Go With the Flow

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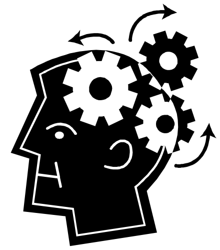
GOALS & OBJECTIVES

"Go With The Flow"
incorporates teaching strategies that are designed to:



- involve students in investigation and discovery activities
- require students to use analysis skills

- welcome curiosity
- encourage questioning
- reward creativity

- use a team approach and

  emphasize team learning

- provide experience in using laboratory instruments

- promote clear and effective oral and written communication

- advocate the use of technology as a resource tool
- integrate mathematics and science.

LESSON PLAN

Title: Biology/Life Science: *Go With The Flow!*

Subject(s): Science

Course(s): Biology, Comprehensive Science 1, Comprehensive Science 2, Comprehensive Science 3

Grade level(s): Grade 6, Grade 7, Grade 8, Secondary

Length: 8 Hour(s)

Florida Standards:

*<u>**SC.F.1.** (FL - SC.F. Processes of Life)</u> The student describes patterns of structure and function in living things.

*<u>**. . SC.F.1.4.1.** (FL - SC.F. Processes of Life)</u> knows that the body processes involve specific biochemical reactions governed by biochemical principles.

*<u>**. . SC.F.1.4.4.** (FL - SC.F. Processes of Life)</u> understands that biological systems obey the same laws of conservation as physical systems.

*<u>**SC.H.1.** (FL - SC.H. The Nature of Science)</u> The student uses the scientific processes and habits of mind to solve problems.

*<u>**. . SC.H.1.3.4.** (FL - SC.H. The Nature of Science)</u> knows that accurate record keeping openness and replication are essential to maintaining an investigator's credibility with other scientists and society.

*<u>**. . SC.H.1.3.5.** (FL - SC.H. The Nature of Science)</u> knows that a change in one or more variables may alter the outcome of an investigation.

*<u>**. . SC.H.1.4.1.** (FL - SC.H. The Nature of Science)</u> knows that investigations are conducted to explore new phenomena to check on previous results to test how well a theory predicts and to compare different theories.

*<u>**SC.H.2.** (FL - SC.H. The Nature of Science)</u> The student understands that most natural events occur in comprehensible consistent patterns.

*<u>**. . SC.H.2.3.1.** (FL - SC.H. The Nature of Science)</u> recognizes that patterns exist within and across systems.

*<u>**. . SC.H.2.4.1.** (FL - SC.H. The Nature of Science)</u> knows that scientists assume that the universe is a vast system in which basic rules exist that may range from very simple to extremely complex but that scientists operate on the belief that the rules can be discovered by careful systemic study.

*<u>**SC.A.1.** (FL - SC.A. The Nature of Matter)</u> The student understands that all matter has observable measurable properties.

*<u>**. . SC.A.1.3.5.** (FL - SC.A. The Nature of Matter)</u> knows the difference between a physical change in a substance (i.e. altering the shape form volume or density) and a chemical change (i.e. producing new substances with different characteristics).

*__. . SC.A.1.4.4.__ (FL - SC.A. The Nature of Matter) experiments and determines that the rates of reaction among atoms and molecules depend on the concentration pressure and temperature of the reactants and the presence or absence of catalysts.

Abstract:
A cell membrane functions as a gateway through which chemical substances and small particles may enter or leave a cell. These substances move through the membrane by physical processes, such as diffusion, osmosis, dialysis, and filtration, or by physiological processes, such as active transport, phagocytosis and pinocytosis. Within this lesson are several activities exploring these concepts.

Products:
Graphic
Reports
Group Project
Other

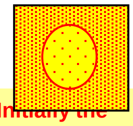
Pre-Assessment Strategies:
Background Knowledge

Technology-based Activity(ies):
Word Processing

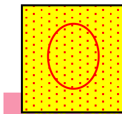
Action Plan:
These activities are not in any set order.
They may be presented as

- Teacher demonstration
- Fishbowl presentation
- Lab activity

Go With The Flow!, is a compilation of activities that engage students in the exploration of the basic principles of diffusion and osmosis. This is accomplished through investigative collaborative learning activities.
All cells must be capable of taking in nutrients and eliminating wastes. Several processes are involved in the transportation of materials across cell membranes, but none is more important than the process of **diffusion**. Knowledge about diffusion is the key to understanding how the lungs and blood system work, as well as the many forms of transport, especially in lower animals and plants.

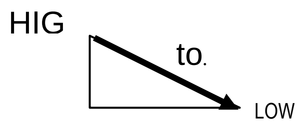


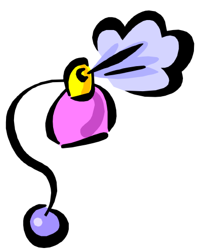
Initially the concentration of particles is greater outside the cell than inside



Over a period of time, the substance has diffused into the cell so that the concentration inside and outside the cell is equal.

Diffusion is a type of passive transport in which no energy is expended. It is the random movement of particles (molecules, atoms, ions) from a region of high concentration to a region of lower concentration. Diffusion always follows this concentration gradient…. from





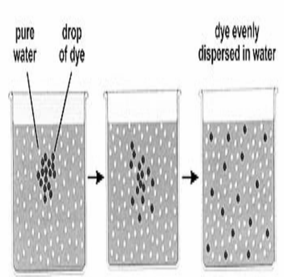
You are in a large (10 ft x 10 ft x10 ft) elevator. An obnoxious individual with a lit cigar gets on at the third floor with the cigar still burning. You are also unfortunate enough to be in a very tall building and the person says "Hey we're both going to the 62nd floor!" Disliking smoke you move to the farthest corner you can. Eventually you are unable to escape the smoke! This is an example of diffusion in action! The nearer one is to the source, the greater the concentration of a given substance. You probably experience this when someone arrives freshly doused in perfume or cologne, especially the cheap stuff. Not only does the process of diffusion explain the aroma of a cut onion permeating the entire room but it is also the process, which enables oxygen and carbon dioxide to enter and leave red blood cells.

The rate of diffusion is dependent upon the temperature and the size of the particles. An increase in temperature causes an increase in kinetic energy. The particles will move around more rapidly, thus diffusing at a faster rate. Which 'diffuses' into your ice tea quicker: a solid cube of sugar or granulated sugar? Instinctively you answered, "granulated sugar"! Diffusion also occurs faster with an increase in surface area, i.e. particle size, smaller particles diffuse faster than larger ones.

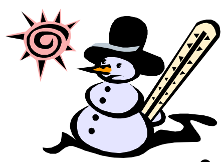
Osmosis is a special type of diffusion. It is the diffusion of water. As with diffusion, osmosis occurs when the concentrations of solutions on either side of a permeable membrane are not equal. Water will flow from its highest concentration to its lower concentration. Osmosis is responsibility for natural phenomenon such as a tomato plant standing upright or getting 'frog's fingers' when one stays in a bath for to long a time.

