

Using Scientific Method

A horticulturist (plant scientist) complains to the city that a nearby residence is ruining his flowers because of the detergent being used to wash their cars. The soap runs into a stream that goes near his flower beds. As an inquiring scientist, you want to find out whether soap can affect flower growth. We will set up the experiment and use the results to answer the questions below.

Before we can design an experiment, there are several important components to take into account!

- _____ - What the scientist changes. (Hint: **I** change the **I**ndependent variable) **YOU ONLY WANT ONE!**
- _____ - What the scientist measures or what is being studied.
- _____ - The group that is under NORMAL conditions.
- _____ - The group that the scientist changes the independent variable in.
- _____ - The parts of the experiment that you keep the same so that the only thing that is different is the Independent Variable.

Questions:

1. Write a hypothesis that relates to this experiment.

2. Describe your control group and your experimental groups in detail. Make sure you describe what variables are used.

3. Based on the experiment done, create a data table to show your results. This should include your experimental and control groups!

4. Explain why you need a control group.

5. What are some things you kept constant? Why is this needed to make the experiment valid?

Identifying Parts of Experiments

For each of the following experiments, identify the Independent Variable, the dependent variable, the control group, the experimental group(s), and any constants that might be present.

1. Alex is studying the effect of sunlight on plant growth. His hypothesis is that plants that are exposed to sunlight will grow better than plants that are not exposed to sunlight. In order to test his hypothesis, he follows the following procedures. He obtains two of the same type of plant, puts them in identical pots with potting soil from the same bag. Then he puts one plant in the sunlight and the other in a dark room. He waters the plants with 200 mL of water every other day for two weeks.

IV:
Control Group:
Constants:

DV:
Experimental Group(s)

2. John notices that his mom waters the plants in their house every other day. He asks, "Will plants grow if they are not watered regularly?" He hypothesizes that plants that are not watered regularly will not grow as large as plants that are watered regularly. In order to test his hypothesis, he conducts the following experiment.
 - a. Obtain two healthy plants of the same variety and size.
 - b. Plant each plant in the same type of pot and the same brand of potting mix.
 - c. Place both plants in the same window of the house.
 - d. Water one of the plants every other day with 250 mL of water.
 - e. Water the other plant once a week with 250 mL of water.
 - f. Measure the height of the plants once a day for one month.

IV:
Control Group:
Constants:

DV:
Experimental Group(s)

3. In science class, Kathy has been studying protists. She has been learning specifically about protists called algae that live in ponds. She knows that algae thrive when there are plenty of nutrients available for them. Kathy asks, "Will water that has been treated with fertilizer have more algae than water that has not been treated with fertilizer?" In order to test her hypothesis, Kathy does the following experiment.
 - a. Obtain a sample of algae from the teacher.
 - b. Obtain two beakers with 500 mL of water in each beaker.
 - c. Put one teaspoon of plant fertilizer in one of the beakers.
 - d. Put an equal amount of algae sample in each of the beakers.
 - e. Place the beakers in a sunny window for two weeks.
 - f. Using a microscope, examine algae growth in each of the beakers every other day for the two weeks and record your results.

IV:
Control Group:
Constants:

DV:
Experimental Group(s)

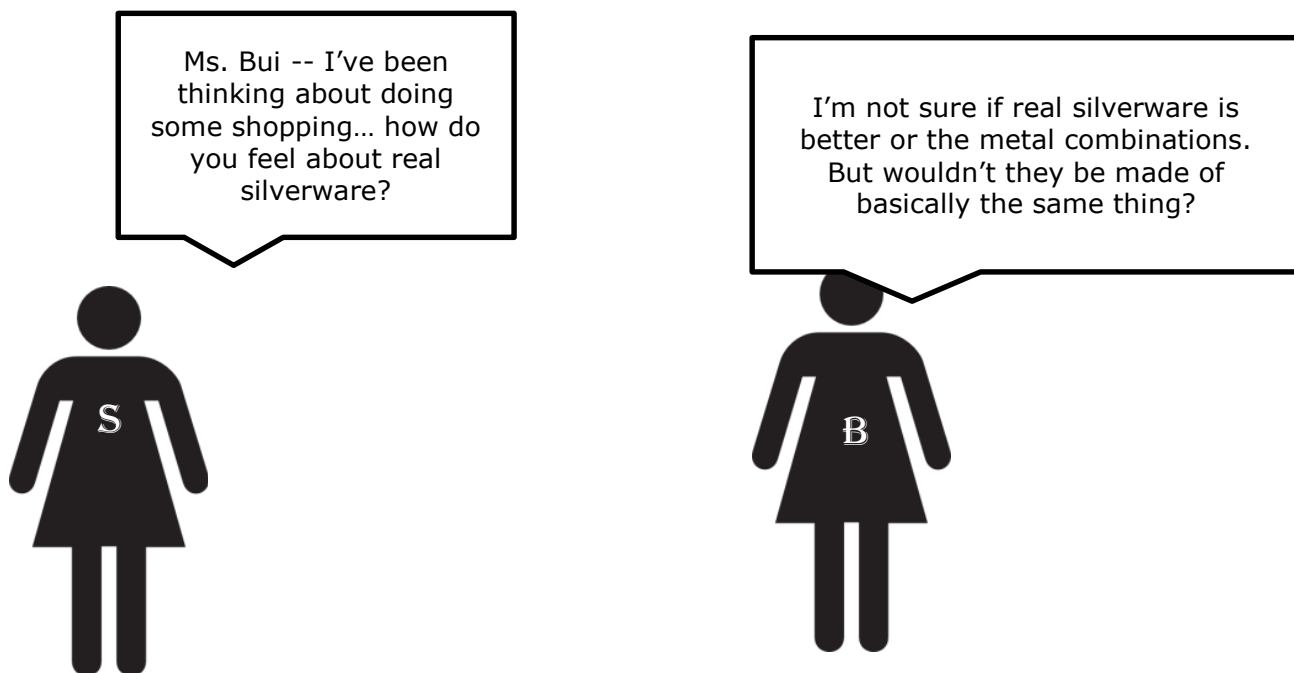
STERNGRR Matching

<u>Characteristic of Life</u>	<u>My definition of the characteristic</u>	<u>Example in Organism</u> <i>(example on card)</i>	<u>Example in humans</u> <i>(drawn or written)</i>
Synthesis			
Transport			
Excretion			
Regulation			
Nutrition			
Growth and Development			
Respiration			
Reproduction			

What's the Matter? – Ms. Adventures in Science

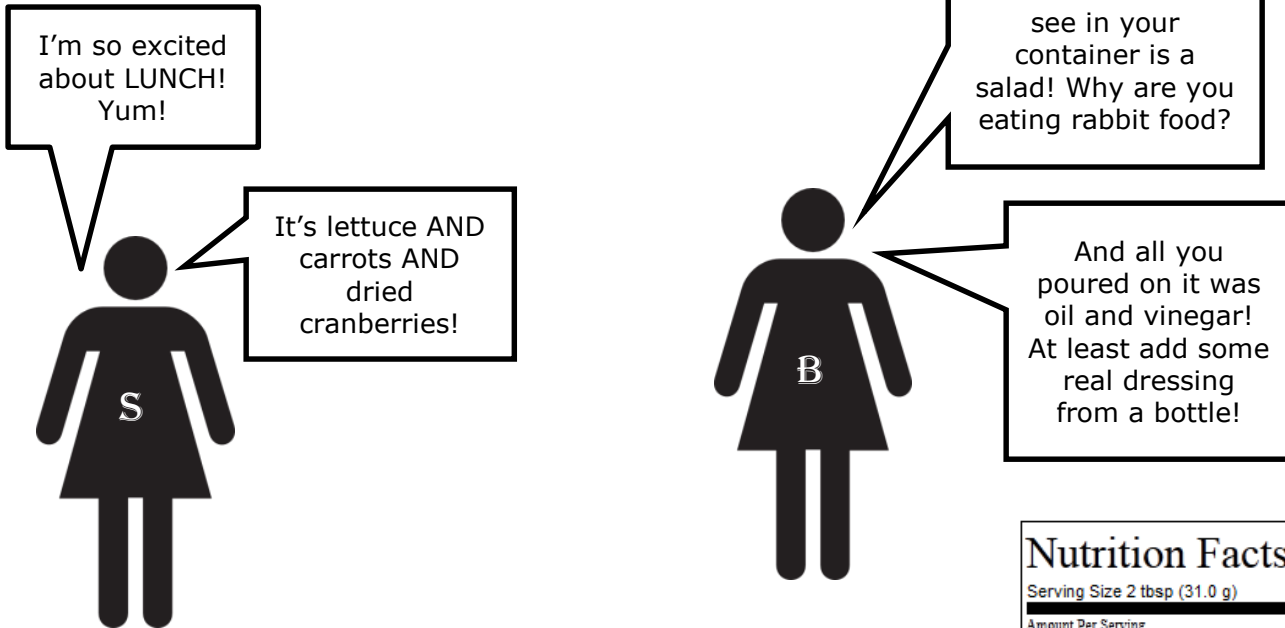
Examine the cartoons below to find the misconceptions of Schimizzi and Bui.

Part A) What's the matter?



1. If silver is one element, what is the smallest part that pure silverware would be made of?
2. What holds all those small pieces together to give them shape?
3. If metal combination silverware is made of combinations of more than one metal, what is the smallest part that combo silverware would be made of?
4. What holds all those small pieces together to give them shape?
5. Identify if combination silverware would be organic or inorganic and explain **why**.

Part B) Why are you eating **THAT**?



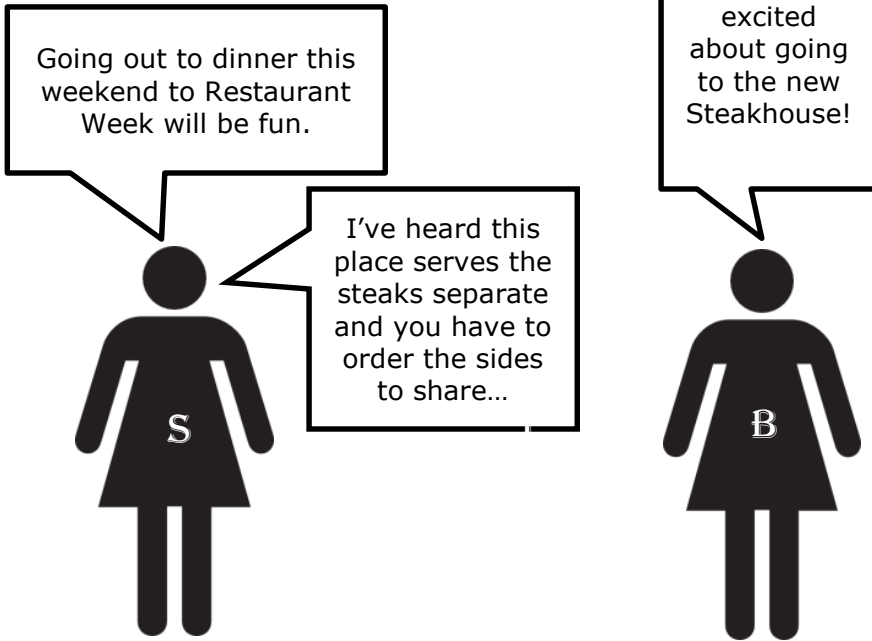
Nutrition Facts	
Serving Size 2 tbsp (31.0 g)	
Amount Per Serving	
Calories 109	Calories from Fat 100
	% Daily Value*
Total Fat 11.1g	17%
Saturated Fat 1.2g	6%
Cholesterol 0mg	0%
Sodium 505mg	21%
Total Carbohydrates 1.8g	1%
Dietary Fiber 0.2g	1%
Sugars 1.3g	
Protein 0.1g	
Vitamin A 0%	Vitamin C 0%
Calcium 0%	Iron 0%

* Based on a 2000 calorie diet

[See more extended nutritional details](#)

- How is the salad similar to **AND** different from the fork you eat it with?
- What do the cranberries, carrots and lettuce have in common? How are they different?
- Why are cranberries the only part of the salad that is sweet?
- Why is the salad dressing an important part of the meal? Is there anything missing from the meal?
- Besides taste, we eat food to supply our body with the basic monomers. List the monomers you could get from the salad and describe how they'd be used in the body.

Part C) Planning dinner



11. What macromolecules will be found in the steak?
12. What types of cells will need the monomers and what will those cells use them for?
13. The Atkins Diet says the meal would be complete with just the steak. Argue for or against the statement using evidence from your notes.
14. Choose two different sides they could share on the double date and explain what in the sides would be good for the body.
15. Mrs. Schimizzi always orders unsweet tea. Mrs. Bui always orders water. Is there any significant difference between what they order? Why or why not?

BONUS: The suggested calorie intake is 2,000 calories a day. The Dietary Guidelines for America recommends 30% should be from fat, 15% from protein and 55% from carbohydrates. How many calories of each is that? Mrs. Schimizzi wants to keep her fat intake the same as recommended, but make her carbohydrates and protein intake equal to each other. What percentage and then calories would that be?

Biology Apps – Unit 1

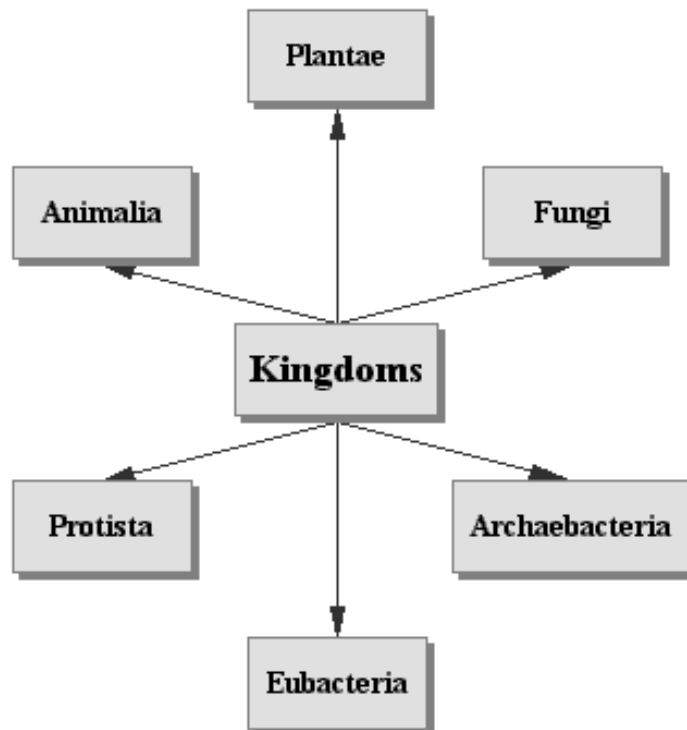


Living organisms share many characteristics.

Identify which of the 8 life processes is being described, using each only ONCE.

1. Bald men are unable to assemble hair proteins out of amino acids. _____
2. Hyperhydrosis is when people improperly control their sweating. _____
3. A fruit contains seeds which are actually baby plants in dormancy. _____
4. Plasmodia is an infectious organism that is carried in bloodstreams. _____
5. Aquatic plants will release excess oxygen into aquariums for fish. _____
6. The brain shows high demand for oxygen due to high energy needs. _____
7. Tadpoles have gills, but later become frogs which have lungs. _____
8. Phytoplankton use the sun's energy to make their body, which is eaten by other marine animals. _____

9. Create side boxes that explain which characteristics were used to group living organisms into each of these 6 kingdoms.



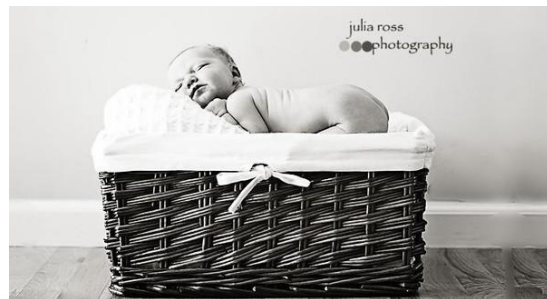
Unit 2 Intro

Text One: *Raising Baby Caroline: Life With PKU*

By Michelle Forman, *Senior Media Specialist*, APHL

<http://www.aphlblog.org/2012/09/raising-baby-caroline-life-with-pku/>

Amy and Steve were very excited about their first child. She had a healthy pregnancy and every ultrasound showed a healthy, growing baby girl. Caroline was three days old and Amy wanted to get out of the house for a little while, so her mother took her to Target for a quick break. As they walked through the parking lot, Amy's phone rang. She saw that it was the pediatrician's office and assumed they were calling to remind her of Caroline's first visit scheduled for the next day. Amy answered, "Hello?" The person on the other line sounded very serious and exuded urgency, "Amy, your daughter's newborn screen showed positive results for PKU. You need to take her to the University hospital immediately."



Text Two: *Genetics Home Reference: Phenylketonuria* <http://ghr.nlm.nih.gov/condition/phenylketonuria>

What is phenylketonuria?

Phenylketonuria (commonly known as PKU) is an inherited disorder that increases the levels of a substance called phenylalanine in the blood. Phenylalanine (an amino acid) is a building block of proteins that is obtained through the diet. It is found in all proteins and in some artificial sweeteners. If PKU is not treated, phenylalanine can build up to harmful levels in the body, causing permanent intellectual disability and other serious health problems.

How common is phenylketonuria?

The occurrence of PKU varies among ethnic groups and geographic regions worldwide. In the United States, PKU occurs in 1 in 10,000 to 15,000 newborns. Most cases of PKU are detected shortly after birth by newborn screening, and treatment is started promptly. As a result, the severe signs and symptoms of classic PKU are rarely seen.

What genes are related to phenylketonuria?

Mutations in the *PAH* gene cause phenylketonuria. The *PAH* gene provides instructions for making an enzyme called phenylalanine hydroxylase. This enzyme converts the amino acid phenylalanine to other important compounds in the body. If gene mutations reduce the activity of phenylalanine hydroxylase, phenylalanine from the diet is not processed effectively. As a result, this amino acid can build up to toxic levels in the blood and other tissues. Because nerve cells in the brain are particularly sensitive to phenylalanine levels, excessive amounts of this substance can cause brain damage.

Text Three: *PKU News. Baby Foods List.* <http://pkunews.org/diet/BabyFoodsList.htm>

Brand	Food	Measure	Mg Phe/	Protein	Calories
Beechnut	Stage 1, Applesauce	1 jar (2.5 oz.)	0.07	0.2	45
Beechnut	Stage 1, Pears	1 jar (2.5 oz.)	0.13	0.3	40
Beechnut	Stage 1, Chiquita Bananas	1 jar (2.5 oz.)	0.61	0.9	70
Beechnut	Stage 1, Peaches	1 jar (2.5 oz.)	0.25	0.5	45
Beechnut	Stage 2, Applesauce	1 jar (4 oz.)	0.06	0.3	70
Beechnut	Stage 2, Apples & Blueberries	1 jar (4 oz.)	0.07	0.3	80
Beechnut	Stage 2, Apple, Mango & Kiwi	1 jar (4 oz.)	0.13	0.5	100
Beechnut	Stage 2, Good Morning Mixed Fruit Yogurt	1 jar (4 oz.)	1.02	2.2	180

Analysis

- 1) What three questions do you have after reading the three texts?
- 2) Based on the text, what foods could baby Caroline NOT eat?
- 3) List three things the text tells you about proteins.
- 4) Based on the text, what is the relationship between an amino acid and a protein?
- 5) Based on the text, how would you describe what an enzyme is.
- 6) If baby Caroline needs to eat 200 calories and she must consume 7 oz. of food, what are possible combinations that will best minimize the amount of phenylalanine (Phe) that she consumes?
- 7) How should Amy explain to Caroline's day care provider about how to help Caroline eat safely?

Unit Two Summary

1. Biology is the study of _____.
2. The smallest unit of life is a _____.
3. Multiple atoms held together by a bond is called a _____.
4. Molecules are classified as _____ based on the presence of CHO.
5. Carbohydrates are made of _____ arranged into a _____.
6. Carbohydrate examples include _____.
7. Carbohydrates are used for _____ and cell structure.
8. Lipids are made of _____ arranged into a _____.
9. Lipid examples include _____.
10. Lipids are used for _____ and they make up the cell _____.
11. Nucleic acids are made of _____ arranged into a _____.
12. Nucleic acid examples include _____.
13. Nucleic acids are used for _____.
14. Proteins are made of _____ arranged into a _____.
15. Protein examples include _____.
16. Proteins are used for _____ and cell structure.
17. Enzymes speed up _____ and are called _____.
18. Enzymes have a specifically shaped _____ where the _____ fits.
19. Enzymes are unchanged during the reaction, so they are _____.
20. Changes in _____ can denature the enzyme which means to change its _____ so the reaction doesn't occur anymore.



Biology Apps – Unit 2.1

What is Science?

1. A scientist performs an experiment where cancer patients are given different amounts of chemotherapy and then asks patients how they feel. Patients who received the least chemotherapy felt the best but died the soonest.
 - a. What type of evidence is this experiment lacking?
 - b. If the doctor decided to tell all physicians to give the maximum chemotherapy, this could be a flawed example of _____ reasoning.
2. A teacher examines student test scores and develops a hypothesis. “If students complete a study guide, then their test grades are higher.”
 - a. How could the teacher design an experiment to test this hypothesis?
 - b. What else should the teacher consider?

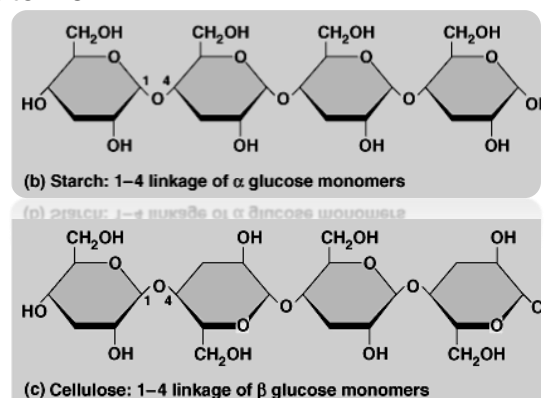
What does Biology study?

3. A biologist studies small units called _____, but a chemist studies even smaller units called _____ of matter.
4. A biologist is studying matter from an asteroid. Based on the important life elements, if the asteroid contains life, molecules would contain _____ and might even have all _____ essential elements.
5. What are the four major organic compounds important to life?

6. Consider starch and cellulose.

- a. Why are they both considered carbohydrates?

- b. How are they different from each other IN FUNCTION?

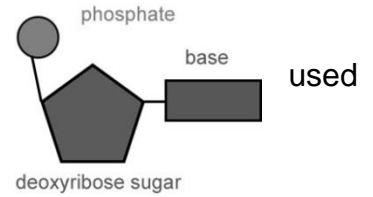


<http://faculty.cbu.ca/cologowski/2008%20BIO1101%20Biomolecules%20>

7. What two things do both carbohydrates and lipids have in common?

8. A student buys French fries for lunch. What two indicators would test positive and WHY?

9. The shape on the right is called a _____ and is to build polymers called _____.



10. DNA and RNA are both nucleic acids.

<http://dna02.wikispaces.com/Structure+of+DNA+nucleotides>

a. They are both made of small units called _____.

b. One strand weighs 80kDa. The other weighs 40 kDa. Which one is DNA, which one is RNA? Why?

11. What is the subunit of proteins?

12. If you are infected with the rhinovirus (common cold), your immune system makes a protein called an antibody to tag and destroy that virus. Those antibodies do not protect you from the influenza virus.

a. Explain what must be different between the rhinovirus and the influenza virus.

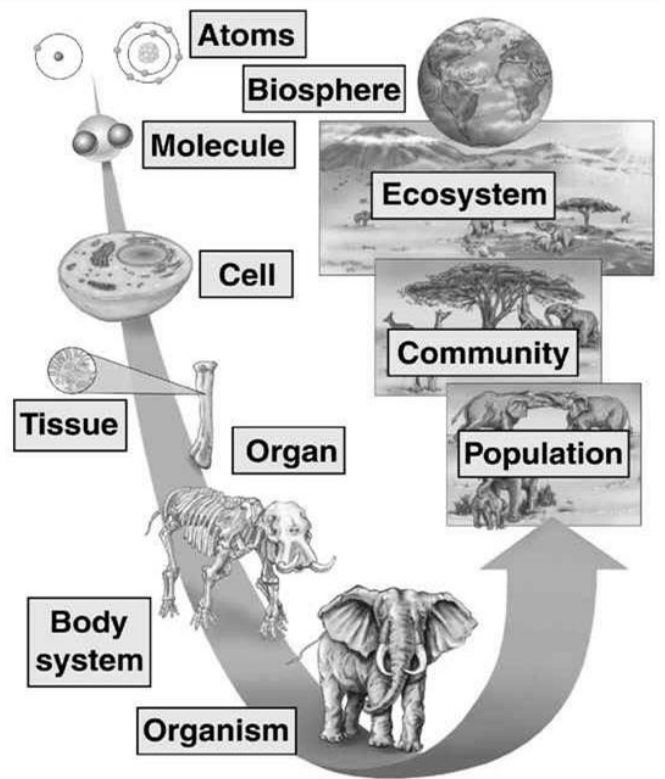
b. Explain why eating a protein rich diet is important for keeping your immune system functioning.

13. A young woman has sickle cell anemia. Her doctor told her the disease was caused by a mutation in her DNA sequence. The effect is that one protein is the wrong shape. The cellular effect is that her red blood cells are misshapen. The body effect is that she cannot carry oxygen very well and her blood can clot.

a. True or False: Sickle cell anemia is caused by an incorrect amino acid sequence that caused an incorrect nucleotide sequence.

b. Use the diagram and captions to the right to explain why a doctor needs to study chemistry in order to understand sickle cell anemia.

c. People with sickle cell anemia can be protected from a disease spread by mosquitoes called malaria. Biologists would then be studying levels known as _____ seen on the right as a level with more than one type of organism.



http://www.ux1.eiu.edu/~cfruf/bio3002/levels_ecology.htm

14. Below is a helpful acronym.

Please Come Late Nate
And Ask Me To Narrate

a. Explain WHAT it helps you remember.

b. Create a NEW acronym.

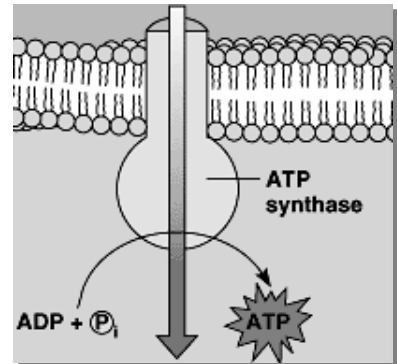
15. Name the four characteristics of enzymes.

16. An enzyme reaction is happening in the picture to the right.

a. What are the two reactants?

b. What is the product?

c. What is the enzyme?



d. If the cell is exposed to excess acid, the cell can't make ATP. Why?

http://chemwiki.ucdavis.edu/Biological_Chemistry/Biochemical_Energy/ATP%2F%2FADP

e. What would you expect if the cell was exposed to excess base?

f. A researcher is designing an experiment to see if alcohol influences the rate of the enzyme ATP synthase. What other conditions does the researcher need to keep constant in the cell to ensure that alcohol is causing an effect on the enzyme ?

17. Pepsin and trypsin both digest proteins. Pepsin digests protein in the stomach. Trypsin digests protein in the intestine. What about their location might require two different enzymes?

18. The Dead Sea is the saltiest body of water on Earth.

a. Why is it called the Dead Sea?

b. What type of organism might be able to survive in these extreme conditions?

Unit 2.1 Preview
Textbook pgs.45-48, 51-53

A. Important Vocabulary to Remember

Vocab Word	Definition from glossary	Diagram with caption

B. Important Diagrams to Analyze

Read the caption of Figure 2-21(pg 52) and answer the following question.

C. Important Big Ideas to Evaluate

After reading pgs. 51-53, sketch a picture from these pages. Create your own caption that includes a vocabulary word from the vocab matching.

Unit 2.1 Review

A. Understanding Examples -- **Complete** the following 5 statements.

1. Macromolecules are polymers made of _____.
2. The best sources of energy are _____ and _____.
3. Glucose is an example of a small sugar and starch is how _____ store carbs.
4. Enzymes are made of _____ so that they can be specifically shaped.
5. An enzyme _____ chemical reactions that turn substrates into _____.

B. Analyzing applications -- Correctly match each vocab word with an appropriate experiment

- | | | |
|-----------------|---------------|-----------------|
| 1. Phospholipid | 4. Antibodies | 7. Lock and Key |
| 2. Glucose | 5. Substrates | |
| 3. Nucleic Acid | 6. Denature | |

- a. When examining how a drug works, the pharmacist notices that it binds to the molecules on the cell surface.
- b. A chef knows that cooking meat to a certain temperature will kill the living things by damaging enzymes.
- c. A long-distance runner knows to carb-load with this sugar because it is good for getting energy,
- d. The chemical engineer knows they have to isolate a specific enzyme to break down the oil from the oil spill.
- e. Your mom knew it was important for you to eat a healthy diet when you are sick so your body can make the proteins to help you get better.
- f. The cancer researcher discovered there was a mutation in the information that tells the cell how to function.
- g. In order to get a reaction to start, the chemist had to add the beginning ingredients.

<u>Figure 2.1 e</u>	<u>Figure 2.1 f</u>
How are these two diagrams related to each other?	



The Case of the Missing Swag

Problem

You scored free tickets from 96.1 The Beat, to the iHeartRadio Music Festival. As part of the deal, you get to meet Lil Wayne! On the day of the concert, a limo picks you up and security takes you straight backstage to meet your idol.

You get the chance to be inside of Lil Wayne's tour bus as he gets ready for the show! As you chat, you get to wander around the bus, and he even offers to autograph some souvenirs for you when you come back after the concert. He leaves the bus first and, as you walk out, you see some celebrities at the gift and snacks table. Staring as you walk, you run right into a group of girls. You just ran into Paris Hilton, Lindsay Lohan, Britney Spears, and Miley Cyrus and they start screaming at you! Angry that they were so rude, you storm off to find your seat. The concert turns out to be amazing, and you watch Rihanna, Usher, and Lil Wayne perform.

You return to get Lil Wayne's autograph but, when you walk into the bus, his security team slams you into the wall. He starts going off and accuses you of stealing his new diamond grill AND throwing up on his custom Gucci suit. You swear you didn't do it, but no one believes you. Who else could have taken it? Then you remember seeing those girls walk towards his tour bus. You also remember seeing them each eating a different snack from the giveaway table. Being the Biologist that you are, you promise to solve this case using what you know about macromolecules! You scrape up the vomit as evidence and set out to solve the case!

Background

<u>Macromolecule</u>	<u>Indicator to use</u>	<u>Initial color</u>	<u>Color change</u>
Simple Sugar			
Starch			
Protein			
Lipid			

You remember that a chemical **indicator** changes _____ when a particular molecule is present.

Before the show you saw the four culprits eating the following items. Consider what macromolecules each item contains:

Suspects	Food they were seen eating	Glucose? Y/N	Starch? Y/N	Protein? Y/N	Lipid? Y/N
Paris	Baked potato with butter				
Lindsay	Cherry pie				
Britney	Fried chicken				
Miley	Candied peanuts				

Hypothesis Write a hypothesis using the “if, then” format to predict who left the vomit behind.

Procedure

Follow the procedure for each indicator and record your data.

Data

Testing Vomit Sample	Iodine	Benedicts	Biuret	Brown Bag
Observations (before/after)				
Conclusion about Macromolecule (present/not)				
Does this eliminate any suspects?				

Analysis/Conclusion

1. Based on your data, who stole the swag? How do you know? _____
2. If a chemical is added to a solution and turns from yellow to blue/black – the chemical was _____ and the solution contained _____.
3. If a chemical is added to a solution and turns from blue to purple – the chemical was _____ and the solution contained _____.
4. If a chemical is added to a solution and turns from blue to orange (after boiling) the chemical was _____ and the solution contained _____.
5. If the brown paper bag has transparent spots, your food must have contained _____.
6. What are other examples of carbohydrates and why do you need to eat them?

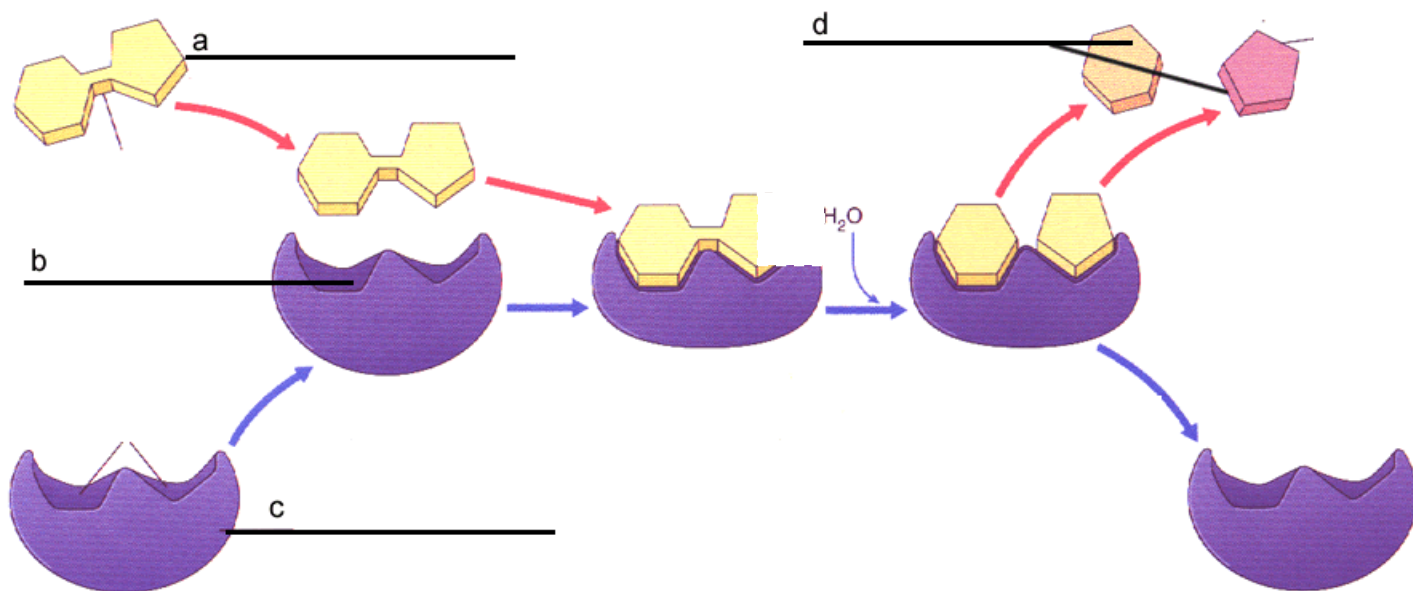
7. What are other examples of lipids and why do you need to eat them?

8. What are other examples of proteins and why do you need to eat them?

9. When you digest your food, your body is breaking the food from _____ to _____.
10. What special type of protein would aid in digestion? Why? _____

Why pour hydrogen peroxide on a cut?

Your cells contain an enzyme known as catalase. If you were to cut yourself, hydrogen peroxide (H_2O_2) is often used to clean the wound. How does this work? The catalase in your cells will break down H_2O_2 into H_2O and O_2 . This **IS** the reaction. You will see the injured area bubble indicating oxygen is being released and water is helping clear the wound of debris.



Trial One: Enzymes are biological catalysts

1. When you added H_2O_2 to the spinach that contains catalase, the H_2O_2 was broken down into H_2O and O_2 .
 - a. The enzyme was _____
 - b. The substrate was _____
 - c. The products are _____
2. When you add hydrogen peroxide to a clean beaker, it _____ because _____.
 - If it does foam, what does that mean?
3. Hydrogen peroxide is kept in a dark bottle because sunlight breaks it down slowly over time. Explain why this means the enzyme catalase is a **catalyst**.

Trial Two: Enzymes are specific

4. Use the example of pouring alcohol into the spinach solution to explain why catalase is specific to hydrogen peroxide. Refer to the diagram above.

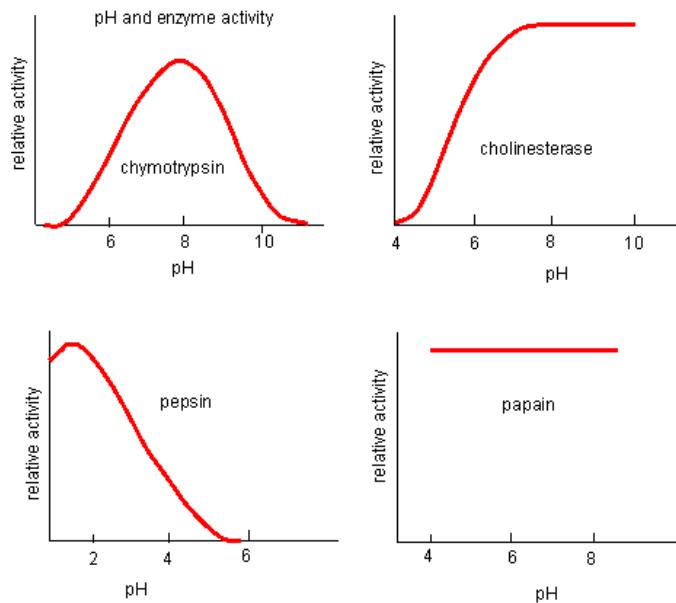
Trial Three: Enzymes are reusable

5. Use the example of adding more hydrogen peroxide to explain why catalase is reusable.

Trial Four: Enzymes can be denatured

6. Use the example of adding acid to explain how catalase can be denatured and what the effects are.

7. Use the graphs at the bottom right (**and** your knowledge of substrate shape) to explain why your body has thousands of different enzymes.



Trial Five: Design your own

Write out the steps to design your own enzyme experiment.

Unit 3 Intro

Text One: Riley and Teagan, Sisters Living With Cystic Fibrosis

By Nancy Maddox, writer <http://www.aphblog.org/2013/09/riley-and-teagan-sisters-living-with-cystic-fibrosis/>

Sara Rose Barth affectionately refers to her two young daughters—Riley, age 6, and Teagan, almost 4—as mini mes. “Riley is exactly like her father in personality and stubbornness and being a night owl. Teagan is the early riser, the organizer, creative and over-the-top. She would be my mini me.” Yet despite their differences, Barth says the girls “have a true sister bond.” Both were born with cystic fibrosis (CF), an inherited disorder that affects about 30,000 US children and adults and about 70,000 people worldwide. People with CF have a defective gene that causes the body to produce unusually thick, sticky mucus that clogs the airways—leading to potentially life-threatening lung infections—and obstructs the pancreatic ducts that secrete enzymes to help the body break down and absorb food.

Text Two: *Genetics Home Reference: Cystic Fibrosis* <http://ghr.nlm.nih.gov/condition/cystic-fibrosis>

What is cystic fibrosis? Cystic fibrosis is an inherited disease characterized by the buildup of thick, sticky mucus that can damage many of the body’s organs. Over time, mucus buildup and infections result in permanent lung damage, including the formation of scar tissue (fibrosis) and cysts in the lungs. Most people with cystic fibrosis also have digestive problems. Other digestive problems result from a buildup of thick, sticky mucus in the pancreas. The pancreas is an organ that produces insulin (a hormone that helps control blood sugar levels). It also makes enzymes that help digest food. In people with cystic fibrosis, mucus blocks the ducts of the pancreas, reducing the production of insulin and preventing digestive enzymes from reaching the intestines to aid digestion.

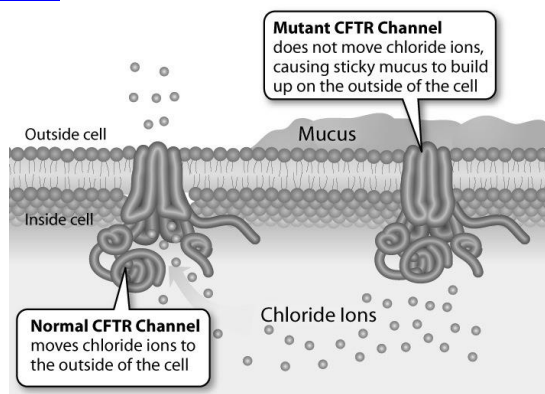
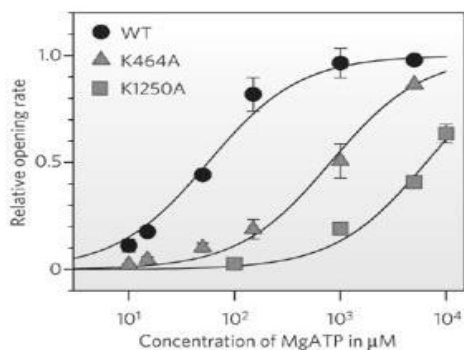
How common is cystic fibrosis? Cystic fibrosis is a common genetic disease within the white population in the United States. The disease occurs in 1 in 2,500 to 3,500 white newborns. Cystic fibrosis is less common in other ethnic groups, affecting about 1 in 17,000 African Americans and 1 in 31,000 Asian Americans.

What genes are related to cystic fibrosis? Mutations in the *CFTR* gene cause cystic fibrosis. The *CFTR* gene provides instructions for making a channel that transports negatively charged particles called chloride ions into and out of cells. Chloride is a component of sodium chloride, a common salt found in sweat. Chloride also has important functions in cells; for example, the flow of chloride ions helps control the movement of water in tissues, which is necessary for the production of thin, freely flowing mucus. Mutations in the *CFTR* gene disrupt the function of the chloride channels, preventing them from regulating the flow of chloride ions and water across cell membranes.

Text Three and Four: *The ABC protein turned chloride channel whose failure causes cystic fibrosis*

http://www.nature.com/nature/journal/v440/n7083/fig_tab/nature04712_F3.html

Cystic Fibrosis <http://learn.genetics.utah.edu/content/disorders/singlegene/cf/>



Analysis

- 1) What three questions do you have after reading the three texts?
- 2) Based on the texts, what effect does the cystic fibrosis mutation have on pancreatic enzymes?
- 3) List three things the texts tell you about chloride channels in the cell membrane.
- 4) Based on the texts, what is the relationship between a channel and the cell membrane?
- 5) In Text Three, the chart, WT is for the wild-type (normal). At 10^2 concentration of ATP, how does the wild-type channel compare to the mutant channels?
- 6) What impact does increasing the amount of ATP have on the difference between the wild-type and the mutants?

Unit Three Summary

1. _____ cells are small cells that do not have a nucleus or complex organelles.
2. _____ cells are larger, complex and have a nucleus and membrane-bound organelles.
3. The _____ is the barrier that protects the inside of the cell from the outside environment by regulating what enters and leaves the cell.
4. All cells have four structures: cell membrane, cytoplasm, DNA. and _____.
5. The small functioning parts that perform functions for cells are called _____.
6. The DNA of eukaryotic cells is found in the _____.
7. Amino acids are joined together to form proteins at the _____.
8. The _____ has folded membranes to increase the amount of energy production for the cell.
9. _____ are found in plant cells and are the site of photosynthesis.
10. Plant cells have a _____ made of cellulose to provide rigid support.
11. _____ are only found in animal cells and are used for cell reproduction.
12. _____ cells are cells that have not differentiated to become specialized cells.
13. One way cells maintain _____ is to transport substances across their cell membrane.
14. _____ transport does not require energy and moves WITH the concentration gradient.
15. _____ is the spreading out of molecules from high to low concentration.
16. _____ is the diffusion of WATER across a membrane.
17. In a salt water solution _____ is the solute and _____ is the solvent.
18. A freshwater plant placed into a saltwater solution would _____ because water would leave the plant cells.
19. _____ transport requires energy (ATP) and moves molecules AGAINST the concentration gradient (low to high concentration).
20. A protist like the paramecium is adapted to survive in an aquatic environment because it has an adaptation called a _____ to pump out water.

Unit 3.1 Preview
Textbook pgs.172-180

A. Important Vocabulary to Remember

Vocab Word	Definition from textbook	Diagram with caption

B. Important Diagrams to Analyze

Read the caption of Figure 7-10 (pg 179) and answer the bolded question in a complete sentence.

C. Important Big Ideas to Evaluate

After reading pgs. 174-178, sketch a picture from these pages. Create your own caption that includes a vocabulary word from the vocab matching.

