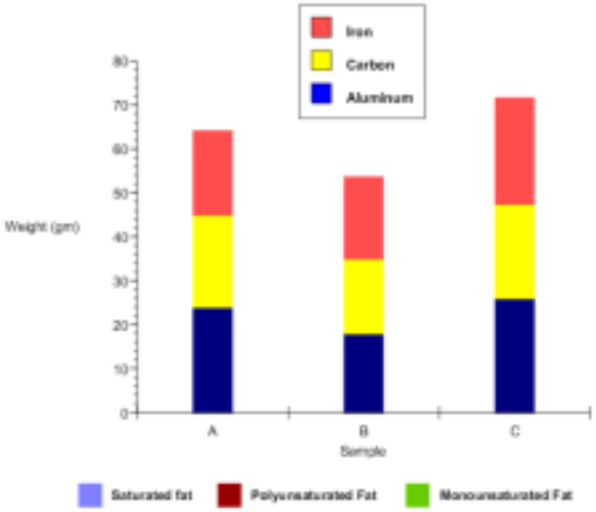


Figure 1. A Bar Graph

Stacked Bar Graph or Weighted Bar Graph

A standard **bar** chart compares individual data points with each other. In a **stacked bar** chart, parts of the data are adjacent (in the case of horizontal **bars**) or **stacked** (in the case of vertical **bars**, aka columns); each **bar** displays a total amount, broken down into sub-amounts.

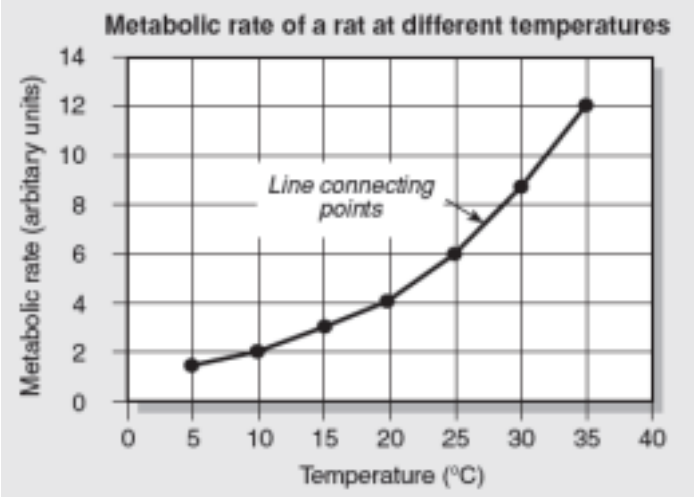


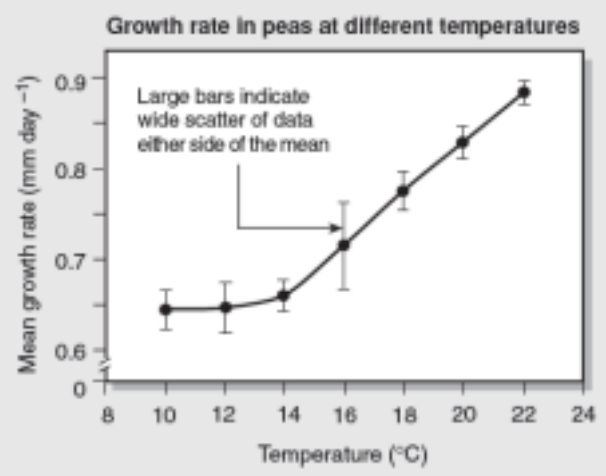
Guidelines for Line Graphs

Line graphs used when **one variable (the independent variable) affects another**, the dependent variable.

- Data must be **continuous** for both variables.
- The dependent variable is usually the **biological response**.
- The independent variable is often time or the **experimental treatment**.
- In cases where there is an implied trend (e.g. one variable increases with the other), a **line of best fit** is usually plotted through the data points to show the relationship.
- If fluctuations in the data are likely to be important (e.g. with climate and other environmental data) the **data points are usually connected** directly (point to point).

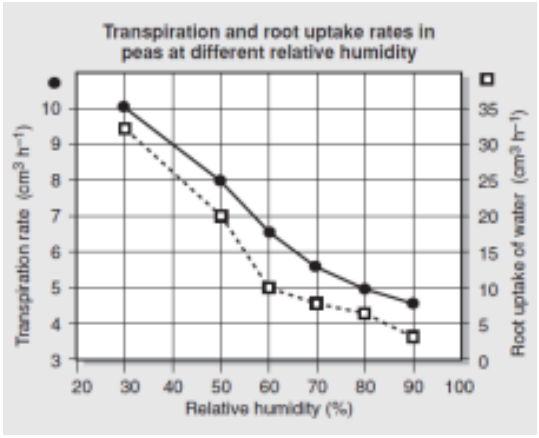
- Take care to **NOT** extend the line past the last data point; if the line extends past the last data point, it should be a dashed line or have an arrow point on the end to indicate that data is being extrapolated.
- Can be drawn with **measure of error**. The data are presented as points (the calculated means), with bars above and below, indicating a measure of variability or spread in the data (e.g. standard error, standard deviation or 95% confidence intervals).
- Where no error value has been calculated, the scatter can be shown by plotting the individual data points vertically above and below the mean. By convention, bars are not used to indicate the range of raw values in a data set.