Activities provided in *Go With The Flow!,* allows students to investigate the properties of diffusion and osmosis through hands-on, minds-on experimentation and witness the relevancy of science through experience.

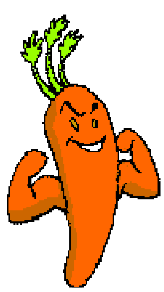
- **Osmosis:Eggactly** is an exploration in which students use eggs as a model of a typical cell to observe the processes of diffusion and osmosis. Using vinegar, students will dissolve the shell of an egg. Once the shell has been removed, the students will make tactile observations of their 'cells'. They identify variables, describe the relationship between variables, measure and observe the changes in the mass and circumference of eggs.

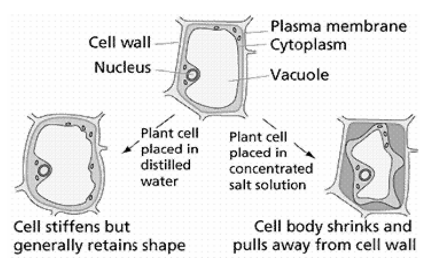


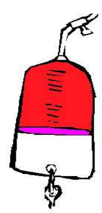
- **It's in the Bag** is an investigation in which students will use a plastic bag to simulate the selectively permeable membrane of a cell. They will observe how a membrane influences the process of diffusion. Baggies© brand plastic bags may be used as an alternative to dialysis tubing.



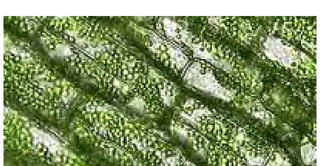
- **Factors Affecting Diffusion** identifies several factors, which influence the rate of diffusion. Students will investigate the factors affecting the rate at which various substances diffuse.
    - o Gas diffusing into a gas: Placing Vanilla Extract into a balloon and determining the rate of diffusion
    - o Solid diffusing into a liquid: Solid potassium permanganate into both hot and cold water
    - o Liquid diffusing into a liquid: Food coloring dissolving in hot and cold water
- In **Awesome Osmosis** students investigate the process of osmosis by observing the turgor (how firm or limp the carrot appears) pressure of carrots as influenced by different solutions after a 24 hour period of time.







- In **Osmosis starring in "What's my Tonicity"**, students will collect quantitative data while investigating the process of osmosis. Students will simulate what would happen if incorrect solutions (not isotonic to the organism) are given to organisms, i.e. hypotonic or hypertonic. They will determine a relationship between tonicity and mass gain or loss.
- In the activity ***Elodea* and Osmosis**, Students explore the effect of hypertonic and hypotonic



solutions on a living organism, i.e. *elodea,* an aquatic plant. Through the use of a microscope students will view the process of osmosis as the individual cells swell or shrink. Students will witness the importance of osmosis and diffusion to their daily lives

COMPARING RAW EGG TO ONE TREATED WITH VINEGAR

OSMOSIS: EGGACTLY

OBJECTIVE:

Students will use eggs as a model of a typical cell to observe the processes of diffusion and osmosis. They will:

- identify variables and describe relationships between them.
- measure and observe the changes in the mass and size of eggs.

MATERIALS:/group

3-400 mL beakers or clear plastic cups
corn syrup
distilled water
balance
meter stick/tape measure
vinegar
25 % salt water solution
eggs
100 mL graduated cylinder
aluminum foil

PROCEDURE:

1. Place 3 eggs into a beaker of vinegar. Make sure that all the eggs are covered with the vinegar. (Note each egg may also be placed into it's own cup and then covered with vinegar)
2. Record your observations in Data Table 1 every day for 3 days.
3. On day 2, pour off the vinegar and add 'fresh' vinegar so that the eggs are completely covered.
4. Let the eggs remain in the beaker for 3 days until the outer shell is dissolved.
5. Remove the eggs from the vinegar. Rinse with water. (If necessary, on the 3rd day, with your thumb **gently** rub the remaining shell off of the eggs under running water if necessary.)Make tactile observations and record in Data Table 2.
6. Determine the mass and circumference of each egg. Record in your data table.
7. Place each egg into a separate beaker and cover one with 150mL of distilled water, another with 150 mL of corn syrup, and the last one with 150 mL of a 25% salt water solution. Tightly cover the beaker with aluminum foil.
8. Daily remove the eggs. Determine mass and circumference and record in the data table.
9. On the 5th day of the experiment, take final measurements: mass, circumference, and final volume of liquid and record in Data Table 2.
10. Clean up all your materials. Dispose of eggs according to your teacher's instructions.

RESULTS

Data Table 1:Observations of Eggs and Vinegar

DAY	1	2	3
Observation of Egg in Vinegar			
Tactile Observations			

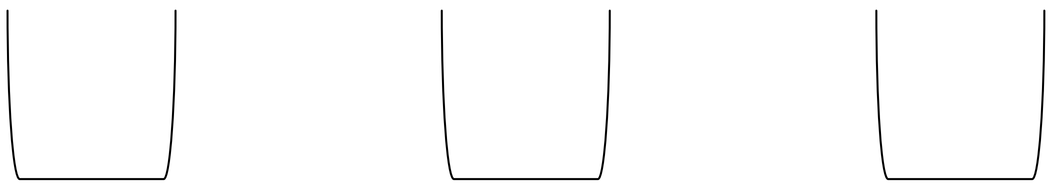
Data Table 2: Daily Observations of Eggs in different solutions

Solution	Mass(g)			Circumference (cm)			Volume of Liquids(mL)		Difference in Volume (mL)
	Day 3	Day 4	Day 5	Day 3	Day 4	Day 5	Day 3	Day 5	
Distilled water									
Corn syrup									
Salt water									

ANALYSIS:

1. Look at your observations for days 1-3, where did the shell go?
2. Why were you instructed to replace the vinegar on day 2?
3. Which egg circumference is the largest? Why?
4. Which egg circumference is the smallest? Why?
5. Examine the difference in volume data, which solution gained the most amount water? Which solution gained the least amount of water? Relate the change in mass of the egg to this data.
6. Could the egg represent a model of a cell with a cell membrane? Explain your reasoning.
7. Why does the lady next door use table salt to kill the weeds in the driveway cracks?
8. After sprinkling sugar on top of a grapefruit, a 'syrup' forms on top. Explain?

9. Draw a picture of each of the 3 beakers, their solutions, and eggs. Use arrows to indicate the flow of water either into or out of the egg.