Unit 3.1 Review

A. Understanding Examples -- **Complete** the following 5 statements.

1. Prokaryotic cells are simple cells and examples are _____.
2. Eukaryotic cells have the DNA stored in the _____.
3. Only plant cells have a _____ whose job is to make _____.
4. The mitochondria has a folded inner membrane so that it can make more _____.
5. Muscle cells would have a lot of _____ so they can make energy.

B. Analyzing applications -- Correctly match each vocab word with an appropriate experiment

- | | | |
|---|--|---|
| <ol style="list-style-type: none"> 1. Eukaryotic 2. Ribosome 3. Golgi Apparatus 4. Cell wall 5. Vacuole 6. Lysosome 7. Chloroplast | <ol style="list-style-type: none"> a. A florist knows that plants will store extra water so they don't wilt. b. When examining why a plant will bend in the wind, but not break because it has an extra structure for support. c. Since the cell was missing a nucleus, the student knew it was NOT this type of cell d. An experiment showed that removing this organelle | <ol style="list-style-type: none"> e. The brain sends lots of chemical messengers, so a neurologist founds lots of this packaging organelle. f. White blood cells have to digest invaders before they make you sick, so an immunologist found lots of this organelle. g. If you damage this organelle, the body won't be able to make any enzymes. |
|---|--|---|

C. Evaluating Scenarios -- Redraw the two listed diagrams **from your handbook.**

<u>Figure 3.1 i</u>	<u>Figure 3.1 j</u>
How are these two diagrams related to each other?	

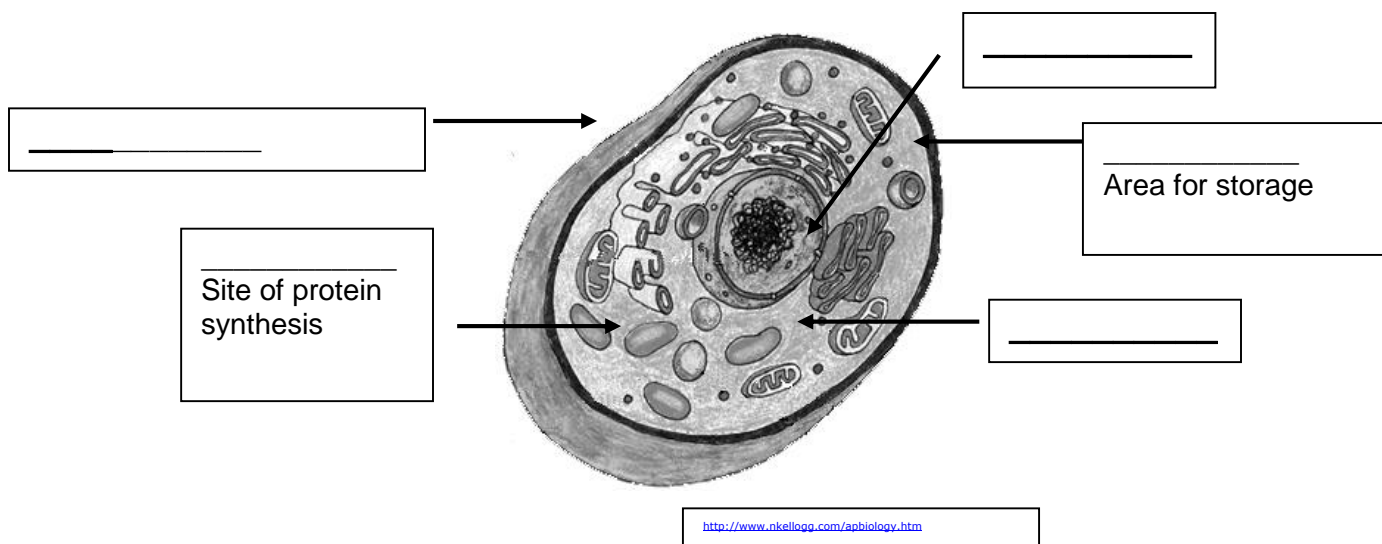
Biology Apps – Unit 3.1



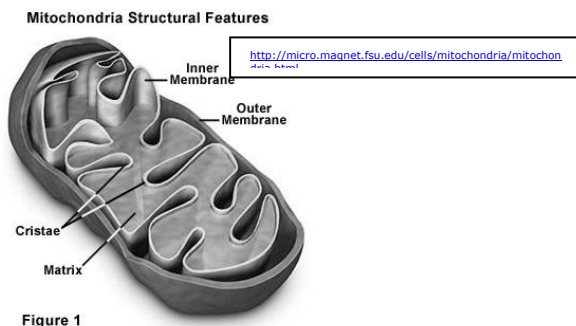
Cell organelles

1. What four structures are found in ALL cells?
2. Alzheimer's disease has been found to be linked to "leaky cells" that have poor regulation of what is entering and exiting a cell. What cell organelle would be implicated in this discovery?
3. What are the two main types of cells?
4. How is the location of the DNA different in prokaryotic and eukaryotic cells?
5. Indicate whether the following living organisms are made of EUKARYOTIC or PROKARYOTIC cells.

Trees (plants) _____	Mushroom (fungus) _____
Insects (animal) _____	Bacteria _____
Amoeba (protist) _____	Yeast (fungus) _____
6. Identify the following organelles based on the picture and their function.



7. How does the structure of a mitochondria relate to its function?



8. What is the function of a ribosome?
9. How would the following organelles interact to perform cell functions?
DNA, Endoplasmic reticulum, Ribosomes, Golgi complex

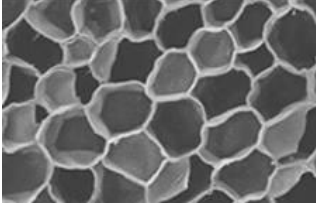
Plant and Animal Cell Differences

10. How many organelles do plant and animal cells have in common?
11. What two structures are found in plant cells but not animal cells?
12. What is the function of the chloroplast?
13. Antibiotics target the peptidoglycan found in bacterial cell walls and cause cell death. Why do antibiotics not harm animal cells? Would it harm plant cells? Why?
14. What structure is found in animal cells but not plant cells?

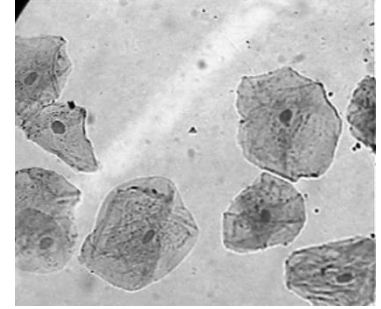
Cell specialization creates different cells within an organism.

15. What is cell specialization?
16. Give one specific example of HOW the structure of a cell relates to its specific function.
17. What is a stem cell?
18. If all of your cells, including stem cells, contain the SAME DNA, what allows each cell to have specific functions?
19. Researchers are trying to remove adult cells (such as from the skin epidermis) and transform them into nerve or pancreatic cells. What would make a cell become a pancreatic cell? What type of patient would this help?

Cell Inquiry Lab



To observe a variety of cells and identify similarities and differences



Part A: Observe Cork Cells

- Observe the cork cells under 40x then 100x and finally 400x.
- Draw what you see on 400x on half of the front of your paper.

Part B: Observe Cheek Cells

- Chew on your cheek to loosen some cells. Use a toothpick to scrape some off **the inside of your cheek**.
- Put a drop of methylene blue dye on a glass slide.
- Roll the toothpick in the dye to get the cheek cells on the slide.
- Place a coverslip on top.
- Observe under 40x then 100x and 400x.
- From what you see on **400x**, pick ONE and draw it to fill the other half of your paper. LABEL the cell membrane, the cytoplasm and the nucleus.

Part C: Analyzing Cell Differences

1. On the back of your paper, draw 3 large circles. Label the circles:

#2 Onion

#5 Blood

#6 Nerve

2. **FOR EACH CELL**, draw what you see and after reading the description, pick out two important facts to write in bullet form.

a.

b.

3. **Answer the following in complete sentences:**

a. How is cell 2 different from cells 5 and 6?

b. Multiple sclerosis is a disorder that can cause individuals to lose the ability to walk or speak. It is caused by the degeneration (break down) of the myelin sheath (the protein that covers part of the nerve cell). Why might the loss of this protein cause this damage?

Structures in a Eukaryotic Cell

- 1) To create Figure One, draw one cheek cell magnified to take up the entire space.
- 2) Label the three structures of the cell that can be identified through the microscope.
- 3) To create a model of *any* eukaryotic cell, use a different color to add other structures.
- 4) Using the pieces of colored paper, identify where specific macromolecules would be found inside the eukaryotic cell. Glue the pieces as close as possible to the organelle discussed.
- 5) Cheek cells are epithelial (lining and protection) cells. These cells are found in areas of high wear and tear and therefore divide often and have very limited differentiation. Using Figure Two, choose a different cell in the human body that would be differentiated for a different purpose. Represent the differentiation with the quantity of specific organelles.
- 6) To create Figure Three, draw the protective cells of the *Ipomoea batatas*. *Compare and contrast these protective cells.*

Figure One:

Figure Two

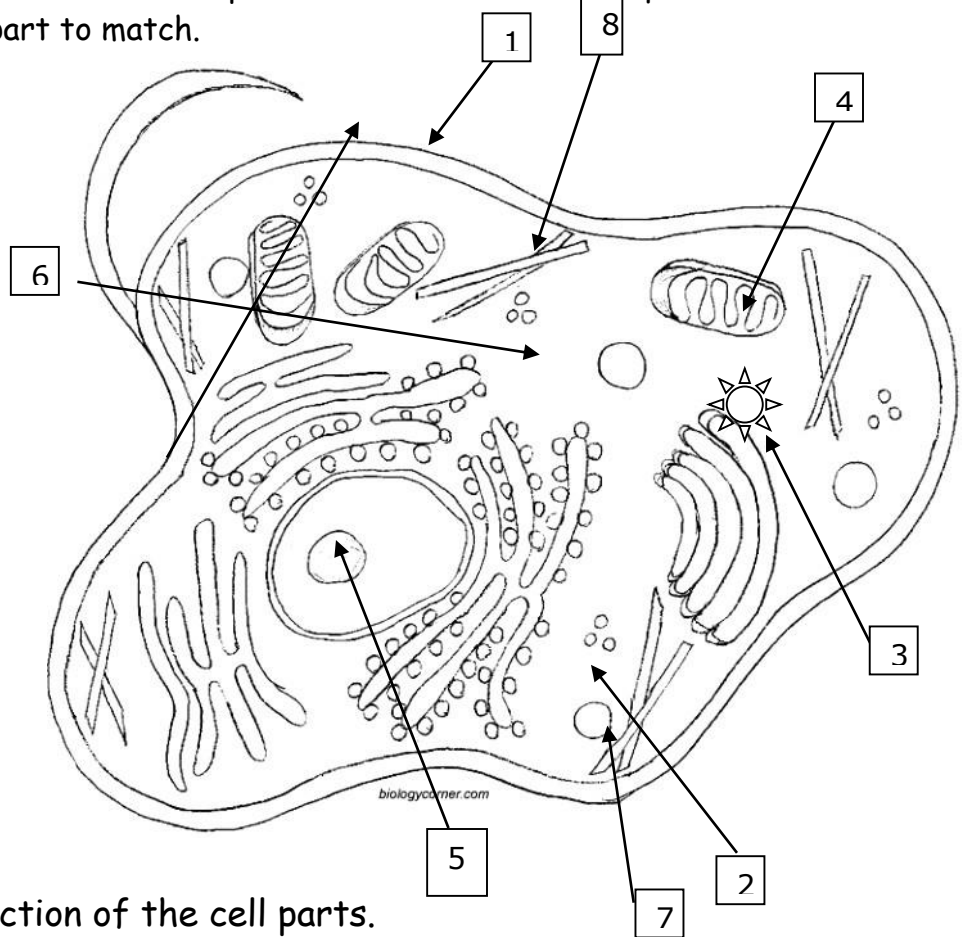
Figure Three

These cells are similar to the human cheek cells by:

These cells are different from the human cheek cells by:

Animal Cell Coloring

Directions: Choose a color for each of the parts below and fill in the square with the color of your choice. Color the cell part to match.

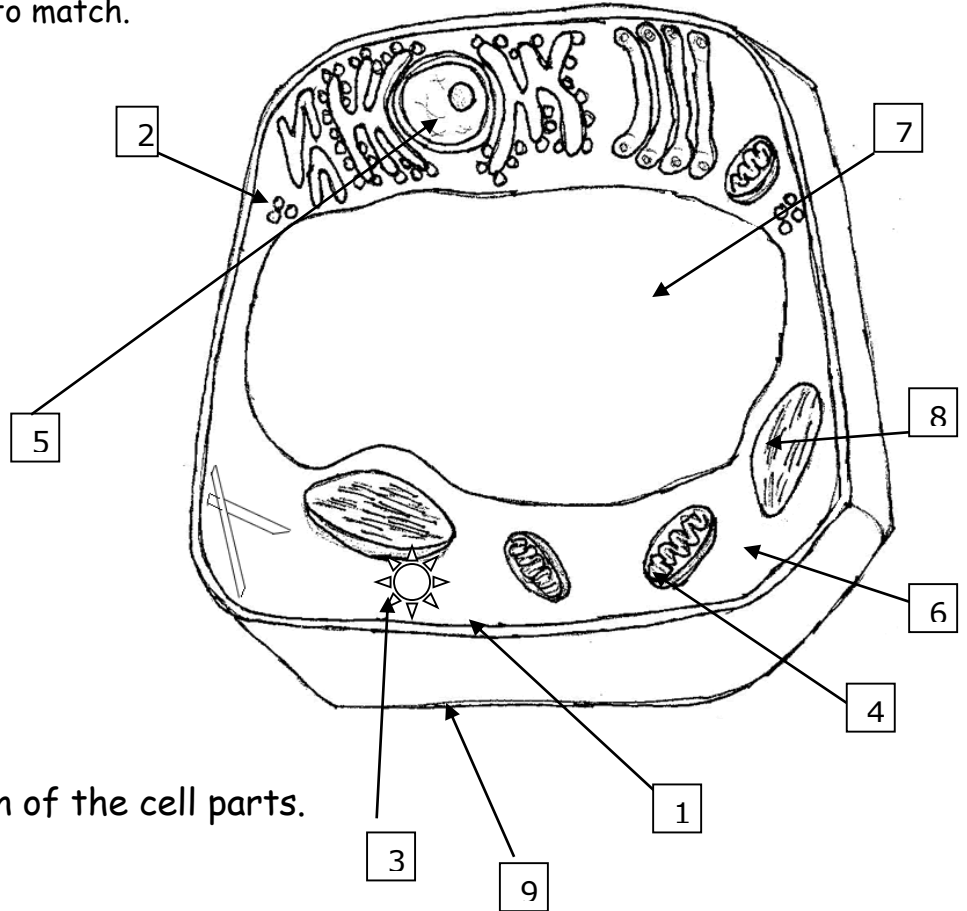


Briefly describe the function of the cell parts.

1. Cell membrane
2. Ribosome
3. Lysosome
4. Mitochondria
5. Nucleus
6. Cytoplasm
7. Vacuole
8. Centrioles

Plant Cell Coloring

Directions: Choose a color for each of the parts below and fill in the square with the color of your choice. Color the cell part to match.

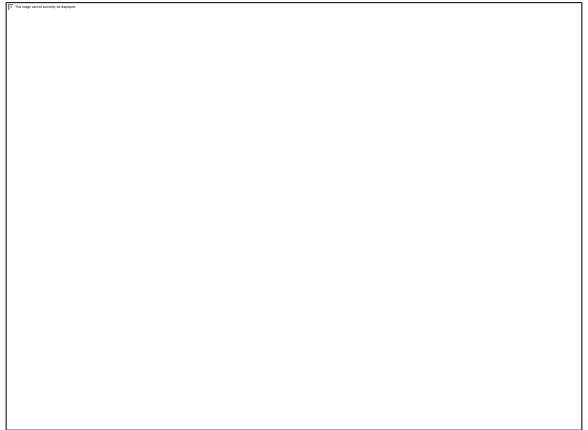


Briefly describe the function of the cell parts.

1. Cell membrane
2. Ribosome
3. Lysosome
4. Mitochondria
5. Nucleus
6. Cytoplasm
7. Large Vacuole
8. Chloroplast
9. Cell Wall

WHEN CELL COMMUNICATION GOES WRONG

The cells in our bodies are constantly sending out and receiving signals. But what if a cell fails to send out a signal at the proper time? Or what if a signal doesn't reach its target? What if a target cell does not respond to a signal, or a cell responds even though it has not received a signal? These are just a few ways in which cell communication can go wrong, resulting in disease. In fact, most diseases involve at least one breakdown in cell communication.



Losing The Signal The food that you eat is broken down into sugar, which enters the blood stream. Normally, cells in the pancreas release a signal, called insulin, that tells your liver, muscle and fat cells to store this sugar for later use. In type I diabetes, the pancreatic cells that produce insulin are lost. Consequently, the insulin signal is also lost. As a result, sugar accumulates to toxic levels in the blood. Without treatment, diabetes can lead to kidney failure, blindness and heart disease in later life.

Normal blood sugar regulation. After food enters the body (1), it is broken down and sugar enters the bloodstream (2). Sugar stimulates cells in the pancreas to release insulin (3). Insulin travels through the blood to other cells in the body and signals them to take up sugar (4).

When A Signal Doesn't Reach Its Target Multiple sclerosis is a disease in which the protective wrappings around nerve cells in the brain and spinal cord are destroyed. The affected nerve cells can no longer transmit signals from one area of the brain to another. The nerve damage caused by multiple sclerosis leads to many problems, including muscle weakness, blurred or double vision, difficulty with balance, uncontrolled movements, and depression.

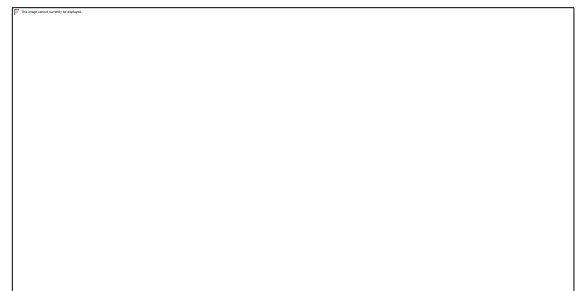


When The Target Ignores The Signal

Type I and type II diabetes have very similar symptoms, but they have different causes. While people who have type I diabetes are unable to produce the insulin signal, those with type II diabetes do produce insulin. However, the cells of type II diabetics have lost the ability to respond to insulin. The end result is the same - blood sugar levels become dangerously high.



Too Much Signal A stroke occurs when a blockage forms in a blood vessel, cutting off blood flow to part of the brain. The immediate result is the death of nearby brain cells. But the most catastrophic event comes later, when the dying cells release large amounts of the signaling molecule glutamate. Low concentrations of glutamate control many actions in the brain, but at high concentrations it is toxic to cells. Through a process called excitotoxicity, glutamate spreads through the brain and kills cells that were not affected by the blockage, often leading to widespread brain damage.



Excitotoxicity: After a brain injury such as a stroke, lethal amounts of signaling molecules leak out of dying nerve cells resulting in widespread damage to the brain.

Multiple Breakdowns

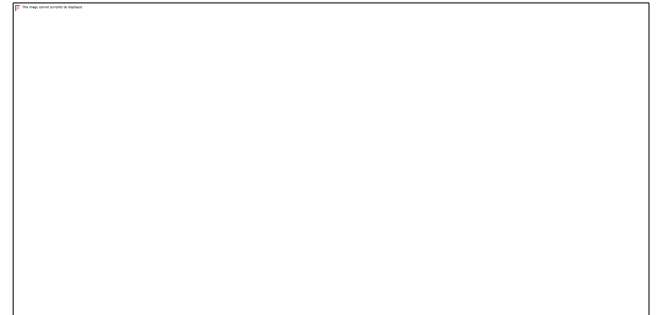
Cell growth and division is such an important process that it is under tight control with many checks and balances. But even so, cell communication can break down. The result is uncontrolled cell growth, often leading to cancer. Cancer can occur in many ways, but it always requires multiple signaling breakdowns. Often, cancer begins when a cell gains the ability to grow and divide even in the absence of a signal. Ordinarily this unregulated growth triggers a signal for self-destruction. But when the cell also loses the ability to respond to death signals, it divides out of control, forming a tumor. Later cell communication events cause blood vessels to grow into the tumor, enabling it to grow larger. Additional signals allow the cancer to spread to other parts of the body.



Many mechanisms maintain appropriate cell growth: Cell division occurs in response to external signals (1). Enzymes repair damaged DNA (2). Cells make connections with their neighbors (3). If these connections suddenly change, neighboring cells send out an alert. Cells respect and stay within tissue boundaries (4). If a cell is beyond repair, it initiates its own death (5).

Treatments

Just as cell communication can go wrong resulting in disease, many disease treatments rely on cell communication. If you think of disease as a roadblock in cell communication, treatment is an alternate route. The first step is to locate the problem. The second step is to find a way around the problem. Sometimes it's easy. The treatment for type I diabetes is to inject insulin into the blood stream. Other times it's more difficult, especially in diseases such as cancer where cell communication has broken down in multiple places. During an asthma attack, signaling molecules cause a narrowing of breathing passages in the lungs, making it difficult to breathe. Many drugs that treat asthma mimic natural signals that tell muscle cells in the lungs to relax, allowing breathing passages to open.



1. The cells in your pancreas release a signal to tell your liver, muscle, and fat cells to store the sugar for later use. What is the name of this signal? _____ Use your notes from Unit 4 to determine what type of organic macromolecule this is. _____
2. Multiple sclerosis is when nerve cells can no longer transmit signals from one area of the _____ to another. Draw a picture of a nerve cell below.
3. In type I diabetes, the insulin signal is no longer made. What is the difference in type II diabetes?
4. Dying cells release glutamate which poison other nearby cells. What causes this to happen?
5. Ordinarily, unregulated cell growth results in a signal for ____-_____. If the cell also loses the ability to respond to the death signals, it continues to grow forming a _____.
6. Looking at the last picture, some medicines can mimic natural signals telling the muscle cells in the lungs to relax. What type of attack caused the initial narrowing of the breathing passages?

Unit 3.2 Preview
Textbook pgs.184-185, 202, 214, 222

A. **Important Vocabulary to Remember**

Vocab Word	Definition from textbook	Diagram with caption

B. **Important Diagrams to Analyze**

Read the caption of Figure 7-12 (pg 182) and answer the bold question found in Figure 7-13 on pg 183.

C. **Important Big Ideas to Evaluate**

After reading pgs. 184-185, sketch a picture from these pages. Create your own caption that includes a vocabulary word from the vocab matching.

Unit 3.2 Review

A. Understanding Examples -- **Complete** the following statements.

1. If there is more salt than water in a cell, the _____ will move into the cell.
2. The cell membrane called selectively _____ because it only allows certain things in and out of the cell.
3. Passive transport does not require _____ and includes the examples of _____ and _____.
4. Active transport moves molecules from a _____ to _____ concentration.

B. Analyzing applications -- Correctly match each vocab word with an appropriate experiment

- | | | |
|---|---|---|
| <ol style="list-style-type: none"> 1. Concentration 2. Equilibrium 3. Phospholipid 4. ATP 5. Cell wall | <ol style="list-style-type: none"> a. This molecule is used to build the cell membrane that is found around ALL cells. b. The aquarium needed to have the same amount of salt in the water so that it would be similar to the fish's body. c. After examining a plant and a bacterium, the scientist found that THIS helps these | <ol style="list-style-type: none"> cells protect against bursting. d. Nerve cells pump sodium ions from a low to a high concentration using THIS as an energy source. e. A chemical engineer created several different solutions with different amounts of salt. |
|---|---|---|

C. Evaluating Scenarios -- Redraw the two listed diagrams **from your handbook.**

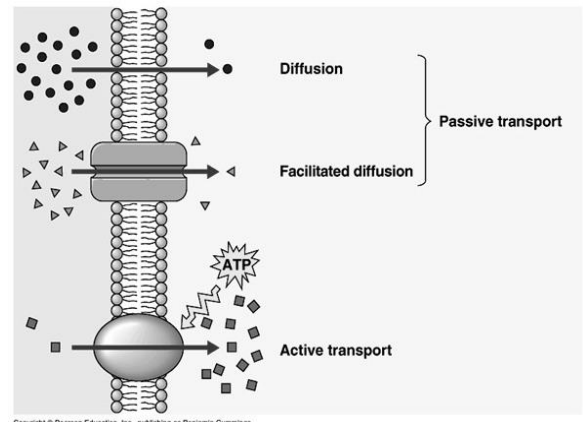
<u>Figure 3.2e</u>	<u>Figure 3.2f</u>
How are these two diagrams related to each other?	

Biology Apps – Unit 3.2



Cell Transport

1. What structure do molecules pass through when entering or leaving the cell?
2. Label a protein and a phospholipid on the cell membrane pictured below.

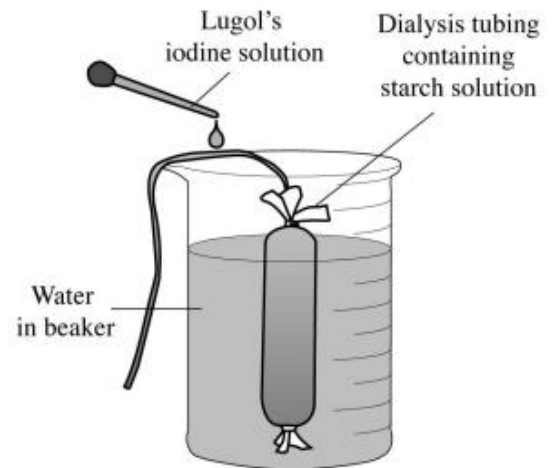


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3. What type of transport requires no energy? This includes diffusion and osmosis?

<http://web.ics.purdue.edu/~s-smille/AN-SC230/Digestive%20Physiology/Absorption.html>

4. What makes diffusion possible?
5. Look at the picture to the right and predict what will happen to the cell and the solution surrounding the cell if the dialysis tubing is like a cell membrane.



6. A protist that **normally** lives in the ocean is placed into a freshwater environment. Explain what will happen to the protist cell.
7. A freshwater plant is placed into a saltwater aquarium. Explain what will happen using the following terms: osmosis, water, high to low, shrink
8. What term is used to describe an equal distribution of molecules between a cell and its environment?
9. What type of transport moves molecules against the concentration gradient?

Cell Transport Practice

For the problems below, a semi-permeable membrane is separating the two solutions.

1. Where do you find a semi-permeable membrane?
2. What is the movement of water across a membrane called?
3. During passive transport, molecules will move from _____ concentration to _____ concentration.

Fill in the missing amounts on the lines provided. For the prediction, tell which way the water will move.

A		Prediction _____
B		Prediction _____
C		Prediction _____

4. Any molecules will spread out from high to low _____.
5. The difference between a high concentration and a low concentration _____.
6. Types of transport that do not require energy _____.
7. The cell membrane is selectively permeable based on _____.
8. The small holes in the membrane are _____.
9. Osmosis is the movement of _____ from _____ concentrations to _____ concentrations.
10. Distilled water is _____% water.
11. The more solute, the less room for _____.
12. A seawater plant is placed in distilled water. What happens to the plant?
13. T/F – Oxygen and carbon dioxide must be pumped into cells using active transport.

Names: _____

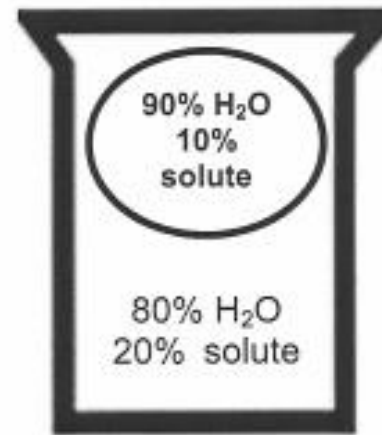
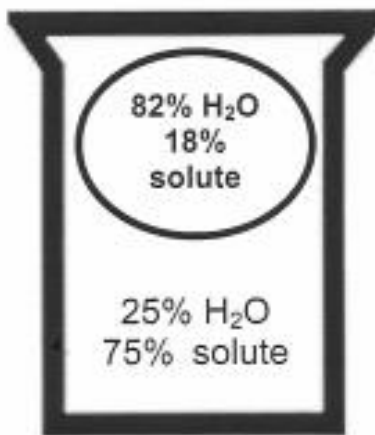
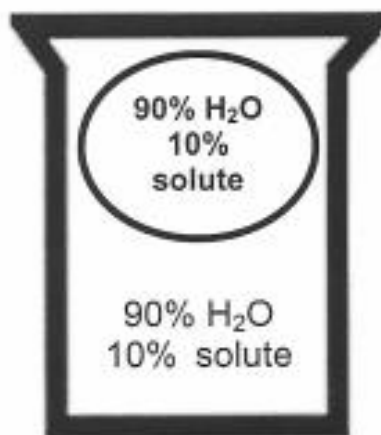
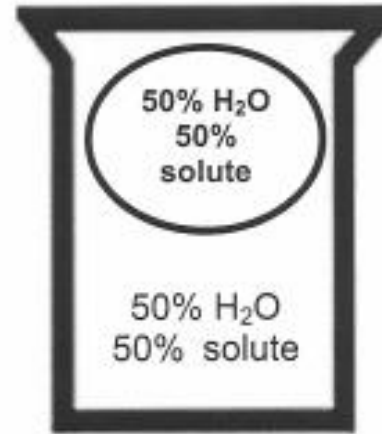
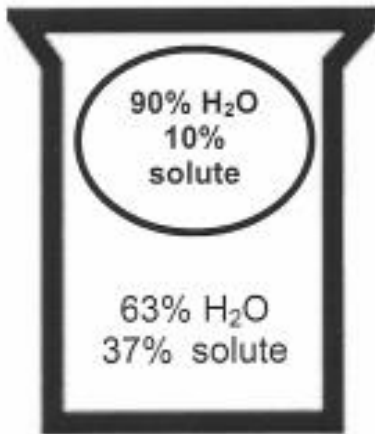
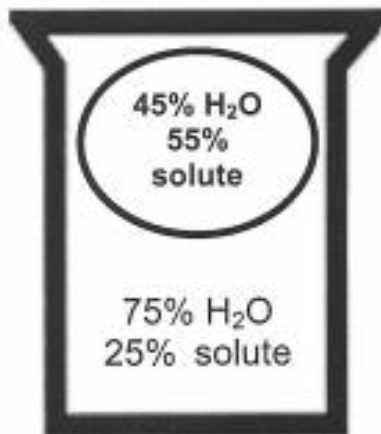
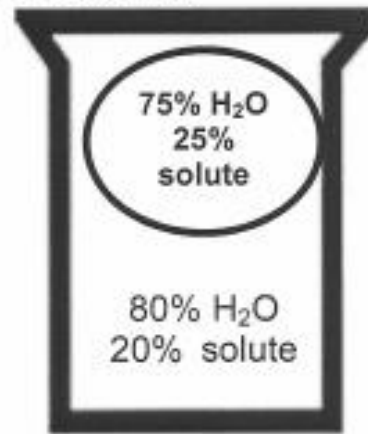
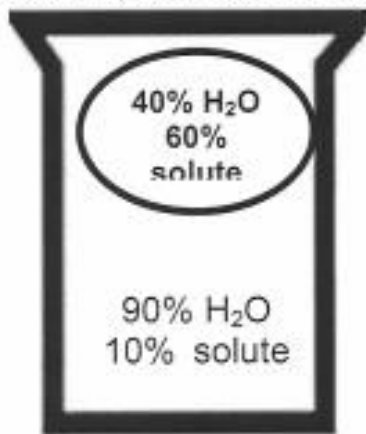
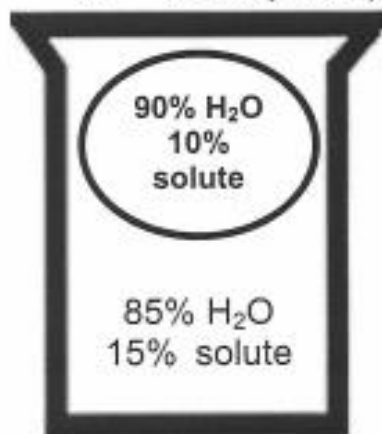
Period: _____

Date: _ _ _

Osmosis Worksheet

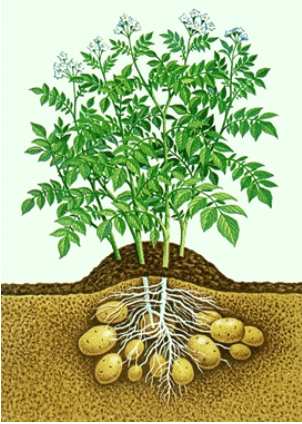
Below are animal cells placed in beakers of various concentrations.

1. Draw an arrow to show which way the water would move by osmosis
2. Fill in any missing percentages (water or solute)
3. Identify the type of solution (isotonic, hypertonic, or hypotonic)



Models for Osmosis

Potatoes as a Model:



Explore:

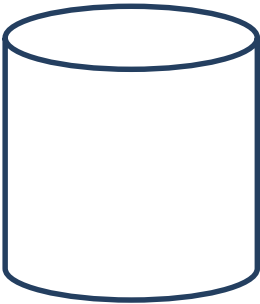
- 1) The potato is made of cells that...

- 2) If a piece of potato was placed in pure water, then...

- 3) If a piece of potato was placed in salt water, then...

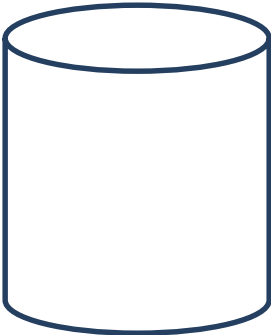
Collect Data:

Potato in Pure Water



<i>Initial Weight</i> _____ grams	<i>Initial Length</i> _____ cm	<i>Initial Texture</i>
<i>Final Weight</i> _____ grams	<i>Final Length</i> _____ cm	<i>Final Texture</i>
<i>Change in Weight</i> _____ grams	<i>Change in Length</i> _____ cm	<i>Change in Texture</i>

Potato in Salt Water



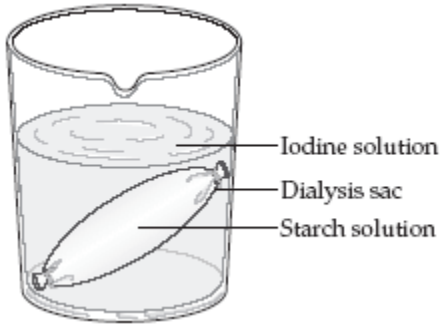
<i>Initial Weight</i> _____ grams	<i>Initial Length</i> _____ cm	<i>Initial Texture</i>
<i>Final Weight</i> _____ grams	<i>Final Length</i> _____ cm	<i>Final Texture</i>
<i>Change in Weight</i> _____ grams	<i>Change in Length</i> _____ cm	<i>Change in Texture</i>

Analysis: (Use your science vocabulary to explain what happened to the potato.)

Evaluate: An orthodontist told the patient that after getting braces, your gums will be swollen with inflammation. The orthodontist advises swishing with salt water to decrease the swelling. Would this be helpful? The patient is also considering just drinking the salt water.

Comparing and contrasting:

A dialysis tubing bag is filled with high concentrations of starch and water. The bag is placed into water and iodine is added.



Initial Observations:

Final Observations:

Analysis: (Use your science vocabulary to explain what happened to each type of molecule.)

Creating a model:

Using the Cell Transport Case Studies, create a model to represent your case study.

Evaluating a model:

Record the sample model for case study #1 here. Use the principles of cell transport to evaluate if this is a correct representation.

Unit 4.1 Preview

Textbook pgs.202-303, 206-207, 208, 214, 221-222, 232

D. Important Vocabulary to Remember

Vocab Word	Definition from textbook	Diagram with caption

E. Important Diagrams to Analyze

Read the caption of Figure 8-3 (pg 203) and answer the bolded question in a complete sentence.

F. Important Big Ideas to Evaluate

After reading pgs. 202-203, sketch a picture from these pages. Create your own caption that includes a vocabulary word from the vocab matching.

Unit 4.1 Review

D. Understanding Examples -- **Complete** the following 5 statements.

1. _____ is the molecule that ALL cells use for energy.
2. Eukaryotic cells, including _____ and _____ have an organelle called a _____ that is used for cellular respiration.
3. Only plant cells have a _____ whose job is to make _____.
4. The mitochondria has a folded inner membrane so that it can make more _____.
5. The _____ has stacks of membranes to increase surface area to make more carbohydrates during photosynthesis.

E. Analyzing applications -- Correctly match each vocab word with an appropriate experiment

- | | | |
|---|---|---|
| <ol style="list-style-type: none"> 1. Glucose 2. Oxygen 3. Fermentation 4. ATP 5. Chlorophyll 6. Carbon dioxide 7. Water | <ol style="list-style-type: none"> a. Richard Wilstatter discovered received a Nobel Prize for his work on this protein that captures light in the chloroplast. b. Used by respiration and produced by photosynthesis, this molecule is cycled by all living things. c. When you eat a fruit, it tastes sweet and gives you energy because of this molecule. | <ol style="list-style-type: none"> d. An experiment showed that removing this organelle prevents plants from making their own food. e. This molecule is used by ALL living cells as an energy source. f. Plants need this gas to build a carbohydrate. g. Jan van Helmont discovered that plants grew partially by taking this out of the soil the plant grew in. |
|---|---|---|

F. Evaluating Scenarios -- Redraw the two listed diagrams **from your handbook.**

<u>Figure 4.1b</u>	<u>Figure 4.1e</u>
<p>How are these two diagrams related to each other?</p>	

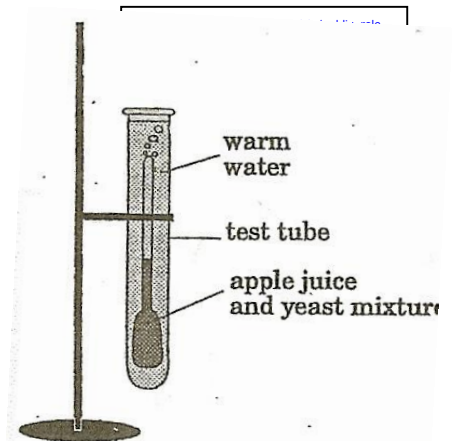
Biology Apps – Unit 4.1



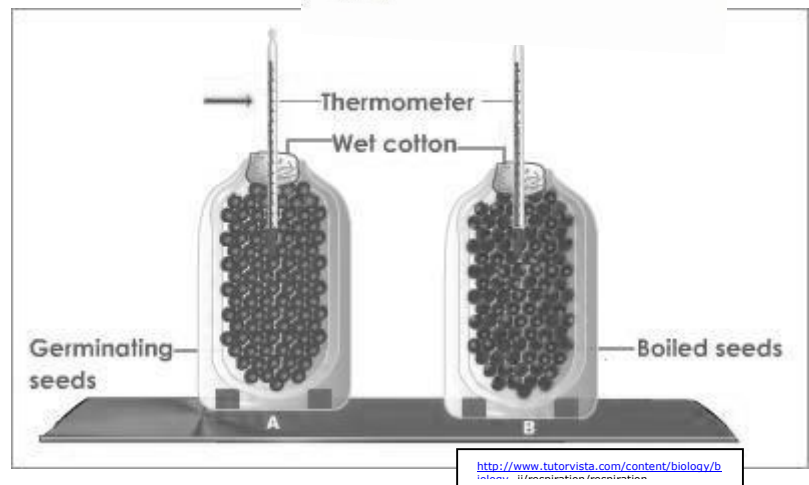
Energy in cells

1. Where is the energy in ATP stored?
2. What reactants are required for aerobic cellular respiration to occur?
3. Where does cellular respiration occur in eukaryotic cells?
4. How is fermentation/anaerobic respiration SIMILAR to aerobic respiration?
5. How is fermentation/anaerobic respiration DIFFERENT from aerobic respiration?

6. Yeast cells are placed in a test tube with apple juice and surrounded by warm water.
 - a. What reaction is occurring?
 - b. Identify the bubbles being created



7. Germinating seeds are seeds that are just beginning to grow. If the two set-ups were kept in the dark, which set-up (A or B) would have higher rates of respiration and why?



8. What is the equation for photosynthesis?
9. Solar energy is transferred into chemical energy. Explain how this sentence represents photosynthesis.

10. What is the relationship between photosynthesis and respiration? (address at least two factors)



The Regulation of Respiration

Remembering Important Knowledge

- Regulation means to _____.
- Respiration is a process that involves the **bodily** functions of _____ and _____.
 - On a **cellular** level, respiration occurs when _____
_____.
- Cellular respiration can be regulated by controlling the availability of the _____.
 - An example is that if oxygen is not available, some cells can perform _____
_____ which is a variation because _____.

Understanding Examples

- The lab set-up contains yeast and apple juice. Draw a picture to represent your initial observations and a second picture to represent the end of the demonstration.

<u>Initial observation</u>	<u>Final observation</u>
	

Describe what happened and WHY. Include a picture of what is happening on a cellular level.

Applying Your Knowledge

- List two ways you think you can **increase** the rate of this reaction. Choose one and predict what would happen.
 -
 -

<u>Beginning</u>	<u>Hypothetical ending</u>
<p>Explain WHY you think you got these results.</p>	

Analyzing Applications

- Examine the two bread recipes and determine how they are different and why they will produce different bread.

—

Amish White Bread – share this recipe with all your friends!

- 2 cups warm water (110 degrees F)
- 2/3 cup white sugar
- 1 ½ tablespoons active dry yeast
- 1 ½ teaspoon salt
- ¼ cup vegetable oil
- 6 cups bread flour

~ In a large bowl, dissolve the sugar in warm water and then stir in yeast. Allow to proof until yeast resembles a creamy foam.

~ Mix salt and oil into the yeast. Mix in flour one cup at a time. Knead dough on a lightly floured surface until smooth. Place in a well-oiled bowl and turn dough to coat. Allow to rise until doubled in bulk, about 1 hour.

~ Punch dough down, knead for a few minutes and divide in half. Shape into loaves and place in two well-oiled loaf pans. Allow to rise for 30 minutes.

~ Bake at 350 degrees F for 30 minutes.

Unleavened Matzo Bread – perfect for Passover

- 4 cups all purpose flour
- 1 tsp baking powder
- 1 tsp baking soda
- 1 tsp salt
- 1 ½ cup milk with 1 tbsp white vinegar or lemon juice added
- 1 egg

~ Mix together, knead and mold into 2 long, rather flat loaves. Place on floured cookie sheet. Bake at 425 degrees for 20 minutes. Test doneness with a toothpick and bake longer if not dry enough in center.