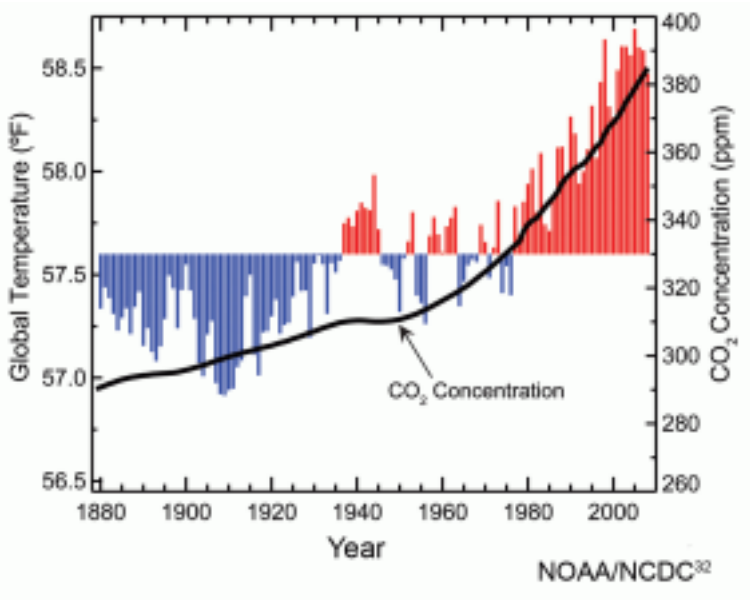


Plotting Multiple Data Sets

- A single figure can be used to show two or more data sets, *i.e. more than one curve can be plotted per set of axes.* This type of presentation is useful when you want to **visually compare the trends** for two or more treatments, or the **response of one species against the response of another**.
- If the two data sets use the **same measurement units** and a similar range of values for the independent variable, one scale on the Y axis is used
- If the two data sets use **different units and/or have a very different range of values** for the independent variable, two scales for the y axis are used. The scales can be adjusted if necessary to avoid overlapping plots.



a. The two curves must be distinguished with **a key.**



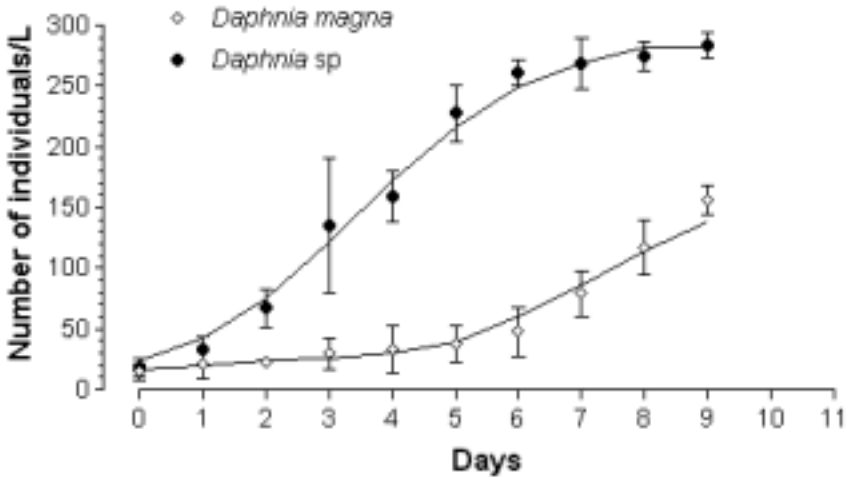


Figure 2. Mean population density (±1 standard deviation) of two species of *Daphnia* following artificial eutrophication of a small farm pond by application of organic fertilizer. Six replicate 1 L water samples were drawn from 50 cm depth at 1100 hr each day.

Guidelines for Scatter Graphs

• Use when comparing one measured variable against another—looking for **trends or associations**. • If the relationship appears to be linear, a **linear regression line** can be calculated & plotted to help filter out the pattern that isn't always apparent. In the example shown, **the value *r*** can be used to help determine if there is a statistical correlation between the x & y variables to infer the possibility of causal mechanisms. • The data for this graph must be **continuous** for both variables.

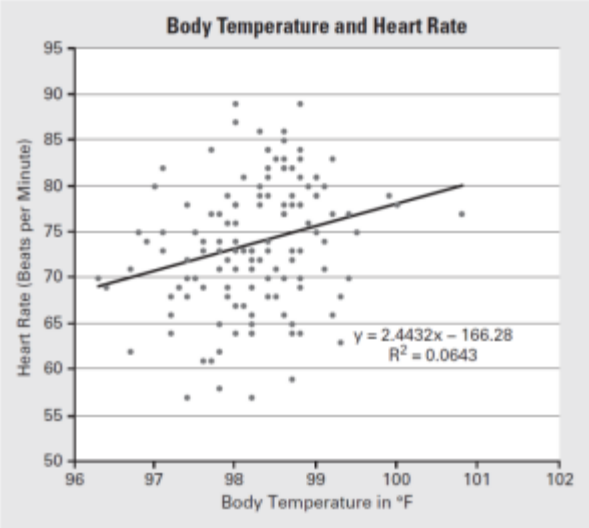
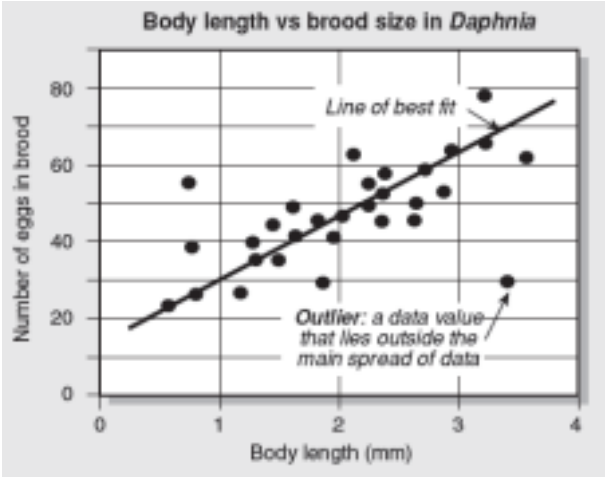