10. Explain how this experiment is illustrating the principles of diffusion and osmosis.

Teacher Notes:

- While rubbing the shell off of the egg, some students may break their eggs, therefore prepare a few extra eggs or allow groups to share data.
- The shell, calcium carbonate and vinegar (acetic acid) react, in a double replacement reaction. Carbon dioxide gas is being formed, as is calcium acetate, and water.
- The corn syrup forms a hypertonic solution. The egg circumference will decrease; the volume of the liquid in the cup should increase.
- The water is a hypotonic solution. The egg circumference will increase. The volume of the liquid in the cup should decrease.
- The salt water solution should be close to being isotonic. No change should be observed.

Name
Period Date

DIALYSIS: MOVEMENT THROUGH A SELECTIVELY PERMEABLE MEMBRANE

OBJECTIVE:

Students will use dialysis tubing to model and demonstrate diffusion.

Materials

dialysis tubing (Baggies © brand plastic bags provide a less expensive alternative)
Soluble starch (or use liquid starch found in laundry aisle of market)

Iodine solution	dental floss
salt water solution	400 mL beaker
0.1M silver nitrate solution (AgNO3)****	scissors
graduated cylinder	2 eye droppers
2 small test tubes	goggles

****be careful not to get on anything as it will **stain** it black

Observations:

Put on safety glasses.

1. Describe the appearance of:
    a. the iodine (or IKI) solution

    b. the starch solution

    c. the salt water solution

2. Place 20 drops of starch into a test tube. Place 20 drops of water into another test tube. Add 3-5 drops of iodine to each test tube.
3. Record your results

If the color of the solution changes to blue-black, then starch is present.

4. Place 20 drops of salt water into a test tube. Place 20 drops of water into another test tube. Add 3-5 drops of silver nitrate to each test tube.
5. Record your results

If a precipitate forms, i.e., the solution turns cloudy, then salt is present.

PROCEDURE

1. Cut a piece of dialysis tubing approximately 7 cm long. Soak it in water for a few minutes. Using your thumb and forefinger, rub the tubing between the two fingers until it 'opens'.
2. Seal one end the dialysis tubing by tying it off with dental floss.

3. Carefully, place 10mL of the starch solution and 10 ml of the salt water solution into the dialysis tubing and seal tightly with dental floss. *Make sure that all of the air has been removed before sealing. Rinse the sealed tubing with water to ensure that none of the salt or starch solution is present on the outside of the bag.*
4. Immerse the filled dialysis tubing into a 400 mL beaker containing distilled water. Allow the tubing to remain in the distilled water for at least 20 minutes.
5. After 20 minutes remove some of the water from the beaker and test for the presence of starch and salt. Refer to the Observations Section for the way to test for these substances.

Substance	Starch	Salt
Present in Beaker water (+ or -)		

6. Place some iodine solution into the beaker water and allow it to remain for at least 5 minutes.
7. Record your observations below

ANALYSIS

1. How might the dialysis tubing be like a cell?
2. Which substance/s moved out of the tubing and into the beaker water? Provide evidence for your answer.
3. Which substance/s remained inside of the tubing? Provide evidence for your answer.
4. What substance/s moved from the beaker water into the tubing? Provide evidence for your answer.
5. What part of the cell is the tubing like?
6. Suggest a plausible reason as to why a substance may of may not be able to move out of the tubing.
7. Was this a demonstration of osmosis or diffusion?
8. Relate this activity to a dialysis machine used by a kidney patient.

Below are some sites that may help you understand kidney failure and dialysis.

- http://www.coolware.com/health/medical_reporter/kidney2.html
- http://www.emh.org/services/emhdialysis.htm
- http://www.kidney.org/general/news/african-american.cfm

Teacher Notes:

- The dialysis tubing acts like the selectively permeable membrane of the cell. Starch is too large a molecule for it to pass through the membrane, while both salt (NaCl) and iodine (IKI-iodine potassium0iodine) solution will.
- An interesting extension may be for students to predict from a list which substances will pass through the membrane and which will not. Remember that you must have a way to test to see if the substance passes through, e.g. Glucose will pass through (you can use Benedicts test or a glucose strip); protein will not pass through (use a commercial protein strip test)

Factors Affecting the Rate of Diffusion

OBJECTIVES:

- Students will form hypothesis and observe demonstrations of particle movement.
- Students will identify variables and describe relationships in simulations of particle movement.

MATERIALS

3 – 600 mL beakers	3 finger bowls
hot plate	stop watch
pippette	vanilla or peppermint extract
matches	balloons
potassium permanganate $KMnO_4$	water
ice cubes	magnetic stirrer
glass stirring rod	food coloring
thermometer	tweezers
safety googles	graph paper
polar coordinate graph paper	

(circular go to http://www.mathematicshelpcentral.com/graph_paper.htm to download a graph paper program)

<u>Demonstration A:</u> Diffusion of a Gas in a Gas

1. Using a pipette, have the teacher place 4-5 drops of vanilla/peppermint extract into a balloon.
2. Repeat for a total of 1 balloon/ row.
3. Have a student blow up, tie, and place each balloon at the beginning of each row in the front of the room.
4. Each student should record his/her distance from the balloon at the front of his/her row in meters and his/her observations in PART A of the Analysis.
5. Each student will raise his/her hand as soon as his/her smell the vanilla.
6. For the next 15 minutes students will record:
    a. the time when they first begin to smell the vanilla
    b. the time when their neighbors directly in front of them, to their left, right, and behind them raise their hand to indicate that they smell the vanilla.
    c. their neighbors' distances from the balloons. (ask them for their data)
    d. the time when the smell becomes the strongest to you
    e. the time when the smell remains the same strength to you, or you no longer 'smell' it
7. Record in your data table the time and distance that the vanilla was first smelled from the students sitting in the first seat of your row and the last seat of your row.

<u>Demonstration B:</u> Diffusion of a Liquid in a Liquid

1. Pour equal amounts of water into 3 beakers. One beaker is at room temperature, one beaker is set on a magnetic stirrer (drop the magnetic stirring bar into the beaker), and the third beaker of water has been heated on a hot plate.
2. Write a hypothesis concerning the amount of time it will take for the coloring to become evenly and completely diffused in each beaker. Record in PART B.
3. Equal amounts of food coloring are added to each beaker.
4. Time each beaker until the food coloring is completely diffused.
5. Turn the hot plate on, turn the magnetic stirrer on)

6. Record findings, and state a conclusion in PART B.

<u>Experimentation C:</u> Diffusion of Solid in a Liquid

1. Put on safety goggles.
2. Place a finger bowl in the center of the polar graph paper and trace its outline. Make a total of 3 drawings.
3. Fill one of the finger bowls about half-full with ice, cold water. Fill another about half-full with room-temperature water, and the third about half-full with hot water.
4. Record the temperature of each in the Data Table, in PART C.
5. Center each of the finger bowls on a piece of the graph paper. Have your fingerbowl graph paper drawings next to the you to record the data.
6. Using tweezers, place one crystal of KMnO4 in the center of each finger bowl.
7. Record the time.
8. Make sure that the crystal of KMnO4 lines up with the center of the graph paper. Be careful not to touch the KMnO4.
9. After 5 minutes, mark the farthest distance (cm) KMnO4 has traveled in each bowl. To measure on the polar coordinate graph paper, place a ruler along one of the lines radiating out from the middle. Mark the distance(s) on the fingerbowl graph paper drawings.
10. Repeat this process for a total of 20 minutes, recording the distance every 5 minutes.
11. Record any observations concerning the color, intensity, or shape of the colored region. Your record may include your drawings showing the progression of the potassium permanganate.
12. Pour the water into designated waste containers, rinse the bowls and put away.