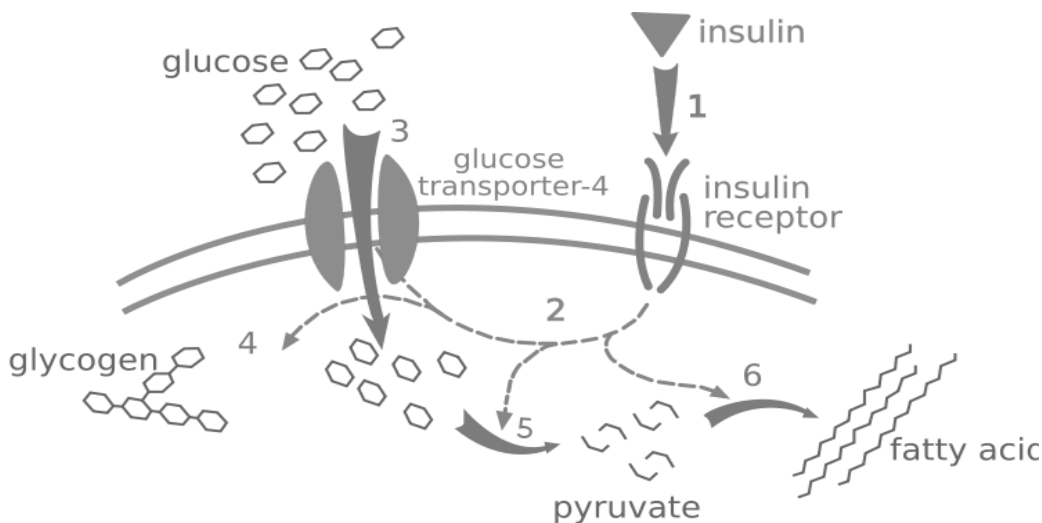
- Your friend Hanna is making matzo - unleavened bread for Passover. She accidentally added yeast to her recipe. Explain two ways she could fix her bread dough. _____

Evaluating Scenarios

- After baking the Amish White Bread, you eat a whole loaf while being a couch potato and watching an episode of The Biggest Loser. What happens to the carbs? Use the numbers in the picture below to help. _____
- Your friend Michael heard you baked bread, sprinted a mile over to your house in only 7 minutes and is a little out of breath. Explain why the respiration in his muscle cells would be different than in your cells. _____

Creating a Model

- Michael is training for a half marathon (13.1 miles)! His race is in three weeks, and you offer to cook him dinner the night before. You know he'll want to eat lots of carbs and in your research on the best foods to eat before a half marathon, you discover that lots of endurance athletes use a process called carb-loading. One source suggests 12 grams of carbohydrates for every kilogram of body mass. Michael weighs 185 pounds. Plan a meal including portion sizes that you think will best help Michael the night before his race. Show your planning process here as well. **(hint 1 kg = 2.02 pounds).**



- You are very inspired by Michael's commitment to fitness, and you decide to examine your eating habits to determine if there are changes you should make. Have one other person in your group answer the questions below:
 - Do you think your family's eating habits meets good nutritional expectations? Why or why not?

What would you be interested in changing about your eating habits?

• In and Out of the Mitochondria

Inside of any eukaryotic cell are the mitochondria. Use this to write the correct formula for cellular respiration.

Now use those chemicals to label what is going in and out of the mitochondria.

- Label the two reactants used in respiration.
- Label the three products produced by respiration.
- Answer the questions at the bottom.

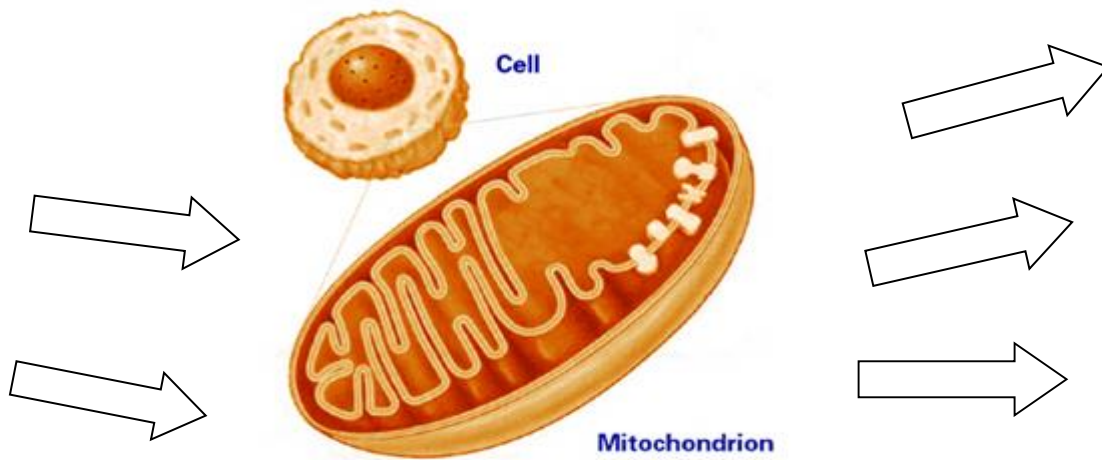


Fig. 1. A mitochondrion, one of the "intracellular powerhouses" found in every cell of the body.

1. What gas would be diffusing INTO the mitochondria?
2. What gas would be diffusing OUT of the mitochondria?
3. List two foods that are sources of $C_6H_{12}O_6$
4. What type of cell would be performing HIGH rates of respiration?
5. What do muscle cells do when they run out of oxygen?

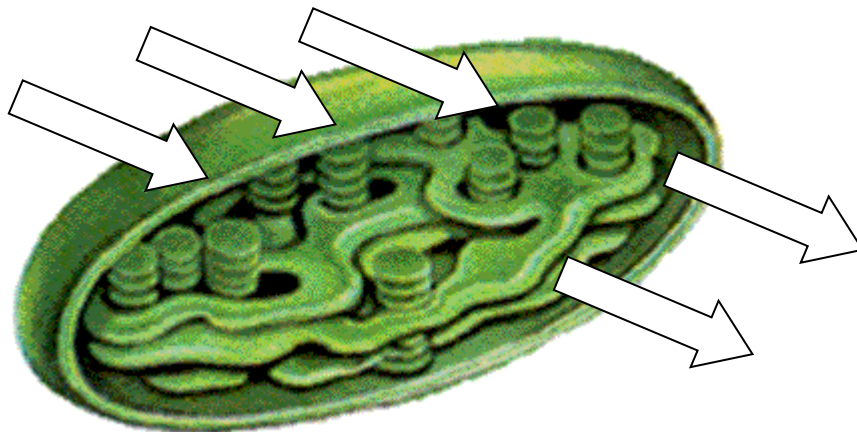
In and Out of the Chloroplast

Inside of a leaf, inside of a plant cell, is the chloroplast. The chloroplast is the organelle where photosynthesis occurs. The chloroplast uses things from the environment to **produce food** for the plant.

- Listed below are 5 different parts of photosynthesis...
 - $C_6H_{12}O_6$ (glucose/sugar)
 - H_2O (water)
 - CO_2 (carbon dioxide gas)
 - Sunlight (energy)
 - O_2 (oxygen gas)
- Write the ones that are USED by the plant in the reactant box on the left (these are the **reactants**).
- You should be left with what will be produced during photosynthesis (these are the **products**).

_____ + _____ + _____ Reactants	=	_____ + _____ Products
------------------------------------	---	---------------------------

Now use those chemicals to label what is going in (3 things) to be USED **and** what is coming out (2 things) of the chloroplast that is MADE.



6. What gas would be diffusing INTO the chloroplast?
7. What gas would be diffusing OUT of the chloroplast?
8. List 4 factors that affect the rate of photosynthesis.

Unit 5 Intro

Text One: How can I save the planet when I can't tell green from brown?

By Geoffrey Hope-Terry <http://www.colourblindawareness.org/colour-blindness/living-with-colour-vision-deficiency/how-can-i-save-the-planet-when-i-cant-tell-green-from-brown/>

I have known that I was color blind since being diagnosed at the age of 10 and have found it to be a cause of some difficulty throughout my career, often finding himself the butt of jokes from people who don't appreciate the difficulties. Chances are, you know someone who, like me, is color blind, but you may not appreciate the daily difficulties we face. This is what happened yesterday. Although the dawn woke me up, the wonderful hues of a splendid sunrise were lost on me. It just looked light but uninteresting.

My condition is red-green color deficiency, or deuteranopia, which affects about 8% of the male population, but hardly any women. It's the common form of color blindness and because red and green are 2 of the 3 primary colors, it distorts the way I see virtually all shades. Yesterday I needed to buy the ingredients for our evening meal. The lady at the register knows me well – and that's the attraction. After an hour hunting round for everything on my list I went to pay. She patiently returned all the unripe tomatoes that I spent ages choosing, replacing them with good ones and exchanged my green olives for black ones, which she knows I prefer.

Text Two: *Genetics Home Reference: Color Vision Deficiency* <http://ghr.nlm.nih.gov/condition/color-vision-deficiency>

What is color vision deficiency? Color vision deficiency (sometimes called color blindness) represents a group of conditions that affect the perception of color. Red-green color vision defects are the most common form of color vision deficiency.

How common is color vision deficiency? Red-green color vision defects are the most common form of color vision deficiency. This condition affects males much more often than females. Among populations with Northern European ancestry, it occurs in about 1 in 12 males and 1 in 200 females. Red-green color vision defects have a lower incidence in almost all other populations studied.

What genes are related to color vision deficiency?

Mutations in the *OPN1LW*, *OPN1MW*, and *OPN1SW* genes cause the forms of color vision deficiency described above. The proteins produced from these genes play essential roles in color vision. They are found in the retina, which is the light-sensitive tissue at the back of the eye. The retina contains two types of light receptor cells, called rods and cones, that transmit visual signals from the eye to the brain. Rods provide vision in low light. Cones provide vision in bright light, including color vision. There are three types of cones, each containing a specific pigment (a photopigment called an opsin) that is most sensitive to particular wavelengths of light. The brain combines input from all three types of cones to produce normal color vision.

The *OPN1LW*, *OPN1MW*, and *OPN1SW* genes provide instructions for making the three opsin pigments in cones. The opsin made from the *OPN1LW* gene is more sensitive to light in the yellow/orange part of the visible spectrum (long-wavelength light), and cones with this pigment are called long-wavelength-sensitive or L cones. The opsin made from the *OPN1MW* gene is more sensitive to light in the middle of the visible spectrum (yellow/green light), and cones with this pigment are called middle-wavelength-sensitive or M cones. The opsin made from the *OPN1SW* gene is more sensitive to light in the blue/violet part of the visible spectrum (short-wavelength light), and cones with this pigment are called short-wavelength-sensitive or S cones. Genetic changes involving the *OPN1LW* or *OPN1MW* gene cause red-green color vision defects.

Text Three: Prevalence rate for color vision

http://www.cdc.gov/nchs/data/series/sr_11/sr11_118.pdf

Analysis

- 1) What three questions do you have after reading the three texts?

- 2) Based on the texts, what is the relationship between a pigment and a protein?

- 3) List three things the texts tell you about the differences in the pigments.

- 4) Based on the diagrams, what are two trends that appear to be significantly different between the groups that were measured?

- 5) How is red-green colorblindness different from other genetic diseases?



Table A. Prevalence rates for color vision deficiencies among children 6-11 years of age by race and sex: United States, 1963-65

Race and sex	Estimated number of children affected	Rate per 100 children
Both sexes		
Total	902,000	3.80
Boys		
Total	839,000	6.95
White	773,000	7.44
Negro	66,000	4.04
Girls		
Total	63,000	0.53
White	50,000	0.50
Negro	13,000	0.76

Unit Five Summary

1. DNA contains the code for proteins which determine our _____.
2. Weak _____ bonds connect the nitrogen bases. DNA pairs A-T and _____.
3. In order for each body cell to receive exact copies of the genetic material _____ must occur. This happens during _____ of the cell cycle.
4. Semi-conservative means that DNA replication results in each DNA molecule being half _____ and half _____.
5. Protein synthesis requires _____. _____ brings the code from the nucleus to the ribosome, where _____ delivers the corresponding amino acids.
6. _____ occurs in the nucleus; here we rewrite the DNA code.
7. _____ occurs in the ribosome; amino acids are assembled into a protein.
8. A mistake in the DNA sequence that changes one nitrogen base is called a _____.
9. A mistake in the DNA sequence that adds or deletes a nitrogen base is called a _____ - _____.
10. The union of the sperm and egg is called _____. The single celled zygote must go through _____ to grow and develop.
11. An allele is a _____ version of the same gene, Ex: _____.
12. Dominant genes _____ recessive genes.
13. For the recessive trait to be expressed as the _____, the genotype must be _____.
14. You have _____ alleles for every trait, one from _____ and one from _____.
15. Codominance means that _____ versions of the trait will be expressed.
16. _____ results in a blended phenotype.
17. Our blood type is controlled by _____.
18. Sex-linked disorders are carried on the _____ chromosome and because _____ have only one of these chromosomes they are more likely to _____.
19. A bell-shaped curve is used to show _____ inheritance.
20. The dominant disorder that causes brain degeneration is called _____.
21. Sickle cell affected people that are _____ are immune to _____.
22. Nondisjunction is when _____ fail to separate, this can cause disorders like Trisomy 21 aka _____.
23. A picture of chromosomes called a _____ can identify a disorder like _____, where a male can have XXY.
24. Gel electrophoresis can be used to create a _____. The _____ pieces move further down the gel.
25. _____ are used to cut the desired gene and vector before they can be spliced together. Then the _____ DNA can be inserted into the host, which will produce the desired proteins like _____.
26. Create a fill-in-the-blank question with a vocabulary word that was not used in the above questions.

Unit 5.1 Preview

Textbook pgs.294, 299, 300-301, 304-305, 307

A. Important Vocabulary to Remember

Vocab Word	Textbook definition	Diagram with caption

B. Important Diagrams to Analyze

Read the caption of Figure 12-20 (pg. 307) and answer the following question: **Why would a deletion be worse than a substitution or insertion?**

C. Important Big Ideas to Evaluate

After reading pgs. 300-301 and 304-305, sketch a picture from these pages. Create your own caption that includes a vocabulary word from the vocab matching.

Unit 5.1 Review

A. Understanding Examples -- **Complete** the following 5 statements.

1. DNA is made of _____ held together in two strands by _____ bonds.
2. The three parts of the monomer are _____, _____, and _____.
3. The genetic material is condensed into a neatly packaged _____.
4. During DNA replication, DNA is _____ so that it can prepare for cell division.
5. Replication occurs during _____ of the cell cycle and _____ are used to proofread the new DNA for errors.

B. Analyzing applications -- Correctly match each vocab word with an appropriate experiment

- | | | |
|---|---|--|
| <ol style="list-style-type: none"> 1. Sugar phosphate backbone 2. Complementary base pairs 3. 1/2 old, 1/2 new | <ol style="list-style-type: none"> a. Chargaff noticed that the amount of A always equaled the amount of T, and G=C. b. Rosalind Franklin was able to take pictures of this external structure to help discover DNA was a double helix. | <ol style="list-style-type: none"> c. Meselson and Stahl performed an experiment to prove that copies of DNA had either the left or the right of the original strand. |
|---|---|--|

C. Evaluating Scenarios -- Redraw the two listed diagrams **from your handbook.**

<u>Figure 3.1 f</u>	<u>Figure 3.1 g</u>
How are these two diagrams related to each other?	

Biology Apps – Unit 5.1



DNA Structure and Replication

1. What two parts of the nucleotide make up the sides of a DNA molecule?
Highlight them in yellow in the diagram to the right as well.

2. What type of bond holds the “steps” together? _____
Circle them in the diagram to the right as well.

3. Methylene blue is used to visualize DNA. If used on a eukaryotic cell, which cell structure/organelle would be stained blue?

4. A human and a dog both have DNA.

a) DNA is made up of a monomer called a _____.

b) The only difference between the DNA of a human and that of a dog is that the order and number of the four _____ are different.

c) Their names are:

5. If a strand of DNA contains 10% Adenine. What is the percent of the following?

G - _____

T - _____

C - _____

6. What is complementary strand of DNA for the following sequence?

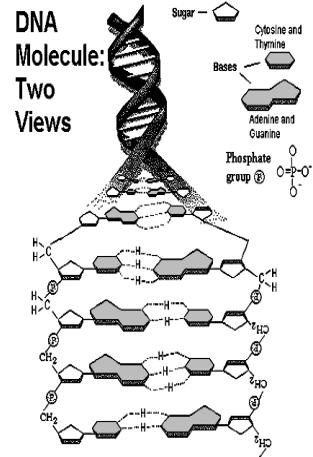
AAT-CGC-GGA-TCA

7. All cells use DNA replication.

a) When does this process occur?

b) Why is this process necessary?

8. Why is your answer to #2 important to the DNA Replication process?



http://www.accessexcellence.org/RC/VL/GG/images/dna_molecule.gif

9. The end result of replication is...?

a. Describe in words.

b. Describe with a picture.

10. An enzyme that adds/pairs the nitrogen bases during replication is damaged.

a. What steps will still occur?

b. What steps will NOT occur?



DNA - The Double Helix



Recall that the nucleus is a small spherical, dense body in a cell. It is often called the "control center" because it controls all the activities of the cell including cell reproduction, and heredity. Chromosomes are microscopic, threadlike strands composed of the chemical DNA (short for deoxyribonucleic acid). In simple terms, DNA controls the production of proteins within the cell. These proteins in turn, form the structural units of cells and control all chemical processes within the cell. Think of proteins as the building blocks for an organism, proteins make up your skin, your hair, parts of individual cells. How you look is largely determined by the proteins that are made. The proteins that are made is determined by the sequence of DNA in the nucleus.

Chromosomes are composed of genes, which is a segment of DNA that codes for a particular protein which in turn codes for a trait. Hence you hear it commonly referred to as the gene for baldness or the gene for blue eyes. Meanwhile, DNA is the chemical that genes and chromosomes are made of. DNA is called a nucleic acid because it was first found in the nucleus. We now know that DNA is also found in organelles, the mitochondria and chloroplasts, though it is the DNA in the nucleus that actually controls the cell's workings.

In 1953, James Watson and Francis Crick established the structure of DNA. The shape of DNA is a double helix which is like a twisted ladder. The sides of the ladder are made of alternating sugar and phosphate molecules. The sugar is deoxyribose. **Color all the phosphates pink (one is labeled with a "p"). Color all the deoxyriboses blue (one is labeled with a "D") .**

The rungs of the ladder are pairs of 4 types of nitrogen bases. The bases are known by their coded letters A, G, T, C. These bases always bond in a certain way. Adenine will only bond to thymine. Guanine will only bond with cytosine. This is known as the "Base-Pair Rule". The bases can occur in any order along a strand of DNA. The order of these bases is the code that contains the instructions. For instance ATGCACATA would code for a different gene than AATTACGGA. A strand of DNA contains millions of bases. (For simplicity, the image only contains a few.)

Color the thymines orange. 
Color the guanines purple. 

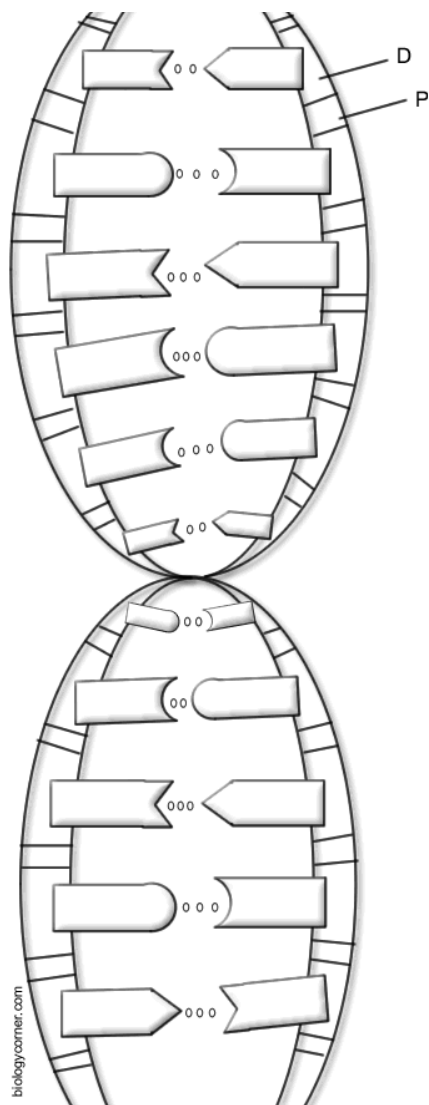
Color the adenines green. 
Color the cytosines yellow. 

Note that that the bases attach to the sides of the ladder at the sugars and not the phosphate.

The DNA helix is actually made of repeating units called nucleotides. Each nucleotide consists of three molecules: a sugar (deoxyribose), a phosphate which links the sugars together, and then one of the four bases. Two of the bases are purines - adenine and guanine. The pyrimidines are thymine and cytosine. Note that the pyrimidines are single ringed and the purines are double ringed. Color the nucleotides using the same colors as you colored them in the double helix.

The two sides of the DNA ladder are held together loosely by hydrogen bonds. The DNA can actually "unzip" when it needs to replicate - or make a copy of itself. DNA needs to copy itself when a cell divides, so that the new cells each contain a copy of the DNA. Without these instructions, the new cells wouldn't have the correct information. The hydrogen bonds are represented by small circles.

Color the hydrogen bonds grey.



1. Write out the full name for DNA.

2. What is a gene?

3. Where in the cell are chromosomes located?

4. DNA can be found in what two organelles?

5. What two scientists established the structure of DNA?

6. What is the shape of DNA?

7. What are the sides of the DNA ladder made of?

8. What are the "rungs" of the DNA ladder made of?

9. What sugar is found in DNA? _____ In RNA? _____
10. How do the bases bond together? A bonds with _____ G bonds with _____
11. DNA is made of repeating units called _____

13. What does DNA code for?

14. Proteins are made where in the cell?

15. How do some cells become brain cells and others become skin cells, when the DNA in ALL the cells is exactly the same. In other words, if the instructions are exactly the same, how does one cell become a brain cell and another a skin cell?

16. Why is DNA called the "Blueprint of Life"?

Unit 5.2 Preview
Textbook pgs.291, 294, 299, 300-301, 304-305, 307

A. Important Vocabulary to Remember

Vocab Word	Textbook definition	Diagram with caption

B. Important Diagrams to Analyze

Read the caption of Figure 12-17 (pg. 303) and answer the bold question in a complete sentence.

C. Important Big Ideas to Evaluate

After reading pgs. 304-305, sketch a picture from these pages. Create your own caption that includes a vocabulary word from the vocab matching.

Unit 5.2 Review

A. Understanding Examples -- **Complete** the following 5 statements.

1. During protein synthesis, the first step is _____ the DNA code into _____ during transcription.
2. The codon on the _____ attracts the anticodon on the _____ in order to bring amino acids.
3. The order of amino acids is determined by the mRNA, which was determined by _____.
4. A _____ bond connects the amino acids into a chain that must _____ into a specific shape to become a functioning _____.
5. The _____ is the organelle where all 3 types of RNA come together during translation.
6. Any change in the order of the DNA nucleotides is called a _____ which can sometimes change the protein.

B. Analyzing applications -- Correctly match each vocab word with an appropriate experiment

- | | | |
|-------------|--|--|
| 1. Gene | a. If a cell does not have this nucleotide, protein synthesis cannot occur. | phenotypes by exposing their DNA to UV rays and other toxic chemicals. |
| 2. Uracil | b. Beadle and Tatum discovered that one section of DNA could code for a specific enzyme. | d. Dr. Palade received the Nobel Prize for discovering that all cells had organelles where protein synthesis occurred. |
| 3. Ribosome | c. Thomas Hunt Morgan created changes in the flies | |
| 4. Mutation | | |

C. Evaluating Scenarios -- Redraw the two listed diagrams **from your handbook**.

Figure 3.2 a	Figure 3.2 f
How are these two diagrams related to each other?	



Biology Apps – Unit 5.2

Protein Synthesis

- Describe what the central dogma of biology
- Transcribe the following DNA strand. **CGC-ATG-AAC**

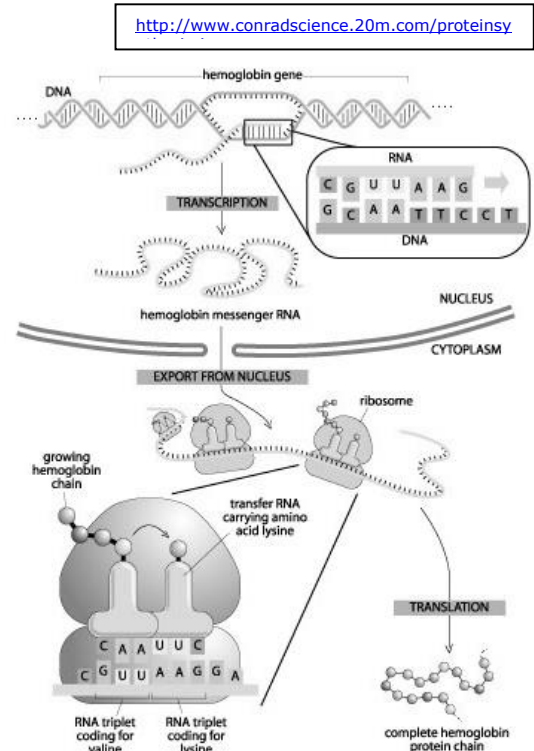
3. What molecules are used during transcription?

4. Why is transcription necessary?

5. Translation

a) What molecules are involved in translation?

b) Which molecules are used only in translation?
Circle them in the diagram to the right.



6. Here is the DNA sequence for protein hemoglobin.
TAC-CAC-GAC-AGA-CCG.

a. Transcribe this sequence into mRNA.

b. Translate this sequence in amino acids.

First Letter	Second Letter				Third Letter
	U	C	A	G	
U	phenylalanine	serine	tyrosine	cysteine	U
	phenylalanine	serine	tyrosine	cysteine	C
	leucine	serine	stop	stop	A
	leucine	serine	stop	tryptophan	G
C	leucine	proline	histidine	arginine	U
	leucine	proline	histidine	arginine	C
	leucine	proline	glutamine	arginine	A
	leucine	proline	glutamine	arginine	G
A	isoleucine	threonine	asparagine	serine	U
	isoleucine	threonine	asparagine	serine	C
	isoleucine	threonine	lysine	arginine	A
	(start) methionine	threonine	lysine	arginine	G
G	valine	alanine	aspartate	glycine	U
	valine	alanine	aspartate	glycine	C
	valine	alanine	glutamate	glycine	A
	valine	alanine	glutamate	glycine	G

7. There are 30 nucleotides in a strand of DNA.
- How many amino acids would be coded from this strand?

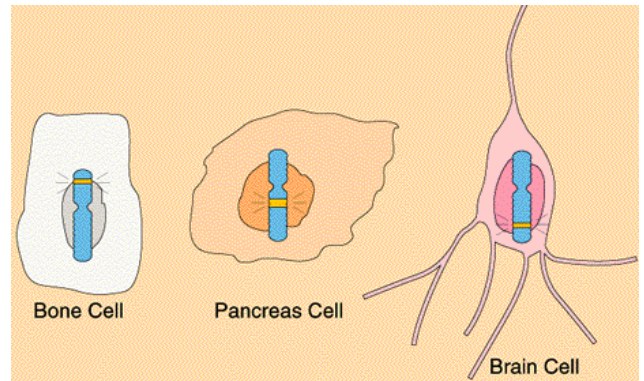
 - What if there were only 29 nucleotides?
8. How many different codons would code for the amino acid serine?
9. What are all the different possible codons for the amino acid tyrosine?
10. If the amino acid is methionine what would be the:
- mRNA?

 - DNA?
11. The DNA code for hemoglobin is **TAC-CAC-GAC-AGA-CCG** .
- If the second "C" in the sequence was changed to "G", would the same protein be made? _____ This is known as a _____ mutation.

 - What is the resulting amino acid sequence?
12. If the second "C" in the sequence was deleted, would the same protein be made? _____
This is known as a _____ mutation.

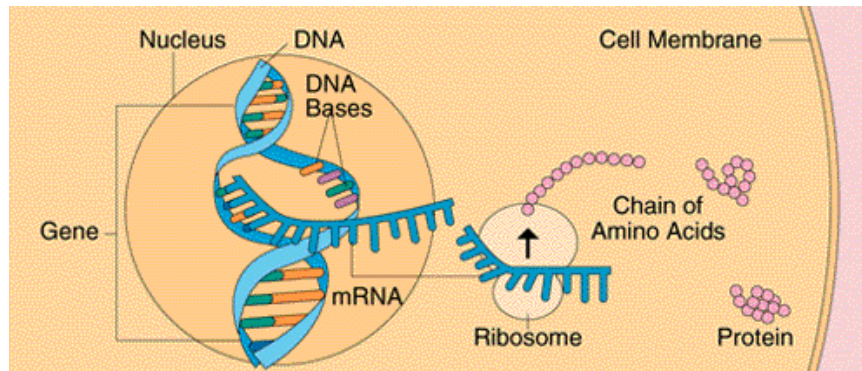
What are genes?

DNA resides in nucleus of each of the body's trillions of cells. Every human cell contains the same DNA. Each cell has 46 chromosomes of double-stranded DNA. The DNA in each chromosome constitutes many genes (as well as vast stretches of non-coding DNA, the function of which is unknown). A gene is any given segment along the DNA that encodes instructions that allow a cell to produce a specific product - typically, a protein such as an enzyme - that initiates one specific action. There are between 50,000 and 100,000 genes, and every gene is made up of thousands, even hundreds of thousands, of chemical bases.



Different genes are activated in different cells, creating the specific proteins that give a particular cell type its character. Your bone cells make proteins called BMPs that help your bone turn solid. Your pancreas cells make proteins called insulin to regulate blood sugar. Your brain cells make myelin which helps send signals from one brain cell to another.

For a cell to make protein, the information from a **particular** gene is "copied", base by base, from DNA into new strands of messenger RNA (mRNA). Then mRNA travels out of the nucleus into the cytoplasm, to cell organelles called ribosomes. There, mRNA directs the assembly of amino acids that fold into completed protein molecule.



1. *What is a gene?*
2. *What does a gene code for?*
3. *How many genes do humans typically have?*
4. *Why does the information have to be copied into mRNA?*
5. *"Information is copied base by base into mRNA." Is **copied** the correct word? How would you describe the process?*
6. *How do genes allow different types of cell?*

Practicing DNA Transcription and Translation

For the following examples, give the appropriate sequence of DNA, mRNA, tRNA and/or polypeptide (AA = amino acids). Remember: A codon chart can only be used for decoding a strand of mRNA.

Codon Chart

Second Position

		U	C	A	G	
First Position (5')	U	Phenylalanine	Serine	Tyrosine	Cysteine	U
		Phenylalanine	Serine	Tyrosine	Cysteine	C
		Leucine	Serine	Stop	Stop	A
		Leucine	Serine	Stop	Tryptophan	G
	C	Leucine	Proline	Histidine	Arginine	U
		Leucine	Proline	Histidine	Arginine	C
		Leucine	Proline	Glutamine	Arginine	A
		Leucine	Proline	Glutamine	Arginine	G
	A	Isoleucine	Threonine	Asparagine	Serine	U
		Isoleucine	Threonine	Asparagine	Serine	C
		Isoleucine	Threonine	Lysine	Arginine	A
		Methionine	Threonine	Lysine	Arginine	G
G	Valine	Alanine	Aspartic acid	Glycine	U	
	Valine	Alanine	Aspartic acid	Glycine	C	
	Valine	Alanine	Glutamic acid	Glycine	A	
	Valine	Alanine	Glutamic acid	Glycine	G	

Third Position
(3')

Example 1:

DNA: T A C G C G C C T A G G G G G T G G

mRNA: _____

AA: _____

Example 2:

DNA: T T C G A T T A G A T G C C G A A G

mRNA: _____

tRNA: _____

AA: _____

Example 3:

DNA: C _ _ - _ G _ - A _ _ - A _ - _ _ C - _ T _

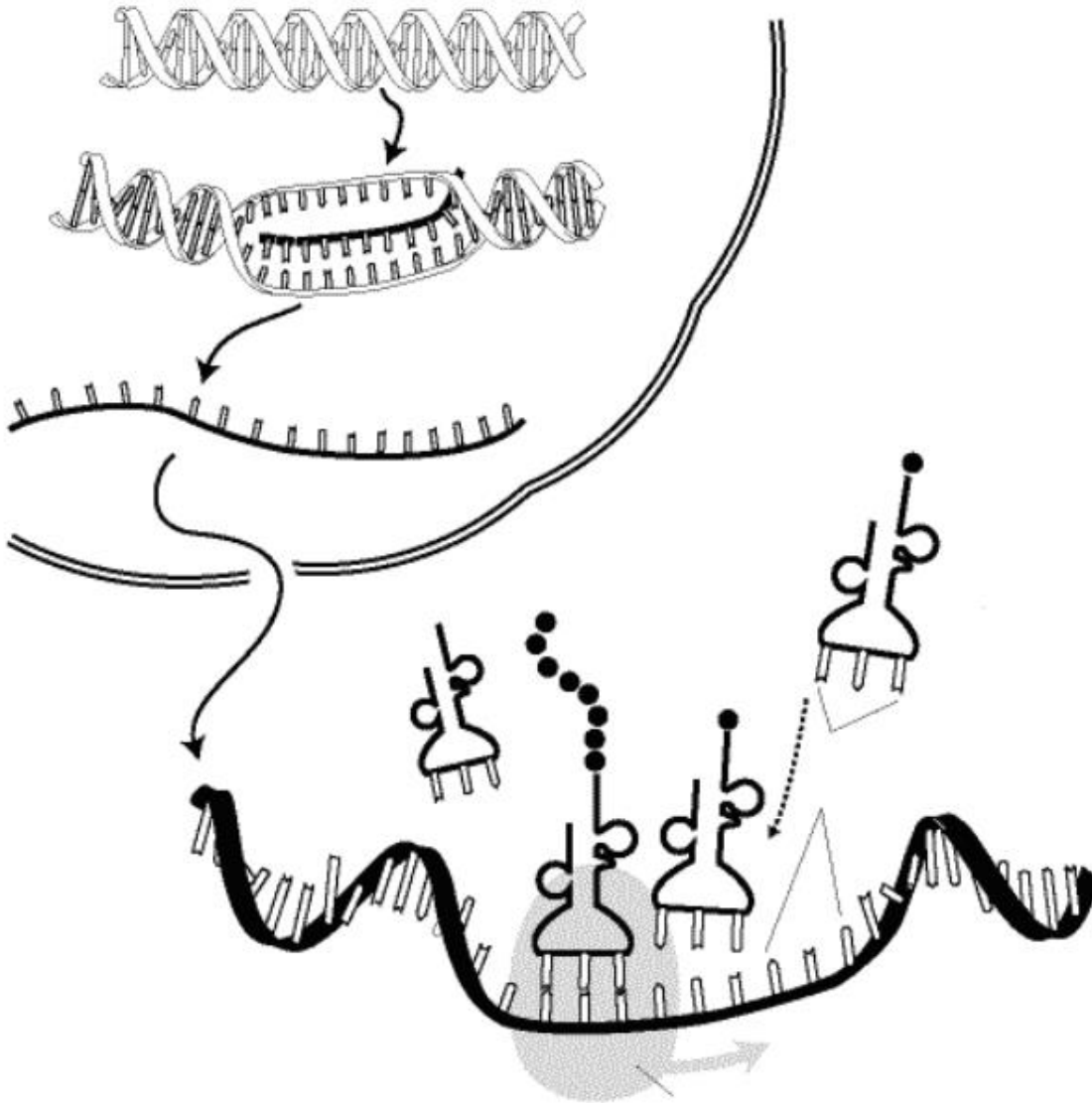
mRNA: _ U _ - _ A - _ _ C - _ _ A - _ G _ - _ A _

tRNA: _ A U - G _ U - _ U G - G _ U - C C _ - G _ A

AA: _____

Protein Synthesis Overview Diagram

Label the summary of protein synthesis diagrammed below using the following terms: transcription, translation, DNA, mRNA, ribosome, tRNA, amino acid, polypeptide, nucleus, codon, and anticodon.



How DNA Controls the Workings of the Cell

Below are two partial sequences of DNA bases (shown for only one side of DNA) Sequence 1 is from a human and sequence 2 is from a cow. A section of DNA that contains the instructions to build a protein is called a gene. In this case, the gene codes to make the protein insulin. Insulin is necessary for the uptake of sugar from the blood. Without insulin, a person cannot use digested sugars the same way others can, and they have a disease called diabetes.

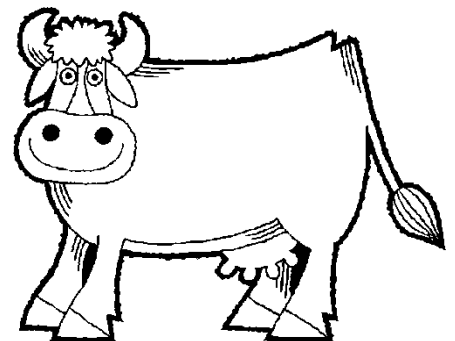
Instructions:

1. Using the DNA sequence, make a complimentary mRNA strand for both the human and the cow. Write the RNA directly below the DNA strand (remember to use RNA base pair rules and substitute U's for T's in RNA)
2. Use the codon table in your book to determine what amino acids are assembled to make the insulin protein in both the cow and the human. Write your amino acid chain directly below the RNA sequence.

<p><u>Sequence 1 - Human</u></p> <p>DNA: C C A T A G C A C G T T A C A A C G T G A A G G T A A</p> <p>mRNA :</p> <p>Amino Acids:</p> <p><u>Sequence 2 - Cow</u></p> <p>DNA: C C G T A G C A T G T T A C A A C G C G A A G G C A C</p> <p>mRNA:</p> <p>Amino Acids:</p>
--

Analysis

1. Comparing the human gene to the cow gene, how many of the **codons** are exactly the same? _____
2. How many of the amino acids in the sequence are exactly the same? _____
3. Could two humans (or two cows) have *some* differences in their DNA sequences for insulin, yet still make the exact same insulin proteins? Explain.
4. Find ALL of the codons that can code for the amino acid **leucine** and list them.



5. The DNA sequences above code for a functional version of the protein – insulin. If the protein is not made of the correct amino acids, it cannot perform its functions, and the individual will have a disease called diabetes.

Suppose a person has a mutation in their DNA and the first triplet for the insulin gene reads T A T. The normal gene reads T A G. What amino acid does the mutant DNA and the normal DNA code for and will the person with this mutation be diabetic?

6. Another mutation changes the insulin gene to read T C T (instead of the normal T A G). Will this person be diabetic? Explain.

7. What type of mutation is shown in numbers 5 and 6? How many amino acids are affected?

8. The cow’s original mRNA was GGCAUCGUACAAUGUUGCGCUUCCGUG . Write it in codons .

9. If a deletion occurred and the first “C” was deleted, how would be the new sequence written in codons?

What type of mutation is this?

10. DNA sequences are often used to determine relationships between organisms. DNA sequences that code for a particular gene can vary, though organisms that are closely related will have very similar sequences. This table shows the amino acid sequences of 4 organisms.

Human: C C A T A G C A C C T A	Chimpanzee: C C A T A A C A C C T A
Pig: C C A T G T A A A C G A	Cricket: C C T A A A G G G A C G

Based on these sequences, which two organisms are most closely related? _____

11. An unknown organism is found in the forest and the gene is sequenced as follows:

Unknown: C C A T G G A A T C G A

Based on the chart above, what kind of an animal do you think this is? _____

Extension: How might a mutation be beneficial?

Unit 5.3 Preview

Textbook pgs. 322, 327, 331 342, 350-351. 352(bottom)-353

A. Important Vocabulary to Remember

Vocab Word	Matching <u>similar</u> to glossary	Matching <u>different</u> from glossary

B. Important Diagrams to Analyze

Read the caption of Figure 14-1 (pg. 341) and answer the bold question in a complete sentence.

C. Important Big Ideas to Evaluate

After reading pgs. 322, 327, 331 sketch a picture from these pages. Create your own caption that includes a vocabulary word from the vocab matching.

Unit 5.3 Review

A. Understanding Examples -- **Complete** the following 5 statements.

1. In a pedigree, if your shape is filled in, _____.
2. Genetic engineering is most successful in bacteria to make _____.
3. Restriction enzymes _____ DNA in certain areas, which can be unique in each person.
4. In order to get DNA in the bacteria, a plasmid is used to _____ the desired gene.
5. DNA fingerprints are made when _____ push different size pieces of DNA through a gel.
6. The Human Genome Project was designed to identify the _____ of all the different genes.

B. Analyzing applications -- Correctly match each vocab word with an appropriate experiment

- | | | |
|--|--|--|
| <ol style="list-style-type: none"> 1. Restriction enzymes 2. Gel electrophoresis 3. Plasmid 4. Gene therapy 5. Insulin 6. Genome 7. Environment | <ol style="list-style-type: none"> b. A patient with cystic fibrosis is interested in a clinical trial that might modify her DNA so that she no longer has a trace of her mutated gene. c. Discovery of EcoR1 identified that this was made to destroy invading viral DNA. d. A cDNA library contains copies of all the genes for an organism. e. Forensic scientists use this process to create | <p>the DNA fingerprints used in both criminal and paternity cases.</p> <ol style="list-style-type: none"> f. Genentech in California was the first successful company to use bacteria to create synthetic versions of this important human hormone. g. Small circular DNA fragments are able to enter bacterial cells and can help transfer genes, including antibiotic resistance |
|--|--|--|

C. Evaluating Scenarios -- Redraw the two listed diagrams **from your handbook**.

Figure 3.4 g	Figure 3.4 m
How are these two diagrams related to each other?	



<http://www.apple.com/ios/apps/app-store.html>

Biology Apps – Unit 5.3

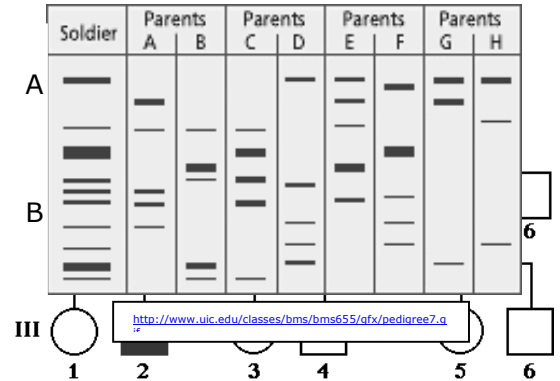
Biotechnology

1. Look at the DNA fingerprint to the right.

A. Who are the soldier's parents? _____

B. Does band A or B have more base-pairs? _____

C. What force is used to separate the DNA pieces?



2. A woman was attacked by 2 men for her purse and she fought back. As they ran one man said "hurry son". A DNA sample was taken from underneath her fingernails and from 3 potential suspects.

A. Which suspect did she scratch? _____

B. Which suspects are related? _____



http://glencoe.mcgraw-hill.com/0073103335/0073103335_ch05_016

3. What protein is now widely produced by genetic engineering?

4. What is the Human Genome Project?

Unit 6.1 Preview
Textbook pgs.246-248, 275 (bottom) -278

A. **Important Vocabulary to Remember**

Vocab Word	Definition from textbook	Diagram with caption

B. **Important Diagrams to Analyze**

Read the caption of Figure 11-16 (pg. 276) and answer the bold question in a complete sentence.

C. **Important Big Ideas to Evaluate**

After reading pgs. 246-248, sketch a picture from these pages. Create your own caption that includes a vocabulary word from the vocab matching.

Unit 6.1 Review

A. Understanding Examples -- **Complete** the following 5 statements.

1. Asexual reproduction does not need a mate, so the offspring are _____.
2. Mitosis makes _____ cells that are _____ ploid and genetically identical.
3. The stage of mitosis that separate the copies of the doubled chromosome is _____.
4. Meiosis makes _____ cells that are _____ ploid, different and called gamete cells.
5. After _____, sexual reproduction is complete.

B. Analyzing applications -- Correctly match each vocab word with an appropriate experiment

- | | | |
|--|--|---|
| <ol style="list-style-type: none"> 1. Regeneration 2. Cytokinesis 3. Centromere 4. Diploid 5. Haploid 6. Meiosis 7. Crossing Over | <ol style="list-style-type: none"> a. When observing plant root cell division, a supportive structure will form during the last stage. b. A fertility expert explains that the male's body must undergo this process in order to make viable sperm. c. The salamander's tail was destroyed, but the vet said it could grow back as an identical copy. d. The ovum cells were found to have 50% of the DNA as the skin cells. | <ol style="list-style-type: none"> e. The doctor explained that fraternal twins are different because the two eggs were created when information was switched between chromosomes. f. When studying someone with too many chromosomes, the geneticist found that this structure didn't separate. g. Puppies have one chromosome from each parent, making chromosomes comes in pairs. |
|--|--|---|

C. Evaluating Scenarios -- Redraw the two listed diagrams **from your handbook**.

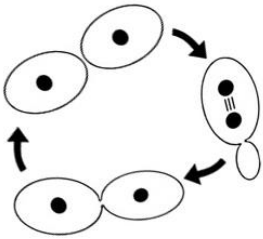
<u>Figure 2.3 i</u>	<u>Figure 2.3 m</u>
How are these two diagrams related to each other?	