Figure 3. A Scatterplot with a Linear Regression Line

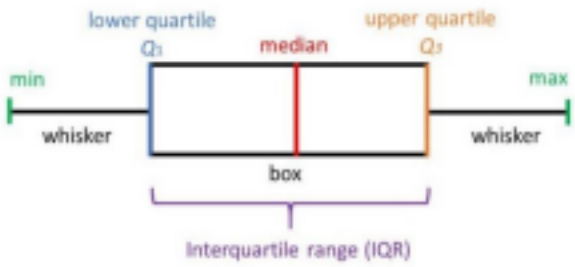


Guidelines for Box and Whisker Plot

• The data should be **nonparametric**

• Descriptive statistics for this data should be **medians and quartiles**.

• Ticks at the tops and bottoms of vertical lines show **highest and lowest values** in the data set. • Top of each box shows **upper quartile**; bottom of each box shows **lower quartile**



• The horizontal line represents the **median**.

Use to show

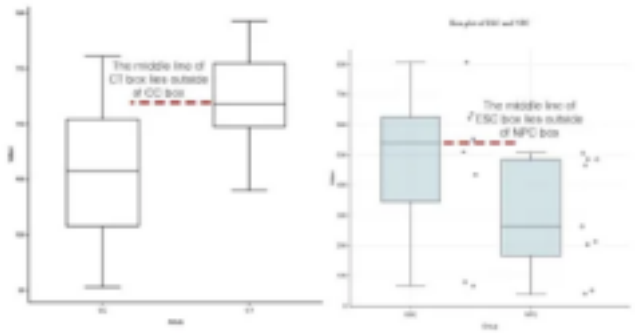
• skewness of data

• distribution of data

• the range of data

• outliers

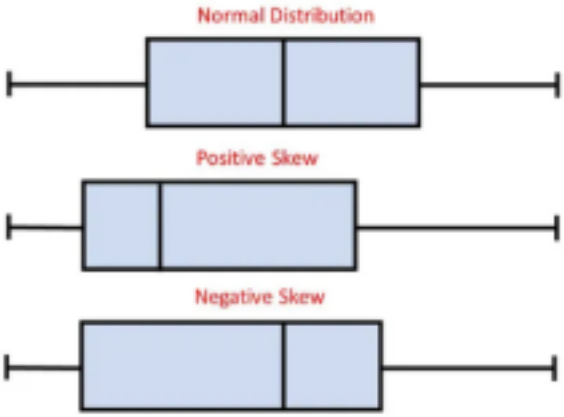
Compare the respective medians of each box plot. If the median line of a box plot lies outside of the box of a comparison box plot, then there is likely to be a difference between the two groups.



Source: https://blog.bioturing.com/2018/05/22/how-to-compare-box-plots/

Box plots are useful as they show the skewness of a data set

The box plot shape will show if a statistical data set is normally distributed or skewed.

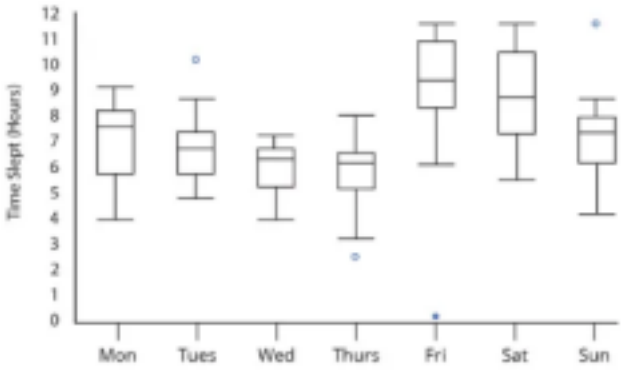


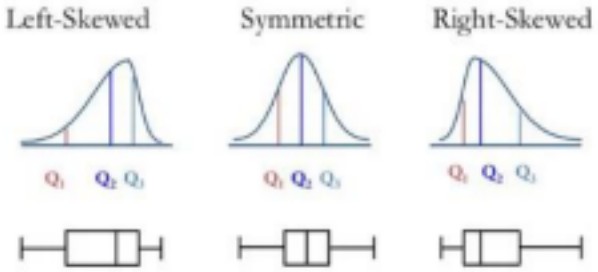
When the median is in the middle of the box, and the whiskers are about the same on both sides of the box, then the distribution is symmetric.

When the median is closer to the bottom of the box, and if the whisker is shorter on the lower end of the box, then the distribution is positively skewed (skewed right).

When the median is closer to the top of the box, and if the whisker is shorter on the upper end of the box, then the distribution is negatively skewed (skewed left).

Compare the interquartile ranges (that is, the box lengths), to examine how the data is dispersed between each sample. The longer the box the more dispersed the data. The smaller the less dispersed the data.