Name ______________________________ Period__________ Date ____________

PART A: DIFFUSION OF A GAS IN A GAS

DIFFUSION OF GAS IN GAS OBSERVATIONS

TIME (s)	OBSERVATIONS	DISTANCE FROM BALLOON (m)
a. O	Initial time	
b.	When you first smell the vanilla	
c.	When the smell is the strongest to you	
d.	When the smell remains the same strength to you	
e.	Student to your right	
f.	Student to your left	
g.	Student in front of you	
h.	Student behind you	
i.	Student in first seat of your row	
j.	Student in last seat of your row	

The rate of diffusion can be calculated by using the following formula: $\frac{\text{Distance from balloon (m)}}{\text{Time to travel (s)}}$

1. Use the formula to determine the rate in which the gas diffused to: (Show your work!)

   a. You

   b. Your right neighbor

   c. Your left neighbor

   d. The neighbor in front of you

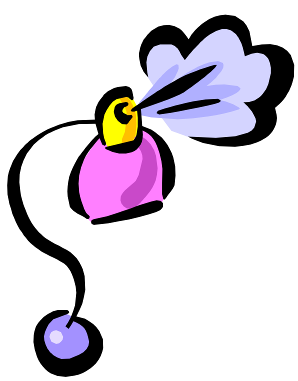
   e. The neighbor behind you

f. The student in the first seat of your row

g. The student in the last seat of your row

2. Identify the:
   a. Independent variable in this activity
   b. Dependent variable in this activity
3. Prepare a graph of the **data (b, e-j).** Remember that the IV is on the X-axis, and the DV is on the Y-axis.
4. Describe the relationship between the rate of diffusion and distance.

5. Compose A one-sentence summary: Diffusion begins with ____________________________ continues with ____and ends with ______________________________.



Name ________________________________Period__________Date ____________

PART B: DIFFUSION OF A LIQUID IN A LIQUID

1. Hypotheses:
   a. Ice, cold water

   b. Room temperature water

   c. Water being stirred

Observations of Diffusion of a Liquid in a Liquid

Substance	Time(s)	Observations
ice, cold water		
room temperature water		
water being stirred		

2. Conclusion:

PART C: DIFFUSION OF SOLID IN A LIQUID

Observations of Diffusion of a Solid in a Liquid

Substance	Initial water Temperature	Distance (cm) after 5 minutes	Distance (cm) after 10 minutes	Distance (cm) after 15 minutes	Distance (cm) after 20 minutes	Observations
ice, cold water						
room temp water						
hot water						

1. Prepare a bar graph to show the maximum distance traveled by the $KMnO_4$ at each temperature in the 20-minute period.
2. At which temperature did the $KMnO_4$ travel the farthest during the 20-minute period?

3. The rate of diffusion is defined as the distance divided by the time. Calculate the rate of diffusion for each of the temperatures,
   Show ALL your work!

   $$\frac{\text{Distance (cm)}}{\text{Time to travel(s)}}$$

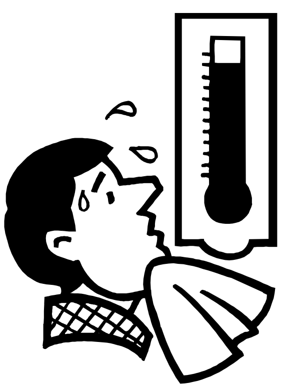
   a. ice, cold

   b. room temp

   c. hot water

4. Based upon your calculations in #4, describe how temperature affects the rate of diffusion.

   a. What causes this effect?



Name______________________ Period_____Date_____

Awesome Osmosis

Procedures for conducting the activity:

Students will investigate the process of osmosis by observing the turgor pressure of carrots as influenced by different solutions.

Materials

- 2- 400 mL beakers
- thread
- salt
- water
- fresh carrots
- graduated cylinder
- ruler
- balance

Student Procedures:

Procedure

1. Examine a carrot. Record your observations: texture, firmness, color, etc.
2. Fill 2 beakers with 250 mL of water.
3. Add 15 g of salt to one of the beakers.
4. Cut the carrot into 2 pieces that will fit easily into the beaker and be totally covered with water.
5. Tightly tie a piece of string 2cm below the cut end of both pieces. Be sure to make a tight knot!
6. Place one carrot piece, the cut end down, into the "Salt Water" beaker.
7. Place the other carrot piece, the cut end down, into the "Fresh Water" beaker.
8. Formulate a hypothesis as to what differences you will observe after 24 hours of immersion in the two different solutions. Record your hypothesis below.
9. Allow the carrots to remain undisturbed for 24 hours.
10. Remove the carrots and examine. Record your observations, including the tightness of the string.

Analysis

Write Your Hypothesis Here:

1. For the conditions of the carrots after 24 hours, Choose either *Fresh water or Salt water* to complete each statement
    1. Loose thread was found in

2. Tight thread was found in
3. Soft texture was observed in
4. Firm texture was observed in
5. Increase in cell size
6. Decrease in cell size
7. Loss of water by cells
8. Gain of water by cells

2. What was the purpose of tying thread on each carrot?

3. In which kind of water did the carrot cells lose water? Provide evidence for your answer.

4. In which kind of water did the carrot cells gain water? Provide evidence for your answer.

5. You want to serve fresh vegetables and dip for your guest, but all you find in your refrigerator is week old, kind of limp carrots and celery. What can you do to try and make your veggies crisper?

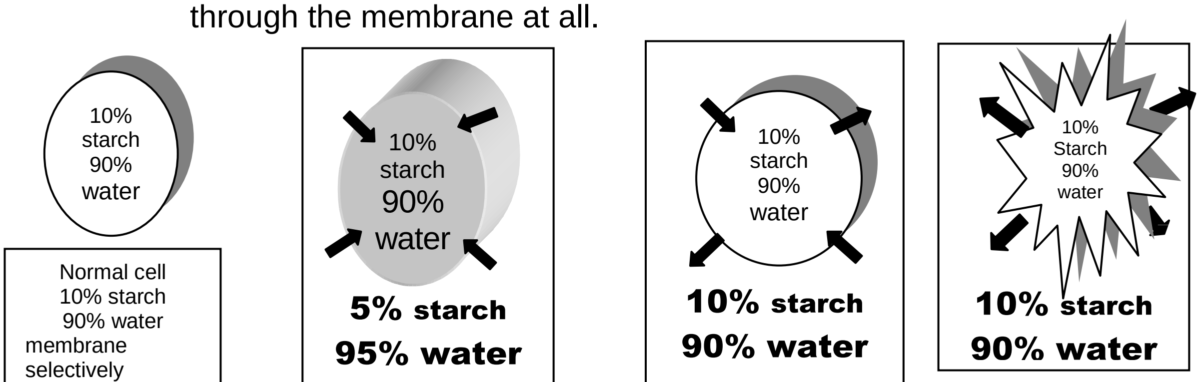
6. Explain how this experiment demonstrates osmosis.