Biology Apps – Unit 6.1

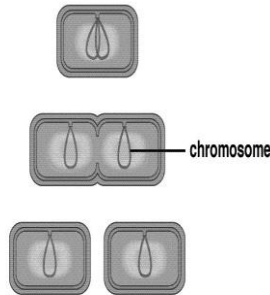


Reproduction

1. How many sources of genetic material are involved in asexual reproduction? In sexual reproduction?
2. Identify the following types of asexual reproduction:



<http://regentsprep.org/regents/biology/units>

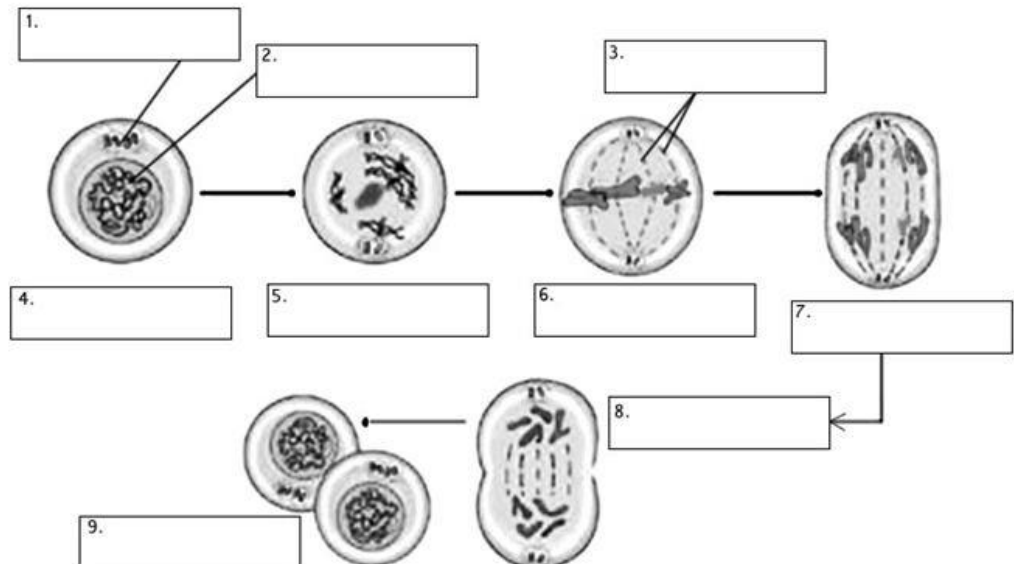


<http://andyannie.us>

Eukaryotic Cell Cycle

3. What are three reasons that cells divide?
4. How is the genetic material “prepared” for cell division during interphase?
5. What is happening during the following parts of interphase:
 G1:
 Synthesis:
 G2:

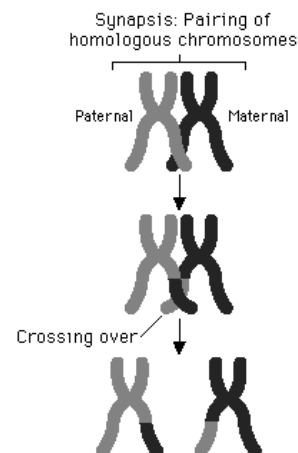
6. Label the phases and structures involved in the eukaryotic cell cycle pictured to the right.



7. How many daughter cells are produced as a result of mitosis, and how do these cells compare to the parent cell?
8. An alligator's cells contain 32 chromosomes. If a body cell goes through mitosis, how many chromosomes in the daughter cells?
9. How are cancer and mitosis related?

Meiosis

10. What are gametes?
11. How is a zygote produced from gametes?
12. How is the chromosome number of a gamete different from the chromosome number of a somatic cell?
13. What is the purpose of meiosis?
14. Name five sources of variation meiosis provides.
15. Explain how nondisjunction can result in a baby that has Down's syndrome
16. Describe crossing over.



Asexual Reproduction

1. Single-celled organisms, such as Paramecium, can reproduce very quickly by asexual reproduction. A Paramecium can divide in two, grow and be ready to divide again in 8 hours.

(a) What must a Paramecium do if it is to grow in size before it can divide?

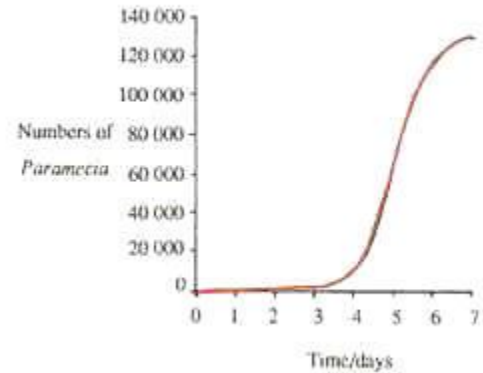
(b) One Paramecium is placed in a jar of pond water. If the conditions are perfect it will divide in two every 8 hours. How many Paramecia would be present in the jar after :

(i) one day (24h) and

(ii) one week?

(c) In fact the numbers of Paramecia in the jar will probably follow the pattern shown in the graph opposite. After one week are there: more Paramecia or less Paramecia than you calculated in part (b)?

(d) Can you explain why there should be a difference between your calculations and this graph?



Select the organisms that perform this type of asexual reproduction.

_____ 2. Binary Fission

_____ 3. Budding

_____ 4. Sporulation

_____ 5. Regeneration

_____ 6. Vegetative reproduction

A. Star fish

B. Amoeba

C. yeast

D. Hydra

E. White potato plant

Select the appropriate definition for each type of asexual reproduction.

_____ 7. Mitosis

_____ 8. Regeneration

_____ 9. Spore Formation

_____ 10. Binary Fission

_____ 11. Budding

A. growing back a missing part

B. section of a cell grows and separates from the original cell

C. cellular division

D. smaller Identical cells produced from frequent cell division

E. organism divided into two with a copy of parents DNA

12. What are the advantages to asexual reproduction?

13. What are the advantages of sexual reproduction?

Mitosis Practice

1. Mitosis is how cells make identical copies of themselves. Doing this is how organisms grow. In the following examples underline the place where you would expect to see **more** mitosis happening:

a baby's bones

an elder's bones

a tree bud in spring

a tree bud in winter

the hair follicles of a bald man

the hair follicles of a hairy man

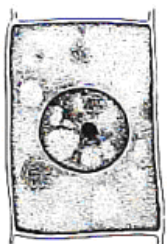
a yeast culture with lots of sugar

a yeast culture with no sugar

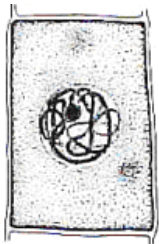
an egg in your fridge

an egg with a chick

2. All cells must undergo division in order to make more cells. The following diagram is showing part of the cycle of a **plant cell**. Label the four stages of mitosis and then DRAW the result of cytokinesis.



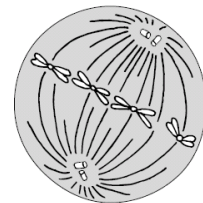
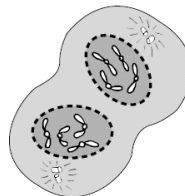
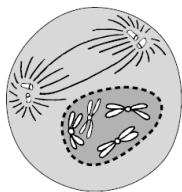
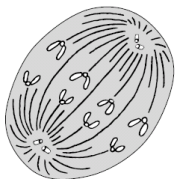
Interphase



cell plate

Cytokinesis

3. Only cells that have a nucleus use mitosis since mitosis is the division of the nucleus. Animal cells will undergo mitosis. Place a number below each picture to put the stages in the correct order. At least once, label the centrioles, spindle fibers, sister chromatids, and centromeres IF they are present.



4. Explain why there are only four pictures labeling mitosis but question 2 has six steps.

Mitotic Disrupters From Higher Plants and Their Potential Uses as Herbicides¹

MARTIN A. VAUGHAN and KEVIN C. VAUGHN²

Abstract. Mitotic disrupters from higher plants have been studied for their effects on animal cells, but their effects on plant cells have been studied less. The plant-derived compounds have counterparts among herbicides with respect to cellular effects and, in some cases, mode of action. Cellular effects in common are arrested pro-metaphases (colchicine, dinitroanilines), multipolar divisions (*Vinca* alkaloids, carbamates), and production of binucleate cells (caffeine, dichlobenil). The potential of these natural compounds, either directly or as the basis of new chemistries for herbicides, has remained largely untapped. Nomenclature: Dichlobenil, 2,6-dichloro-benzonitrile.

Additional index words: Colchicine, caffeine, maytansine, podophyllotoxin, taxol, trewiasine, *Vinca* alkaloids.

NEXT

INTRODUCTION

Many of today's herbicides have as a primary or secondary mode of action the disruption of mitosis (14). These herbicides include the dinitroaniline, carbamate, and phosphoric amide groups as well as others such as DCPA (dimethyl 2,3,5,6-tetrachloro-1,4-benzenedicarboxylate). However, the most highly studied chemicals that disrupt mitosis in both plant and animal cells are compounds which are produced by plants. The potential for use of these natural substances from plants as herbicides is great. Whether used as the herbicide itself or as the basis of herbicide chemistries, these compounds are potentially effective, low cost, selective, and environmentally safe herbicides.

ROLE OF MICROTUBULES IN MITOSIS

In most instances, these natural compounds interfere with the functions and formation of microtubules in the cell. Microtubules are unbranched cylinders or "tubes", 25 nm diam, found in all eukaryotic cells. They are composed of non-identical protein subunits called tubulin. The tubulin subunits assemble and disassemble at appropriate times and places through the division cycle of the cell, forming microtubule structures which are related to specific cellular processes.

During interphase, or the nondividing period of the cell cycle, microtubules form an elaborate network near the plasma membrane of the plant cell and direct the deposition of cellulose microfibrils in the cell wall

(Figure 1A). Before onset of mitosis, a ring of microtubules forms around the nucleus along the short axis of the cell (35) (Figure 1B). The preprophase band of microtubules has no known function. It does seem to predict the plane of the subsequent cell division and may serve as a pool of tubulin subunits (35, 51).

At the onset of mitosis, prophase, microtubules form around the condensing chromosomes (Figure 1C). At metaphase, the chromosomes align at the center of the cell, and microtubules of the mitotic spindle attach to the kinetochores of the chromosomes (Figure 1D). The chromatids of the chromosomes are separated at anaphase and are transported to opposite poles of the cell as chromosome-to-pole microtubules shorten and microtubules begin to form between the separated groups of chromosomes.

When the chromosomes reach opposite poles, and daughter nuclei begin to form, the new plasma membrane and cell wall forms between the daughter nuclei. This cell plate begins to form in the center of the cell and proceeds to the edge of the cell. Membrane vesicles containing cell wall material derived from Golgi bodies in the area fuse, forming the new membrane, and deposit their contents to form the new cell wall. The development of the cell plate is associated with and mirrored by microtubules on either side of the forming cell plate (Figure 1E). These microtubules are thought to function in the movement and arrangement of the Golgi vesicles at the cell plate.

CELL DIVISION EFFECTS OF MITOTIC DISRUPTERS

The types of mitotic inhibition produced by plant mitotic disrupters or herbicides can be grouped into distinct effects that result in root growth inhibition and phytotoxic effects. One type of disruption is distinguished by the inability of the chromosomes to

¹ Received for publication May 9, 1988, and in revised form June 29, 1988. Supported in part by a USDA competitive grant 86-CRCR-1-1933 to Kevin C. Vaughn.

² Plant Physiol., U.S. Dep. Agric., Agric. Res. Serv., South. Weed Sci. Lab., Stoneville, MS 38776.

<p>Bio 1.2 Analyze the cell as a living system.</p>	<p>Bio.1.2.2</p>	<p>Analyze how cells grow and reproduce in terms of interphase, mitosis and cytokinesis.</p>
--	------------------	--

1. The authors are researching to see if mitotic disrupters can be used as herbicides. Break the word herbicide down... what does an herbicide do?
2. Look at the title of the journal that is publishing this article (lower right corner). Who might be using herbicides and why?
3. According to the authors, how specifically do most mitotic disrupters interfere with mitosis?
4. If the herbicide is applied during interphase, what would happen to the cell?
5. If the herbicide is applied during prophase, what would happen to the cell?
6. If the herbicide is applied during metaphase, what would happen to the cell?
7. If the herbicide is applied during anaphase, what would happen to the cell?
8. If the herbicide is applied during the development of the cell plate, what would happen to the cell?
9. Why would a farmer be interested in this journal article? Make a **claim**, support it with **evidence** from the text and provide the specific **reasoning** or explanation.

Haploid and Diploid Practice

Applying the concepts of mitosis and meiosis to chromosome number

1. If a cell with two chromosomes were in interphase, what form would the DNA be in? Draw and label.
2. If a cell with two chromosomes in interphase received a signal to divide, what would happen to the DNA?
3. If a cell with two chromosomes were in prophase, what form would the DNA be in? Draw and label.
4. If a cell with two chromosomes underwent mitosis, how many chromosomes would the resulting cells have? Draw and label.
5. If a cell with two chromosomes underwent meiosis, how many chromosomes would the resulting cells have? Draw and label.
6. What is the definition of diploid and why does this occur?
7. What is the definition of haploid and why does this occur?

The data table below shows the chromosome number for somatic cells.

Organism	Chromosome #	Organism	Chromosome #
<i>Mosquito</i>	6	<i>Housefly</i>	12
<i>Frog</i>	26	<i>Orangutan</i>	48
<i>Pea plant</i>	14	<i>Corn</i>	20
<i>Human</i>	46	<i>Dog</i>	78

8. *What is the chromosome number for diploid human cells?* _____
9. *What is the chromosome number for haploid pea plant cells?* _____
10. *What is the chromosome number for diploid orangutan cells?* _____
11. *What is the chromosome number for human gamete cells?* _____
12. *If a frog cell had 26 chromosomes, would that be diploid or haploid?* _____
13. *If a housefly cell had 6 chromosomes, would that be diploid or haploid?* _____

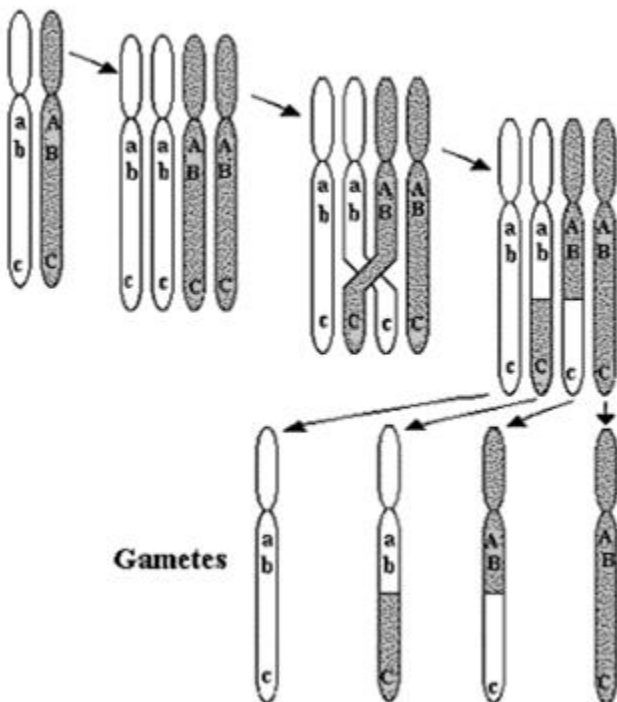
14. If a mosquito cell had 3 chromosomes, would that be diploid or haploid? _____
15. If a corn cell had 20 chromosomes, would that be diploid or haploid? _____
16. If a dog cell had 78 chromosomes would it be a gamete or somatic cell? _____
17. If a frog cell had 13 chromosomes would it be a gamete or somatic cell? _____
18. If a human cell had 23 chromosomes would it be a gamete or somatic cells? _____
19. Why is the chromosome number in each of the eukaryotic cells an even number?
20. What are the names for the gender specific forms of gametes?
21. What is the process called when the gametes fuse to form a zygote?
22. Is the zygote a diploid or haploid cell?
23. In order to build a multicellular organism, what must happen next?

Circle diploid or haploid in each of the questions below.

24. In the human body, nervous system cells are diploid or haploid.
25. In the human body, gamete cells are diploid or haploid.
26. In the human body, egg cells are diploid or haploid.
27. In the human body, liver cells are diploid or haploid.
28. In the human body, bone cells are diploid or haploid.
29. In the human body, somatic cells are diploid or haploid.
30. In the human body, body cells are diploid or haploid.

Genetic Variation in Meiosis

1. What is meiosis?
2. What type of cell undergoes meiosis?
3. Meiosis produces reproductive/sex cells called _____ like _____ and _____.
4. What is the chromosome number for humans?
5. The fusion(fertilization) of a _____ and an _____ produces a _____ with a 46 (2n) chromosome number.
6. Every sperm and egg cell is genetically _____ with a _____ chromosome number.
7. One way in which genetic variation can occur is through _____-over. During this process the doubled chromosomes pair up and some parts of the chromosome (or genes) can _____ places.
8. This diagram will show you how **crossing-over** occurs. The letters represent different versions of a gene on the homologous chromosome (like different hair color). Notice the movement of those genes (letters) and answer the following questions. Each number represents a step in the process.



8a. What phase has occurred during step 1?

8b. Crossing over occurred between steps _____ and _____.

8c. At the end of the process each chromosome contains a gene combination that is genetically _____.

8d. In step 4, this diagram shows you that the homologous chromosomes are _____ and each gene combination would indicate a genetic variation between the 4 _____ produced.

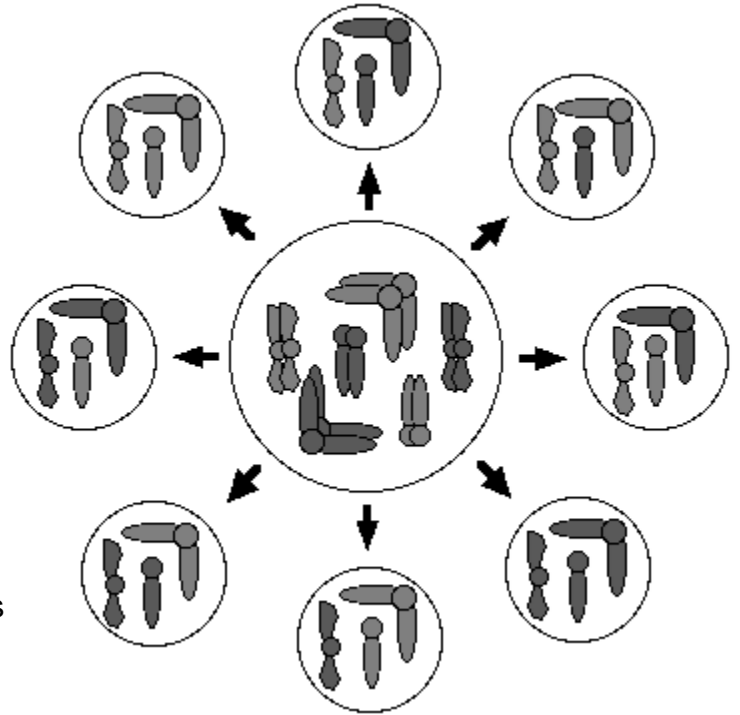
9. The next figure illustrates Random Assortment. The cell in the middle shows the homologous chromosome pairs. (Notice that the different shapes represent the different chromosomes.)

9a. Random Assortment occurs because the chromosome pairs line up randomly during _____-phase.

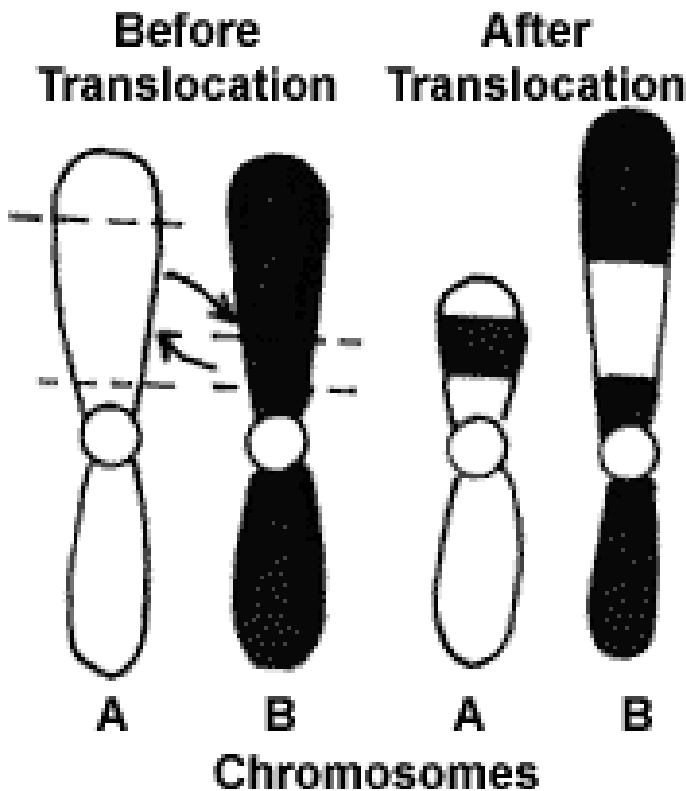
9b. This allows a _____ of chromosomes from both parents to occur, which creates variation in the gametes that are produced.

9c. In this example the organism has a chromosome number of 6. So the haploid number is _____.

9d. Random assortment of chromosomes in humans produces 2^{23} (8,388,608) different combinations of chromosomes! So imagine the variation that can occur in a zygote, when a random sperm cell _____ a random egg cell!



EXTRA CREDIT The possibility of mistakes occurring during meiosis exists. A translocation is a mistake that occurs when crossing-over happens between two non-homologous pairs = big error. They are the most common chromosomal abnormalities in humans—1 in 500 people have a translocation.

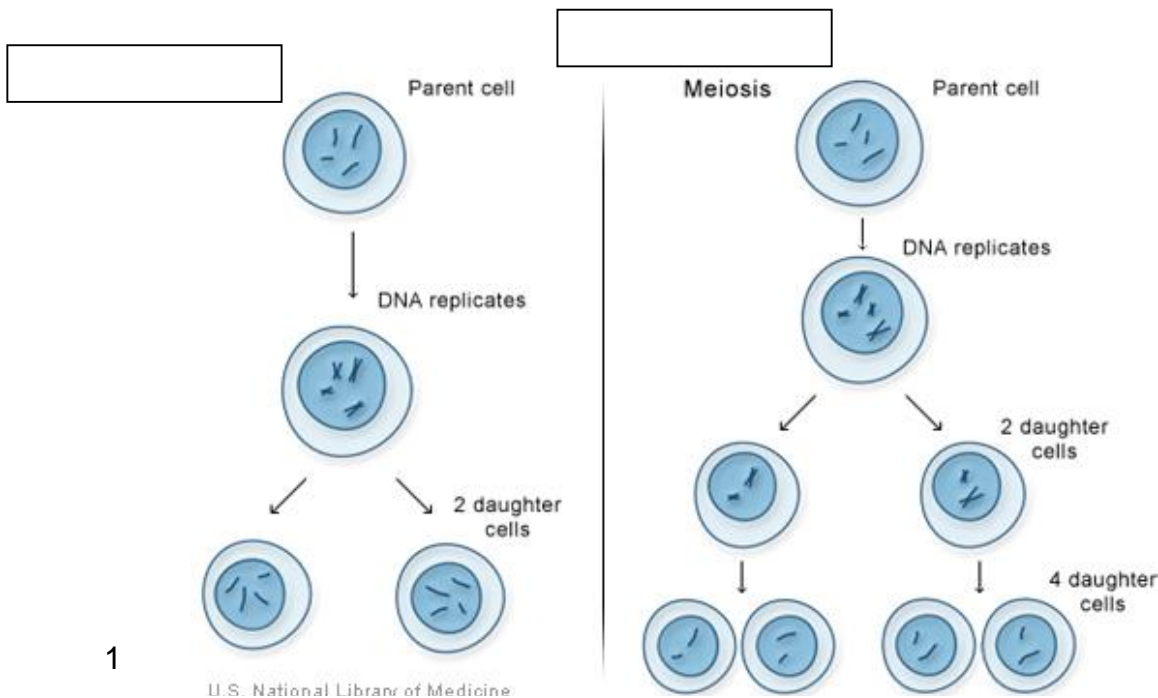


10. Think about the role of DNA. If this mutation is not fatal, what problems could it cause? What process could it affect?

Meiosis and Sexual Reproduction Review

Phases	Meiosis	half	doubled	haploid
Four	sexual	sex	two	fertilization
Diploid	crossing-over	homologous		variation

- Mitosis is for asexual reproduction whereas _____ is for sexual reproduction.
- Gametes are also called _____ cells.
- Meiosis goes through the same _____ as mitosis but MEIOSIS goes through _____ divisions.
- During Meiosis I, the chromosome number is cut in _____. The cells have 23(half) the chromosome number but they are still _____. So, Meiosis II separates the doubled chromosomes and the result is _____ cells with a _____ chromosome number.
- The gametes (sex) cells made as a result of Meiosis can then combine in a process called _____, where 23 chromosomes from the mothers egg and 23 chromosomes from the fathers sperm form a _____ cell called a zygote with 46 chromosomes.
- Meiosis is a form of sexual reproduction which means the offspring are genetically different. The sources of the genetic variation are : random assortment of chromosomes, random fertilization and _____.
- In the process of crossing-over, a gene on one of the _____ chromosomes is exchanged with the gene on the other chromosome allowing for more genetic possibilities for the offspring.
- Homologous chromosomes are similar in that they code for the same traits but can have a _____ of the trait.
- Label each picture as either mitosis or meiosis.



11. When sexual reproduction is used, there are extra steps before the full organism is produced. Which of the following is the correct order of these steps?

- A) Mitosis → Fertilization → Meiosis C) Meiosis → Mitosis → Fertilization
B) Mitosis → Meiosis → Fertilization D) Meiosis → Fertilization → Mitosis

12. Organisms that use sexual reproduction would be more successful in times of danger because there is

- A) a slower reproduction time frame C) closer relationships between organisms
B) more genetic variety D) none of the above

13. Meiosis produces which of the following to prepare for sexual reproduction?

- A) genetic variation C) a reduced chromosome number
B) both A&B D) none of the above

14. During which process is DNA copied to prepare for division?

- A) Mitosis B) Meiosis C) both A&B D) neither

15. What type of cells result after meiosis?

- A) diploid somatic cells C) diploid gamete cell B)
haploid somatic cells D) haploid gamete cells

16. A cell with a diploid chromosome number of 12 divided two times, producing four cells with six chromosomes each. The process that produced these four cells was most likely

- A) internal fertilization C) mitotic cell division
B) external fertilization D) meiotic cell division

17. Meiosis produces _____ cells that are genetically _____.

- A) 2; identical C) 2; different
B) 4; identical D) 4; different

18. A sperm cell of an alligator has 16 chromosomes. What is the total number of chromosomes normally present in a stomach cell of this alligator? A) 8 B) 32 C) 48 D) 16

19. If the following somatic cell undergoes meiosis, each of the daughter cells will have how many chromosomes?

- A) 2 homologous pairs C) 2 doubled chromosomes
B) 4 chromosomes D) 2 chromosomes

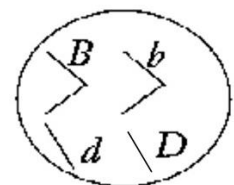
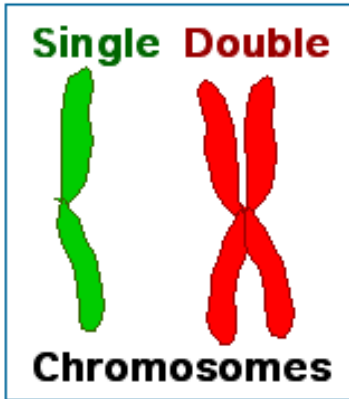


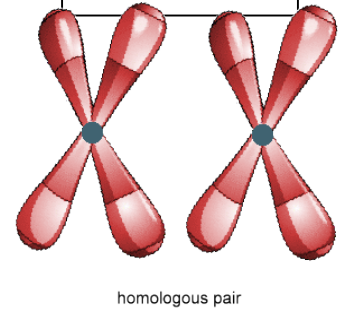
Figure One



Overview of Mitosis and Meiosis

1. What is different between the single and doubled chromosomes in Figure One?
2. Label the following on Figure One. (sister chromatid, centromere)
3. What is the relationship between two sister chromatids of the doubled chromosome?

Figure Two

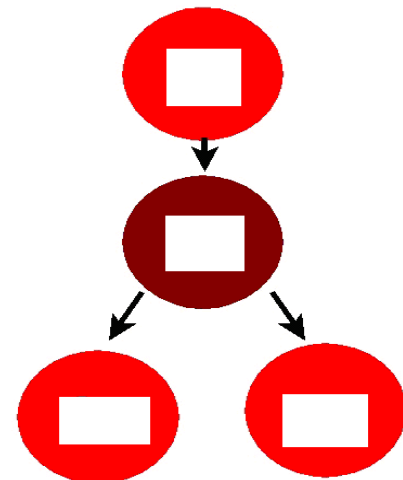
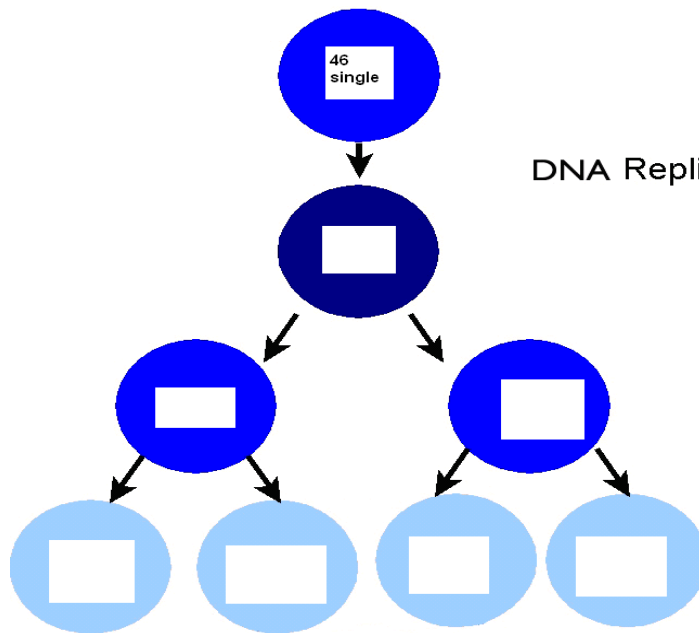


4. What does Figure Two show?
5. Where did the pair of chromosomes come from?

6. Why do they look like X's?

7. Label the following diagrams as Mitosis or Meiosis.

8. What does "46 single" mean? Use the following words in the rest of the blanks (46 or 23) (single or double)



9. What occurs during DNA Replication?

10. Why did the chromosome number not double?

11. Describe the end result of Mitosis. Describe the end result of Meiosis.

12. In which has complete reproduction occurred?

13. What must occur next for meiosis to produce another **organism?**

Unit 7.1 Preview
Textbook pgs.264(bottom)-266, 268, 272-273

A. Important Vocabulary to Remember

Vocab Word	Textbook definition	Diagram with caption

B. Important Diagrams to Analyze

Read the caption of Figure 11-8 (pg. 269) and answer the bold question in a complete sentence.

C. Important Big Ideas to Evaluate

After reading pgs.264, 266, 268, 272-273 sketch a picture from these pages. Create your own caption that includes a vocabulary word from the vocab matching.

Unit 7.1 Review

A. Understanding Examples -- **Complete** the following 5 statements.

1. A genotype is written as ___ letters, one letter for each allele received from the parents.
2. In a heterozygote, the dominant allele _____ the recessive allele and the phenotype is dominant.
3. Examples of _____ traits include human height and skin color.
4. Sex-linked traits are always found on the _____ chromosome.
5. Males cannot be carriers for _____ trait.
6. PKU symptoms can be completely prevented by _____.

B. Analyzing applications -- Correctly match each vocab word with an appropriate experiment

- | | | |
|--|---|--|
| <ol style="list-style-type: none"> 1. Genotype 2. Punnett Square 3. Codominance 4. Sex-linked 5. Incomplete dominance 6. Carrier | <p>compared with the number of short plants. When he did a cross, he could predict what the offspring would be like.</p> <ol style="list-style-type: none"> b. Sometimes a dominant tall plant crossed with another tall plant would produce short plants. c. After the gene was sequenced, letters were used to represent the two alleles that and individual had. | <ol style="list-style-type: none"> d. A black chicken mated with a white chicken produced baby chicks a checkered pattern. e. More males are colorblind, due to the short length of the Y chromosome and missing allele. f. Red flowers crossed with white flowers produce a blended pink flower. |
| <ol style="list-style-type: none"> a. Mendel tracked the number of tall plants | | |

C. Evaluating Scenarios -- Redraw the two listed diagrams **from your handbook**.

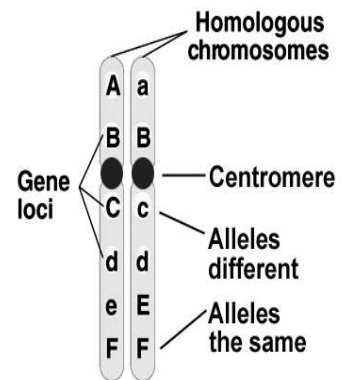
Figure 3.3 c	Figure 3.3 f
How are these two diagrams related to each other?	

Biology Apps – Unit 7.1



Genetics

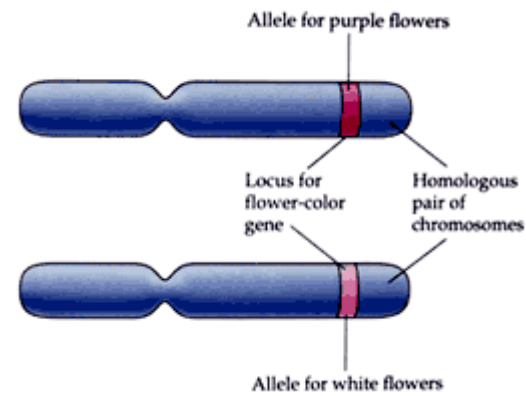
- Where did you get each of the chromosomes in the homologous pair?
- What is the difference between a phenotype and a genotype?
- Brown eyes (B) is dominant to blue eyes (b). Refer to the diagram on the right.
 - What is her genotype?
 - What are other possible genotypes for brown eyes?
- Tay-Sachs breaks down the central nervous system leading to premature death. It is a recessive disease. What genotype would a person with the disorder have?
- PKU, Cystic Fibrosis, and Tay-Sach's are all recessive disorders. What would be the dominant phenotype for these traits?
- A person with PKU cannot break down an amino acid found in milk, which can lead to brain damage. If mom was heterozygous for the disorder and dad was homozygous recessive, what is the percent chance that they have a child with the disease? (Draw a Punnett square to justify your answer.)
- Huntington's disease is dominant. A woman is homozygous recessive despite having parents that suffered from the disease.
 - Could any of her eggs contain the gene for Huntington's disease? _____
 - What genotype must her husband have to ensure that none of her children would inherit the disease? _____
- A man and woman plan to have children and learn they could be potential carriers of the cystic fibrosis. The **normal** amino acid sequence (for a person without the disease) would code for **Arg-Pro-Phe-Gly-Val**.
 - The man's mRNA sequence is **CGG-CCC-UUU-GGA-GCA**. What is his amino acid sequence?
 - The woman's mRNA sequence is **AGA-CCA-UUU-GGA-GUA**. What is her amino acid sequence?
 - Who is a potential carrier? _____
 - What is the likelihood that their children be affected? _____ %
 - Carriers? _____ %



<http://iws.collin.edu/biopage/faculty/mcculloch/1406/notes/genetics/Images/Homologous%20Pair.JPG>

9. A sample of blood can contain some sickle and some normal red blood cells. Therefore Sickle cell anemia is an example of _____ inheritance.
- a) A woman is a carrier of sickle cell anemia but her husband is not. What is the chance they will have a child that is heterozygous? _____ (Draw a Punnett square to justify your answer)
10. 4 o'clock flowers are incompletely dominant. The flowers can bloom red, white, or pink. If the parent flowers were red and white what genotypes and phenotypes could the offspring have? (Draw a Punnett square to justify your answer)
11. Darin has blood type AB. His wife is blood type B, but is heterozygous. What are the possible phenotypes that their offspring could have? (Draw a Punnett square to justify your answer)
12. Dan is blood type B, Mary is A.
- a) Would they be able to have a child that is type O? _____
- b) What genotypes would they have to have? (Draw a Punnett square to justify your answer)
- c) What genotype would not allow them to have a type O child? (Draw a Punnett square to justify your answer)
13. Hemophilia is a recessive disorder that is more common in men. A man with hemophilia has a child with a woman that is a carrier. What is the possibility that any child will have hemophilia? (Draw a Punnett square to justify your answer)
14. Why can't we use a Punnett square to determine polygenic traits?

What is an allele?



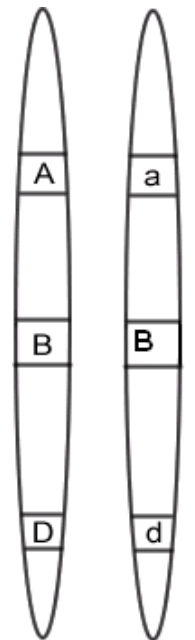
You know that homologous chromosomes pair up during meiosis. Homologous chromosomes have genes that are similar. One came from your _____ and one from your _____.

Remember a gene codes for a specific _____. The genes on each homologous chromosomes code for the same traits, or characteristic, such as eye color. But there are slightly different sequences on each homologous chromosome and those may produce different proteins for the same trait. A trait is a physical characteristic, like tongue rolling. So your mom could have given you the gene for rolling your tongue and your dad gave you the gene for not rolling your tongue.

In this case, the two different forms of the gene are called _____. For most traits, there are two alleles. One on each homologous chromosome, which came from each of your parents. You can inherit two of the same type of allele, and this is called _____zygous. If you inherit two different versions, you are called _____zygous.

You may be wondering what will happen if two alleles are different. In fact, only one of the alleles will be expressed in this case. The gene of the unexpressed allele is not transcribed and translated. The expressed gene is said to be dominant over the unexpressed gene, which is described as recessive.

1. What are homologous chromosomes?
2. Where did you get your homologous chromosomes?
3. What does a gene have the code for?
4. What is a trait? What is an example of a trait?
5. What is an allele?
6. The expressed allele is called _____.
7. The unexpressed allele is called _____.
8. Does figure 2 show homologous or doubled chromosomes? How do you know?
9. If the letter **B** is the trait for eye color, does this person have two alleles that are the same or two alleles that are different?

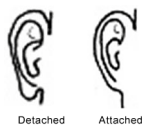






Human Traits

Part I: Determining Genotypes from Phenotypes

Work with a partner to complete the following data table based on your individual traits.

- 1) Indicate YOUR OWN phenotype for each trait in the column labeled "phenotype".
- 2) Record your possible genotypes in the column labeled "genotype".

Trait	Phenotype	Possible Genotype(s)
PTC Tasting: <ul style="list-style-type: none"> • Tasting ability is dominant (TT or Tt) • Non-tasting is recessive (tt) 		
Earlobe Attachment: <ul style="list-style-type: none"> • Detached earlobes is dominant (EE or Ee) • Attached earlobes is recessive (ee) 		
Tongue Rolling: <ul style="list-style-type: none"> • Tongue rolling ability is dominant (RR or Rr) • Non-rolling is recessive (rr) 		
Cleft Chin: <ul style="list-style-type: none"> • Cleft chin is dominant (CC or Cc) • Smooth chin is recessive (cc) 		
Dimples: <ul style="list-style-type: none"> • Having dimples is dominant (DD or Dd) • No dimples is recessive (dd) 		
Hairline: <ul style="list-style-type: none"> • Having a widow's peak is dominant (HH or Hh) • Straight hairline is recessive (hh) 		
Freckles: <ul style="list-style-type: none"> • Having freckles is dominant (FF or Ff) • No freckles is recessive (ff) 		

Summary

1. List all of your dominant traits. _____
2. List all of your recessive traits. _____
3. What is the class ratio of PTC tasters to non-tasters? _____
4. Can you always determine a person's genotype for a trait from his/her phenotype? Explain.

5. What determines your traits? _____

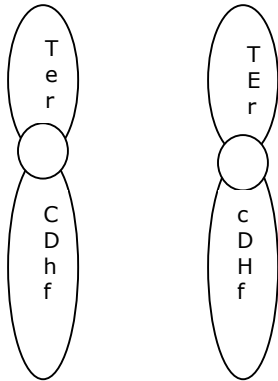
Part II: Traits on Chromosomes

Recall that chromosomes work in "homologous pairs" with each chromosome of a pair coming from a different parent. Each chromosome in a pair carries "alleles" for the same genes. The two alleles together determine an individual's traits.

Using the alleles shown for the traits on the previous page, determine the genotype and phenotype for each individual, based on the chromosome pair shown.

Melissa:

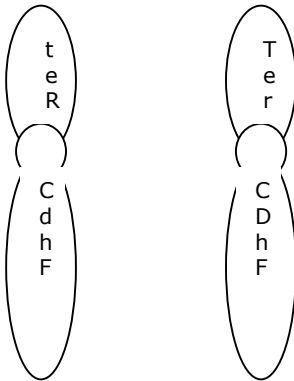
(from mother) (from father)



Genotypes	Phenotypes

Bobby:

(from mother) (from father)



Genotypes	Phenotypes

Summary

1. Did Melissa's father have PTC tasting ability? _____
2. Could either of Melissa's parents have had tongue rolling ability? _____
3. Will Bobby's children have a cleft chin? _____
4. Is it possible for Bobby to have children with a widow's peak? _____
5. Use the following words to summarize this activity: allele, genotype, phenotype

Human Genetics Practice

Practicing Genotype/Phenotype and Dominant/Recessive

1. A woman has cystic fibrosis, a recessive disease that causes mucus to accumulate in the lungs. Her husband was recently tested and found to be a carrier of the recessive allele.
 - a. _____ would be the allele for normal and _____ for cystic fibrosis
 - b. What is the genotype of the woman? _____ (described as _____ zygous)
 - c. What is the genotype of the husband? _____ (described as _____ zygous)
 - d. Draw and fill in the Punnett Square that shows the possibilities of offspring.

 - e. What is the chance they will have
 - i. a child with cystic fibrosis? _____ or _____ %
 - ii. a normal child? _____ or _____ %
 - iii. a child that is a carrier? _____ or _____ %
 - iv. a child that is Nn would have what phenotype? _____

2. A woman is a carrier of the recessive allele for phenylketonuria, a recessive disease that cannot break down an amino acid and results in brain damage. Her husband is homozygous dominant and does not have PKU.
 - a. _____ would be the allele for normal and _____ for PKU
 - b. What is the genotype of the woman? _____ (described as _____ zygous)
 - c. What is the genotype of the husband? _____ (described as _____ zygous)
 - d. Draw and fill in the Punnett Square that shows the possibilities of offspring.

 - e. What is the chance they will have
 - i. a child with PKU? _____ or _____ %
 - ii. a normal child? _____ or _____ %
 - iii. a child that is a carrier? _____ or _____ %
 - f. When receiving genetic counseling before having children, the couple is told that this disease is "lucky" because you can control it with diet. HOW?

Practicing working backwards

3. A woman has Huntington's disease which is dominant and causes brain deterioration. Her husband is normal for the disease.

a. _____ would be the allele for normal and _____ for Huntington's

b. What are the possible genotypes of the woman?