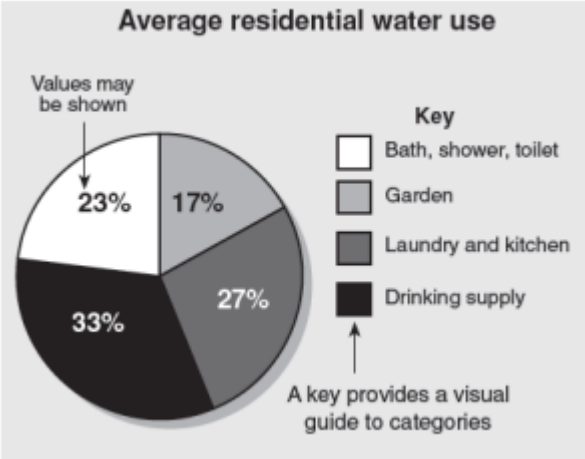




Guidelines for Circle Graphs

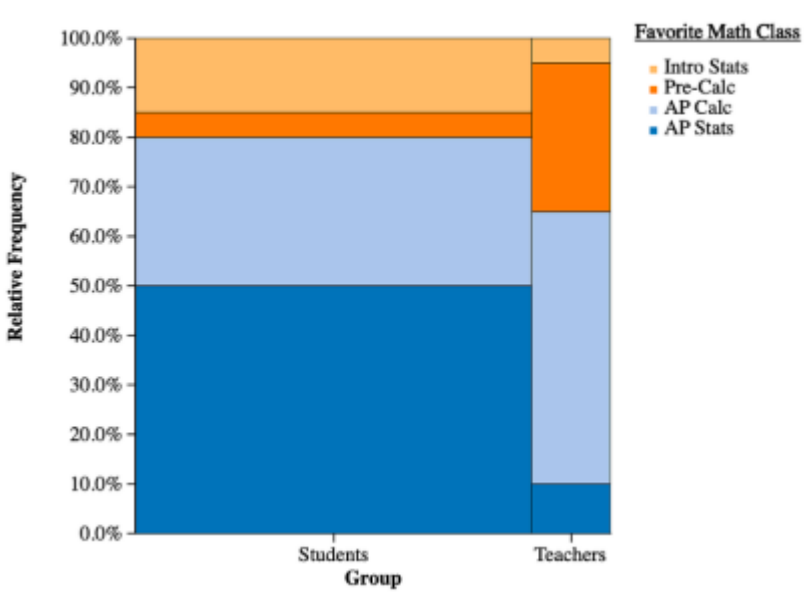
Circle graphs can be used instead of bar graphs, generally in cases
where there are six or fewer categories involved. A circle graph provides strong visual impact of the **relative proportions** in each category, particularly where one of the categories is very dominant.

- Data for one variable are discontinuous (non-numerical or categories)
- Data for the dependent variable are usually in the form of **counts, proportions or percentages.**



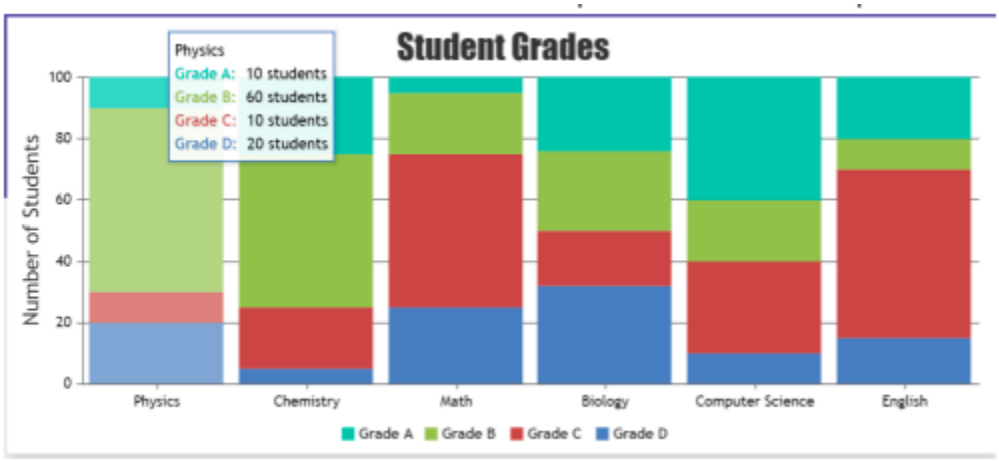
Example of Mosaic Plot

- similar to a stacked bar graph but the x axis
  is scaled to represent the relative size of
  each group.
- Students are not expected to be able to
  make this graph type but might need to
  interpret the data.



Stacked Column Charts

- Works well when the focus of the chart is to compare the totals and one part of the totals.