Name____________________________
Period______Date_____________

Osmosis Starring in "Do You Know Your Tonicity?"

OBJECTIVE: Students will collect quantitative data while investigating the process of osmosis. They will determine a relationship between tonicity and mass gain /loss.

BACKGROUND: Osmosis is the movement of a solvent, in the case of living organisms (water), through a selectively permeable membrane. Even though water will move through a membrane in both directions, there may be a net or overall movement in one direction due to differences in solute concentration. Remember that substances will diffuse from an area of higher concentration to lower concentration. If, for instance, a cell is placed in pure distilled water, the concentration of water will be greater outside the cell and less inside the cell; thus, there will be a net movement of water into the cell. Water molecules will move toward the lower concentration of water inside the cell. Because the cell membrane is a porous structure with different sized pores, gasses and water move quickly and substances like glucose, amino acids, and fatty acids move across the membrane slowly. More complex molecules such as proteins, polysaccharides, lipids, and nucleic acids are unable to diffuse through the membrane at all.



Normal cell
10% starch
90% water
membrane selectively permeable, starch may not cross

Hypotonic Solution
The solution outside the cell has a greater concentration of solvent, i.e. water (smaller concentration solute). Water flows into the cell; cell will swell up and may burst

Isotonic Solution
The solution outside the cell is equal to the concentration of solute and solvent inside the cell, water flows into and out of the cell at the same rate

Hypertonic Solution
The solution outside the cell has a smaller concentration of solvent, i.e. water (greater concentration solute). Water flows out the cell; cell will shrivel and shrink

MATERIALS

Dialysis tubing or Baggies© brand plastic bags
100 % starch solution see teacher preparation
50% starch solution
25% starch solution
distilled water
4-600mL beakers
four eye droppers
graduated cylinder
goggles

PROCEDURE:

1. Put on safety goggles.
2. Prepare starch solutions by using the following dilutions (100% = initial concentration; 50% = 10mL water + 10 mL initial starch solution; 25% = 15 mL water + 5 mL initial starch solution)
3. Fill a 100mL beaker with distilled water and place five 8 cm strips of dialysis tubing into the beaker. Wait 5 minutes and gently roll the tubing between your fingers until at least one end of the tubing opens.
4. Tie off one end of the tubing by folding over and using waxed dental floss.
5. Using a clean eyedropper, fill dialysis tubing with the correct solution, tie off the other end firmly.
6. Wipe the bag off with a paper towel and then determine the mass of the filled bag.
7. Fill each bag and beaker according to the following table. Be sure to place each bag into the correct beaker
8. Each bag should be covered completely with its correct solution.

Mass Determinations of Dialysis Tubing

Beaker # / Bag #	Solution in Dialysis Bag	Beaker Water Solution	Initial Mass of Tubing & Solution (g)	Final Mass of Tubing & Solution (g)	Net Change Difference Between Initial – Final Mass (g)
1	100 % starch	Distilled water			
2	Distilled water	100% starch			
3	50% starch	Distilled water			
4	25% starch	Distilled water			
5	Distilled water	Distilled water			

9. Use the principles of osmosis to predict which way the water will move, either **into** or **out** of the bag.

Beaker #1__________ Beaker #2 __________ Beaker#3______________

Beaker # 4 __________ Beaker #5 __________

10. For each beaker, Predict what will happen to each bag. Use

‘+’ to indicate small mass gain

‘++’ for large mass gain

‘- ‘ for small mass loss

‘- -‘ for large mass loss

‘0’ for no change

Beaker #1__________ Beaker #2 __________ Beaker#3______________

Beaker # 4 __________ Beaker #5 __________

Also record your predictions in the data table entitled: Comparing Predictions to Actual Results

11. After 24 hours, remove each bag from its beaker, wipe dry with a paper towel and determine the final mass.
12. Record in the Data Table Above, **Mass Determinations of Dialysis Tubing**
13. Determine the difference between the initial and final mass, or the net change and record in the data table above entitled: **Mass Determinations of Dialysis Tubing**
14. Summarize your results using the notation in step #10.

Comparing Prdictions to Actual Results

Bag #	Prediction (gain, loss)	Result (gain, loss)
1		
2		
3		
4		
5		

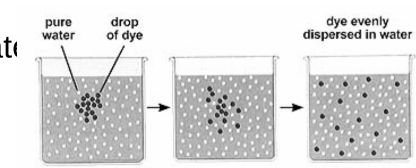
15. Explain any differences that you notice.

16. When experimenting with starch dissolved in water, which molecules flow across a selectively permeable membrane and which ones do not?

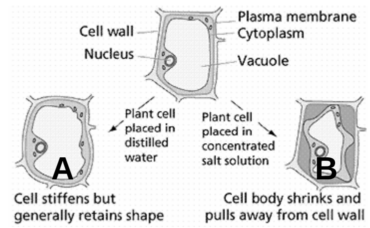
17. When two solutions are separated by a selectively permeable membrane, how does the solute, i.e. starch in this case, concentration affect the direction in which water flows?

18. Make a general statement relating the direction of water flow to the concentration of solute in solutions separated by a selectively permeable membrane.

19. Explain the process that is being illustrat



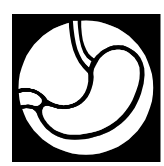
20. Explain the whether the cell is being placed into a hypotonic, isotonic, or hypertonic solution. Label figures A & B as to the type of solution it is being placed into.



21. Account for the net change in mass in each beaker. Do this by diagramming each bag as a cell; show the relative concentrations of cells (bags) and solutions (beaker 'water'), use arrows to show the flow of water. Label each beaker/bag combination as hypotonic, isotonic, or hypertonic. Use background information to help you in this task.

#1	#2	#3	#4	#5

22. Describe the sites in which osmosis occurs in human being within each of the following body systems:
    a. Digestive system



    b. Urinary system

    c. Circulatory system

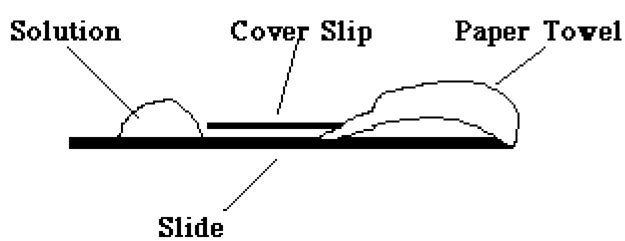
Exploratory Activity: Osmosis in *Elodea* Cells

Introduction: One of the functions of the cell membrane is to control the flow of materials into and out of the cell. However Plants also have a cell wall for protection. In this investigation, you will observe the effects of placing plant cells in salt water solutions of various concentrations.