_____ (described as _____ zygous) **OR** _____ (described as _____ zygous)

c. What is the genotype of the husband? _____ (described as _____ zygous)

i. Why can he only be one genotype?

d. Draw and fill in the Punnett Square that shows the possibilities of offspring.

e. What is the chance they will have

i. a child that is homozygous dominant? _____ or _____ %

ii. a child that is heterozygous? _____ or _____ %

iii. a child that is homozygous recessive? _____ or _____ %

iv. a child that is Nn would have what phenotype? _____

4. A young couple recently had a child that was diagnosed with Tay-Sachs, a recessive disease that results in brain deterioration at a very young age. Neither of the parents have the disease.

a. _____ would be the allele for normal and _____ for Tay-Sachs

b. What is the genotype of the baby with Tay-Sachs? _____ (described as _____ zygous)

c. What is the genotype of BOTH the parents? _____ (described as _____ zygous)

i. Why must they be this genotype?

d. Draw and fill in the Punnett Square that shows the possibilities of offspring.

e. What is the chance their next child will

i. have Tay-Sachs? _____ or _____ %

ii. be normal? _____ or _____ %

be the same genotype as the parents _____ or _____ %

Codominant/Incomplete Dominant

1. In pea plants, purple flowers are dominant to white. Cross a homozygous purple pea plant with a white pea plant.

- a) What would be the allele for purple? _____ for white? _____
- b) What are the genotypes of the parents? _____ x _____
- c) What is the predicted genotypic ratio for the offspring? _____
- d) What is the predicted phenotypic ratio for the offspring? _____
- e) Out of 50 plants, how many do you expect to be purple? _____
- f) Out of 50 plants, how many do you expect to be white? _____

2. In pea plants, being resistant to the common necrosis virus is codominant with not being resistant. In heterozygotes, cells produce BOTH a resistant version of an enzyme AND a mutated version. Cross a resistant pea plant with a mutated pea plant.

- a) What would be the allele for resistant? _____ for mutated? _____
- b) What are the genotypes of the parents? _____ x _____
- c) What is the predicted genotypic ratio for the offspring? _____
- d) What is the predicted phenotypic ratio for the offspring? _____
- e) Out of 50 plants, how many do you expect to be resistant? _____
- f) Out of 50 plants, how many do you expect to be mutated? _____

3. In flowers called impatiens, a red flower was crossed with a white flower. The offspring had BOTH red petals and white petals. A farmer crossed a heterozygote with a white flower.

- a) What would be the allele for red? _____ for white? _____
- b) What are the genotypes of the parents? _____ x _____
- c) What is the predicted genotypic ratio for the offspring? _____
- d) What is the predicted phenotypic ratio for the offspring? _____
- e) Out of 50 plants, how many do you expect to be red? _____
- f) Out of 50 plants, how many do you expect to be white? _____
- g) Out of 50 plants, how many do you expect to be red AND white on the same flower? _____

4. In flowers called 4 o'clock flowers, flower color is INCOMPLETELY dominant. A farmer crossed a red flower with a white flower.

- a) What would be the allele for red? _____ for white? _____
- b) What are the genotypes of the parents? _____ x _____
- c) What is the predicted genotypic ratio for the offspring? _____
- d) What is the predicted phenotypic ratio for the offspring? _____
- e) Out of 50 plants, how many do you expect to be red? _____
- f) Out of 50 plants, how many do you expect to be white? _____
- g) Out of 50 plants, how many do you expect to be pink? _____

5. Two pink flowers were crossed and some red offspring were produced.

- a) What would be the allele for red? _____ for white? _____
- b) What are the genotypes of the parents? _____ x _____
- c) What is the predicted genotypic ratio for the offspring? _____
- d) What is the predicted phenotypic ratio for the offspring? _____
- e) Out of 50 plants, how many do you expect to be red? _____
- f) Out of 50 plants, how many do you expect to be white? _____
- g) **** Be careful***** Out of 50 plants, how many do you expect to be red AND white on the same flower? _____ **WHY???**

6. Write your own problem:

Codominant/Incomplete Dominant

1. In pea plants, purple flowers are dominant to white. Cross a homozygous purple pea plant with a white pea plant.

- g) What would be the allele for purple? _____ for white? _____
- h) What are the genotypes of the parents? _____ x _____
- i) What is the predicted genotypic ratio for the offspring? _____
- j) What is the predicted phenotypic ratio for the offspring? _____
- k) Out of 50 plants, how many do you expect to be purple? _____
- l) Out of 50 plants, how many do you expect to be white? _____

2. In pea plants, being resistant to the common necrosis virus is codominant with not being resistant. In heterozygotes, cells produce BOTH a resistant version of an enzyme AND a mutated version. Cross a resistant pea plant with a mutated pea plant.

- g) What would be the allele for resistant? _____ for mutated? _____
- h) What are the genotypes of the parents? _____ x _____
- i) What is the predicted genotypic ratio for the offspring? _____
- j) What is the predicted phenotypic ratio for the offspring? _____
- k) Out of 50 plants, how many do you expect to be resistant? _____
- l) Out of 50 plants, how many do you expect to be mutated? _____

3. In flowers called impatiens, a red flower was crossed with a white flower. The offspring had BOTH red petals and white petals. A farmer crossed a heterozygote with a white flower.

- h) What would be the allele for red? _____ for white? _____
- i) What are the genotypes of the parents? _____ x _____
- j) What is the predicted genotypic ratio for the offspring? _____
- k) What is the predicted phenotypic ratio for the offspring? _____
- l) Out of 50 plants, how many do you expect to be red? _____
- m) Out of 50 plants, how many do you expect to be white? _____
- n) Out of 50 plants, how many do you expect to be red AND white on the same flower? _____

4. In flowers called 4 o'clock flowers, flower color is INCOMPLETELY dominant. A farmer crossed a red flower with a white flower.

- h) What would be the allele for red? _____ for white? _____
- i) What are the genotypes of the parents? _____ x _____
- j) What is the predicted genotypic ratio for the offspring? _____
- k) What is the predicted phenotypic ratio for the offspring? _____
- l) Out of 50 plants, how many do you expect to be red? _____
- m) Out of 50 plants, how many do you expect to be white? _____

n) Out of 50 plants, how many do you expect to be pink? _____

5. Two pink flowers were crossed and some red offspring were produced.

h) What would be the allele for red? _____ for white? _____

i) What are the genotypes of the parents? _____ x _____

j) What is the predicted genotypic ratio for the offspring? _____

k) What is the predicted phenotypic ratio for the offspring? _____

l) Out of 50 plants, how many do you expect to be red? _____

m) Out of 50 plants, how many do you expect to be white? _____

n) **** Be careful***** Out of 50 plants, how many do you expect to be red AND white on the same flower? _____ **WHY???**

6. Write your own problem:

Multiple Alleles Worksheet (Blood types)

Human blood types are determined by genes that follow the CODOMINANCE pattern of inheritance. There are two dominant alleles (I^A and I^B) and one recessive allele (i).

Blood Type (Phenotype)	Genotype
O	ii
AB	$I^A I^B$
A	$I^A I^A$ or $I^A i$
B	$I^B I^B$ or $I^B i$

- Write the genotype for each person based on the description:
 - Homozygous for the "B" allele _____
 - Heterozygous for the "A" allele _____
 - Type O _____
 - Type "A" and had a type "O" parent _____
 - Type "AB" _____
- Pretend that Brad Pitt is homozygous for the type B allele, and Angelina Jolie is type "O." **What are all the possible blood types of their baby?**
- Draw a Punnett square showing all the possible blood types for the offspring produced by a type "O" mother and an a Type "AB" father
- Mrs. Clink is type "A" and Mr. Clink is type "O." They have three children named Matthew, Mark, and Luke. Mark is type "O," Matthew is type "A," and Luke is type "AB." Based on this information:
 - Mr. Clink must have the genotype _____
 - Mrs. Clink must have the genotype _____ because _____ has blood type _____
 - Luke cannot be the child of these parents because neither parent has the allele _____.
- Two parents think their baby was switched at the hospital. Its 1968, so DNA fingerprinting technology does not exist yet. The mother has blood type "O," the father has blood type "AB," and the baby has blood type "B."
 - Mother's genotype: _____
 - Father's genotype: _____
 - Baby's genotype: _____ or _____
 - Punnett square showing all possible genotypes for children produced by this couple
 - Was the baby switched?

6. Two other parents think their baby was switched at the hospital. The mother has blood type "A," the father has blood type "B," and the baby has blood type "AB."
- Mother's genotype: _____ or _____
 - Father's genotype: _____ or _____
 - Baby's genotype: _____
 - Punnett square that shows the baby's genotype as a possibility:
 - Was the baby switched?
7. Based on the information in this table, which man **could not** be the father of the baby? Justify your answer with a Punnett square.

Name	Blood Type
Mother	Type A
Baby	Type B
Sammy the player	Type O
George the sleeze	Type AB
The waiter	Type A
The cable guy	Type B

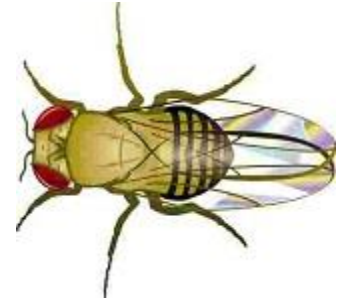
8. Based on the information in this table, which man **could not** be the father of the baby? Justify your answer with a Punnett square.

Name	Blood Type
Mother	Type O
Baby	Type AB
Bartender	Type O
Guy at the club	Type AB
Cabdriver	Type A
Flight attendant	Type B

9. Explain why blood type data cannot prove who the father of a baby is, and can only prove who the father is not.

Genetics - Sex (X) Linked Genes

In fruit flies, eye color is a sex linked trait. Red is dominant to white.



1. What are the sexes and eye colors of flies with the following genotypes?

$X^R X^r$ _____ $X^R Y$ _____
 $X^r X^r$ _____

$X^R X^R$ _____ $X^r Y$ _____

2. What are the genotypes of these flies:

white eyed, male _____ red eyed female (heterozygous) _____

white eyed, female _____ red eyed, male _____

3. Show the cross of a white eyed female $X^r X^r$ with a red-eyed male $X^R Y$.

4. Show a cross between a pure red eyed female and a white eyed male.
What are the genotypes of the parents:

_____ and _____

How many are:

white eyed, male _____

white eyed, female _____

red eyed, male _____

red eyed, female _____

5. Show the cross of a red eyed female (heterozygous) and a red eyed male.

What are the genotypes of the parents?

_____ & _____

How many are:

white eyed, male _____

white eyed, female _____

red eyed, male _____

red eyed, female _____

Math: What if in the above cross, 100 males were produced and 200 females. How many total red-eyed flies would there be? _____

Human Sex Linkage

6. In humans, hemophilia is a sex linked trait. Females can be normal, carriers, or have the disease. Males will either have the disease or not (but they won't ever be carriers)

$X^H X^H$ = female, normal

$X^H X^h$ = female, carrier

$X^h X^h$ = female, hemophiliac

$X^H Y$ = male, normal

$X^h Y$ = male, hemophiliac

Show the cross of a man who has hemophilia with a woman who is a carrier.

What is the probability that their children will have the disease? _____

7. A woman who is a carrier marries a normal man. Show the cross. What is the probability that their children will have hemophilia? What sex will a child in the family with hemophilia be?

8. A woman who has hemophilia marries a normal man. How many of their children will have hemophilia, and what is their sex?

Calico Cat Genetics

9. In cats, the gene for calico (multicolored) cats is codominant. Females that receive a **B** and an **R** gene have black and orange splotches on white coats. Males can only be black or orange, but never calico.

Here's what a calico female's genotype would look like: $X^B X^R$

Show the cross of a female calico cat with a black male?

What percentage of the kittens will be black and male? _____

What percentage of the kittens will be calico and male? _____

What percentage of the kittens will be calico and female? _____

10. Show the cross of a female black cat, with a male orange cat.

What percentage of the kittens will be calico and female? _____ What color will all the male cats be?



Biology Apps – Unit 7.2

1. The pedigree to the right tracks the recessive disorder hemophilia, which affects the ability to clot properly.

A. Which female is **least** likely to be a heterozygote, III-1, III-3, or III-5? Why?

B. Who is most likely a carrier?

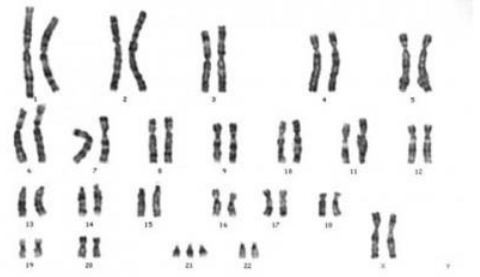
C. Who is affected?

D. Can II-6 be a carrier? Why or why not?

2. Identify the following diseases:

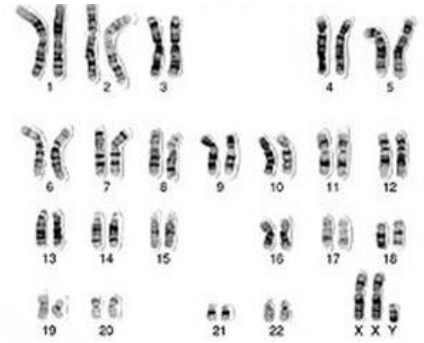
- | | |
|---------|---|
| A _____ | A recessive disorder that affects the way the body breaks down proteins contained in foods. |
| B _____ | Inheritance of an extra X sex chromosome. |
| C _____ | A sex chromosomal disorder affecting females in which all or part of the second X chromosome is missing. |
| D _____ | An autosomal disease in which the lungs, liver, and pancreas secrete large amounts of thick mucus. |
| E _____ | A disease affecting the shape of red blood cells causing oxygen deprivation, pain, swelling, and tissue damage. |
| F _____ | The most common chromosomal disorder. |
| G _____ | An X-linked disease affecting males in which blood fails to clot normally. |
| H _____ | An autosomal disease of dominant inheritance involving central nervous system degeneration. |
| I _____ | An autosomal disease of recessive inheritance involving central nervous system degeneration in infants. |

2. Refer to the karyotype to the right.
 - A. What disorder does this person have? _____
 - B. What is their gender? _____
 - C. What symptoms would they exhibit?



[https://encrypted-](https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9CqRmVUEVCe)

3. Refer to the karyotype to the right.
 - A. What disorder does this person have? _____
 - B. What is their gender? _____
 - C. What symptoms would they exhibit?



[http://pphisbio.wikispaces.com/file/view/Karyotype%20](http://pphisbio.wikispaces.com/file/view/Karyotype%20Disorders+in+24+1+cell+of+human+ovum+of+ova+of+ova+of+ova)

4. What is the cause of most chromosomal disorders? What does that mean?

5. What is a disorder caused by a sex chromosome aneuploidy?

Human Genetics Practice and Pedigrees
Inquiry
Love at the Support Group



When dealing with a genetic disease, many families seek support from other people who have experienced similar difficulties. Sometimes this leads to love at the support group, which can influence how prevalent the disease is in a family.

1. Huntington's Disease is _____ and would be represented by the allele _____. Being normal would be _____ and would be represented by the allele _____.
 - a) Jane has Huntington's disease, but her husband Bill does not.
 - Jane's genotype could be _____ or _____.
 - Bill's genotype would be _____.
 - b) Jane and Bill have 5 children (3 girls and 2 boys), none of whom have Huntington's.
 - The children's genotype are all _____.
 - This means Jane's genotype is _____.
 - c) Jane and Bill's son Robert married a woman name Alexis. Alexis has Huntington's, but Alexis's mom did not.
 - Robert and Alexis have a son Ryan. What is the chance Ryan will have Huntington's? _____ %. Show the Punnett Square.
 - d) Draw a pedigree to represent this family. Shade in the shapes of who has Huntington's.

2. Cystic fibrosis is _____ and would be represented by the allele _____.
 Being normal would be _____ and would be represented by the allele _____.
- a) Carla and her husband Frank are both normal
- Carla's genotype could be _____ or _____.
 - Frank's genotype could be _____ or _____.
- b) Carla and Frank have 2 daughters, and one (Cynthia) has cystic fibrosis.
- Cynthia's genotype MUST be _____.
 - This means Carla's genotype is _____ and Frank's genotype is _____.
- c) After being tested, the other daughter Alicia is found to be a carrier. Alicia's husband (Nathan) is also a carrier.
- Alicia and Nathan are both _____zygous.
 - Alicia and Nathan have a baby boy, Josh. What is the chance Josh has cystic fibrosis? _____%. Show the Punnett.
- d) Draw a pedigree to represent this family. Shade in the shapes of who has cystic fibrosis.

3. Sickle cell anemia is _____ and would be represented by the allele _____.
 Being normal would be _____ and would be represented by the allele _____.
- a) Michelle is heterozygous for sickle cell and her husband Mike is normal.
- Michelle's genotype is _____.
 - Mike's genotype is _____.
- b) Michelle and Mike have 3 sons, and one (Kyle) is heterozygous.
- Kyle's genotype is _____.

- c) Kyle is married to Jessica. They have a daughter, Brittney, who has sickle cell.
- Brittney's genotype must be _____.
 - This means Jessica's genotype must be _____.
 - What is the chance Kyle and Jessica's next child has 100% normal cells? Show the Punnett.

d) Draw a pedigree to represent this family. Shade in the shapes of who have 100% sickled cells. Half fill the shapes of those who have 50% sickled cells.

4. Hemophilia is _____ and would be represented by the allele _____. Being normal would be _____ and would be represented by the allele _____.

a) Alice has hemophilia. Her husband William does not.

- Alice's genotype would be _____.
- William's genotype would be _____.

b) Alice and William have 3 sons and a daughter (Cooper).

- All of the sons have the same genotype which is _____.
- The daughter's genotype must be _____.

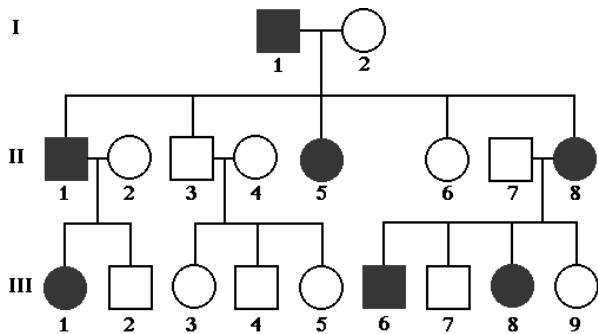
c) Cooper marries a man (Luke). Cooper and Luke have a daughter (Mary). Mary has hemophilia.

- Mary's genotype must be _____.
- This means her dad's genotype must have been _____.

d) Draw a pedigree to represent this family. Shade in the shapes of who has hemophilia.

Pedigree Problems

Use the pedigree below to answer questions 1-4:

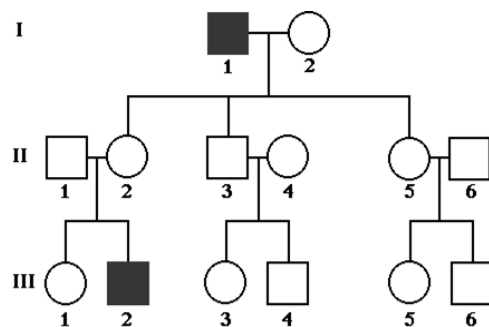


- Does this pedigree show a dominant or a recessive trait? _____
- Is this trait sex-linked or autosomal? _____
- What is the genotype of individuals I-1 _____ and I-2 _____
- What is the probability that individuals I-1 and I-2 will pass the trait to their offspring?

Probability = _____

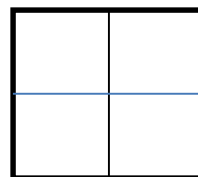


Use the pedigree below to answer questions 5-8:



- Does this pedigree show a dominant or a recessive trait? _____
- Is this trait sex-linked or autosomal? _____
- What is the genotype of individuals I-1 _____ and I-2 _____
- What is the probability that individuals I-1 and I-2 will pass the trait to their offspring?

Probability = _____



Construct a pedigree for each of the following families.

Write the name and genotype for each member of the family beneath their symbol.

9. Cystic fibrosis is a recessive gene. Darlene had cystic fibrosis. She married Darren who did not and was not a carrier. Together they had three children: Marsha, Marla, and Max. All three children were carriers. Marsha married a homozygous normal man, Marvin, and they had two normal, non-carrier girls-Maeve and Mabel. Max married a carrier woman, Midge. They had a son, Marshall, who had cystic fibrosis.

10. Huntington's is a dominant gene. Shari married John, and they were both heterozygous for Huntington's. They had two children-Bruno and Brianna. Bruno was homozygous dominant. He married Jessie, who had no trace of the gene. Together they had Buford, a bouncing baby boy. Brianna, who had no trace of the gene, married Jackson. Jackson was homozygous recessive. They had a girl-Bessie.

Karyotyping and Mutations Worksheet

Introduction: A normal human has 46 chromosomes that are organized into 23 pairs. Pairs 1-22 represent the autosomal chromosomes (autosomes). The genes that control the vast majority of human traits are controlled by genes that are on autosomes. The final pair of chromosomes are the sex chromosomes. The larger of the chromosomes is the X chromosome, the smaller of the two is the Y chromosome. Use the karyotypes included in the worksheet to answer the questions.

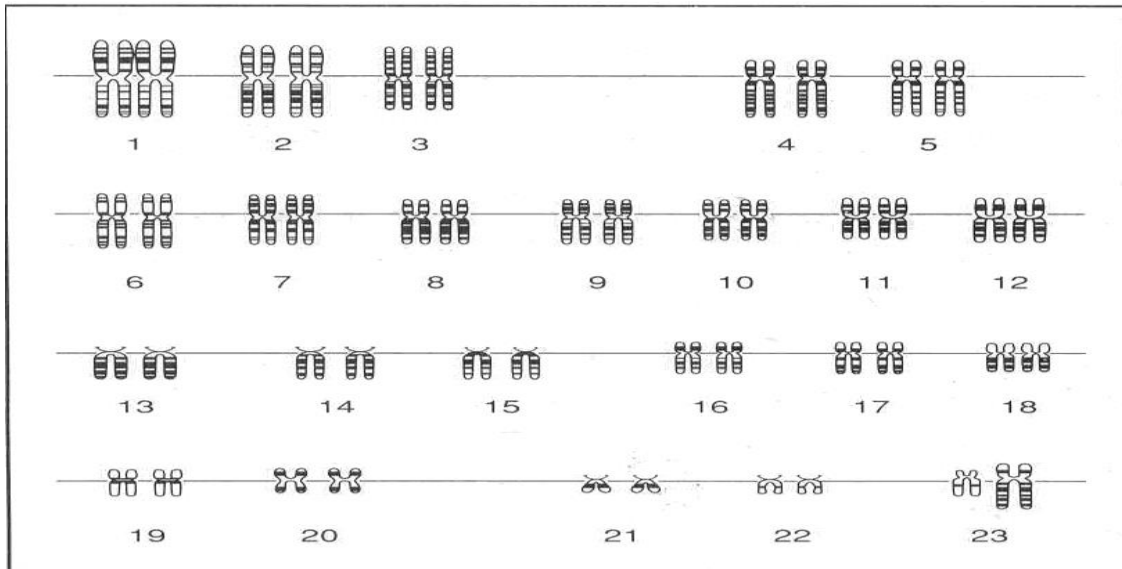


Figure 1

1. Is the individual above a male or a female?
2. How many chromosomes does a normal person have?
3. Does the person above have a normal or abnormal number of chromosomes?

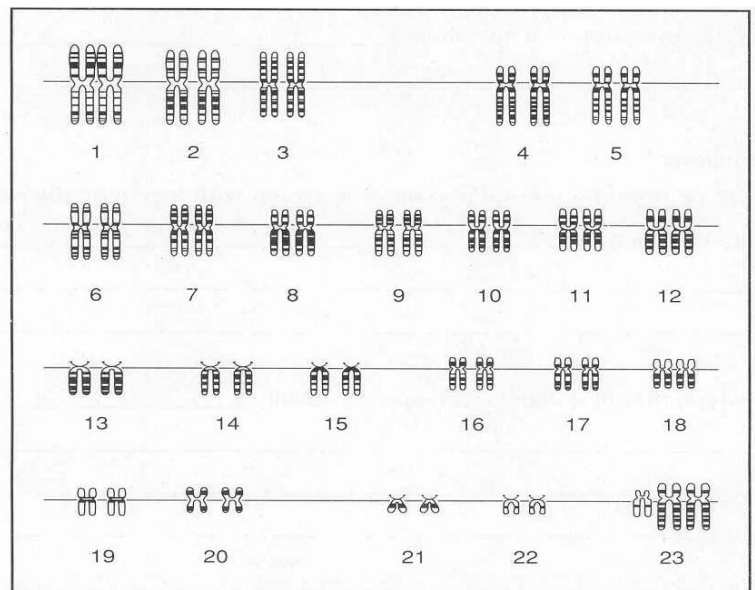


Figure 4

4. Is the individual to the right a male or a female?
5. Does the person to the right have a normal or abnormal number of chromosomes? If abnormal what is different?

6. Which kind of chromosome is affected, autosomal or sex chromosomes?

7. Which chromosome is the longest and has the most genes? 1 or 21

8. Which chromosome is the shortest and has the fewest genes? 2 or 22

9. In a normal karyotype how many autosomal chromosomes are there?

10. In a normal karyotype how many sex chromosomes are there?

11. Nondisjunction is a chromosomal mutation that occurs during meiosis. Use the book to write a definition of nondisjunction.

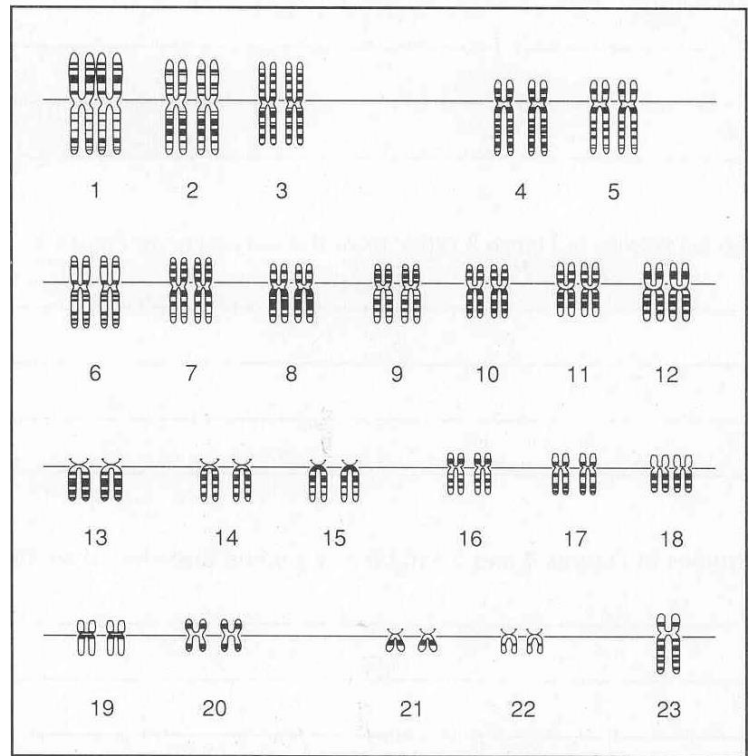


Figure 5

12. One type of nondisjunction mutation is trisomy 21. What is another name for it?

13. Identify the disorder in karyotype Figure 4. _____

14. Identify the disorder in karyotype Figure 5. _____

15. What is a mutation?

16. What is the difference between a gene mutation and a chromosomal mutation?

17. In order for a mutation to be passed on to children, what kind of cell must the mutation occur in? Explain your answer.

Genetic Inquiry

Nature vs. Nurture

Ask a Geneticist by Amy Radermacher, [Stanford University](#)

"I believe that I have Attention-Deficit Hyperactivity Disorder (ADHD) and I think it is a result of the alcohol and tobacco use of my mother while she was pregnant with me. If that is true, is it also true that it is now a part of my genetic make-up and something that my children can inherit?"

-A curious adult from Michigan



What a great question that really gets at the root causes of ADHD. The quick answer is that if your ADHD comes solely from what your mom did, then you probably won't pass it down to your kids. Why? Because smoking and drinking don't usually cause ADHD by affecting the fetus' DNA. Instead, they directly affect how the brain develops. And if the DNA isn't affected, the disease won't be passed on.

It is important to note that there are at least a couple of ways to end up with ADHD. It can be caused by the genes we get from mom or dad. Or by what we're exposed to in the womb. Or a combination of the two. But only genes are passed down to our kids.

Let's think about this in an easier way, with apples. Some apple trees make big apples while other trees make small ones. Their DNA tells them how big to make their apples. But some years, the trees get more sun or rain than other years. And the years where there's a drought, all the trees grow smaller apples because there's not as much rain. So apple size depends on both genetics and the environment. What's the difference? Genetic causes come from DNA. Environmental causes don't. And only the genetic causes are usually passed down.

It's the same way with ADHD. Your chance of getting ADHD is a combination of your genetic risks and your environmental risks. For example, we can inherit genes that make getting ADHD more likely. Many of these genes have something to do with a brain chemical called dopamine. Dopamine controls the flow of information into the front of the brain. What does that have to do with ADHD?

Scientists think that people with ADHD may not have enough dopamine in their brains. This messes up the flow of information getting to their brains. So they have a hard time paying attention. And are easily distracted. These types of ADHD risk genes that you can inherit are some of the genetic causes of ADHD. Because they are based on what DNA you have.

But the environment that you live and work in can also increase your chances for getting ADHD. Like a drought can make apples smaller.

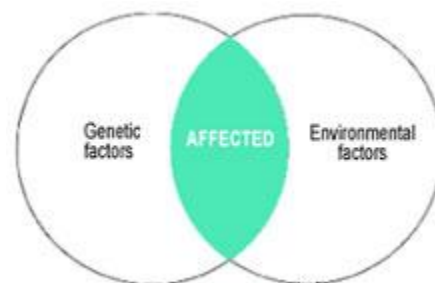
We know about many environmental risks for ADHD. Some of these are what you weighed at birth, what you eat, or if you were exposed to lead as a child. And, getting back to your question, whether your mom smoked or drank when she was pregnant with you.

But none of these usually affect your grandchildren. Why? It has to do with how tobacco and alcohol put the fetus at risk for ADHD. Alcohol and tobacco both contain chemicals toxic to the fetus. And when these chemicals get into the blood of the fetus, they can get to the brain. There they can change the way the brain develops.

Take smoking, for example. We all know cigarettes have nicotine. Well, nicotine looks a lot like one of the brain's main chemicals called acetylcholine. So nicotine can unlock all the doors in the brain that acetylcholine can. Except nicotine acts differently than acetylcholine after unlocking these doors.

These differences between nicotine and acetylcholine can change the way the brain develops. And this puts children and adults at risk for ADHD. The nicotine in cigarettes is an environmental risk for ADHD. Because it comes from the environment. Not your DNA.

Imagine you have the tree with the big apples and don't water it. And you treat the tree that makes smaller apples well. You set it up so they each make the same size apple. Now you plant seeds from each. What size apples do you



The risks for ADHD are a combination of genes and the environment.

think they'll each make? That's right, the first tree still makes bigger apples. This is because our poor treatment didn't affect the tree's DNA. And so the smaller apple size is not passed down to the tree's offspring. Each new apple tree starts over with the DNA from its seed. And doesn't even know about its parent's environmental causes.

Many chemicals in tobacco and alcohol work the same way. By changing the way the brain's chemicals talk to each other. Since this doesn't change the fetus' DNA, these changes in the brain aren't inherited.

Of course tobacco smoke can damage DNA too. This is why smoking gives you lung cancer!

We also know that most cases of smoking-related ADHD happen by affecting the brain's development not its DNA. But we are still learning about how smoking and drinking during pregnancy affects people.

So what if the toxic chemicals in tobacco and alcohol did change the fetus' DNA? Then the ADHD could be passed on if the change happened very early on. Or in a special set of cells.



Tobacco smoke can damage DNA

To understand why, let's go a bit into inheritance. You pass on your DNA to your children. If you're a man, you pass on DNA through your sperm. If you're a woman, through your eggs. The body has a finely tuned process for sending out DNA through the sperm or eggs. It draws from a special pool of cells created when you're a fetus. Once this pool of cells has been set up, your body doesn't add any more cells. It only takes away cells to send them out as eggs or sperm. The DNA you pass on to your children only comes from this special pool of cells.

Relating this to apple trees, they pass on their DNA through the seeds in the apples. You can grow a whole new tree from just one seed. If the DNA in the tree's leaves changes, these changes aren't in the seeds. So they aren't passed on to the next generation of apple trees.

The same with ADHD. If your brain's DNA changed when your mom smoked or drank during pregnancy, these changes aren't passed on to your children. Because these changes in DNA happened in your brain. Not in the special pool of cells you pass to your children.

So, yeah, your mom's tobacco and alcohol use may have caused your ADHD. But the good news is that this probably won't be passed on to your kids.

Amy Radermacher

1. Summarize this article in two sentences.
2. Retell the apple tree example, but use a different organism.
3. Give an example of a trait you think is 100% genetic (determined by DNA).
4. Give an example of a trait you think is 100% environmental.
5. Give an example of a trait that you think is influenced by both nature and nurture.

Unit 8 Intro

Text One: 10 years of Living With Sickle Cell

By Michelle Forman <http://www.aphiblog.org/2012/09/happy-birthday-to-ary-10-years-of-living-with-sickle-cell/>
 Fred and Yvette welcomed their beautiful baby girl, Ary, in 2002. Because they were experienced parents, they were familiar with newborn screening as part of the battery of tests performed on new babies. A few days later the phone rang. "The person asked for the parents of Aryiana. That obviously grabbed my attention because she was a newborn!" They identified themselves as being from the Maryland Department of Health and said that Ary tested positive for sickle cell disease. It wasn't until Ary was eight that she had her first crisis – several more have followed since then. The crises leave Ary in a great deal of pain. The only way to deal with them is to treat the pain with medication and wait for it to pass. In retrospect, Fred and Yvette can identify what went wrong leading to those crises.



Text Two: Genetics Home Reference: Sickle Cell Disease

<http://ghr.nlm.nih.gov/condition/sickle-cell-disease>

What is sickle cell disease?

Sickle cell disease is a group of disorders that affects hemoglobin, the molecule in red blood cells that delivers oxygen to cells throughout the body. People with this disorder have atypical hemoglobin molecules called hemoglobin S, which can distort red blood cells into a sickle, or crescent, shape. Signs and symptoms of sickle cell disease usually begin in early childhood. Characteristic features of this disorder include a low number of red blood cells (anemia), repeated infections, and periodic episodes of pain. The severity of symptoms varies from person to person. Some people have mild symptoms, while others are frequently hospitalized for more serious complications.

How common is sickle cell disease?

Sickle cell disease affects millions of people worldwide. It is most common among people whose ancestors come from Africa; Mediterranean countries such as Greece, Turkey, and Italy; the Arabian Peninsula; India; and Spanish-speaking regions in South America, Central America, and parts of the Caribbean. Sickle cell disease is the most common inherited blood disorder in the United States, affecting 70,000 to 80,000 Americans. The disease is estimated to occur in 1 in 500 African Americans and 1 in 1,000 to 1,400 Hispanic Americans.

What genes are related to sickle cell disease?

Mutations in the *HBB* gene cause sickle cell disease.

Hemoglobin consists of four protein subunits, typically, two subunits called alpha-globin and two subunits called beta-globin. The *HBB* gene provides instructions for making beta-globin. Various versions of beta-globin result from different mutations in the *HBB* gene. Abnormal versions of beta-globin can distort red blood cells into a sickle shape. The sickle-shaped red blood cells die prematurely, which can lead to anemia. Sometimes the inflexible, sickle-shaped cells get stuck in small blood vessels and can cause serious medical complications.

Text Three: Sickle Cell Disease, Malaria and Human

Evolution <http://oxfordpresents.com/bozzone/sickle-cell-disease/>

Analysis

1) What three questions do you have after reading the three texts?

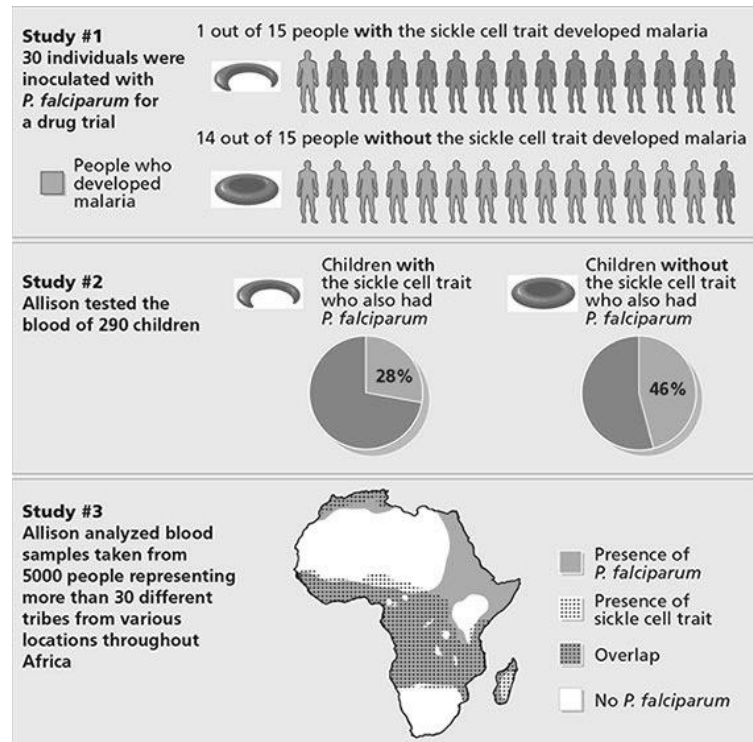
2) Based on the texts, what effect does the structure of the hemoglobin molecule have on the function of the cells?

3) List three things the texts tell you about the protein hemoglobin.

4) Based on the diagrams, what is the relationship between having the sickle cell trait and getting malaria?

5) Using evidence from the diagrams, does having the sickle cell trait guarantee that you won't develop malaria?

6) Malaria is a disease transferred by mosquitoes that live in tropical areas. Based on Study #3 in the diagram, why might the sickle cell trait be more likely to be found in those regions of Africa?



Unit Eight Summary

1. _____ idea that life came from nonliving material, also called spontaneous generation
2. Heterotroph Hypothesis explains the _____ of cells
3. _____ explains the evolution of eukaryotic cells
4. _____ process by which new species could develop.
5. _____ inherited trait that helps organism survive in environment
6. Beak size is an example of a _____ adaptation.
7. _____ compare DNA, RNA or amino acid sequences
8. Anatomical structures that have the same structure but different function are _____
9. _____ evolve individuals do not.
10. _____ changes in the DNA of an organism if the change affects the phenotype.
11. Environmental changes can cause three types of natural selection _____, _____, and _____
12. _____ is the development of a new species.
13. _____ is a population becoming separated by distance, evolves differently which leads to a new species.
14. Small changes occurring constantly in a species until a new species develops is an example of _____
15. A long period of no change is followed by a period of very rapid change, leading to a new species is an example of _____
16. A disease causing organism is known as a _____
17. The two types of immunity are _____ and _____
18. _____ are types of medication that interfere with a virus's life cycle.
19. _____ and _____ are examples of evolution occurring today.
20. Every organism receives two names _____ and _____. This is referred to as _____.
21. _____, _____, and _____ are the three domains.
22. _____ is defined as a group of organisms which can interbreed and produce fertile offspring.
23. _____, _____, and _____ are used in classifying organisms.
24. _____ are used to show a visual representation of the evolutionary relationships
25. A tool scientists use to identify organisms using physical traits is known as _____
26. Create a fill-in-the-blank question with a vocabulary word that was not used in the above questions.

Unit 8.1 Preview
Textbook pgs.380, 398 (bottom)-399, 404-405

A. Important Vocabulary to Remember

Vocab Word	Textbook definition	Diagram with caption

B. Important Diagrams to Analyze

Read the caption of Figure 16-15 (pg 407) and answer the bold question in a complete sentence.

C. Important Big Ideas to Evaluate

After reading pgs. 380, 398 (bottom)-399, 404-405 sketch a picture from these pages. Create your own caption that includes a vocabulary word from the vocab matching.

Unit 8.1 Review

A. Understanding Examples -- **Complete** the following 5 statements.

1. The very first cells were prokaryotic, _____ and _____.
2. _____ explains how life started and _____ explains how life continues.
3. If evolution occurs quickly, the timeframe is _____.
4. _____ are traits that are inherited and help an organism survive better.
5. Incorrect use of antibiotics select for bacteria that have a _____, causing evolution to antibiotic resistant bacteria.

B. Analyzing applications -- Correctly match each vocab word with an appropriate experiment

- | | | |
|---|---|--|
| <ol style="list-style-type: none"> 1. Selection force 2. Mimicry 3. Fitness 4. Disruptive selection 5. Gradualism 6. Geographic isolation | <ol style="list-style-type: none"> b. The white bunnies that were camouflaged by the winter snow had 15 bunnies that spring. c. Since polar ice melting, polar bear populations are being affected by this abiotic factor. d. Lake Victoria in Uganda had begun drying up. Now there are some sections that are separated by land, forming two different ecosystems. | <ol style="list-style-type: none"> e. It is an advantage to be a big cockroach because they can compete for food AND it is an advantage to be a small cockroach because you can hide. f. Hoverflies are insects that are black and yellow striped, like a wasp, but they cannot sting like a wasp can. |
|---|---|--|
- a. Overtime, the giraffe accumulated genetic mutations that made the neck longer.

C. Evaluating Scenarios -- Redraw the two listed diagrams **from your handbook**.

<u>Figure 4.1 e</u>	<u>Figure 4.1 k</u>
How are these two diagrams related to each other?	

Biology Apps – Unit 8.1

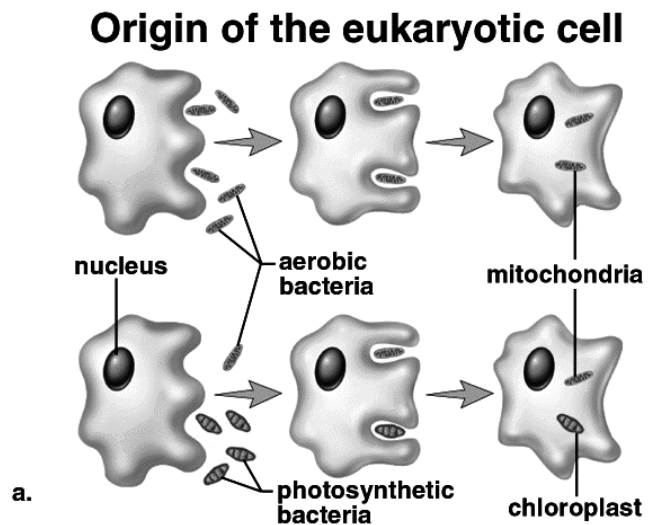


ORIGIN OF CELLS

<http://www.apple.com/osx/apps/app-store.html>

1. What were the conditions of the early atmosphere?
2. What does the heterotroph hypothesis explain?
3. Evolution of Cells – Put the cells in chronological order according to which evolved first.
 - 1) _____
 - 2) _____
 - 3) _____
 - 4) _____

A. Eukaryotic cells
B. Photosynthetic prokaryote
C. Anaerobic prokaryote
D. Aerobic prokaryote
4. Describe what is taking place in the picture below and what evidence supports this theory?