Key Terms for AP Biology Units

1-Basics of Biochemistry

Readings from chapters 2, 3, 4, 5 and 8

anion
atom
atomic mass
atomic nucleus
atomic number
cation
chemical bond
chemical equilibrium
chemical reaction
compound
covalent bond
dalton
double bond
electron
electron shell
electronegativity
element
energy
energy level
hydrogen bond
ion
ionic bond
ionic compound
isotope
mass number
matter
molecular formula
molecule
neutron
nonpolar covalent bond
orbital
periodic table of elements
polar covalent bond
potential energy
product
proton
radioactive isotopes
reactant
salt
single bond
structural formula
trace element
valence
valence shell
Van der Waals interactions
acid
acid precipitation
adhesion
aqueous solution
base
buffer
calorie
Celsius scale
cohesion
colloid
evaporative cooling
heat
heat of vaporization
hydration shell
hydrogen ion
hydrophilic
hydrophobic
hydroxide ion joule (j)
kilocalorie (kcal)
kinetic energy
molarity
mole (mol)
pH
polar molecule
solute

solution

solvent

specific heat

surface tension

temperature

ATP

alpha helix

amino acid

antiparallel

beta pleated sheet

carbohydrate

catalyst

cellulose

chaperonin

chitin

cholesterol

amino group

carbonyl group

carboxyl group

enantiomer

functional group

geometric isomer

condensation reaction

dehydration reaction

denaturation

DNA

deoxyribose

disaccharide

disulfide bridge

double helix

enzyme

fat

hydrocarbon

hydroxyl group isomer

organic chemistry

phosphate group

structural isomer

sulfhydryl group

fatty acid

gene

glycogen

glycosidic linkage

hydrolysis

hydrophobic interaction

lipid

macromolecule

monomer

2-Cell Biology

Readings from chapters 6, 7 and 11

monosaccharide

nucleic acid

nucleotide

peptide bond

phospholipid

polymer

polynucleotide

polypeptide

polysaccharide

primary structure

protein

purine

pyrimidine

quaternary structure RNA

ribose

saturated fatty acid

secondary structure

starch

steroid

tertiary structure

triacylglycerol

unsaturated fatty acid

x-ray crystallography

activation energy

active site

allosteric regulation

anabolic pathway

bioenergetics

catabolic pathway

catalyst

chemical energy

coenzyme

cofactor

competitive inhibitor

cooperativity

endergonic reaction

energy coupling

entropy

enzyme-substrate complex

exergonic reaction

feedback inhibition

actin

basal body

cell fractionation

cell wall

central vacuole

centriole

centrosome

chloroplast

chromatin

chromosome

cilium

collagen

contractile vacuole

crista

cytoplasm

cytoplasmic streaming

cytoskeleton

cytosol

desmosome

dynein

electron microscope

endomembrane system

endoplasmic reticulum

eukaryotic cell

extracellular matrix (ECM) fibronectin

flagellum

food vacuole

gap junction

glycoprotein

golgi apparatus

granum

integrin

intermediate filament

light microscope (LM)

lysosome

microfilament

microtubule

middle lamella

mitochondrial matrix

mitochondrion

myosin

nuclear envelope

nuclear lamina

nucleoid

nucleolus

nucleus

organelle

peroxisome

plasma membrane

plasmodesma

plastid

primary cell wall

prokaryotic cell

proteoglycan

pseudopodium

ribosome

rough ER

scanning electron microscope (SEM)

secondary cell wall

first law of thermodynamics

free energy

free energy of activation

heat

induced fit

kinetic energy

metabolic pathway

metabolism

noncompetitive behavior

phosphorylated

potential energy

second law of thermodynamics

substrate

thermal energy

thermodynamics

smooth ER

stroma

thylakoid

tight junction

tonoplast

transmission electron microscope (TEM)

transport vesicle

ultracentrifuge

vesicle

active transport

amphipathic molecule

aquaporin

concentration gradient

cotransport

diffusion

electrochemical gradient

endocytosis

exocytosis

facilitated diffusion

flaccid

fluid mosaic model

gated protein

glycolipid

glycoprotein

hypertonic

hypotonic

integral protein

ion channel

isotonic

ligand

membrane potential

osmoregulation

osmosis

passive transport

peripheral protein

phagocytosis

pinocytosis

plasmolysis

proton pump

receptor-mediated endocytosis

selective permeability

sodium-potassium pump

tonicity

transport protein

turgid

adenylyl cyclase

cyclic amp

diacylglycerol (DAG)

G protein

G-protein-linked receptor hormone

inositol trisphosphate (IP_3)

ligand

ligand-gated ion channel

local regulator

protein kinase

protein phosphatase

reception

receptor tyrosine kinase response

scaffolding protein

second messenger

signal transduction pathway

transduction

3- Energy Transformation: Photosynthesis

Readings from chapters 10,35,36 & 37

absorption spectrum

action spectrum

autotroph

bundle-sheath cell

C_3 plant

C_4 plant

Calvin cycle

CAM plant

carbon fixation

carotenoid

chlorophyll

chlorophyll *a*

chlorophyll *b*

crassulacean acid metabolism (CAM)

cyclic electron flow

electromagnetic spectrum

glyceraldehyde-3-phosphate (G3P)