Materials: *Elodea* leaves, microscope slides, cover slips, microscope, distilled water, tap water, 5% salt solution, 10% salt solution, paper towel.

Procedure:

1. Prepare a wet mount of an *Elodea* leaf with tap water.
2. Observe the leaf at 40X and record your observations in the space provided below. Increase the magnification to 100X, observe, and record your observations in the space provided below. Pay particular attention to the 'green blobs"
3. Remove the slide from the stage of the microscope.
4. Place 2 drops of the 5% salt solution on the slide at the edge of the cover slip.
5. Tear off a small piece of paper towel and place the torn edge on the slide at the edge of the cover slip that is opposite the side where the salt solution was placed. The piece of towel should begin to soak up water, drawing the salt solution under the cover slip as it does so.



6. Return the slide to the microscope stage and repeat the observations of the cells at 40X and 100X. Record your observations.
7. Repeat the above procedure with the 10% salt water solution. Record your observations.
8. With the slide still on the microscope stage, carry out the procedure outlined in step 5 but use 2 drops of distilled water as the solution. Watch what happens and record your observations.
9. Repeat step 8.
10. Remove the slide from the stage, clean it and the cover slip, and put it away. Put the microscope on low power and put it away.

Observations:

Prepare sketches of a group of *Elodea* cells under each set of conditions. Label the sketches to note the cell structures that you can identify. Be sure to note any changes in the color, size, and shape of the cells. Make your sketches as accurate as possible.

observations

______________________ (title)

______________________ x

observations

______________________ (title)

______________________ x

observations

______________________ (title)

______________________ x

observations

______________________ (title)

______________________ x

observations

______________________ (title)

______________________ x

observations

______________________ (title)

______________________ x

Conclusions: Answer the following questions.

1. What is the shape of the typical *Elodea* cell? What cell structures were you able to identify?

2. What are the small green blobs found inside the cells? What is their function?

3. What happens to the cells as the salt water flows under the cover slip?

4. Describe the difference you observed between the treatments with the 5% and 10% salt water solutions.

5. What happens to the cells when the salt water is flushed out with distilled water?

6. What cell structure protects the *Elodea* from abrupt changes in environment? Do animals also have this protection? Explain your answer.

7. *Elodea* normally lives in fresh water. What changes would you observe in the cells of an *Elodea* plant that was suddenly moved from fresh water to salt water? Why?

ADAPTED FROM THE FOLLOWING
Science Education Connection
Department of Biochemistry
The University of Arizona
http://biology.arizona.edu/sciconn/lessons/mccandless/

Teacher Notes:

- To make 100 mL of the 5% salt water solution add 5g salt to 95mL of water. Mix and then dispense into dropper bottles.
- To make 100 mL of the 10% salt water solution add 10g salt to 90mL of water. Mix and then dispense into dropper bottles.

Ask students the following questions to guide the post-lab discussion. As students answer the questions, sketch an Elodea plant cell on the board, filling in the cell with the subcellular structures being discussed.

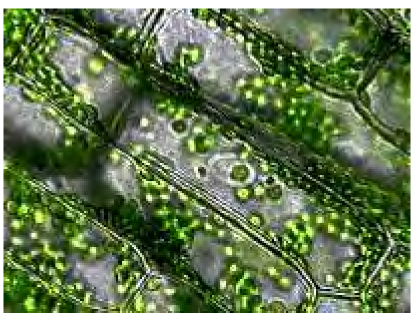
- What color were the Elodea cells? *(They were colorless except for green bodies.)*
- What were the green bodies inside the Elodea cells? *(Chloroplasts.)*
- Where were these green bodies mostly located? *(They were mostly located at the edges of the cell.)*
- Describe the shape of these chloroplasts. *(Ovals.)*
- Why are these chloroplasts green? *(They are green because of the presence of chlorophyll, the light-absorbing pigment necessary for photosynthesis.)*
- Were the chloroplasts stationary or moving around the cell? *(They should have been moving.)*
- Why were the chloroplasts moving around? *(The cytoplasm within the cell is constantly moving, thereby moving the various subcellular structures within the cell as well. This is known as cytoplasmic streaming.)*
- Did anyone notice a large space inside the cell?
- What is this large space? *(The central vacuole.)*
- What is the function of the central vacuole? (The central vacuole is an organelle in plant cells that stores nutrients and water for the cell. It can take in and release water depending on the cell's needs. Animal cells do not have a central vacuole; they have many small vacuoles, which contain proteins, carbohydrates, water, and nutrients.)

The following key concepts should be discussed with students:

- When plant cells are surrounded with salt water, the water inside the plant moves from where there is more water (less salt) through the cell wall and membrane to the outside where there is less water (more salt). This process of water movement from a high concentration of water to a lesser concentration of water is called osmosis.
- When the water movement is out from a cell, we call this plasmolysis.
- Plasmolysis is the shrinking of the cytoplasm of a plant cell in response to diffusion of water out of the cell and into a high salt concentration solution.
- During plasmolysis, the cell membrane pulls away from the cell wall. This does not happen in low salt concentration because of the rigid cell wall. Plant cells maintain their normal size and shape in a low salt concentration solution.
- An animal cell does not have this protection and if it was placed into solutions that are not isotonic. An animal however can MOVE to a new location
- Plasmolysis is a reversible process

ELODEA PICTURES

ELODIA IN FRESHWATER



ELODEA IN A HYPOTONIC SOLUTION (NOTE THE CHLOROPLASTS)

ELODEA IN HYPERTONIC SOLUTION (NOTE THE CHLOROPLASTS)

RESOURCES

Note: These URL's were current and "hot" as of August, 2002

BACKGROUND

http://biology.arizona.edu/sciconn/lessons/mccandless/default.html

- Many of the activities are adapted from this site.

http://biology.arizona.edu/sciconn/lessons/mccandless/reading.html

- Background reading, including elodea lesson, evaluation, osmosis and blood cells.

http://www.sciencenetlinks.com/matrix.cfm

- UNBELIEVABLE site which contains lesson, AAAS benchmarks, interviews with scientists, and Lots of other goodies. Elodea lesson comes partially from here!

http://hyperphysics.phy-astr.gsu.edu/hbase/kinetic/diffus.html

- Indepth explanation of diffusion, osmosis, KMT, includes formulas

http://web.ukonline.co.uk/webwise/spinneret/life/osmsis.htm

- Good tutorial on how substances enter and leave the body… references to the body systems.
- Asks HOTS questions.
- Demonstrates lab activities and then shows pixs of the results.

http://curie.umd.umich.edu/Physlets/Osmosis.html

- Great Osmosis animation… Lecture material is of an advanced nature.

http://highered.mcgrawhill.com/sites/0072346949/student_center0/chapter4/elearning_connections.html

- From the publisher, background and diagrams may be found here.

http://vilenski.org/science/safari/cellstructure/cellmembrane.html

- Great graphic on the cell membrane being a gate.

http://www.usd.edu/%7Ebgoodman/Membrane.htm

- Great graphics and info on cell membranes.

http://www.howe.k12.ok.us/~jimaskew/

- One of my personal favorites. Called the Internet Science ClassroomHas lessons not only in Biology, but all Sciences!