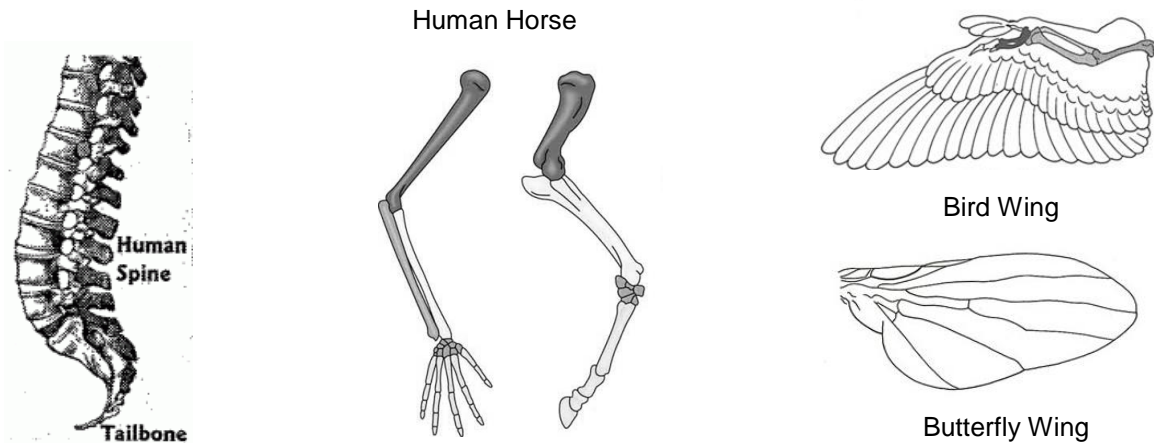


NATURAL SELECTION

5. List Darwin's five factors for Natural Selection.
- _____
 - _____
 - _____
 - _____
 - _____
6. What type of adaptation is being described? **Structural, Physiological, or Behavioral**
- Webbed feet: _____
 - Oxygen moving across the cell membrane: _____
 - Schooling Fish: _____
 - Opposable thumbs: _____
 - Photosynthesis taking place in the chloroplast: _____

EVIDENCE FOR EVOLUTION

7. What type of Anatomical Evidence is presented in each picture? **Homologous, Analogous or Vestigial**



http://www.arrivalofthefittest.com/images/are_you_being_brainwashed2/12_vestigial_structures.gif

<http://itc.gsw.edu/faculty/bcarter/istgeol/paleo2/limbs.jpg>

http://t3.gstatic.com/images?q=tbn:ANd9GcT4LgS_RpkWHZjdEuGcF0wFKfRRnSnA1FViau_rdrtn6YNmviH7

8. How do biochemical similarities support the theory of evolution?

MECHANISMS FOR EVOLUTION

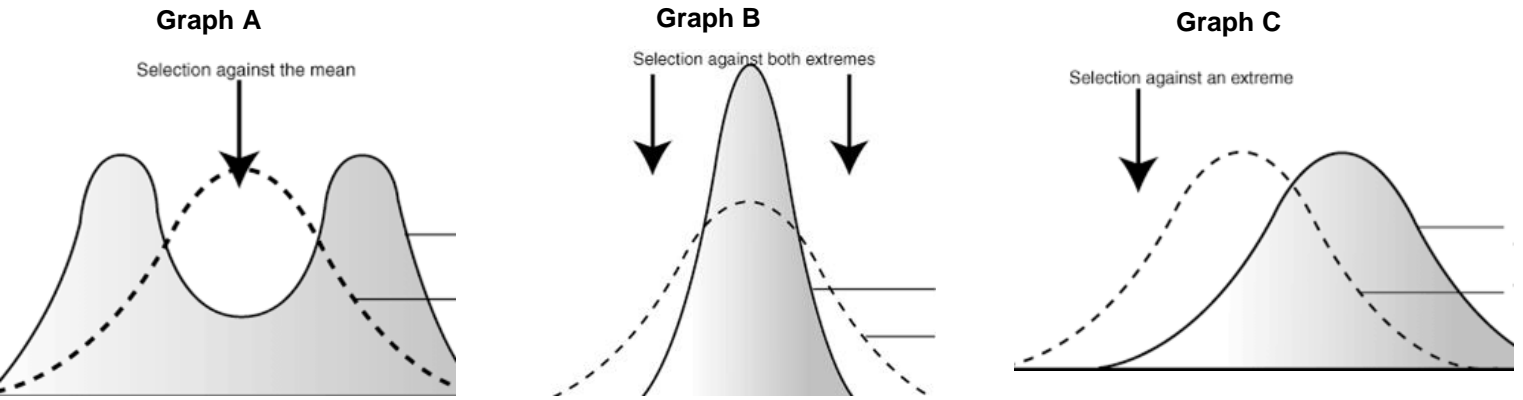
9. What are the three patterns of natural selection?

- 1) _____
- 2) _____
- 3) _____

10. Match the graph to that best represents the following examples.

Original population = - - - - -
 Population after selection = _____

<http://o.quizlet.com/i/UZOBgK0-nzdrUYUr3uBITw.jpg>

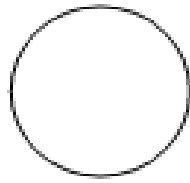


Examples

- 1) _____ Until the 20th century infants weighing 8 lb at birth have a higher survival rate than heavier or lighter infants
- 2) _____ Fishing industry produces selection that favours smaller cod and can produce a decrease in average body size.
- 3) _____ In the finch, *Pyrenestesostrinus* both very large and very small bills are beneficial for eating large and small seeds, respectively

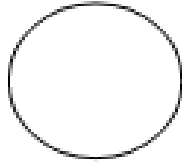
11. Name the two time frames for speciation.

Evolution of Early Life Timeline



Describe the 1st cell.

Why is this the most likely the case?



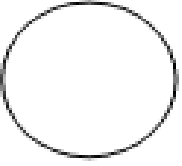
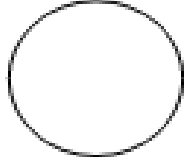
What is one way that these cells are different?

What did the autotrophs produce as waste?

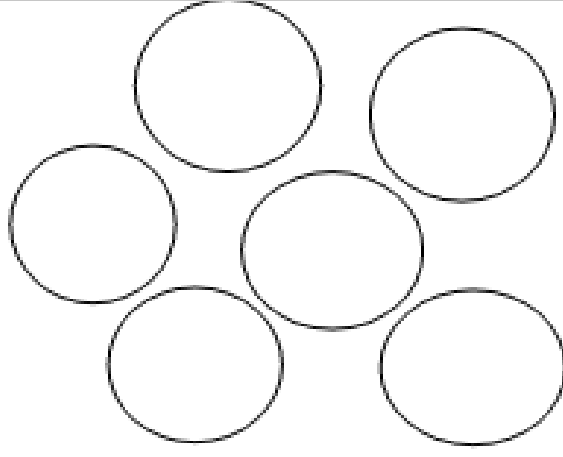


Why can aerobes now exist?

What is the benefit of being aerobic?



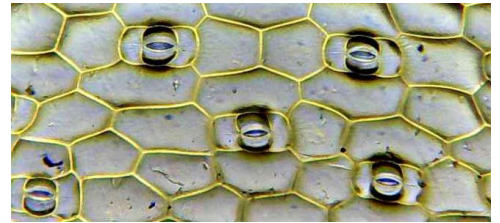
Describe the Endosymbiont Theory.



Darwin's Natural Selection Worksheet

Name _____

1) In the genus of plants called *Tradescantia*, these plants have differing numbers of stomata. Some plants have more than 300 stomata per square mm. Other plants have less than 50 stomata per square mm. The stomata helps the plant not lose water. In a population of 100 plants, 35 were found to have more than 300 stomata per mm². After a severe drought, there were only 42 plants left. 27 of those plants had more than 300 stomata per mm².

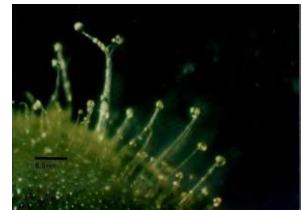


a. Which plant has natural selection selected AGAINST? _____ FOR? _____

Darwin's 5 points: Identify the 5 points in the scenario above.

- Population has variations. _____
- Some variations are favorable. _____
- More offspring are produced than survive. _____
- Those that survive have favorable traits. _____
- A population will change over time. _____

2) In the plant *Solanum scabrum*, some organisms have trichomes on the leaf and stem surfaces. Some organisms do not have trichomes. The trichomes help the plant avoid getting eaten by herbivores. In a population of 100 plants, 40 were found to have trichomes. After a population of deer passed through, there were only 50 plants left. 35 of those plants had trichomes.

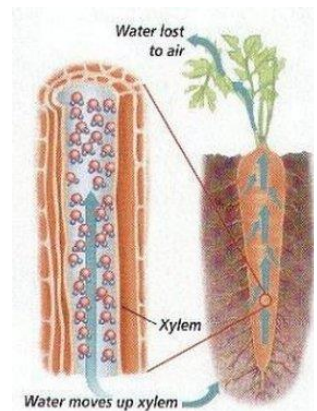


a. What plant will natural selection select AGAINST? _____ FOR? _____

Darwin's 5 points: Identify the 5 points in the scenario above.

- Population has variations. _____
- Some variations are favorable. _____
- More offspring are produced than survive. _____
- Those that survive have favorable traits. _____
- A population will change over time. _____

2) In carrot plants, some organisms have a lot of phloem tubes to move sugars down to the roots. Some organisms do not have large amounts of phloem. The phloem helps the plant store sugar in the root to help the plant survive the winter. In a population of 100 plants, 37 were found to have large amounts of phloem. After a long winter, there were only 50 plants left. 28 of those plants had trichomes.



a. What plant will natural selection select AGAINST? _____ FOR? _____

Darwin's 5 points: Identify the 5 points in the scenario above.

- Population has variations. _____
- Some variations are favorable. _____
- More offspring are produced than survive. _____
- Those that survive have favorable traits. _____
- A population will change over time. _____

Darwin's Natural Selection Worksheet

Name _____

Read the following situations below and identify the 5 points of Darwin's natural selection.

1) There are 2 types of worms: worms that eat at night (nocturnal) and worms that eat during the day (diurnal). The birds eat during the day and seem to be eating ONLY the diurnal worms. The nocturnal worms are in their burrows during this time. Each spring when the worms reproduce, they have about 500 babies but only 100 of these 500 ever become old enough to reproduce.



a. What worm has natural selection selected AGAINST? _____ FOR? _____

Darwin's 5 points: Identify the 5 points in the scenario above.

Population has variations. _____

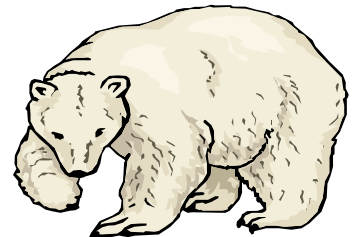
Some variations are favorable. _____

More offspring are produced than survive. _____

Those that survive have favorable traits. _____

A population will change over time. _____

2) There are 3 types of polar bears: ones with thick coats, ones with thin coats and ones with medium coats. It is fall, soon to be winter. The temperatures are dropping rapidly and the bears must be kept warm, or they will freeze to death. Many of the bears have had ~2 cubs each but due to the extreme temperatures, many mothers only have one cub left.



a. What bear will natural selection select AGAINST? _____ FOR? _____

Darwin's 5 points: Identify the 5 points in the scenario above.

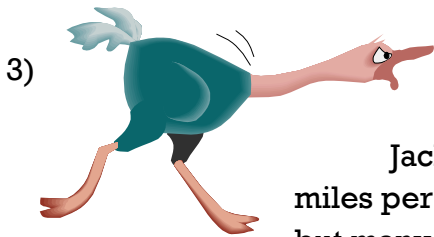
Population has variations. _____

Some variations are favorable. _____

More offspring are produced than survive. _____

Those that survive have favorable traits. _____

A population will change over time. _____



3) In ostriches, there are 2 types: ones that run fast and those that run slowly. The fast birds can reach up to 40 miles an hour. Jackals love to eat ostrich, and they can reach speeds of up to 35-40 miles per hour. A flock of ostrich will lay ~ 10 eggs (each mother only lays 1), but many rodents break into the eggs and eat the fetus before they hatch.

a. What ostrich will natural selection select AGAINST? _____ FOR? _____

Darwin's 5 points: Identify the 5 points in the scenario above.

Population has variations. _____

Some variations are favorable. _____

More offspring are produced than survive. _____

Those that survive have favorable traits. _____

A population will change over time. _____

4) There are two types of rabbits: those that strictly eat grass and those that strictly eat berries and flowers. A drought occurs one year, and the plants have difficulty producing any extras (flowers, berries, etc.). They can only try and keep themselves green. The rabbits have had babies all year long but many are eaten by foxes or hawks. Due to the drought, many have starved to death.

a. What rabbit will natural selection select AGAINST? _____ FOR? _____

Darwin's 5 points: Identify the 5 points in the scenario above.

Population has variations. _____

Some variations are favorable. _____

More offspring are produced than survive. _____

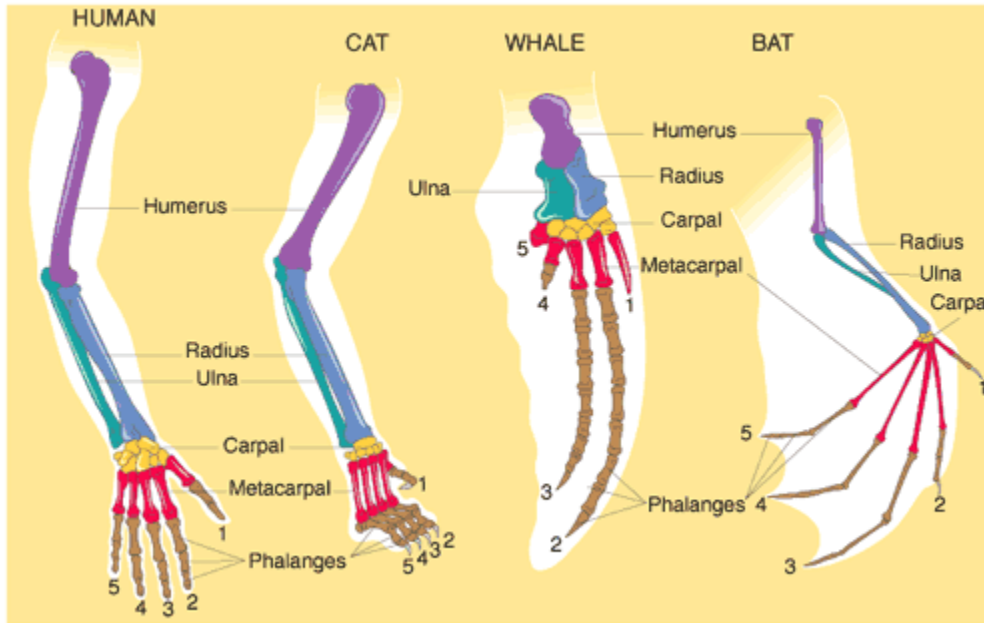
Those that survive have favorable traits. _____

A population will change over time. _____

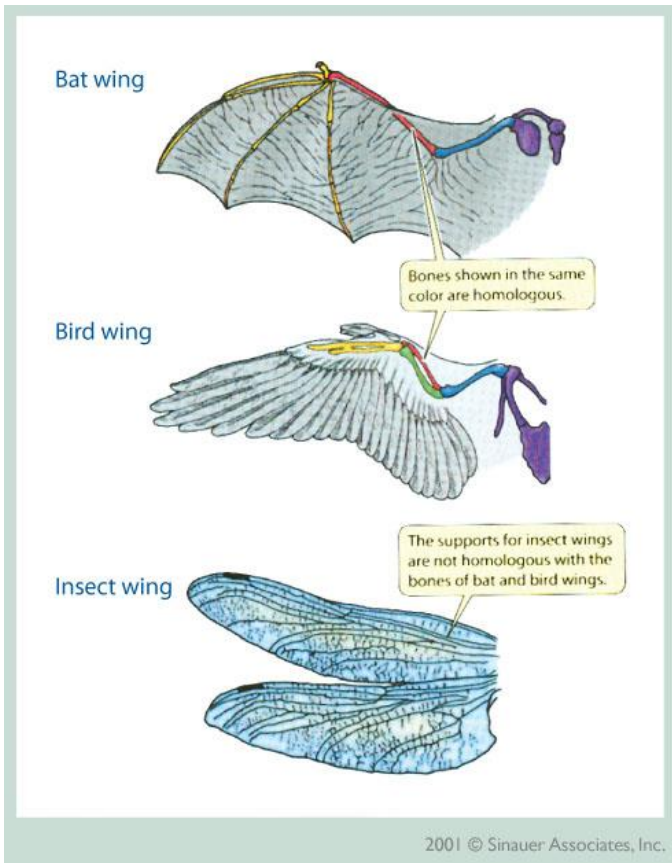
Survival of the Sneakiest

1. Will the most physically strongest always be the one to survive? Why or why not?
2. Explain how the comic is an example of the four conditions required for natural selection.
3. What selection forces are found within the comic?
4. Calling to find a mate is which type of adaptation?
5. If Cricket Carson's wing got plucked off by an evil child, he couldn't play his song any more. Would Cricket Carson's children be able to play a song?
6. Observe the live crickets. What variations are exhibited?
7. Create a scenario in which one type of cricket is favored over the other.

Anatomical Similarities and Differences



1. How does the similar bone arrangement support a common ancestor?



2. How is the example to the left different?

3. Which two animals are more related? What evidence supports this?

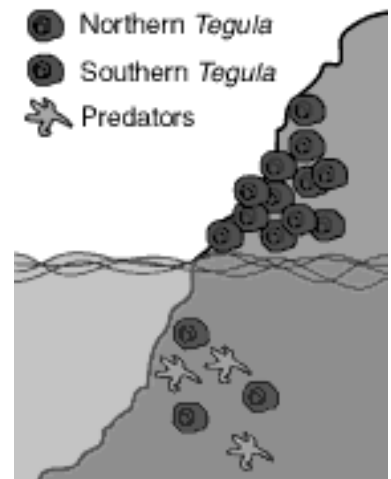
Natural Selection at Work

The Steps of Natural Selection

For example, on rocky shores, animals have ranges that form clear spatial patterns. Some [species](#) live only in deep water, and some only live much higher up the shore. A snail common on California shores (*Tegula aueortincta*, at right) can be found in both ranges. In Southern California, *Tegula* live high up on the shore, while in Northern California, they live in deeper water.

Could natural selection explain this pattern? Michael Fawcett¹ thought so and formulated a hypothesis to test. He found that predators, such as octopi, starfish, and crabs, were more abundant in southern California than in northern California. Perhaps intense predation in the south selected for snails that lived higher up the shore, out of reach of many predators. In the north, selection might not have been as strong, so the snails were not selected to live high on the shore.

Fawcett tested this hypothesis by transplanting snails. He took northern and southern snails, released them in deep water and watched what happened. If predators were around, all the snails high-tailed it towards higher ground (snails can probably sense the chemicals exuded by predators). But southern snails moved further up the shore faster than northern snails. Because the northern snails were slower and didn't move high enough, they were more likely to be eaten by predators.



1. What was the initial difference noticed between the snails?
2. What about the environment was the selecting factor?
3. If all the faster snails survived, this is an example of (stabilizing, disruptive or directional selection).
4. What was REALLY the genetic trait in the snails allowed them to survive better?
5. What might have created the change in the two snails' trait?
6. What is an adaptation?
7. What is an adaptation that might allow the predator (such as an octopus) to survive better?
8. Why was predation needed for natural selection to occur?
9. What are the four steps needed for evolution to occur?

The Evidence of Natural Selection

Two different types of snails are also found, so your job is to figure out how closely related the two mystery snails are to Tegula aureotincta.

10. What type of evidence are you examining?

Tegula aureotincta

11. Which snail shares a more recent ancestor with Tegula aureotincta?

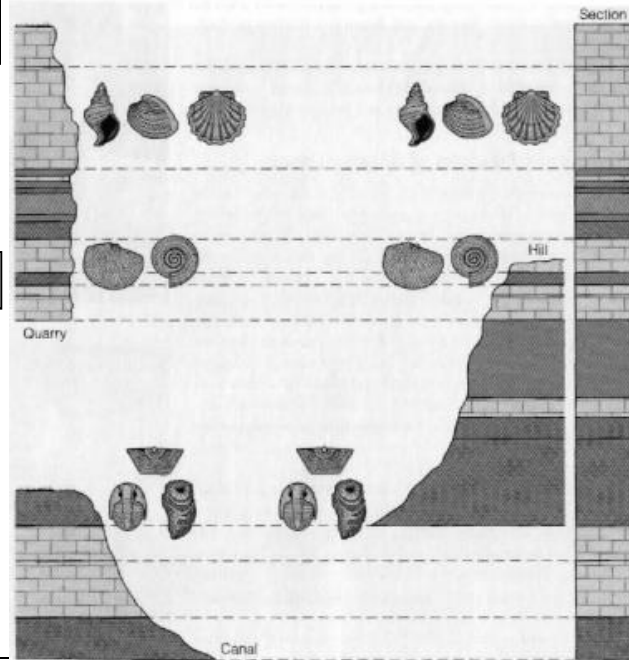


Snail B

Snail A

How do you know?

12. Do you know exactly many years older one is than the other?



<i>SNAIL</i>	Sequence of DNA	Differences from <u>Tegula aureotincta</u>
<u>Tegula aureotincta</u>	GAT AGC TTG TCC AAT TTA CTG GAG CGA GAA AGG CGA	<i>Not applicable</i>
<i>Mystery snail A</i>	GAT AGC CTG TCC AAT GAA CTG GAG CGA GAG AGG CGA	
<i>Mystery snail B</i>	GGT AGC CTG TCC AAT GAA CTG GAG CGG AAA AGG CGG	

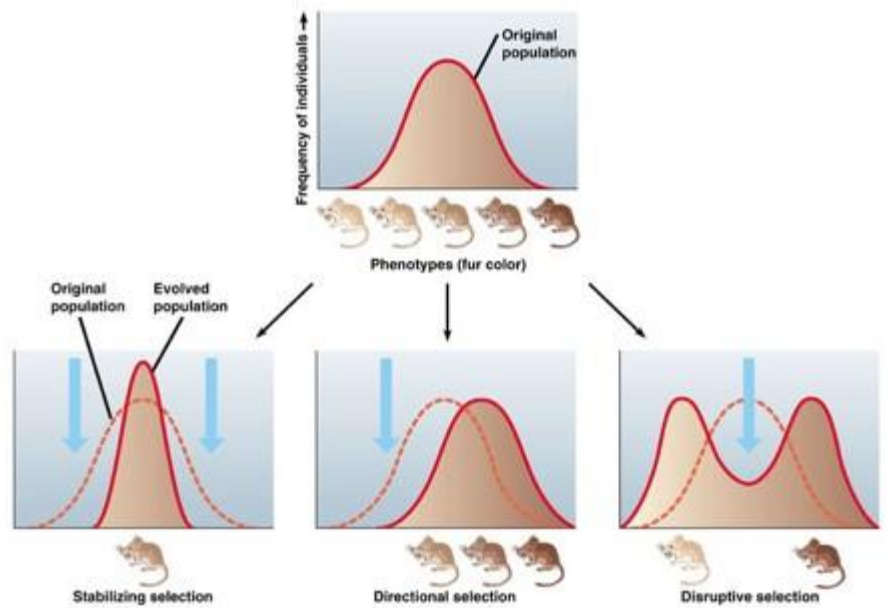
13. What sort of evidence are you examining here?

14. What causes the differences in the above sequences?

15. Which snail has more in common with Tegula aureotincta?

16. DNA fingerprints are another way to compare multiple organisms' DNA. Explain the process of using gel electrophoresis to make a DNA fingerprint **AND** explain how to interpret one.

17. Below is a diagram that explains natural selection in a group of mice. For each type of selection, create a scenario and a graph that represent how the snail population could show those trends.



18. For the majority of Michael Fawcett’s experiment, he saw the slow accumulation of mutations over time. If a novel (new) predator were introduced, the population of snails might change drastically. Explain how the two timeframes are different.



Biology Apps – Unit 8.2

Disease Agents and Natural Selection

<http://www.apple.com/osx/apps/app-store.html>

1. What is a pathogen and give 4 examples?

2. Decide if the following examples are active immunity or passive
 - a. _____ Infant receives the same antibodies his or her mother produces through breast feeding.
 - b. _____ Your doctor thinks this year is going to be a bad year for the flu and suggests you get an influenza vaccination.
 - c. _____ You get strep throat and miss a week of school. Your doctor prescribes antibiotics to help your body fight off the invading bacteria.
 - d. _____ You are stung by a box jellyfish and receive an anti-venom to stop the neurological reaction that is taking place in your body.

AIDS and Natural Selection

3. Using the HIV virus explain Natural Selection. Be sure to include **antivirals** in your answer.

Evolution Today

4. What type of pathogen is killed by antibiotics?

5. Using your notes give two examples of evolution occurring today.
 - 1) _____
 - 2) _____

HIV – The Ultimate Evolver

- 1) What is HIV?

- 2) Reproduction is an important component of natural selection and evolution. What is unique about HIV's reproduction?

- 3) Other versions of the virus infect other organisms such as other primates (SIV) and some felines (FIV). Which version is more similar to HIV? Why is this important?

- 4) During the bubonic plague, the CCR5 mutant allele gave protection to populations where the bubonic plague was high. How is this related to certain populations now being protected from HIV?

- 5) Explain how humans are an example of natural selection and refer to Diagram 1.2.

- 6) "Viruses that happen to survive the drug are favored, and resistant virus strains evolve within the patient, sometimes in just a few weeks." **Explain how HIV is an example of natural selection... and refer to Diagram 1.3 provided.**

Defining Speciation

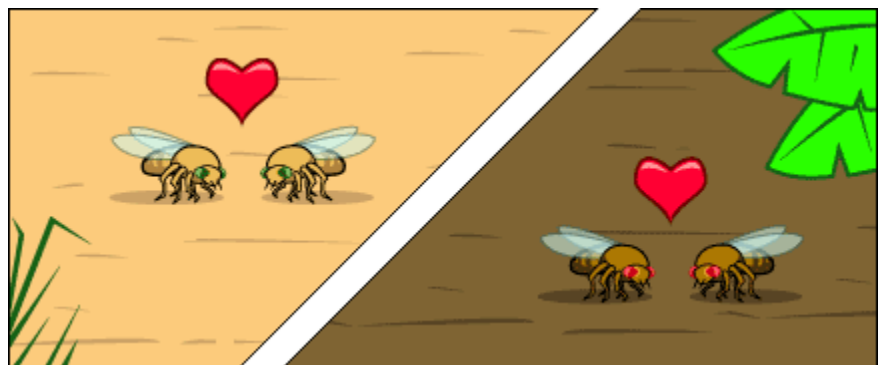
- **The scene:** a population of wild fruit flies minding its own business on several bunches of rotting bananas, cheerfully laying their eggs in the mushy fruit...
- **Disaster strikes:** A hurricane washes the bananas and the immature fruit flies they contain out to sea. The banana bunch eventually washes up on an island off the coast of the mainland. The fruit flies mature and emerge from their slimy nursery onto the lonely island. The two portions of the population, mainland and island, are now too far apart for gene flow (or mating) to unite them. At this point, speciation has not occurred—any fruit flies that got back to the mainland **could** mate and produce healthy offspring with the mainland flies.

1. **What is it called when two parts of a population are separated by space?**



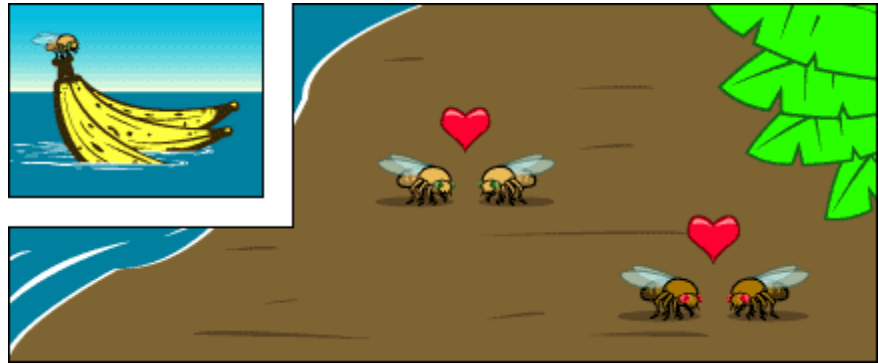
- **The populations diverge:** Ecological conditions are slightly different on the island, and the island population evolves under different selective pressures and experiences different random events than the mainland population does. Morphology, food preferences, and courtship displays change over the course of many generations of natural selection.

2. **What are the four steps of natural selection?**



3. **Morphology is the physical build of the organism. Would this be anatomical, behavioral or physiological variations? How about food preferences and courtship displays?**

- **So we meet again:** When another storm reintroduces the island flies to the mainland, they will not readily mate with the mainland flies since they've evolved different courtship behaviors. The few that do mate with the mainland flies, produce inviable eggs because of other genetic differences between the two populations. The lineage has split now that genes cannot flow between the populations.

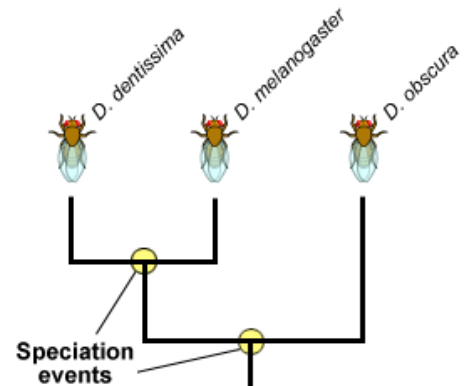


4. Natural disasters would be more similar to gradualism or punctuated equilibrium?

This is a simplified model of speciation by geographic isolation, but it gives an idea of some of the processes that might be at work in speciation. In most real-life cases, we can only put together part of the story from the available evidence.

5. What are the other types of evidence that could be used?

The branching points on this partial *Drosophila* phylogeny represent long past speciation events. Here is one scenario that exemplifies how speciation can happen:



6. According to this tree, which organism is more related to *D. dentissima*?

7. Read the article on the following page. Defend or refute the proposal to change the name of the fruit fly.

Unit 8.3 Preview
pgs. 447-453

A. Important Vocabulary to Remember

Vocab Word	Matching <u>similar</u> to glossary	Matching <u>different</u> from glossary

B. Important Diagrams to Analyze

Read the caption of Figure 18-4 (pg 449) and answer the bold question in a complete sentence.

C. Important Big Ideas to Evaluate

After reading pgs. 447-453 sketch a picture from these pages. Create your own caption that includes a vocabulary word from the vocab matching.

Unit 8.3 Review

A. Understanding Examples -- **Complete** the following 5 statements.

1. With the _____ system, Linnaeus gave each organism a two part name.
2. The most general taxonomic level is _____, there are 6 of these.
3. The most specific taxonomic level is _____.
4. A cladogram or _____ tree can be used to show evolutionary assignments.
5. A _____ is a tool that helps find the name of an organism.

B. Analyzing applications -- Correctly match each vocab word with an appropriate experiment

- | | | |
|---|--|---|
| <ol style="list-style-type: none"> 1. Genus 2. Specie 3. Kingdom 4. Dichotomous Key | <ol style="list-style-type: none"> a. For humans, the 2nd part of our scientific name is <u>sapien</u>. b. The polar bear and the grizzly bear have their first scientific name <u>Ursus</u> in common. c. The polar bear, grizzly bear and panda bear | <ol style="list-style-type: none"> d. When a camper got bitten by a spider, the doctor used a field guide to identify which spider so they could use the correct anti-venom. |
|---|--|---|

C. Evaluating Scenarios -- Redraw the two listed diagrams **from your handbook.**

<u>Figure 4.3 b</u>	<u>Figure 4.3 e</u>
<p>How are these two diagrams related to each other?</p>	

Biology Apps – Unit 8.3

Classification and Speciation



<http://www.apple.com/osx/apps/app-store.html>

1. What are the two parts of a scientific name?
2. What are the domains used in the current classification system?
 - a. _____
 - b. _____
 - c. _____
3. How many kingdoms are used in the current classification system?

Basis for Classification

4. What factors do scientists use when classifying an unidentified organism?
5. What can you learn from a phylogenetic tree?

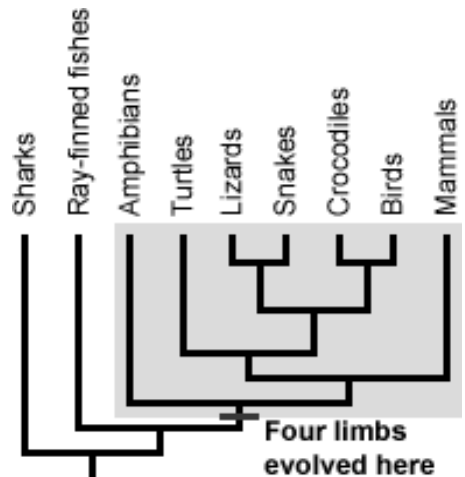
Tools for Classification

Use the cladogram to the right to answer questions 6-8

6. Are crocodiles more closely related to lizards or birds?

7. Were four limbs present before or after the rise of amphibians?

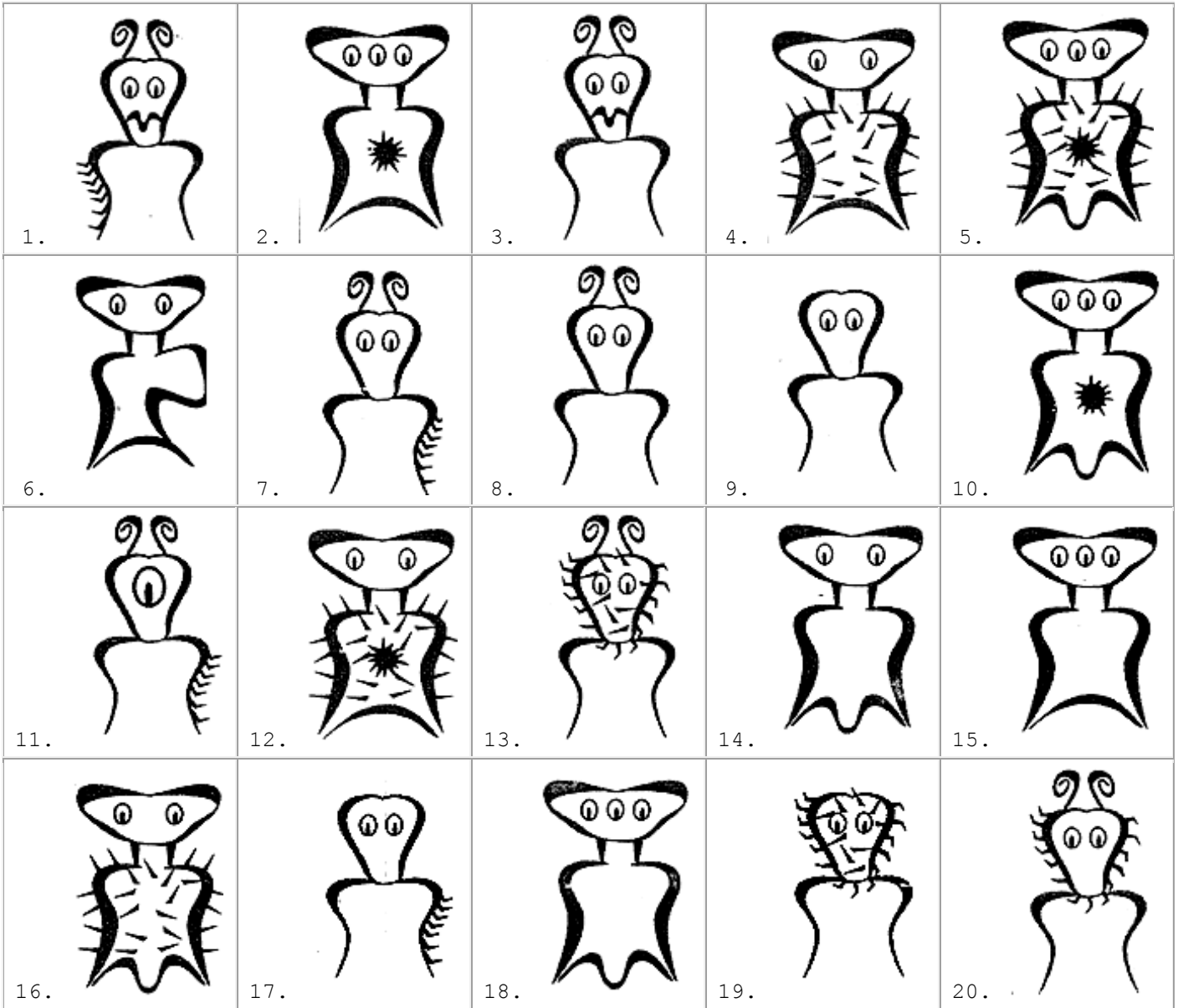
8. Which group is more closely related lizards and snakes or amphibians and ray-finned fish?



http://evolution.berkeley.edu/evolibrary/images/evo/tetrapod_clade.gif

Taxonomy, Classification, and Dichotomous Keys

Help! Scientists have discovered quite a few new creatures on planet Pamishan. They need your help to identify and classify them. Use the dichotomous key on the next page to identify these creatures.



A Key to New Pamishan Creatures

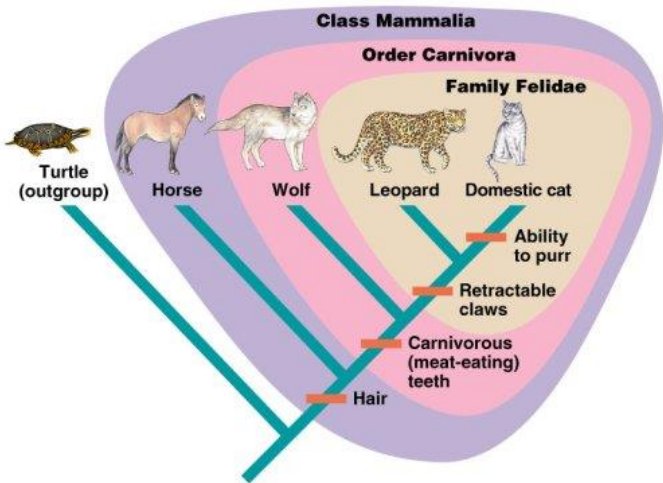
1. a. The creature has a large wide head.....go to 2
b. The creature has a small narrow head.....go to 11
2. a. It has 3 eyesgo to 3
b. It has 2 eyesgo to 7
3. a. There is a star in the middle of its chest.....go to 4
b. There is no star in the middle of its chestgo to 6
4. a. The creature has hair spikes*Broadus hairus*
b. The creature has no hair spikes.....go to 5
5. a. The bottom of the creature is arch-shaped*Broadus archus*
b. The bottom of the creature is M-shaped*Broadus emmus*
6. a. The creature has an arch-shaped bottom*Broadus plainus*
b. The creature has an M-shaped bottom.....*Broadus tritops*
7. a. The creature has hairy spikesgo to 8
b. The creature has no spikes.....go to 10
8. a. There is a star in the middle of its body*Broadus hairystarus*
b. There is no star in the middle of its bodygo to 9
9. a. The creature has an arch shaped bottom*Broadus hairyemmus*
b. The creature has an M shaped bottom*Broadus kiferus*
10. a. The body is symmetrical*Broadus walter*
b. The body is not symmetrical.....*Broadus anderson*
11. a. The creature has no antennaego to 12
b. The creature has antennaego to 14
12. a. There are spikes on the face*Narrowus wolfus*
b. There are no spikes on the facego to 13
13. a. The creature has no spike anywhere*Narrowus blankus*
b. There are spikes on the right leg*Narrowus starboardus*
14. a. The creature has 2 eyes.....go to 15
b. The creature has 1 eye.....*Narrowus cyclops*
15. a. The creature has a mouth.....go to 16
b. The creature has no mouth.....go to 17
16. a. There are spikes on the left leg*Narrowus portus*
b. There are no spikes at all*Narrowus plainus*
17. a. The creature has spikesgo to 18
b. The creature has no spikes*Narrowus georgia*
18. a. There are spikes on the headgo to 19
b. There are spikes on the right leg.....*Narrowus montanian*
19. a. There are spikes covering the face*Narrowus beardus*
b. There are spikes only on the outside edge of head*Narrowus fuzzus*

Cladogram Practice

Part A: Reading Guide

1. Examine Figure 18-6. Using **Linneaus's** classification method, which specie is **least** like the others?
2. Now examine Figure 18-7. **How** is the grouping on the right (the modern day cladogram) different from the classification based on visible similarities?
 _____ Read the caption. **Why** is the grouping different?
3. What is phylogeny?
4. Species within a _____ are _____ related **to each other** than to species in _____ . Why?
5. **T/F** Organisms that appear very similar may not share a recent common ancestor.
6. **Why** is #6 true or false?
7. What is cladistic analysis?
8. What is a derived character?
9. What is a cladogram and how is it useful?

Part B: Cladogram Analysis



Copyright © Pearson Education, Inc., publishing as Benjamin Cummings.

10. How many organisms are in this cladogram?
11. Based on this cladogram, name the organisms that have hair.
12. The domestic cat is most closely related to a _____.
13. What characteristic do leopards and domestic cats share that none of the others do?
14. What characteristics does the wolf share with the leopard and the domestic cat, but NOT the horse?
15. What is the cat's class? _____
 order? _____ family? _____

Part C: Construct a Cladogram

Using page 453 of your textbook, complete the "Quick Lab".

Procedure

1. Based on the presence or absence of the characters, which organism is **least closely related** to the others? (*This is now your "outgroup" like in the cladogram from #11-16 above.*)
2. Using those characters, draw a cladogram below. (*Use the cladogram from #11-16 as a guide. Remember to write the characters and the names of the organisms in the cladogram.*)

Analyze and Conclude

1. What trait (character) separates the least closely related organism from the other animals?
2. List the animals in your cladogram in order of distance from the least closely related organism.
3. Does your cladogram indicate that lizards and humans share a more recent ancestor than either does with an earthworm? Explain. (*Look at how many characters a lizard and human share, how many a lizard and earthworm share and how many a human and earthworm share.*)
4. Where would you insert a frog if you added it to the cladogram? Explain your answer?

Unit 9 Intro

Text One: Battling Huntington's Disease <http://moreintelligentlife.com/content/laura-spinney/health-different-battle>

In 1996, an NBC war reporter and his crew were captured by a renegade platoon of mujahideen guerrillas near the Bosnian town of Dobo. As the sun set and the call to prayer went up, the reporter stared at a blood-spattered wall while a young warrior pulled the pin from a grenade, replaced it with his finger and pressed it to his head. The warrior closed his eyes and prayed. At that moment a military vehicle appeared, and the Bosnian colonel inside it eventually secured the TV crew's release, so Charles Sabine lived to tell the tale. These days, when he tells it, his audience tends to consist of doctors, scientists and families affected by Huntington's disease. That's because in 2005 Sabine discovered he had the disease, a hereditary brain disorder. Not many people are qualified to compare two of the most terrifying situations known to man, but he is one of them. Of his brush with death in Bosnia, he says, "Not that moment nor any other I've experienced instills more dread and terror than this disease." Huntington's has been described as the most disastrous disease known to man because of its peculiarly cruel characteristics. It progressively strips a person of control of his muscles, reason and emotions—though not necessarily in that order.



Text Two: Genetics Home Reference: Huntington Disease <http://ghr.nlm.nih.gov/condition/huntington-disease>

What is Huntington disease? Huntington disease is a progressive brain disorder that causes uncontrolled movements, emotional problems, and loss of thinking ability (cognition). Adult-onset Huntington disease, the most common form of this disorder, usually appears in a person's thirties or forties. Early signs and symptoms can include irritability, depression, small involuntary movements, poor coordination, and trouble learning new information or making decisions. Many people with Huntington disease develop involuntary jerking or twitching movements known as chorea. As the disease progresses, these movements become more pronounced. Affected individuals may have trouble walking, speaking, and swallowing. People with this disorder also experience changes in personality and a decline in thinking and reasoning abilities. Individuals with the adult-onset form of Huntington disease usually live about 15 to 20 years after signs and symptoms begin.

How common is Huntington disease? Huntington disease affects an estimated 3 to 7 per 100,000 people of European ancestry. The disorder appears to be less common in some other populations, including people of Japanese, Chinese, and African descent.

What genes are related to Huntington disease?