heterotroph

light reactions

light-harvesting complex

mesophyll

mesophyll cell

NADP+

noncyclic electron flow

pep carboxylase

photon

photophosphorylation

photorespiration

photosynthesis

photosystem

photosystem I

photosystem II

primary electron acceptor

reaction center

RuBisCo

spectrophotometer

stoma

stroma

thylakoid

visible light

wavelength

abc model

adventitious

annual

apical dominance

apical meristem

axillary bud

bark

biennial

blade

bundle sheath

companion cell

cork

cambium

cortex

cuticle

endodermis

epidermis

fiber

fibrous root system

guard cells

herbaceous

lateral meristem

lateral root

leaf

meristem

mesophyll

morpho genesis

morphology

perennial

petiole

phase change

phloem

pith

plasticity

polarity

primary growth

primary plant body

root hair

root system

secondary growth

secondary plant body

shoot system

sieve plate

sieve-tube member

spongy mesophyll

active transport

aquaporin

bulk flow

Casparian strip

chemiosmosis

circadian rhythm

endodermis

flaccid

guttation

membrane potential

mycorrhizae

osmosis

osmotic potential

passive transport

pressure potential

proton pump

root pressure

solute potential

sugar sink

translocation

transpiration

transport protein

turgid

turgor pressure

vacuolar membrane

water potential

wilting

xerophytes

cation exchange

crop rotation

mycorrhizae

epiphyte

essential element horizon

humus

hydroponic culture loam

macronutrient

micronutrient

mineral nutrient

mycorrhizae

nitrogen fixation

nitrogen-fixing bacteria

nodule

Phytoremediation

sustainable

agriculture topsoil

4-Respiration: Anaerobic & Aerobic

Readings from chapter 9

acetyl CoA

aerobic

alcohol

fermentation

anaerobic

NAD+

oxidation

ATP synthase

beta oxidation

cellular respiration

Chemiosmosis

citric acid cycle

cytochrome

oxidative phosphorylation

oxidizing agent

electron transport chain

facultative

anaerobe fermentation

glycolysis

lactic acid fermentation

proton-motive force redox

reaction

5- Cell Reproduction

Readings from chapters 12 & 13

anchorage dependence

aster

benign tumor

binary fission

cell cycle

cell cycle control system

cell division

cell plate

centromere

centrosome

checkpoint

chromatin

chromosome

cleavage

cleavage furrow

cyclin

Cyclin-dependent kinase (Cdk)

cytokinesis

density-dependent inhibition

G_0 phase

G_1 phase

G_2 phase

gamete

genome

growth factor

interphase

kinetochore

M phase

malignant tumor

meiosis

metaphase

metaphase plate

metastasis

mitosis

mitotic (m) phase

mitotic spindle

mpf

origin of replication

prometaphase

S phase

sister chromatids

somatic cell

telophase

transformation

alternation of generations

asexual reproduction

autosome

Chiasma

clone

reducing agent

reduction

substrate-level phosphorylation

Crossing over

diploid cell

fertilization

gamete

gametophyte

gene

genetics

haploid cell

homologous chromosomes

karyotype

life cycle

locus

meiosis

meiosis I

meiosis II

recombinant chromosome

sex chromosome

sexual reproduction

somatic cell

spore

sporophyte

synapsis

tetrad

variation

zygote

6-Mendelian & Human Genetics

Readings from chapters 12 & 13

allele

amniocentesis

carrier

character

chorionic villus

sampling (cvs)

codominance

complete dominance

cystic fibrosis

dihybrid

dominant allele

epistasis

F_1 generation

F_2 generation

genotype

heterozygous

homozygous

Huntington's disease

hybridization

incomplete (intermediate) dominance

law of independent assortment law of segregation

monohybrid

multifactorial

norm of reaction

P generation

pedigree

phenotype

pleiotropy

5' cap

a site

polygenic inheritance

Punnett square

quantitative character

recessive allele

sickle-cell anemia

Tay-Sachs disease

testcross

trait

true-breeding

aneuploidy

codon

deletion

domain

e site

Barr body

chromosome theory of inheritance

crossing over

cytogenetic map

deletion

Duchenne muscular dystrophy

duplication

genetic map

genetic recombination

genomic imprinting

hemophilia

inversion

linkage map

linked genes

map unit

monosomic

nondisjunction

parental type

alternative RNA splicing

aminoacyl-tRNA synthetase

polyploidy

recombinant

sex-linked gene

translocation

trisonic

exon

frameshift mutation

insertion

wild type

bacteriophage

DNA ligase

DNA polymerase

double helix

helicase

lagging strand

leading strand

nuclease

nucleotide excision repair

Okazaki fragment

origin of replication

phage

primase

primer

replication fork

semiconservative model

single-strand binding protein

telomerase

telomere

topoisomerase

transformation

anticodon

base-pair substitution

intron

messenger RNA

(mRNA) missense

mutation

mutagen

mutation

nonsense mutation

one gene-one polypeptide hypothesis

p site

point mutation

poly-a tail

polyribosome

(polysome) primary transcript

promoter

reading frame

ribosomal RNA

(rRNA) ribosome

ribozyme

RNA polymerase

RNA processing

RNA splicing

signal peptide

signal-recognition particle (srp)

spliceosome

tata box

template strand

terminator

transcription

transcription factor

transcription initiation complex

transcription unit

transfer RNA (tRNA)

translation

triplet code

wobble (third base)

7-Molecular Genetics & DNA Technology

Readings from chapters 18-21

activator

alternative RNA splicing cell

differentiation

chromatin

control element

differential gene expression enhancer

epigenetic inheritance

euchromatin

genomic imprinting

heterochromatin

histone

histone acetylation

gel electrophoresis

microRNA (miRNA)

multigene family

nucleosome

oncogene

p53 gene

proteasome

proto-oncogene

pseudogene

ras gene

repetitive DNA

repressor

retrotransposon

small interfering RNA (siRNA) transcription factor

transposon

tumor-suppressor gene

bacterial artificial chromosome (bac)

biotechnology

cDNA library

clone

cloning vector

complementary DNA (cDNA) denaturation

DNA fingerprint

DNA ligase

DNA microarray assay

electroporation

expression vector

gene cloning

gene therapy

genetic engineering

genetically modified organism (GMO)