MORE LAB ACTIVITIES

http://www.sciencenetlinks.com/matrix.cfm

- The Science NetLinks have a plethora of activities. One of the best!

http://www.und.edu/dept/jcarmich/101lab/lab4/lab4.html

- Labs from University of Dakota… shows good pictorial results.

http://www.the-aps.org/education/k12curric/activities/halversn1.htm

- An in depth treatment of osmosis using the egg as a model of a cell.

http://marinediscovery.arizona.edu/lessonsS01/blennies/2.html

- Background information as well as laboratory experiments.

http://is.asu.edu/plb108/course/labs/diff-osmosis/page1.html

- This activity looks at qualitative movement of dyes in agar. Verrrrrrrrrrrrry interesting.

http://is.asu.edu/plb108/course/labs/diff-osmosis/page11.html

- From the same site, but animation of diffusion of a gas in a gas and **ELODEA experiment in animation**

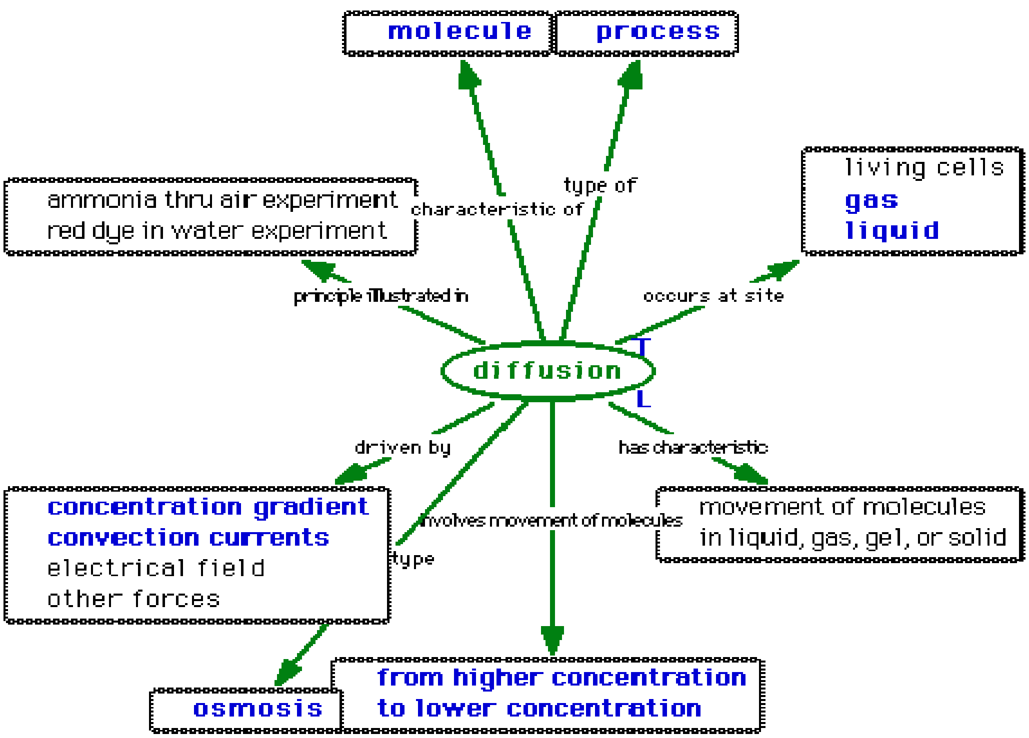
http://www.science-projects.com/Diffuz.htm

- Some labs on diffusion and then osmosis.

VISUAL CONCEPTS

http://www.biologylessons.sdsu.edu/classes/lab5/semnet/diffusion.htm

- An active concept map on osmosis and diffusion.



EXERCISES, QUESTIONS, EVALUATIONS

http://www.mun.ca/biology/Osmosis_Diffusion/tutor2.html#q1

- From the University of Newfoundland, good interactive questions and diagrams.

http://www.gpc.peachnet.edu/~vmicheli/biol107/107omosprob.html

- Osmosis/Diffusion practice questions.

http://personal.nbnet.nb.ca/kvhs/biology/diffosmo.html

- Osmosis and Diffusion review questions.

ANIMATIONS

http://www.biosci.ohiou.edu/introbioslab/Bios170/170_3/170_3.htm

- Great animation of diffusion.
- Get pix of RBC in hypo, iso, and hypertonic solutions.

http://old.jccc.net/~pdecell/cells/diffusion.html

- A SIMPLE animation of diffusion and osmosis.

http://www.bbc.co.uk/scotland/revision/biology/investigating_cells/cells_and_diffusion_rev.shtml#diffusion

- GREAT site from the BBC.
- Great animations and info!

http://www.colorado.edu/epob/academics/web_resources/osmosis/

- REALLY COOL animations.

http://physioweb.med.uvm.edu/diffusion/SDiffPages.htm

- Really AWESOME animations on Brownian movement, diffusion and osmosis, you get control of particles!

http://edtech.clas.pdx.edu/osmosis_tutorial/

- Great animated tutorial on diffusion, osmosis, and the structure of the cell membrane.

http://www.side.wa.edu.au/subjects/science/help/biology11/module4a.html

- Good background info and animations, need shockwave.

http://zoology.okstate.edu/zoo_lrc/biol1114/study_guides/scenarios/2-Fire_and_Ice/concepts/osmosis.htm

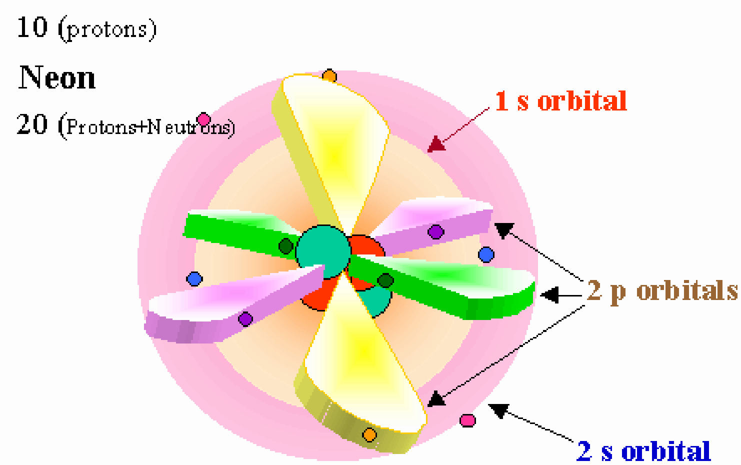
- Need RealPlayer to watch a video on osmosis…..Way Cool!