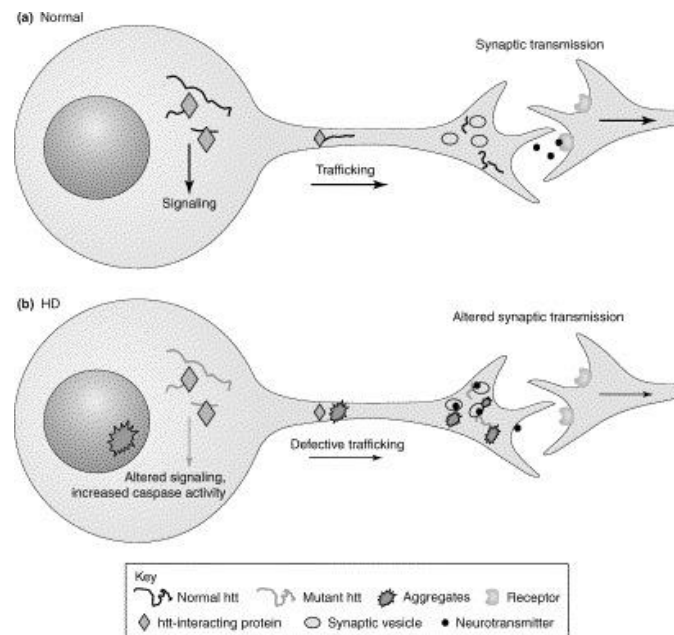
Mutations in the *HTT* gene cause Huntington disease. The *HTT* gene provides instructions for making a protein called huntingtin. Although the function of this protein is unknown, it appears to play an important role in nerve cells (neurons) in the brain. The *HTT* mutation that causes Huntington disease involves a DNA segment known as a CAG trinucleotide repeat. This segment is made up of a series of three DNA building blocks (cytosine, adenine, and guanine) that appear multiple times in a row. Normally, the CAG segment is repeated 10 to 35 times within the gene. In people with Huntington disease, the CAG segment is repeated 36 to more than 120 times. People with 36 to 39 CAG repeats may or may not develop the signs and symptoms of Huntington disease, while people with 40 or more repeats almost always develop the disorder. An increase in the size of the CAG segment leads to the production of an abnormally long version of the huntingtin protein. The elongated protein is cut into smaller, toxic fragments that bind together and accumulate in neurons, disrupting the normal functions of these cells. The dysfunction and eventual death of neurons in certain areas of the brain underlie the signs and symptoms of Huntington disease.

Text Three: Huntingtin Protein Interactions

<http://www.cell.com/cms/attachment/567096/4115397/gr3.gif>

Analysis

- 1) What three questions do you have after reading the three texts?
- 2) Based on the texts, what is the relationship between the normal gene and the mutated gene?
- 3) List three things the texts tell you about the differences that occur in the behavior of someone with Huntington's Disease.
- 4) Based on the diagrams, what is one unique property of a nerve cell's structure?
- 5) If picture (b) has Huntington's, what in the image explains why a person loses the ability to control their muscles and memory?



Unit Nine Summary

1. All living things are classified into three different _____.
2. Domain _____ contains 4 kingdoms of _____ organisms.
3. Domain _____ contains bacteria that live in extreme environments.
4. Kingdoms _____ and _____ contain prokaryotic cells.
5. Kingdom _____ includes eukaryotes that are plant/fungi/animal-like.
6. Kingdom _____ includes heterotrophic organisms that are decomposers.
7. Kingdom _____ includes organisms that have a cellulose cell wall.
8. Kingdom _____ includes organisms that NEVER have cell walls.
9. The three main organs of plants are _____, _____ and _____.
10. Leaf and stem cells have organelles called _____ that perform _____.
11. Photosynthesis is the process of turning _____ gas and _____ into a _____ the plant can use to build its body or to later use in respiration.
12. To transport water and food, some plants use tubes called _____ and _____.
13. Small pores in plants, _____, are for gas exchange, but _____ can be lost.
14. Hormones like _____, _____, _____ regulate plant growth.
15. Plants show _____ when growing toward light, but also respond to gravity and touch.
16. Plants are considered autotrophs because _____.
17. _____ and _____ both have seeds but store them differently.
18. Some plants use animals to help with _____, the transfer of the pollen.
19. Angiosperms have a _____ with male and female parts to attract pollinators.
20. Animals digest food and then use the _____ to absorb nutrients into the blood.
21. Gills and lungs both have large _____ for respiratory gas exchange.
22. To provide force to transport blood, animals have muscles called _____ that can be divided into chambers to separate _____.
23. Waste collected in the blood is often dissolved in _____ before being excreted.
24. _____ are the most efficient at excreting waste because they make only solid waste.
25. _____ can be hermaphrodites but still use internal fertilization with another mate.
26. Both insects and amphibians use _____ to change their body shapes.
27. Specialized cells called _____ help transmit signals due to their long shape.
28. Behaviors that are present at birth and require NO practice are known as _____.
29. Movement toward or away from a stimulus (light or chemicals) is called _____.
30. Animals instinctively try to attract _____ or defend their _____.
31. _____ behaviors require practice.
32. _____ is learning to stop a behavior if there are no rewards/punishments.
33. Operant conditioning is also called _____.
34. Classical conditioning is learning to _____.
35. Imprinting is a combination of _____ and _____.
36. Communication can include the use of chemicals such as insects' use of _____.
37. Create a fill-in-the-blank question with a vocabulary word that was not used in the above questions.

Unit 9.1 Preview
Textbook pgs.448-449, 459-461

A. Important Vocabulary to Remember

Vocab Word	Textbook definition	Diagram with caption

B. Important Diagrams to Analyze

Read the caption of Figure 18-13 (pg 461) and answer the bold question in a complete sentence.

C. Important Big Ideas to Evaluate

After reading pgs. 459-461 sketch a picture from these pages. Create your own caption that includes a vocabulary word from the vocab matching.

Unit 9.1 Review

A. Understanding Examples -- **Complete** the following 5 statements.

1. All living organisms are able to perform the basic life processes known as _____.
2. The two domains that contain prokaryotic cells are _____ and _____.
3. Domain _____ contains the 4 eukaryotic kingdoms.
4. Kingdom fungi is most closely related to _____ due to the lack of a _____ and heterotrophic nature.
5. Only kingdom _____ contains a cell wall composed of the carbohydrate cellulose.

B. Analyzing applications -- Correctly match each vocab word with an appropriate experiment

- | | | |
|---|--|---|
| <ol style="list-style-type: none"> 1. Animalia 2. Fungi 3. Archaea 4. Protista 5. Eubacteria | <ol style="list-style-type: none"> a. A doctor discovers that the patient's red rash is caused by a prokaryotic unicellular organism called <i>S. aureus</i>. b. The ecologist discovers the green algae growing in the pond is unicellular and contains a nucleus. c. The parasite infecting the tree was a mold that was eukaryotic and secreted digestive enzymes. | <ol style="list-style-type: none"> d. The compost pile contains multicellular annelids that contain a nucleus, but no cell wall. e. The Dead Sea contains <i>Halocarcularia marismortui</i>, a prokaryotic organism that can tolerate the amount of salt which is 10 times the amount in the ocean. |
|---|--|---|

C. Evaluating Scenarios -- Redraw the two listed diagrams **from your handbook**.

<u>Figure 5.1 a</u>	<u>Figure (choose one from a previous unit)</u>
How are these two diagrams related to each other?	

Biology Apps – Unit 9.1



<http://www.apple.com/osx/apps/app-store.html>

1. Which 2 kingdoms are prokaryotic?
2. If the physical traits of Archae and Eubacteria are different, what might have caused those differences initially?
3. The organisms of which kingdom do not have cell walls?
4. The local elementary school wants to create a compost pile to help use garden and kitchen waste as fertilizer. Organisms from which 3 kingdoms are essential for speeding up this process?
5. If asked to name a producer, most people automatically identify one kingdom, but the ocean doesn't have trees and bushes. Which 4 kingdoms include producers?
6. The closest kingdom to animals is Kingdom Fungi.
 - a. How are you similar to a fungus?
 - b. How are you different from a fungus?
7. A doctor is trying to diagnose what is infecting a patient and causing intestinal distress. The doctor believes it is a tapeworm, which belongs to Kingdom Animalia.
 - a. How would the doctor narrow out viral infections?
 - b. How would a doctor narrow out bacterial infections?
 - c. How would a doctor narrow out protist infections?
 - d. How would a doctor narrow out fungal infections?

Unit 9.2 Preview
Textbook pgs.579, 596-597, 612, 634-639

A. **Important Vocabulary to Remember**

Vocab Word	Textbook definition	Diagram with caption

B. **Important Diagrams to Analyze**

Read the caption of Figure 24-6 (pg 612) and answer the bold question in a complete sentence.

C. **Important Big Ideas to Evaluate**

After reading pgs. 596-597, 634-635 sketch a picture from these pages. Create your own caption that includes a vocabulary word from the vocab matching.

Unit 9.2 Review

A. Understanding Examples -- **Complete** the following 5 statements.

1. Ferns, Gymnosperms and Angiosperms all have _____ but only Gymnosperms and Angiosperms have _____.
2. _____ moves water down and _____ moves food up.
3. When the stomata is _____, the plant will lose water, gain _____ gas and lose _____ gas.
4. Flowers contain a male structure called a _____ that makes pollen and a female structure called an _____ that makes the eggs.
5. The correct order of plant growth is pollination, _____ and _____.

B. Analyzing applications -- Correctly match each vocab word with an appropriate experiment

- | | | |
|--|--|---|
| <ol style="list-style-type: none"> 1. Root hairs 2. Ethylene 3. Auxin 4. Phototropism 5. Seed coat 6. Dormancy | <p>ripening by storing extra sugars.</p> <ol style="list-style-type: none"> b. All plants are found to have extensions on certain to help increase water absorption. c. Plants can sense the presence of sunlight and will lengthen/bend the cells to grow towards or away from the light. d. To prepare for unfavorable weather, some plants store sugars in the stem to prepare | <p>for next year's growing period.</p> <ol style="list-style-type: none"> e. When growing in response to environmental signals, the plant will make a hormone that lengthens cells so they can bend. f. In order to protect the food source and growing embryo from stomach acid, seeds have a special structure. |
|--|--|---|

C. Evaluating Scenarios -- Redraw the two listed diagrams **from your handbook**.

<u>Figure 5.2 g</u>	<u>Figure 5.2 j</u>
How are these two diagrams related to each other?	



<http://www.apple.com/osx/apps/app-...>

Biology Apps – Unit 9.2

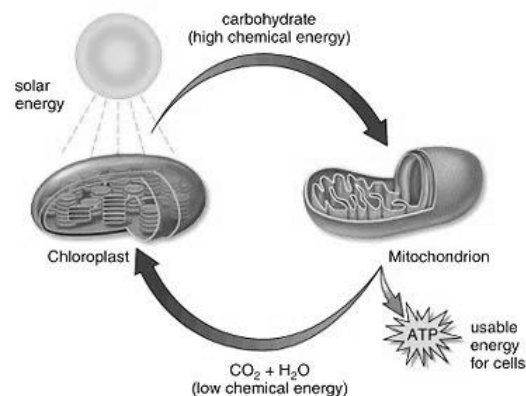
1. What is the importance of photosynthesis to a plant?
2. The roots of a plant are NOT green! They don't even contain chloroplasts. How are they able to obtain food?
3. Consider xylem and phloem.
 - a. What do they have in common?
 - b. How are they different?
4. A garden store owner notices that some plants need less water than others. While observing drought-tolerant plants, the owner notices these plants wilt less, but they also grow more slowly.

- a. The owner observes the drought-tolerant plants under a microscope and notices they have fewer stomata. Why would this match the previous observations the owner made?
- b. Identify the top 3 drought-tolerant plants the owner might want to stock based on the chart to the right.

Plant Number of Stomata/mm ²		
	Upper Surface	Lower Surface
Monocot		
Wheat	50	40
Barley	70	85
Onion	175	175
Dicot		
Sunflower	120	175
Alfalfa	169	188
Geranium	29	179

5. Carbohydrates are found in plant cell walls and in plant vacuoles.
 - a. How are these carbohydrates made?
 - b. What carb is found in plant cell walls and what is its purpose?
 - c. What carb is found in plant vacuoles and why is it being stored?

6. True or False: All plant cells have and only animals have mitochondria. *diagram to the right to support your*



chloroplasts
(Use the answer.)

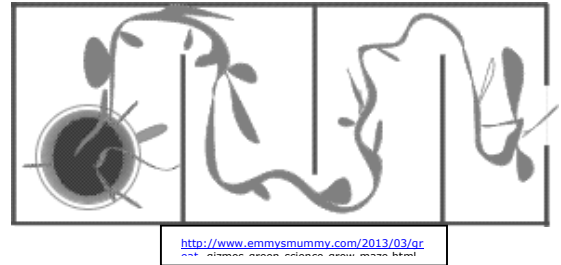
functions.

7. List the three main hormones and their

<http://www.cape.k12.mo.us/CJHS/science/gl...>

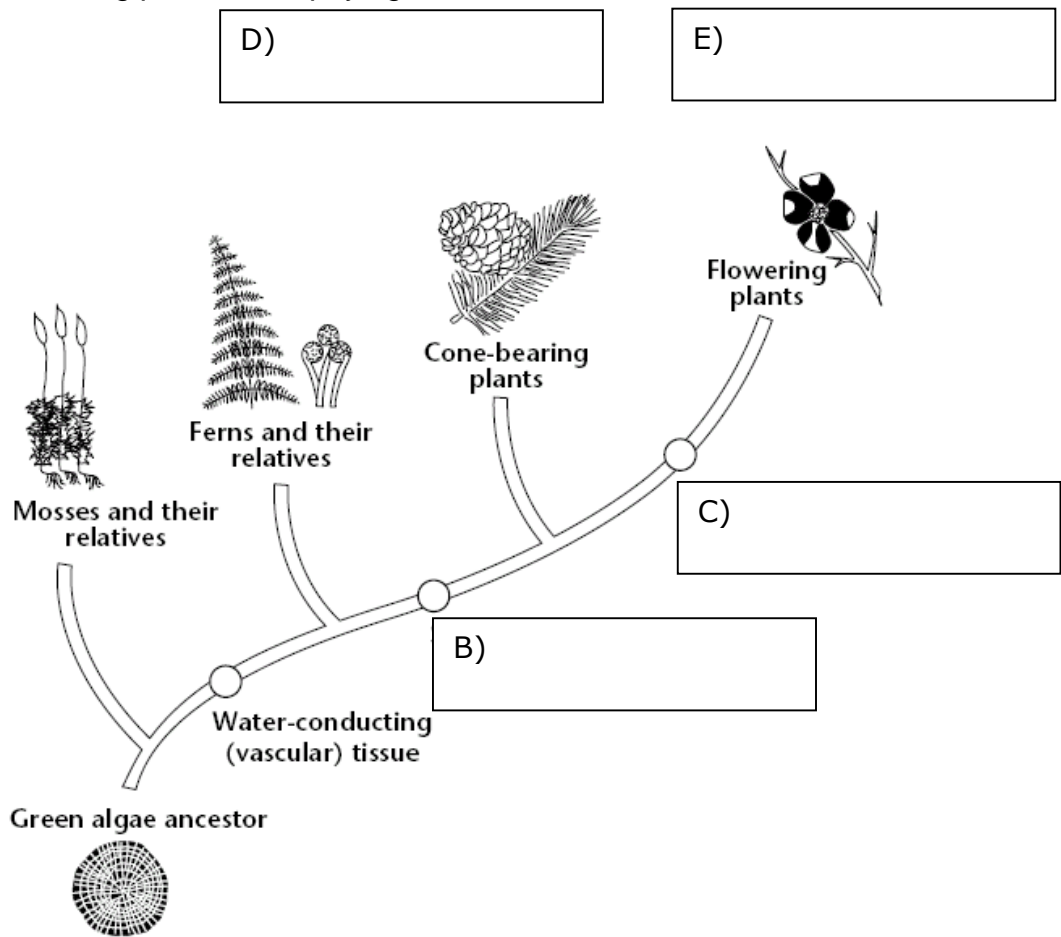
8. List the three main tropisms and their functions.

9. Explain how hormones and tropisms could help a plant "find light" through a maze.



10. What are the four parts of the seed and how does each part serve as an adaptation?

11. Complete the missing parts of the phylogenetic tree below.



Plant Tissue Inquiry

We previously learned that plants use the process of _____ to convert light into sugar. The equation for this process was: **light** + _____ (gas) + **water** → **glucose** + _____ (gas). The water must be absorbed by the plants roots and brought to the stems and leaves where the conversion to sugar occurs. But how does the water make it to the leaves? Consider the redwood trees that grow to be over 250 feet tall!

Day 1

Draw the Base of Celery:

What color is it?

We will use celery and food coloring to determine how the water moves. In your groups take cut one stalk of celery about 2-3 inches. You will have a small beaker and fill it half way with tap water. Add 2 drops of food coloring and set the celery inside the beaker.

What do you think we will observe tomorrow?

_____.

What is the process of water moving through a cell membrane called?

Day 2

Draw the Base of Celery:

What color is it?

Do you notice any specific structures in the celery? _____
_____.

Using the resources available to you identify the two main divisions in plants based on tissue? _____ and _____

What category can the celery be placed under? _____

Explain the difference between the following types of tissue:

Xylem _____

Phloem _____

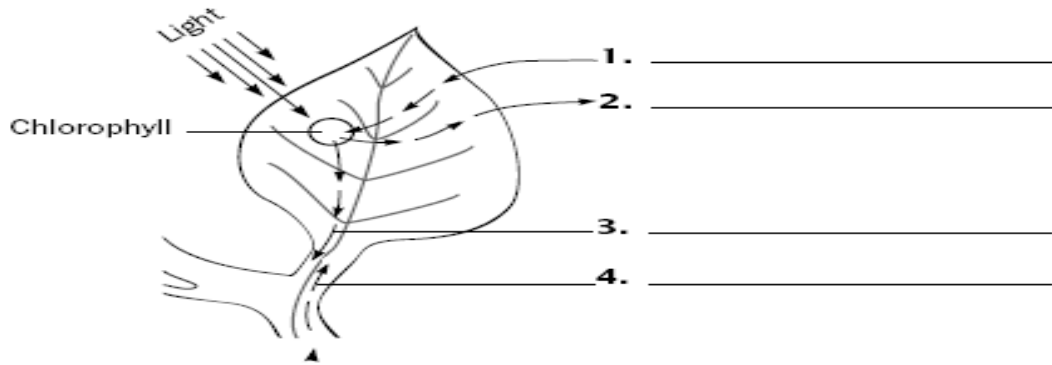
With this knowledge we know that redwood trees have _____ tissue, and after water is absorbed by the roots it must travel up through the _____ to reach the leaves far above the ground.

Moss on the other hand grow together in clumps or mats in damp or shady areas. What type of tissue do you think it has and why does it grow in damp areas? _____

Photosynthesis Worksheet (adapted from Mr. Vorstadt)

After it is labeled, the diagram below will illustrate photosynthesis. Write each of the following terms on the correct numbered line. Then answer the questions that follow.

Carbon Dioxide **Glucose** **Oxygen** **Water**



1. a. In photosynthesis, what substances come in from the outside?
 b. What substances are produced?
2. What is the overall reaction (*formula*) for photosynthesis?
3. How does this compare to the overall reaction for cellular respiration?
4. Where does the energy for photosynthesis come from?
5. What plant pigments are involved in photosynthesis?
6. Explain why chlorophyll appears green to us in terms of what happens to different wavelengths of light that strike a chlorophyll molecule.
7. In what organelle of a plant cell does photosynthesis take place?
8. What is photosynthesis waste product?
9. What is the overall reaction (*formula*) for cell respiration?
10. In what organelle of a cell does cell respiration take place?
11. What is cell respirations wastes product?

Unit 9.3 Preview

Textbook Pgs. 657-659, 695-697, 715-719, 783, 824-827

A. Important Vocabulary to Remember

Vocab Word	Textbook definition	Diagram with caption

B. Important Diagrams to Analyze

Read the caption of Figure 30-26 (pg 786) and answer the following question, "How are amphibians similar to insects?"

C. Important Big Ideas to Evaluate

After reading pgs. 657-659, 695-697, sketch a picture from these pages. Create your own caption that includes a vocabulary word from the vocab matching.

Unit 9.3 Review

A. Understanding Examples -- **Complete** the following 5 statements.

1. Macromolecules are polymers made of _____.
2. The best sources of energy are _____ and _____.
3. Glucose is an example of a small sugar and starch is how _____ store carbs.
4. Enzymes are made of _____ so that they can be specifically shaped.
5. An enzyme _____ chemical reactions that turn substrates into _____.

B. Analyzing applications -- Correctly match each vocab word with an appropriate experiment

- | | | |
|---|---|--|
| <ol style="list-style-type: none"> 1. Small intestine 2. External fertilization 3. Neurons 4. Exoskeleton | <ol style="list-style-type: none"> b. Some drugs like heroin permanently damage the specifically-shaped cells that allow animals to use chemical and electrical signals to communicate between cells. c. A large swarm of cicadas descended on the farmer's field and as they ate and grew, they had to undergo | <ol style="list-style-type: none"> metamorphosis in order to shed this structure as they grew. d. The microvilli increase the surface area in the structure that absorbs nutrients after digestion, so some parasites like the tapeworm find a home in this organ. |
|---|---|--|

C. Evaluating Scenarios -- Redraw the two listed diagrams **from your handbook**.

Figure 5.3 a	Figure 5.3 g
How are these two diagrams related to each other?	

Biology Apps – Unit 9.3

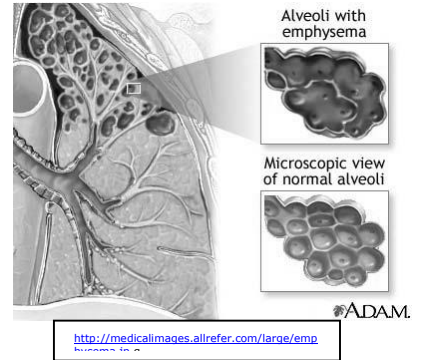


<http://www.apple.com/osx/apps/app-store.html>

1. The small intestine is about 22 feet, 6 inches in an average adult. Why so long?

2. Smoking causes alveoli to lose elasticity, which causes emphysema. Why does this make smokers more often short of breath?

3. How do the digestive, respiratory and circulatory systems work collaboratively to ensure animal survival?



4. A scientist wants to understand how the animal body removes waste. The scientist studies the kidney of a human and the Malphigian tubule of a fruit fly.

a. How would those two structures be similar in shape?

b. Which organism could most likely go longer without a water source?

5. Consider metamorphosis:

a. Which two groups of animals undergo metamorphosis?

b. What is the advantage of metamorphosis?

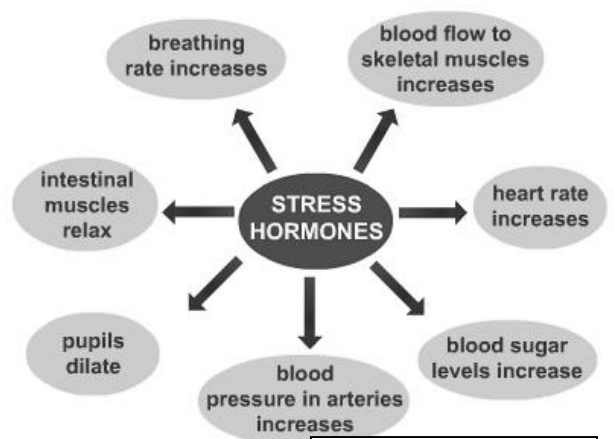
c. What is the disadvantage of metamorphosis?

6. Animal bodies use hormones to regulate their body's response to changing conditions. The fight-or-flight response is a response to stress that uses hormones such as adrenaline.

a. How does the body know if there is stress?

b. Why are hormones produced?

c. Pick three of the effects and explain WHY they would help in a stressful situation.



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Unit 9.4 Preview
Textbook Pgs. 872-882, 733

A. Important Vocabulary to Remember

Vocab Word	Textbook definition	Diagram with caption

B. Important Diagrams to Analyze

Read the caption of Figure 28-21 (pg 733) and answer the bold question in a complete sentence.

C. Important Big Ideas to Evaluate

After reading pgs. 872-882, 733, sketch a picture from these pages. Create your own caption that includes a vocabulary word from the vocab matching.

Unit 9.4 Review

A. Understanding Examples -- **Complete** the following 5 statements.

1. Behaviors that don't need practice are called _____ and include blinking and coughing.
2. Classical conditioning is when an animal learns to _____ 2 separate stimuli.
3. Living in a _____ involves working with many other members to increase your overall survival.
4. To reduce competition, many animals such as dogs and cats will mark their _____ using a scent and then use aggression such as _____ to defend their area and resources.
5. Animals follow patterns of waking and sleeping known as _____ rhythms.

B. Analyzing applications -- Correctly match each vocab word with an appropriate experiment

- | | | |
|---|---|--|
| <ol style="list-style-type: none"> 1. Fight or flight 2. Imprinting 3. Habituation 4. Operant conditioning 5. Pheromones | <ol style="list-style-type: none"> a. Emergency situations can trigger body reflexes in the body to produce hormones without any conscious thought from the human. b. Animals are born expecting to follow something, but some like | <ol style="list-style-type: none"> c. ducklings must learn when to imitate. d. A bird stops responding to a repeated warning call when it is not followed by an attack. e. A rat learns to press a button to get food. f. Fireflies release a chemical that attracts the females in addition to the light. |
|---|---|--|

C. Evaluating Scenarios -- Redraw the two listed diagrams **from your handbook.**

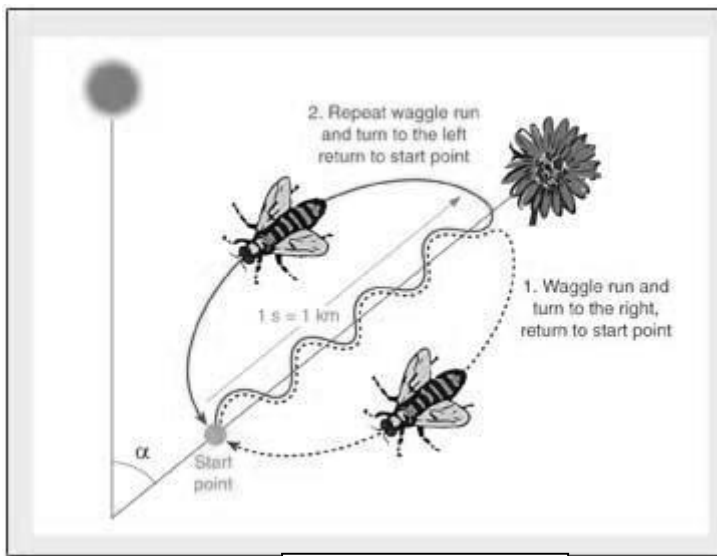
Figure 5.4 b	Figure 5.4 c
How are these two diagrams related to each other?	



<http://www.apple.com/osx/apps/app-store.html>

Biology Apps – Unit 9.4

1. What are the two main types of behaviors?
2. Name two simple innate behaviors.
3. How are pheromones a means of communication?
4. *Identify each of the following as innate or learned.*
 - a. A child begins choking on a piece of popcorn. _____
 - b. The child tries to signal by pointing to their throat. _____
 - c. A mother rushes to the child's side, pushing away others. _____
 - d. A paramedic arrives and performs careful Heimlich. _____
 - e. The child is more careful about eating too quickly. _____
5. The honeybee waggle dance is considered to be both innate and learned. It is used to communicate how to find food sources.
 - a. How would instinct play a role in this behavior?
 - b. How would experience and practice play a role in this behavior?



http://upload.wikimedia.org/wikipedia/commons/6/64/1000px-Honeybee_waggle_dance.svg

Discovery Education Video – Instincts in Animals

- 1) What are instincts?
- 2) How are they passed on?
- 3) What are some examples of instincts?
- 4) Do instincts help animals survive? _____
*What about humans?
- 5) In some animals, can it take longer for instincts to show? _____
*Why?
- 6) Explain how a caterpillar is able to eventually fly.
- 7) What is an involuntary action?
* Give an example of one.
- 8) What is a reflex action?
* Give an example of one.
- 9) From what/whom do animals learn?
- 10) What does learned behavior usually start with?
* Give an example of one.
- 11) Give an example of a combination of instinct and learned behavior.
- 12) Why do birds fly south for the winter?
- 13) True or False --- The more intelligent an animal, the more it relies on learning.

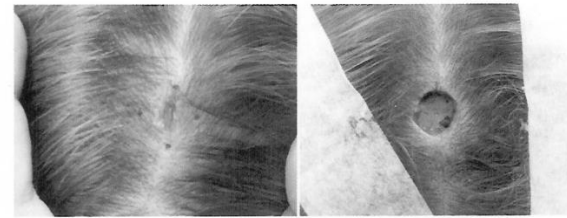
* Explain your answer
- 14) What is the strongest of all animal instincts?

Unit 10 Intro

Text One: My Skin Cancer Journey <http://www.myskincancerjourney.com>

At sixteen I discovered tanning beds and being a fair skinned, freckled teen that didn't tan easily thought this was the way to go. And go I did. I could finally obtain that nice tan complexion without burning. I was tanning out the ying-yang without a worry to be had. The surgeon informed me that I might experience some hair loss around the incision because of the trauma of the surgery. I remember thinking that will definitely not happen to me! Well I was proven wrong. Just like "I won't get skin cancer" I had this stupid bald spot for months. As you can tell from the picture my hair is fine and thin which made it super hard to cover up.

BASAL CELL CARCINOMA ON THE SCALP IS NO FUN. WEAR A HAT, PEOPLE!



Preoperative

Postoperative

Text Two: Genetics Home Reference: MC1R <http://ghr.nlm.nih.gov/condition/huntington-disease>

What is the MC1R gene? The *MC1R* gene provides instructions for making a protein called the melanocortin 1 receptor. This receptor plays an important role in normal pigmentation. The receptor is primarily located on the surface of melanocytes, which are specialized cells that produce a pigment called melanin. Melanin is the substance that gives skin, hair, and eyes their color. Melanin is also found in the light-sensitive tissue at the back of the eye (the retina), where it plays a role in normal vision. Melanocytes make two forms of melanin, eumelanin and pheomelanin. The relative amounts of these two pigments help determine the color of a person's hair and skin. People who produce mostly eumelanin tend to have brown or black hair and dark skin that tans easily. Eumelanin also protects skin from damage caused by ultraviolet (UV) radiation in sunlight. People who produce mostly pheomelanin tend to have red or blond hair, freckles, and light-colored skin that tans poorly. Because pheomelanin does not protect skin from UV radiation, people with more pheomelanin have an increased risk of skin damage caused by sun exposure.

How are changes in the MC1R gene related to health conditions? Many genetic changes in the *MC1R* gene increase the risk of developing skin cancer, including a common, serious form of skin cancer that begins in melanocytes (melanoma). Skin damage caused by UV radiation from the sun is a major risk factor for developing melanoma and other forms of skin cancer. Studies suggest that variations in the *MC1R* gene may also increase the risk of developing melanoma in the absence of UV radiation-related skin damage. In these cases, melanomas can occur in people of dark or light skin coloring. These cancers are often associated with mutations in additional genes related to melanoma risk, such as the *BRAF* and *CDKN2A* genes. Researchers are working to explain the complex relationship among *MC1R* variations, other genetic and environmental factors, and melanoma risk.

Text Three: UV Rays <http://www.surfscience.com/images/stories/TheSurfLife/LifeAsASurfer/surfers%20uv%20rays%20sunscreens.png>

Analysis

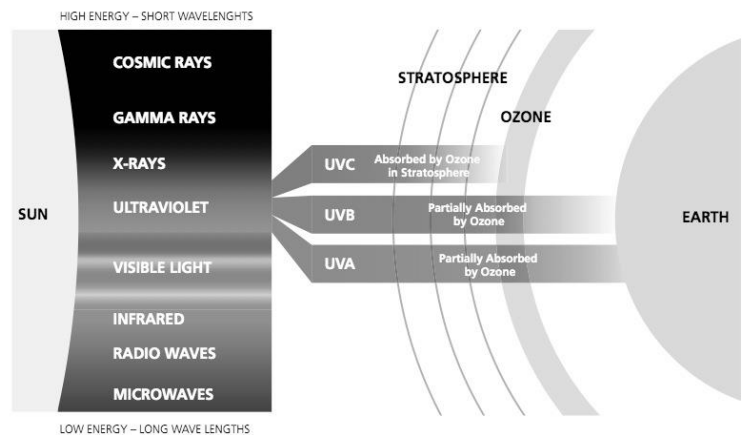
1) What three questions do you have after reading the three texts?

2) Based on the texts, what is the relationship between the normal gene and the mutated gene?

3) Based on the texts, how do differences in genes result in different chances of skin cancer?

4) Based on the reading, what are environmental choices that people can make to reduce their chance of skin cancer?

5) Based on the diagram, what effect does the ozone layer have on a person's chances of developing skin cancer?



Invisible ultraviolet light is described as three wavelengths. UVC is absorbed by the ozone layer of Earth's atmosphere. UVB is partially absorbed by the ozone layer. UVA penetrates the atmosphere and reaches the earth.

Unit Ten Summary

1. _____ is the interaction between biotic and abiotic factors in a given area.
2. _____ is the interaction of biotic factors within an ecosystem
3. An organisms total way of life is defined as a _____
4. A primary consumer is the same thing as a _____
5. _____ feed at all levels of the food web.
6. Organisms that break down waste and decaying material are known as _____
7. Energy is lost as it moves from one trophic level to the next this is known as the _____ rule.
8. Water may enter an ecosystem through _____ and leave the ecosystem through _____ and _____
9. The carbon cycle is powered by _____ and _____
10. _____ is consumed through respiration and decay
11. _____ are responsible for converting nitrogen gas to usable forms.
12. The nitrogen cycle is important to living things for the construction of _____.
13. _____ is defined as a struggle for resources among organisms.
14. Bacteria living in the digestive tract of a human to aid in digestion is an example of _____
15. _____, _____, and _____ are considered limiting factors
16. _____ is the number of individuals an environment can support
17. _____ population growth stabilizes as carrying capacity is reached
18. Three causes of human population growth _____, _____, and _____.
19. Two gases that lead to global warming _____ and _____.
20. An increase in earth's temperature can lead to weather patterns will change worldwide, _____ may melt, flooding coastal cities and contaminating drinking water with saltwater.
21. _____ can cause increased numbers of sunburns, skin cancer, cataracts (leading to blindness), and crop damage.
22. _____ can disrupts aquatic ecosystems, makes soil less fertile, harms plant life, and damages human property.
23. Biodiversity loss can be caused by _____ and _____
24. _____ is the greatest accumulation in lower organisms in the food chain
25. _____ is magnified greatest in organisms higher in the food chain
26. Create a fill-in-the-blank question with a vocabulary word that was not used in the above questions.

Unit 10.1 Preview
Textbook pgs. 64, 69-70, 90-93, 121-124

A. Important Vocabulary to Remember

Vocab Word	Textbook definition	Diagram with caption

B. Important Diagrams to Analyze

Read the caption of Figure 5-7 (pg 126) and answer the bold question in a complete sentence.

C. Important Big Ideas to Evaluate

After reading pgs. 69-70, 90-93, 121-124, sketch a picture from these pages. Create your own caption that includes a vocabulary word from the vocab matching.

Unit 10.1 Review

A. Understanding Examples -- **Complete** the following 5 statements.

1. When studying an _____, you examine the biotic factors and the abiotic factors.
2. A food pyramid will always have _____ on the bottom because they make their own food.
3. The two processes that influence the carbon cycle are _____ and _____.
4. The three types of symbiosis are _____, _____ and _____.
5. Population growth that is limited by other factors (like food, predators) will eventually reach _____ and show a _____-curve pattern.

B. Analyzing applications -- Correctly match each vocab word with an appropriate experiment

- | | | |
|---|---|--|
| <ol style="list-style-type: none"> 1. Decomposer 2. Energy transfer 3. Community 4. Limiting Factor 5. Abiotic factor 6. Commensalism 7. Quadrant Analysis | <ol style="list-style-type: none"> a. A botanist surveys selected National Park areas to estimate the total number of redwood trees. b. An ecologist is studying all the animals that live in the savanna c. The zookeeper notices the polar bear eats a lot more than the fish. d. The wolf population that eats rabbits keeps the rabbit population from being too large. | <ol style="list-style-type: none"> e. A meteorologist notices that weather patterns like temperature and rain affect plant growth. f. A gardener puts bacteria, earthworms and fungi in the compost pile to help recycle nutrients g. A marine biologist notices that barnacles live on the backs of whales without harming the whales. |
|---|---|--|

C. Evaluating Scenarios -- Redraw the two listed diagrams **from your handbook**.

<u>Figure 6.1 g</u>	<u>Figure 6.1 h</u>
How are these two diagrams related to each other?	

Biology Apps – Unit 10.1



<http://www.apple.com/osx/apps/app->

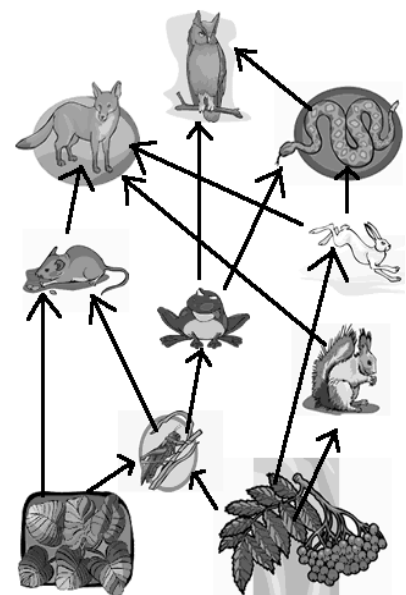
ORGANIZATION OF THE ENVIRONMENT

1. What are the levels of organization of the biosphere? (general to most specific)
2. Would Lake Norman be an example of an ecosystem or a community? Why?
3. What is the difference between a biotic factor and an abiotic factor?
4. Is a seed a biotic factor or an abiotic factor? Why?
5. List as many biotic and abiotic factors as possible from the picture to the right.



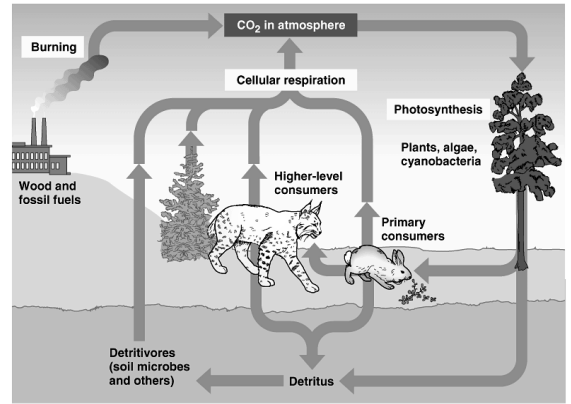
ENERGY FLOW IN ECOSYSTEMS

6. What is a trophic level and give one example.
7. Using the diagram at the right, identify one herbivore, one omnivore and one carnivore. What do they all have in common? How are they different?
8. Why is energy lost as it is transferred in an ecosystem?
9. Could the Earth support more vegetarians or meat-eaters? Explain.
10. What would happen if all the rats were killed?



BIOGEOCHEMICAL CYCLES

- 11. What are the two main processes that drive the carbon cycle?
- 12. What are the two main processes that drive the oxygen cycle?
- 13. How do the carbon and oxygen cycle relate to each other?



- 14. Look at the figure on the right and explain why we should or should not be concerned with deforestation.

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BIOTIC RELATIONSHIPS IN A COMMUNITY

- 15. Both coyotes and bobcats eat rabbits and other small animals. But the coyote also eats grass and fruit. Describe what type of consumer each is **and** describe the biotic relationship between the bobcat and the coyote.

- 16. List **and** define the three types of symbiosis.

- 17. Oxpeckers (*Buphagus africanus*) sit on the back of African mammals such as rhinos. They eat ticks that are found on the rhinos. They also scream warning sounds if other animals come nearby. The oxpeckers have recently been found to also drink the rhino’s blood from the wounds made by the ticks. **Explain what types of symbiosis are seen here.**

POPULATION GROWTH TRENDS

- 18. Under favorable conditions, bacteria can divide every 10 minutes. What would “favorable conditions” mean? What type of population growth pattern/curve would this be?

- 19. Explain the benefits of allowing hunters to hunt deer during certain times of year.

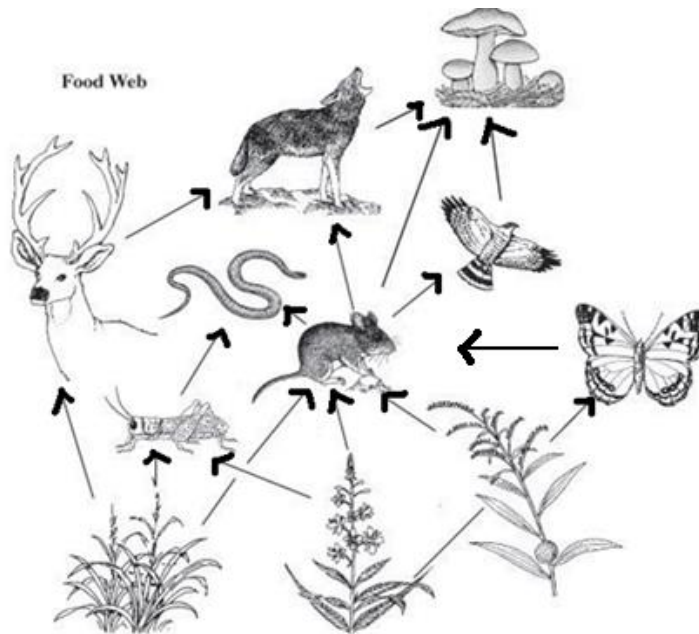
- 20. Explain how the diagram to the right represents the carrying capacity of a population.



<http://mrewert.pbworks.com/f/1304265154/54-17-CarbonCycle->

http://www.bowhunter-ed.com/images/drawings/carrying_capacity_bucket.jpg

Food Web Inquiry



1. What is a producer? (circle the producers in the food web)

2. What is a consumer? _____

3. Explain the difference between these three consumers. What types of organism(s) do they use as a food source?

Grasshopper _____

Mouse _____

Wolf _____

4. The producers are at the base of each food web, if some type of chemical was applied to this ecosystem and all the producers died what would happen to the other organisms?

5. Identify one food chain, consisting of 4 organisms.

_____ → _____ → _____ → _____

6. On the food web the direction of the arrows represent the flow of e_____.

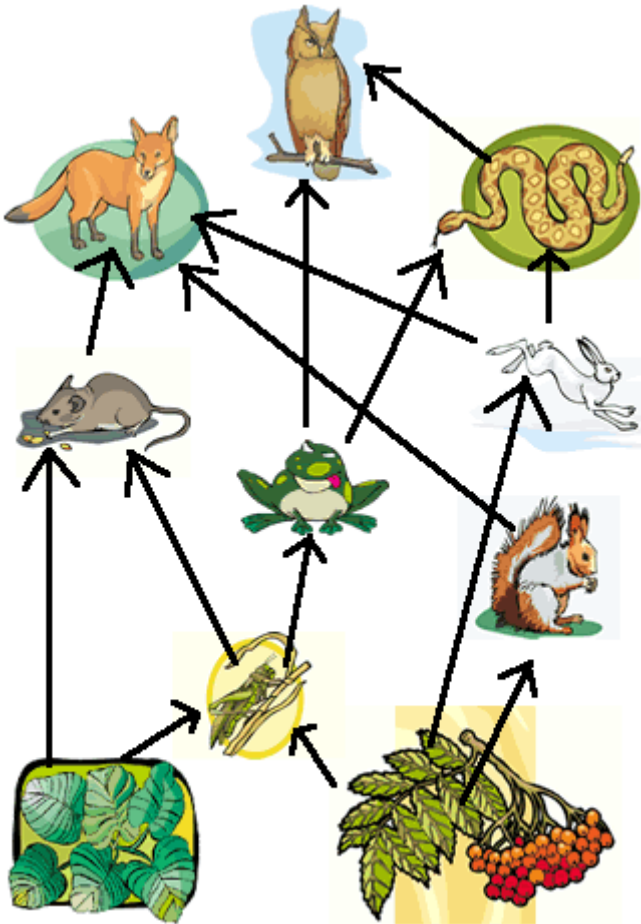
7. If you "compose" something this means that you _____ it.

8. Define decomposer:

Label the decomposer on the food web.

9. What would happen if there were no decomposers? Why are they beneficial to the environment?

Food Web



Identify the:

1. Producers
2. Primary Consumers
3. Secondary Consumers
4. Herbivores
5. Carnivores
6. Omnivores
7. What elements are missing from this food web?

Below, construct a food web using the following animals. This ecosystem represents a farm area. The corn is the main source of food for many of the herbivores in the area. You do not have to draw pictures, you can just use the animal names and draw arrows between them.

SNAKE, CORN, CATERPILLAR, DEER, CROW, GRASS, HAWK, MOUSE, COUGAR, SQUIRREL, MICROORGANISMS (decomposers)

Symbiosis

Part One: -- Match the following vocabulary words to the definition.