genomic library

genomics

human genome project

in vitro mutagenesis

linkage map

nucleic acid hybridization

physical map

polymerase chain reaction

(pcr) proteomics

recombinant DNA

restriction enzyme

8-Evolution

Readings from chapters 22-26

restriction fragment

restriction fragment length polymorphism (RFLP)

restriction site

RNA interference (RNAi)

single nucleotide polymorphism (snp)

southern blotting

sticky end

transgenic

yeast artificial chromosome

(yac) apical meristem

apoptosis

cell differentiation

cell lineage

chimera

clone

cytoplasmic determinants egg-polarity gene

embryonic lethal

homeobox

homeotic gene

induction

maternal effect gene model

organism

morphogen

morphogenesis

organ identity gene

pluripotent

positional information

segmentation gene stem cell

totipotent

CRISPR

artificial selection

biogeography

catastrophism

endemic

evolution

evolutionary

adaptation fossil

gradualism

homologous

structures

homology

natural selection

paleontology sedimentary rock

taxonomy

uniformitarianism

vestigial organ

descent with

modification

average heterozygosity

balanced

polymorphism

balancing selection

bottleneck effect

cline

directional

selection

disruptive

selection

duplication

fitness

founder effect

frequency-dependent selection

gene flow

gene pool

genetic drift

genetic polymorphism

intrasexual selection

microevolution

modern synthesis

mutation

neutral variation

phenotypic polymorphism

population

population genetics

pseudogene

relative fitness

sexual dimorphism

sexual selection

stabilizing selection

adaptive radiation

allometric growth

allopatric speciation

allopolyploid

autopolyploid

biological species concept

ecological species concept

heterochrony

homeotic gene

macroevolution

macroevolution

morphological species concept

paedomorphosis

paleontological species concept

phylogenetic species concept

geographic variation

hardy-weinberg theorem

polyploidy

postzygotic barrier prezygotic barrier

punctuated equilibrium

reproductive isolation speciation

species

species selection

sympatric speciation analogy

binomial

clade

cladistics

cladogram

class

domain

family

fossil record

genus

homoplasy

ingroup

kingdom

maximum parsimony molecular clock

molecular systematic

monophyletic

neutral theory

order

orthologous genes

outgroup

heterozygote advantage

intersexual selection

paralogous genes

paraphyletic

phylogenetic tree

phylogeny

phylogram

phylum

polyphyletic

shared derived character

shared primitive character

specific epithet

systematic

taxon

taxonomy

ultrametric tree

colony

genetic annealing

geologic record

half-life

magnetic reversal

pangaea

radiometric dating

ribozyme

serial endosymbiosis snowball earth hypothesis

stromatolite

three-domain system

9-Diversity of Life I: Prokaryotes, Protists, Fungi, and Plants

Readings from chapters 27, 28, 29, 30 and 31

anaerobic respiration

biofilm

bioremediation

endotoxin

exotoxin

extreme halophile

extreme thermophile

extremophile

facultative anaerobe

fimbria

gram stain

gram-positive

gram-negative

host

methanogen

mutualism

nitrogen fixation

nucleoid region

obligate aerobe

obligate anaerobe

parasitism

peptidoglycan

photoautotroph

photoheterotroph

pilus

plasmid

capsule

chemoautotroph

chemoheterotroph

symbiont

symbiosis

taxis

alternation of generations

amoeba

apicomplexan

blade

brown alga

cellular slime mold

ciliate

conjugation

diatom

dinoflagellate

diplomonad

euglenid

food vacuole

foraminifera

golden alga

green alga

heteromorphic

holdfast

isomorphic

kinetoplastid

mixotroph

Commensalism

decomposer

endospore

oomycete

parabasalid

plasmodial slime mold

plasmodium

protest

pseudopodium

radiolarian

red alga

secondary endosymbiosis

sporozoite

stipe

thallus

lycophyte

megaphyll

megaspore

microphyll

microspore

moss

peat

peristome

phloem

phragmoplast

placental transfer cell

pterophyta

rhizoid

root
seed
seedless vascular plants seta
sorus
sporangium
spore
stoma
tracheid
vascular plant
vascular tissue
xylem
anther
carpel
conifer
cotyledon
cross-pollination
dicot vs. monocot
endosperm
filament
flower
fruit
Integument
ovary
ovule
pericarp
petal
pollen grain
sepal
stamen
stigma
style
ascomycete
basidiomycete
chitin
deuteromycete
ectomycorrhizal fungi
endomycorrhizal fungi
hypha
imperfect fungi
lichen
mold
mycelium
mycorrhizae
yeast
zoospore
zygosporangium