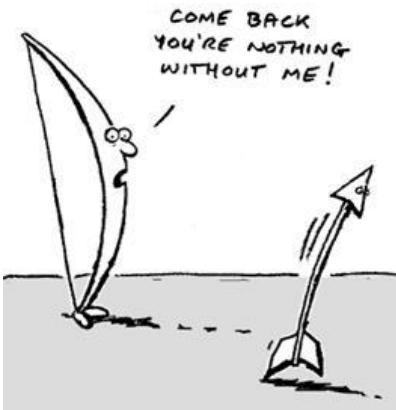
1. One organism is benefited while the other is harmed. The organism that is harm doesn't usually die.
2. Two species living closely together
3. One organism benefits while the other is neither helped nor harmed
4. First organism feeds off of (eats) the second organism; second organism dies.
5. Both organisms benefit from living together

Symbiosis *Predation* *Mutualism*
Commensalism *Parasitism*

- 1. _____
- 2. _____
- 3. _____
- 4. _____
- 5. _____

Part Two: -- Explain how the cartoon below represents symbiosis and what type of relationship this would be.

6.



Part Three: -- Identify the following relationships as mutualism, commensalism or parasitism.

- 7. The sloth's hair provides a perfect place for algae to grow. The green color of the algae helps the sloth blend in with the tree.
- 8. Hippos make trails through vegetation that other animals use to find water holes.
- 9. The red boring sponge attaches itself to coral. Once attached to coral, the sponge reproduces, expands and damages the coral.

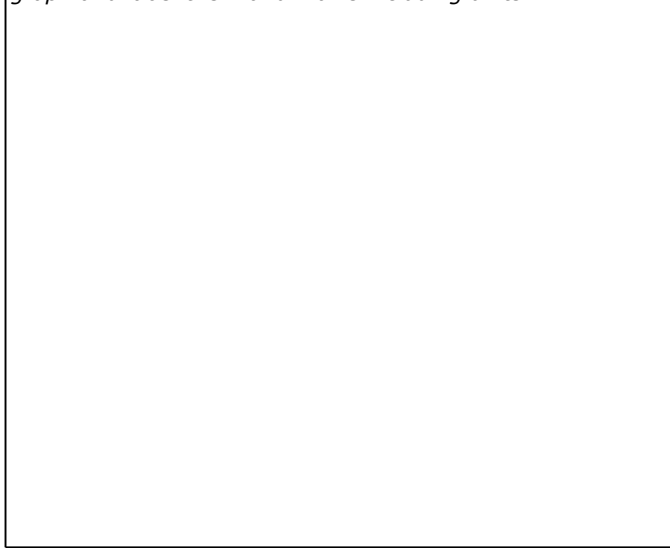
Part Four: -- Explain how a predator/prey relationship is different from parasitism.

Population Growth Trends in Bacteria

Students were growing bacteria in a Petri plate and kept track of the number of bacterial colonies they saw each day.

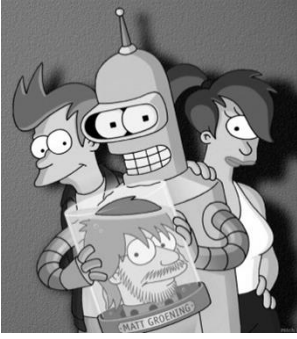
Day	Number of Bacterial Colonies
1	0
2	7
3	15
4	30
5	60
6	120
7	150
8	160
9	170
10	170
11	170

1. Create a graph to track the changes of bacterial colonies over time. Be sure to title the graph and label the X and Y axis including units.



- Based on your graph, when did the population reach 90 colonies?
- What type of growth is during days 1 through 6? (give the name of the growth and the type of curve.)
- What type of curve is shown by days 1 through 11?
- What is it called when the population began to level off at day 10?
- Define the term used to answer number 5. How is the term in number five established? What are some examples of this?
- One lab group decides to apply penicillin (an antibiotic) to their bacteria. Is this a density-dependent limiting factor or a density-independent limiting factor? Why?
- In a Petri dish, there are 5 grams of sugar. Is this a density-dependent limiting factor or a density-independent limiting factor? Why?

Futurama: How Will These Events Affect the Future?



Philip J. Fry was unwittingly cryogenically frozen for one thousand years, and now finds himself in the 31st century as a pizza delivery boy! On a usual delivery, he meets a very unusual scientist who wants to learn more about how things worked in the past. Help Fry explain to Dr. Eye N'styn the workings of 21st century biogeochemical cycles. Use

your knowledge of the cycles to solve these problems!

Problem 1 In attempts to lessen the effects of global warming scientist were able to use “reverse-gravity” to push the Earth further away from the sun. As a result they now need to use artificial rain makers. Which cycle did this affect? _____ Why would New Earth not be able to produce rain anymore? _____

Problem 2 Los Angeles is now a smog-filled wasteland. Even small organisms like fungi and bacteria are no longer able to survive here. If a hybrid rat-pigeon flew through the city and it would die due to smoke inhalation. Would the carbon in its body be returned to the atmosphere? _____ What would have happened in our time? _____

Problem 3 The robot minority suggests getting rid of the pesky trees that are an eye-sore in New New York. What cycle does this affect? _____ How does it affect the cycle? _____

Problem 4 The streets of New New York have been paved with an impenetrable pavement. They noticed that the Hudson River is filled with a green coating for a while after they spray fertilizer in the parks. How would this affect the nitrogen cycle? _____

Unit 10.2 Preview
Textbook pgs. 129-131, 150-152, 157-159

A. Important Vocabulary to Remember

Vocab Word	Textbook definition	Diagram with caption

B. Important Diagrams to Analyze

Read the caption of Figure 5-13 (pg 131) and answer the bold question in a complete sentence.

C. Important Big Ideas to Evaluate

After reading pgs. 150-152, 157-159, sketch a picture from these pages. Create your own caption that includes a vocabulary word from the vocab matching.

Unit 10.2 Review

A. Understanding Examples -- **Complete** the following 5 statements.

1. Human population growth shows an _____-curve because we haven't reached a carrying capacity.
2. Greenhouse gases trap _____ and are produced in excess when we burn _____.
3. _____ is when toxins are passed through a food chain.
4. The most significant danger to biodiversity is _____.

B. Analyzing applications -- Correctly match each vocab word with an appropriate experiment

- | | | |
|---|---|---|
| <ol style="list-style-type: none"> 1. Increasing Population 2. Industrial Revolution 3. Greenhouse gases 4. Ozone 5. CFCs 6. Acid Rain 7. Biomagnification | <ol style="list-style-type: none"> b. Areas with more driving commuters produce more NOx and SOx which can combine with water and the rain then damages ecosystems. c. In developing countries, more people are born each year than the amount of people who die. d. Chemicals that were once used in aerosols and refrigerators can actually destroy the ozone layer. e. Important for trapping some heat to keep the Earth warm, too high | <p>levels can overheat the Earth.</p> <ol style="list-style-type: none"> f. New discoveries have rushed humans into making decisions that prolong human life expectancy, but that also can cause unexpected damage to the Earth. g. Chemicals caught in runoff water will be absorbed by plants, eaten by herbivores and eaten by carnivores, causing top predators like hawks to suffer more than other animals. |
| <ol style="list-style-type: none"> a. Molecules of O3 absorb high energy rays from the sun, preventing damage to living organisms. | | |

C. Evaluating Scenarios -- Redraw the two listed diagrams **from your handbook**.

<u>Figure 6.2 a</u>	<u>Figure 6.2 e</u>
<p>How are these two diagrams related to each other?</p>	



Biology Apps – Unit 10.2

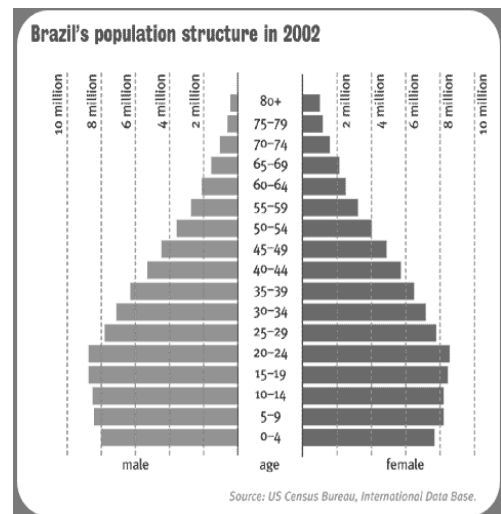
HUMAN POPULATION GROWTH

<http://www.apple.com/osx/apps/app-store.html>

1. What were three causes of human population growth?
 - a. _____
 - b. _____
 - c. _____

2. List two ways humans can help with human population growth?
 - a. _____
 - b. _____

3. Use the histogram to determine if the population is increasing or decreasing. Explain how you know.



GLOBAL WARMING VS OZONE DEPLETION

4. What are the two main greenhouse gases?
 - a. _____
 - b. _____

5. What is the main cause of ozone depletion?

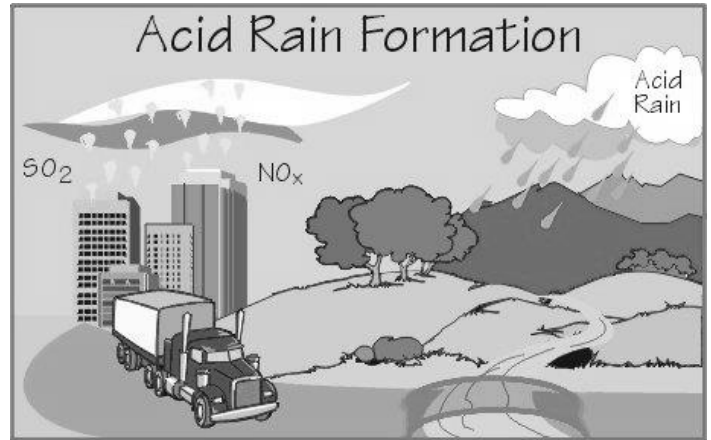
6. How are the effects of global warming different from the effects of ozone depletion?

www.globaleve.org.uk

ACID RAIN

- 7. Use the picture to identify two sources that are the leading cause of Acid Rain?

- 8. Explain how the river in the picture could be affected by the acid rain?



images.tutorvista.com

BIODIVERSITY LOSS AND HABITAT DESTRUCTION

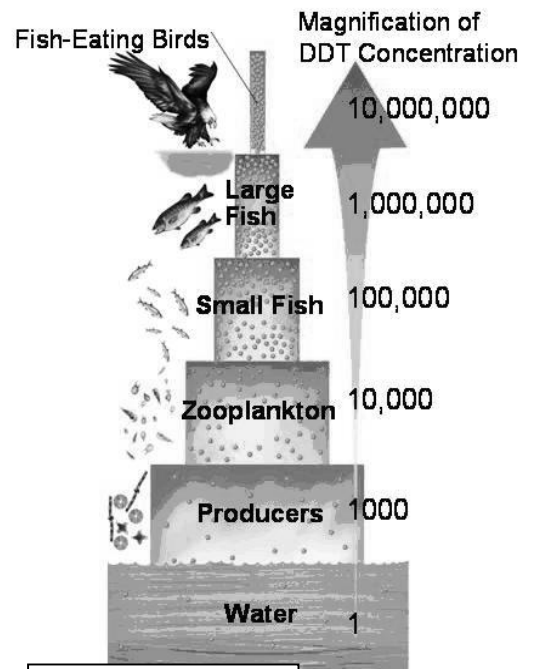
- 9. List two causes of habitat destruction.
 - a. _____
 - b. _____

- 10. What is the difference between bioaccumulation and biomagnification?

Use the picture to the right to answer questions 8-9

- 11. Where is the greatest accumulation?

- 12. Where is the greatest magnification?



www.currentscienceevent.org

Biology CCES EOC Review Packet

Objective 4.1.1 Compare the structure and function of organic molecules in organisms

Macromolecules	Function	Subunits
Carbohydrates		
Proteins		
Lipids		
Nucleic Acids		

Specific Molecule	Function	Subunits
Starch		
Cellulose		
Insulin		
Glycogen		
Glucose		
Enzymes		
Hemoglobin		
Fats		
DNA		
RNA		

Describe the following nutrient tests:

Nutrient	Type of Test	Negative Test	Positive Test
Starch			
Lipids			
Monosaccharides			
Protein			

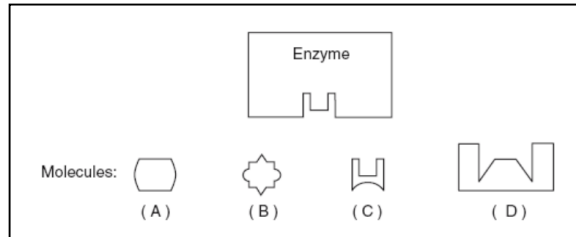
Objective 4.1.3 Develop a cause and effect model for the specificity of enzymes.

Explain why enzymes are specific.

Explain the importance of shape to enzyme function.

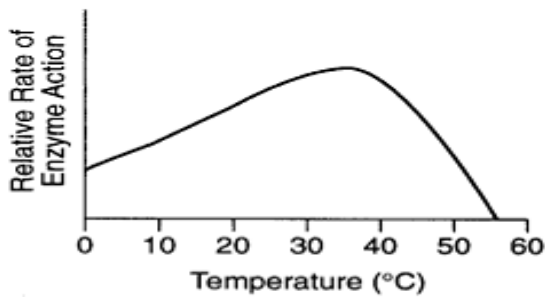
Explain what determines the shape of an enzyme.

Which substrate would fit into the enzyme in the picture?

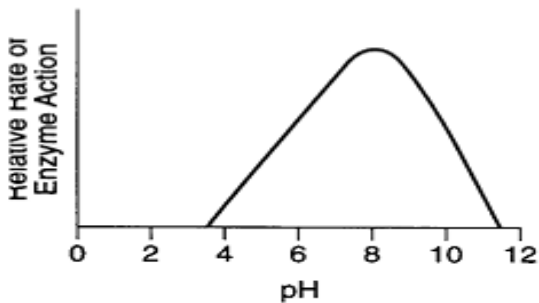


What do enzymes do to the rate of chemical reactions? How?

Look at the graph below and interpret it to determine which temperature range and pH range the enzyme works best in:



OPTIMUM temperature?



OPTIMUM pH range?

How do extreme pH and extreme temperature affect enzymes?

Common characteristics of enzymes:

- They usually end in - _____
- They are _____ - can be used multiple times because they are not destroyed and their shape doesn't change
- They are _____ - SHAPE MATTERS!!

Objective 1.1.1 Summarize the structure and function of organelles in eukaryotic cells & ways these organelles interact with each other to perform the function of the cell.

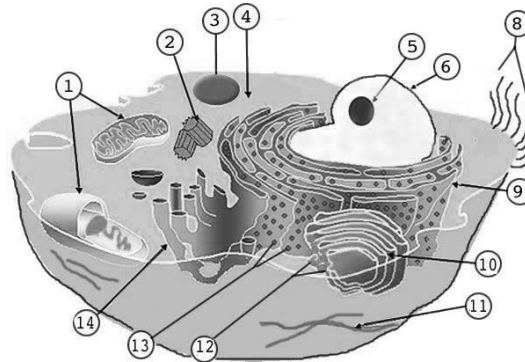
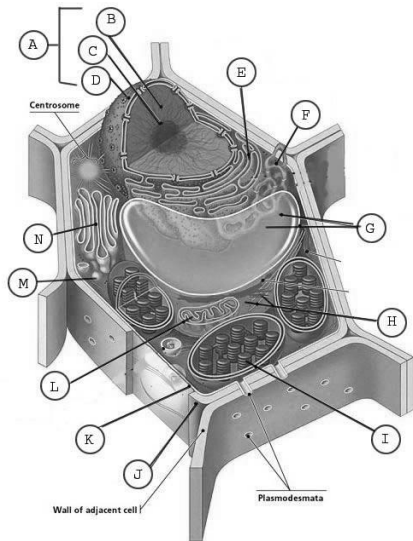
Complete the chart. Also give the letter or number of the part as seen in the diagrams below.

Cell Part	Letter	Structure Description	Function
Nucleus			
Plasma Membrane			
Cell wall			
Mitochondria			
Vacuoles			
Chloroplasts			
Ribosomes			

Which cell is the plant cell (left or right)?

Which structures are found only in the plant cell?

Which structures are found only in the animal cell?



1.1.2 Compare prokaryotic and eukaryotic cells in terms of their general structures and degree of complexity

Compare the following two types of cells:

	Prokaryotic	Eukaryotic
Membrane-bound organelles		
Ribosomes		
Types of chromosomes		
size		

1.1.3 Explain how instructions in DNA lead to cell differentiation and result in cells specialized to perform specific functions in multicellular organisms.

The diagram shows a variety of cells from the human body:

Label these cells (red blood cell, sperm cell, white blood cell, muscle cell, nerve cell)

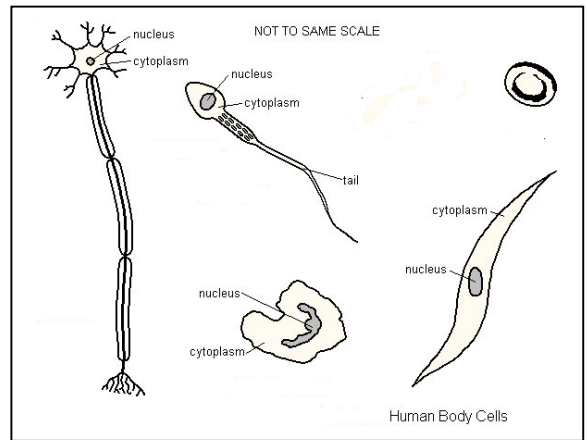
Which cell is adapted for movement?
 What structure makes this movement possible?
 What organelle is very plentiful in these cells in order to provide the energy for movement?

Which cell has no nucleus? What is the function of this cell?

Which cell is involved in the immune system?

Which cell helps in movement of bones?

Which cell is adapted for transmitting messages?



Microscope Use:

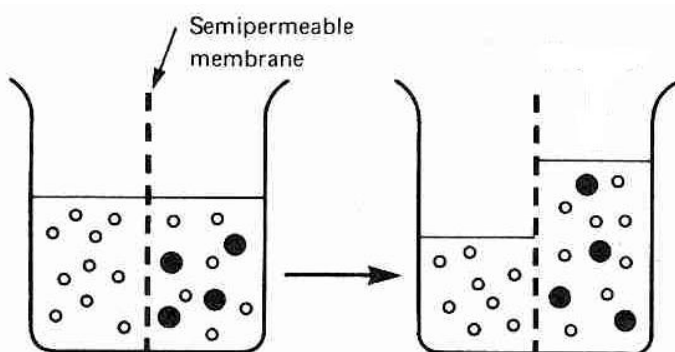
How do you determine total magnification of a microscope?

Calculate magnification if the ocular (eyepiece) is 10x and the objective is 40x.

Put the following in order from smallest to largest:

Organ systems Cells Organs Tissues

1.2.1 Explain how homeostasis is maintained in a cell and within an organism in various environments



Explain what has happened in the diagram to the right.

Why did the large dark molecules NOT move to the left?

How is the semipermeable membrane like a cell membrane?

If the dark molecule is starch, where is the starch concentration greatest (left or right)?

If the white molecule is water, where is the water concentration greatest at first?

In osmosis, water moves from an area of _____ to an area of _____ concentration.

If the dark molecules could move, in what direction would they move? Why?

In diffusion, molecules move from an area of _____ to an area of _____ concentration.

Draw arrows to show which way **water** will move in each of the following situations:

- Salt inside the cell = 65% and outside the cell 40%.
- Sugar inside the cell 27% and outside 80%.

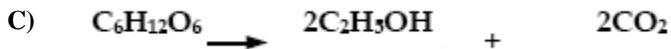
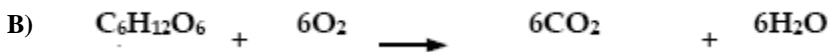
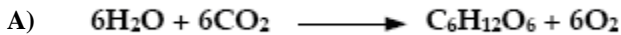
What is homeostasis?

How do cells maintain homeostasis: Consider pH, temperature, blood glucose, water balance
Comparison of active and passive transport

	PASSIVE TRANSPORT	ACTIVE TRANSPORT
Requires energy?		
Low to high concentration or high to low concentration?		
Examples		

4.2.1 Analyze photosynthesis and cellular respiration in terms of how energy is stored, released, and transferred within and between these systems.

Label the following molecules in these equations (water, glucose, oxygen, carbon dioxide, ethyl alcohol)



Which of the above reactions is photosynthesis?

Which of the above reactions is fermentation (anaerobic cellular respiration)?

Which of the above reactions is cellular respiration (aerobic)?

Which reaction(s) requires or stores energy?

Which reaction(s) release energy (ATP)?

Which reaction releases the most energy?

Why?

Which reaction requires chlorophyll?

What is the purpose of the chlorophyll?

Which organisms carry out process A?

Which organisms carry out process B?

Which organisms carry out process C?

Which process uses chloroplasts in eukaryotes?

Which process uses mitochondria in eukaryotes?

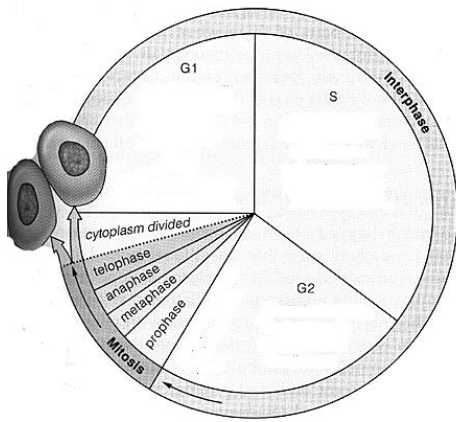
What factors could speed up (or slow down) process A?

What factors could speed up (or slow down) process B?

What factors could speed up (or slow down) process C?

1.2.2 Analyze how cells grow and reproduce in terms of interphase, mitosis, and cytokinesis.

Cell Cycle:

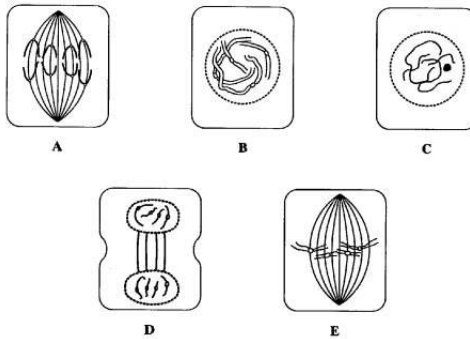


When does the duplication of DNA occur? What is this phase called?

What do G1 and G2 represent?

Does mitosis include cytokinesis (division of the cytoplasm)?

Put the following stages of mitosis (cell division) in order.



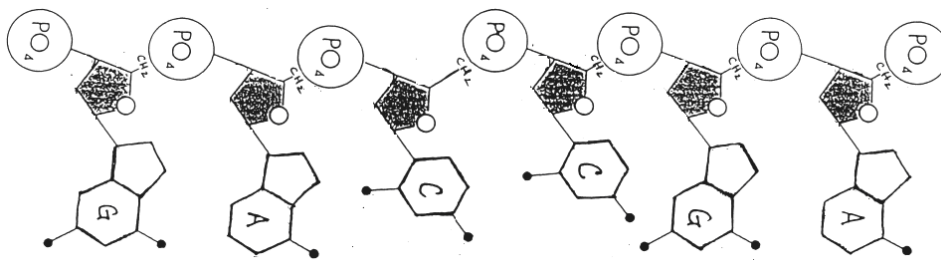
3.1.1 Explain the double-stranded, complementary nature of DNA as related to its function in the cell.

Below is a strand of DNA. DNA in the cells exists as a double helix .

What else needs to be added to this strand to make it a double helix? Give the nucleotide sequence.

What are the black pentagons?

Where are the nitrogen bases?



Compare RNA and DNA in the following table:

	RNA	DNA
Sugars		
Bases		
Strands		
Where In Cell		
Function		

What kind of weak bonds hold the two strands of DNA together?

Why is it important that these bonds be weak?

3.1.2 Explain how DNA and RNA code for proteins and determine traits.

If the strand of DNA above undergoes transcription, what will the sequence of the mRNA be?

		2nd base in codon				
		U	C	A	G	
1st base in codon	U	Phe Phe Leu Leu	Ser Ser Ser Ser	Tyr Tyr STOP STOP	Cys Cys STOP Trp	U C A G
	C	Leu Leu Leu Leu	Pro Pro Pro Pro	His His Gln Gln	Arg Arg Arg Arg	U C A G
	A	Ile Ile Ile Met	Thr Thr Thr Thr	Asn Asn Lys Lys	Ser Ser Arg Arg	U C A G
	G	Val Val Val Val	Ala Ala Ala Ala	Asp Asp Glu Glu	Gly Gly Gly Gly	U C A G

After translation, what would the amino acid sequence be for this section of mRNA? (read from right to left)

What is a codon?

What kind of bonds holds the amino acids together in the protein that is formed?

What are the three types of RNA and what are their functions?

- 1)
- 2)
- 3)

Describe how proteins code for traits (remember the Alien DNA activity).

3.1.3 Explain how mutations in DNA that result from interactions with the environment (i.e. radiation and chemicals) or new combinations in existing genes lead to changes in function and phenotype.

What happens to DNA when a mutation occurs?

How do mutations affect the proteins that are formed?

Name the 2 types of mutations. Which type is likely to have a greater impact?

3.2.1 Explain the role of meiosis in sexual reproduction and genetic variation.

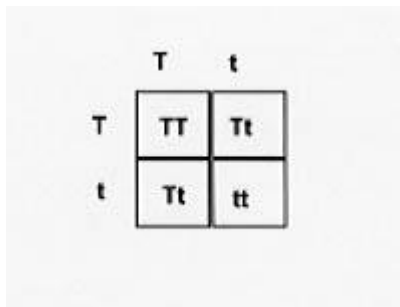
	MITOSIS	MEIOSIS
Type of reproduction (Asexual or sexual)		
Chromosome number of mother cell (1N=haploid or 2N=diploid)		
Chromosome number of daughter cells (1N=haploid or 2N=diploid)		
Number of cell divisions		
Number of cells produced		
When does replication happen?		

Explain each source of genetic variation.

This diagram shows a diploid cell with two pairs of homologous chromosomes. Due to independent assortment, what is the possible genetic make up of the gametes

SOURCES OF VARIATION	Description
Crossing over	
Random assortment of chromosomes	
Gene mutations	
Nondisjunction	
Fertilization	

3.2.2 Predict offspring ratios based on a variety of inheritance patterns (Mendelian/dominance, incomplete dominance, co-dominance, sex-linked, and multiple alleles)



In the Punnett square to the left, T = tall and t=short. Give the genotype for the parents.

Give the phenotype for the parents.

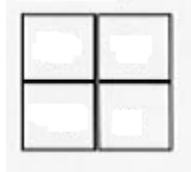
What are the genotypes and phenotypes of the offspring?

What is the genotypic ratio of the offspring?

What is the phenotypic ratio of the offspring?

What environmental factors might affect the expression of these genes for height? Explain.

Some genes produce intermediate phenotypes. Cross a pure breeding red flower (RR) with a pure breeding white flower (R'R'). Give the genotypes and phenotypes of the offspring.



Explain the inheritance of the following disorders: (autosomal or sex-linked / dominant or recessive)

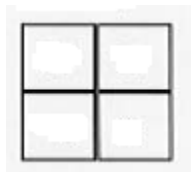
Sickle cell anemia:

Cystic fibrosis:

Huntington Disease:

Blood type

If a woman with type A blood has a child with a man with type B blood and their first child has type O blood, give the genotypes of the woman and the man and do the cross. (Alleles are I^A, I^B, and i)



What are the odds that they will have a child with type O blood again?

What are the odds that they will have a child with homozygous type A blood?

What are the odds that they will have a child with type AB blood?

Polygenic traits

Some traits are considered to be polygenic. What does this mean?

Sketch a graph that shows the phenotype outcome of a polygenic trait.

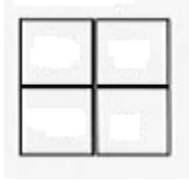
Sex Chromosomes

What are the male sex chromosomes in humans?

What are the female sex chromosomes in humans?

Colorblindness and hemophilia are sex-linked traits. What chromosome are these genes found on?

Cross a female who is a carrier for hemophilia with a normal male.



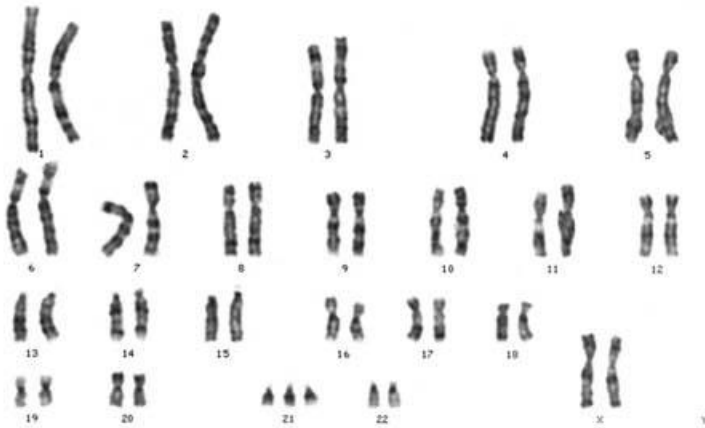
What are the odds that they will have a child with hemophilia?

What are the odds that they will have a daughter with hemophilia?

What are the odds that they will have a daughter who is a carrier for hemophilia?

Why are males more likely to show a sex-linked disorder?

Karyotype



What is the gender of the person whose karyotype is shown to the left?

What is the disorder that this person has? What is your evidence?

What are some of the characteristics of this disorder?

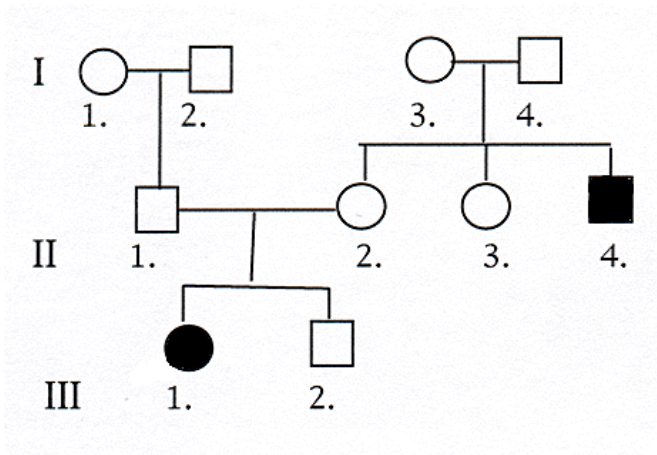
Pedigrees

What is the inheritance pattern shown by this pedigree?

How do you know?

Using A,a, what is the genotype of person II4?

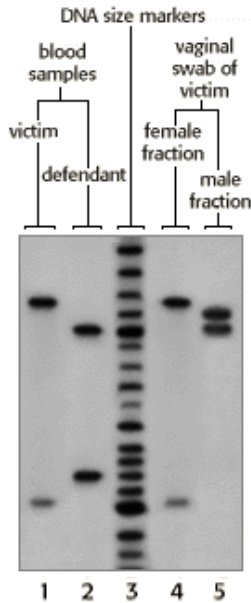
What is the genotype of person I3?



3.2.3 Explain how the environment can influence the expression of genetic traits

Below is a table including examples of disorders or diseases that are caused by a combination of genetics and the environment. For each effect, please check whether the disorder is caused by genetics, or the environment, or both. Please also include a description.

“Effect”	Genetics?	Environment?	Description
Lung/Mouth Cancer			
Skin Cancer			
Diabetes			
PKU			
Heart Disease			



3.3.1 Interpret how DNA is used for comparison and identification of organisms.

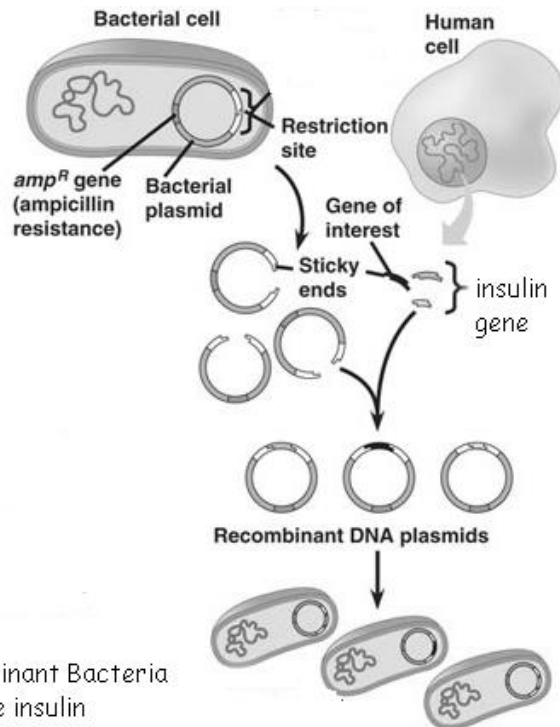
To the left is an electrophoresis gel, showing evidence from a rape case.

Could the defendant be the rapist? Explain your answer.

Which fragments of DNA are the longest? Explain.

What other ways can DNA fingerprinting be useful?

3.3.2 Summarize how transgenic organisms are engineered to benefit society.



Describe the process that is shown in the diagram to the left.

What is the value of this technology?

What are some other applications of this type of technology?

This process can be used to make GMO's –genetically modified organisms. What are some of the ethical issues surrounding this technology?

Recombinant Bacteria produce insulin

3.3.3 Evaluate some of the ethical issues surrounding the use of DNA technology (including cloning, genetically modified organisms, stem cell research, and Human Genome Project)

What were the goals of the human genome project established?

How will the human genome project be useful in determining whether individuals may carry genes for genetic conditions?

How will the human genome project be useful in developing gene therapies?

Why might cloning be controversial?

Embryological stem cells are more controversial than adult stem cells. Where are embryonic stem cells obtained from?

3.4.1 Explain how fossil, biochemical, and anatomical evidence support the theory of evolution.

What did Louis Pasteur contribute to our understanding of the origins of life?

Explain Miller and Urey's hypothesis (pictured).

Why did Miller and Urey put those particular gases into their experiment?

What type of organic molecules did they find?

What is the significance of their experiments?

Most hypotheses state that prokaryotic anaerobes probably evolved first. Why?

The hypotheses then suggest that prokaryotic autotrophs probably evolved? Why?

What would enter the atmosphere as a result of these autotrophs appearing.

Then prokaryotic aerobic heterotrophs could evolve. What can these cells do that others before them cannot?

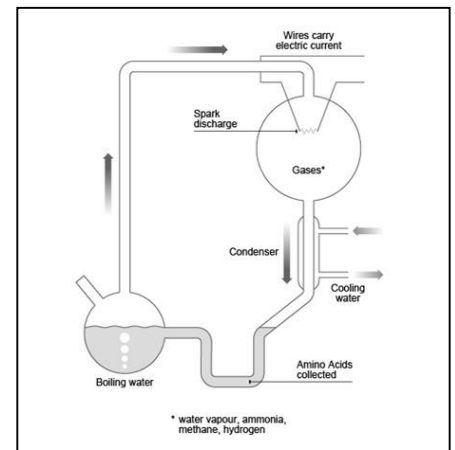
What is the hypothesis explaining how eukaryotic cells evolved?

Describe what fossil evidence can tell us about organisms.

Compare the two types of fossil dating:

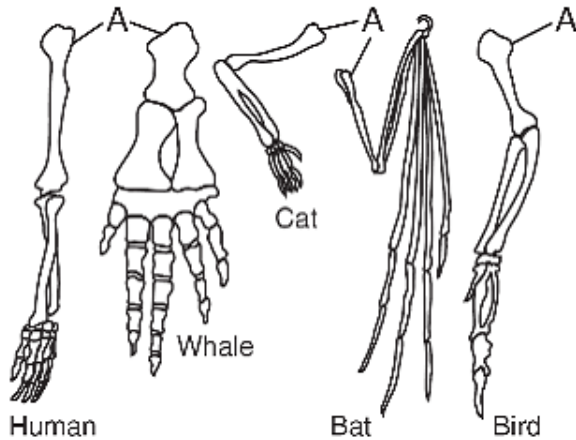
Relative dating:

Absolute dating:



How do the following pieces of evidence support the theory of evolution? What does it tell us about the organisms?

Anatomical structures:



Biochemical evidence:

Species	Sequence of Amino Acids in the Same Part of the Hemoglobin Molecules
Human	Lys-Glu-His-Iso
Horse	Arg-Lys-His-Lys
Gorilla	Lys-Glu-His-Lys
Chimpanzee	Lys-Glu-His-Iso
Zebra	Arg-Lys-His-Arg

3.4.2 Explain how natural selection influences the changes in species over time.

Discuss the steps in Darwin’s theory of evolution by natural selection.

- 1) Populations of organisms have many genetic variations. Where do these come from?
- 2) Organisms could reproduce exponentially but they don’t. Why not?
- 3) Genetic variations lead to different adaptations. What are adaptations?
- 4) Some adaptations have better survival value in certain environments. What does this mean?
- 5) Those organisms with adaptations that better fit them to an environment will survive, reproduce and pass on their genes. What does it mean to be “fit” to an environment?
- 6) The next population will have a high frequency of the genes that have been selected for. Why will the frequency of selected genes increase?
- 7) When this process continues over millions of years, it can lead to speciation. What is speciation?

3.4.3 Explain how various disease agents (bacteria, viruses, chemicals) can influence natural selection.

Describe how a population of bacteria can become resistant to an antibiotic (or an insect to a pesticide) using the steps listed above.

Explain why new flu vaccinations must be developed each year.

Are vaccinations examples of active or passive immunity? Why?

Explain the relationship between sickle cell anemia and malaria.

3.5.1 Explain the historical development and changing nature of the classification systems.

Explain how the organization of the kingdoms and domains has changed over time.

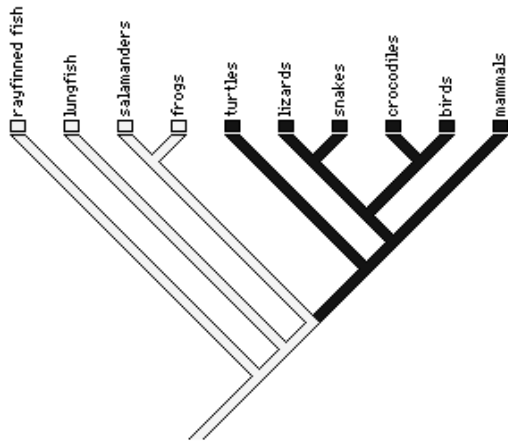
What is the current accepted kingdom-domain system?

What is the current seven-level classification system?

What is binomial nomenclature?

How are DNA and biochemical analysis, embryology, and morphology used to classify organisms?

3.5.2 Analyze the classification of organisms according to their evolutionary relationship (including dichotomous keys and phylogenetic trees)



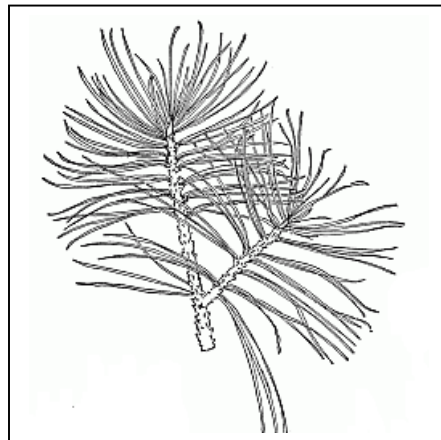
To the left is a phylogenetic tree of some organisms. According to this tree, which pairs of organisms are most closely related?

Which organism is most closely related to the rayfinned fish?

Which organisms are the mammals most closely related to?

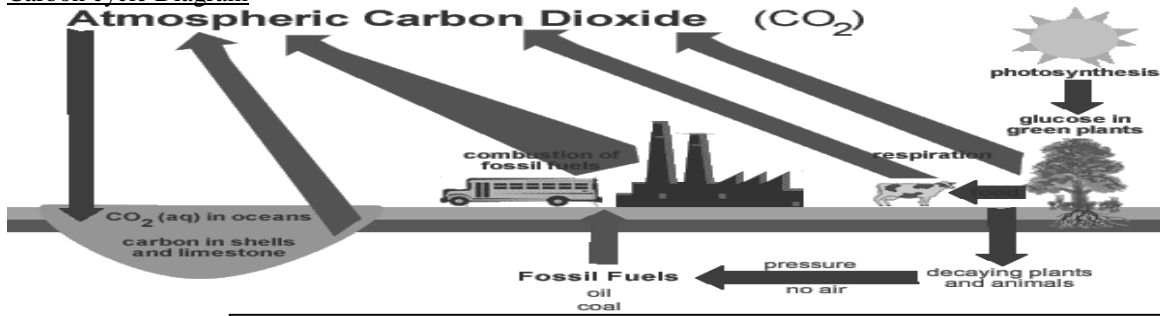
Use the following key to identify the tree branch.

1. a. leaf is needle-like....go to 2
b. leaf is broad..... go to 5
2. a. needles are shortgo to 3
b. needles are long.....go to 4
3. a. underside of needles green...Hemlock
b. underside of needles silver ..Balsam
4. a. 3 needles in bundle....Pitch Pine
b. 5 needles in bundle....White Pine
5. a. edge of leaf round...go to 6
b. edge of leaf serrated...go to 7
6. a. minty odor..... Wintergreen
b. no minty odor.....Laurel



2.1.1 Analyze the flow of energy and cycling of matter (such as water, carbon, nitrogen, and oxygen) through ecosystems relating them to the health and stability of an ecosystem.

Carbon cycle Diagram



Which process(es) put carbon dioxide into the atmosphere?

Which process(es) take carbon dioxide out of the atmosphere?

Explain the Greenhouse Effect in relationship to carbon dioxide in the atmosphere.

What effect might increased atmospheric carbon dioxide have on the environment?

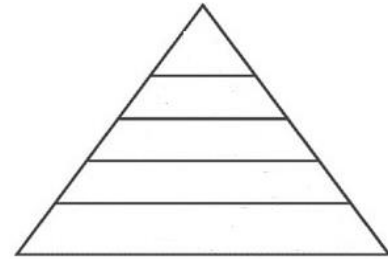
Food Webs

Create an energy pyramid from the food chain: leaves → insects → birds → red fox → bear

Where is the most energy in this pyramid? Where is the least energy?

What happens to energy as it moves through the food chain/web?

Assume there are 10,000 kcal of energy in the leaves? Estimate the amount of energy in each of the other levels



2.1.3 Explain various ways organisms interact with each other (including predation, competition, parasitism, mutualism) and with their environments resulting in stability within ecosystems.

Symbiosis

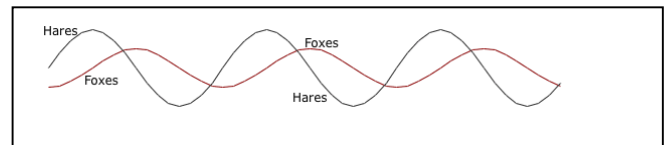
Relationship	Definition	Example
Mutualism		
Commensalism		
Parasitism		

Predator-Prey

In the graph, which organism is the prey? Which is the predator?

Which population increases (or falls) first and why?

Which population increases (or falls) second and why?

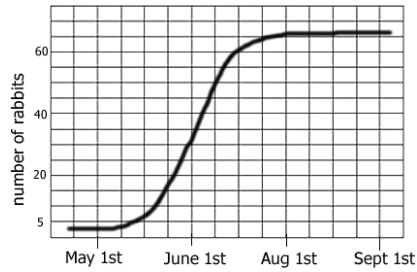


2.1.4 Explain why ecosystems can be relatively stable over hundreds or thousands of years, although populations fluctuate.

Graph 1: Rabbits Over Time

What kind of growth curve is shown?

What is the carrying capacity for rabbits?



During what month were rabbits in exponential growth?

Graph 2: Mexico and US

In Mexico, what percentage of the population is between 0-4 years of age?

In the US?

Which population is growing the fastest?

Which age group has the smallest number in both countries?