10-Diversity of Life II: Invertebrates and Vertebrates

Readings from chapters 32, 33, 34, 40, 41, 42, 43, 44 and 47

acoelomate
anterior vs. posterior
archenteron
bilateral symmetry
blastopore
morula, blastula, gastrula
cambrian explosion
cephalization
coelom
coelomate
determinate cleavage
deuterostome development
diploblastic
dorsal vs. ventral
ectoderm, mesoderm, endoderm
ediacaran fauna
gastrulation
germ layers
grade
indeterminate cleavage
larva
metamorphosis
protostome development
pseudocoelomate
radial vs. spiral cleavage
radial symmetry
schizocoelous
triploblastic
trochophore larva
alimentary canal
ammonite

arthropod

book lung

brachiopod

chelicerae

closed vs. open circulation

complete metamorphosis

copepod

crustacean

cuticle

decapods

echinoderm

ectoproct

exoskeleton

endoskeleton

foot

gastrovascular cavity

hermaphrodite

incomplete metamorphosis

invertebrate

isopod

mandible

mantle

medusa

molting

nematocyst

osculum

parthenogenesis

polyp

radula

suspension feeder

torsion

trilobite

trochophore

tube foot

visceral mass

water vascular system

amniote

amphibian

chondrichthyan

chordate

cloaca

ectothermic

endothermic

lateral line system

mammal

marsupial

monotreme

mosaic evolution

neural crest

notochord

operculum

opposable thumb

osteichthyan

oviparous

ovoviviparous

paleoanthropology

pharyngeal clefts & slits

placenta

ratite

ray & lobe-finned fish

reptile

somites

swim bladder

tetrapod

11-Plant & Animal Behavior

Readings from chapters 39, 40 and 51

phototropism

heliotropism

geotropism

thigmonasty

auxin

gibberellins

abscisic acid

ethylene

cytokinins

photomorphogenesis

germination
tunicate

vertebrate

viviparous

connective tissue

muscle tissue

nerve tissue

epithelial tissue

estivation

metabolic rate

thermoregulation

torpor

vasoconstriction

vasodilation

omnivore, carnivore,

herbivore

countercurrent exchange

stem cell

atrium & ventricle

hemoglobin
optimal foraging theory

game theory

agonistic behavior

altruism

circadian rhythms

photoperiodism

vernalization

gravitropism

statoliths

thigmomorphogenesis

virulent and avirulent

systemic acquired resistance

negative feedback system

positive feedback system

vasodilation

vasoconstriction
erythrocytes

leukocytes

platelets (thrombocytes)

antigen & antibody

apoptosis

major histocompatibility
complex (MHC)

interferon

vaccination

nephron

afferent & efferent arterioles

antidiuretic hormone (ADH)

osmoregulation

negative & positive feedback
systems
daily torpor
ethology

proximate & ultimate

questions

imprinting

kinesis vs. taxis

rheotaxis

pheromones

innate behaviors

cognitive maps

associative learning

classical conditioning

operant conditioning

12-Ecology

Readings from chapters 50, 51, 52, 53, 54 and 55

coefficient of relatedness

Hamilton's rule

Kin selection

Vicarious learning

biogeography

ecology

environmentalism

biotic vs. abiotic

aphotic vs. photic zones

benthos/benthic zone

canopy

biota

chaparral

climate

climograph

community ecology

coniferous forest

coral reef

deep-sea hydrothermal vents

desert

detritus

dispersal

ecosystem ecology

ecotone

estuary

eutrophic vs. oligotrophic lakes

intertidal zone

landscape ecology

limnetic zone

littoral zone

macroclimate vs. microclimate

signal

neritic zone

pelagic biome

organismal ecology

patchiness

permafrost

population

population ecology

precautionary principle

savanna

temperate broadleaf (deciduous) forest

temperate grassland

thermocline

tropical rainforest

tropics

tundra

turnover

wetland

imprinting

behavior

fixed action patterns

polygyny

polyandry

Hamilton's rule & kin selection

social learning & culture

agonistic behavior

altruism

associative learning behavior

behavioral ecology

social learning

classical conditioning

coefficient of relatedness

cognition

cognitive ethology

cognitive map

communication

ethology

fixed action pattern

foraging

game theory

habituation

imprinting

inclusive fitness

innate behavior

kin selection

kinesis

landmark

mate choice

copying monogamous

operant conditioning

optimal foraging

theory pheromone

proximate question

reciprocal altruism

sensitive period

sign stimulus

spatial learning

sociobiology

taxis

ultimate question

cohort

demographic

transition

demography

density

density dependent

density

independent

dispersion

ecological capacity

ecological footprint

emigration

exponential growth

immigration

infant mortality

iteroparity

k-selection

logistic population

growth

mark-recapture

method population

population

dynamics

population

ecology

repeated

reproduction

r-selection

semelparity

survivorship curve

territoriality

zero population

growth

aposematic

coloration

Batesian

mimicry

biomass

bottom-up model

coevolution

commensalism

community

competitive exclusion

cryptic coloration

disturbance

dominant species

dynamic stability hypothesis

ecological niche

ecological succession

ectoparasite

endoparasite

energetic hypothesis

evapotranspiration

facilitator

food chain

food web

herbivory

host

individualistic hypothesis

integrated hypothesis

intermediate disturbance hypothesis

interspecific competition

intraspecific competition

interspecific interaction

invasive species

keystone species

Mullerian mimicry

mutualism

Nonequilibrium

model parasitism

pathogen

predation

primary succession

redundancy model

relative abundance

resource partitioning

secondary succession

species diversity

species richness

species-area curve

top-down model

trophic structure

biogeochemical cycle

biological magnification

critical load

decomposer

Detrivore

detritus

ecosystem

eutrophication

greenhouse effect

green world hypothesis

gross primary production

limiting nutrient

net primary production

primary consumer

production efficiency

secondary consumer

secondary production

tertiary consumer

trophic efficiency

turnover time

biological augmentation

bioremediation

conservation biology

endangered species

threatened species

extinction vortex

minimum viable

population movement

corridor

population viability

analysis restoration

ecology

sustainable development

BIOLOGY IS FUN!

Mrs. Turney

MV Room A- 103