http://zoology.okstate.edu/zoo_lrc/biol1114/study_guides/scenarios/2-Fire_and_Ice/concepts/osmoregulation.htm

- Need RealPlayer to watch a video on osmoregulation of the Kidney.

http://www.salineschools.com/users/diabt/diab.html

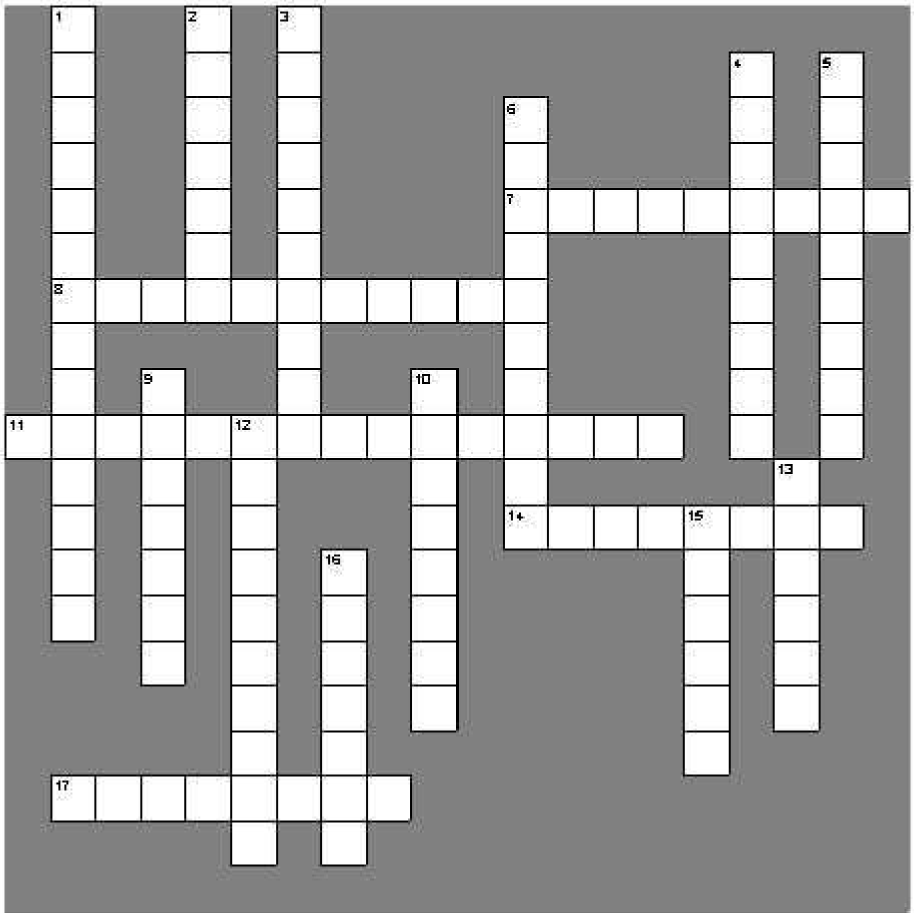
- My name is Tom Diab and I am a High School Teacher at Saline High School in beautiful Saline, Michigan. BELOW you will find my science animations. You are free to view them or if you wish to have them on CD please email me.
- Animations on every science subject!



http://www.sec.org.za/bio/bcwOsDi.html

- A crossword puzzle already made for you

osmosis and diffusion



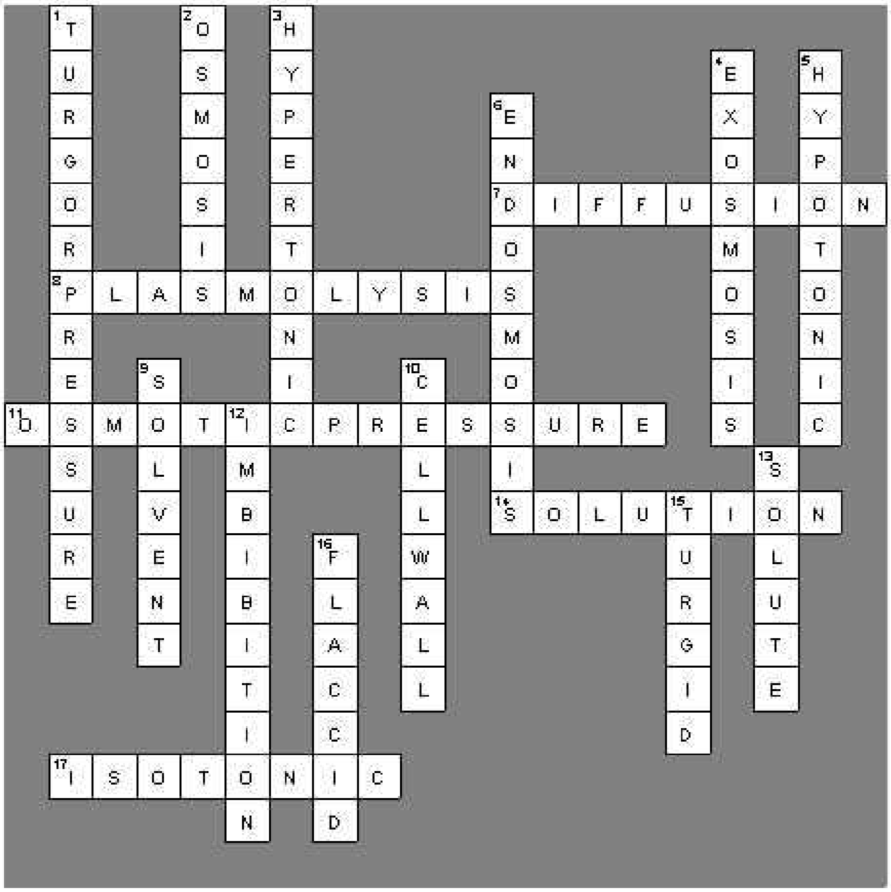
Across

7. movement of molecules from high to low concentration
8. the shrinkage of the cell due to excessive water loss
11. this pressure prevents the cell from increasing in size an no inflow of water.
14. a mixture of solute and a solvent
17. endosmosis is equal to exosmosis, therefore the solution in an out is ....

Down

1. cell contents against the cell wall
2. movement of water through a semi-permeable membrane
3. this solution makes the cell to lose water
4. movement of water out of the cell
5. this solution makes the cell to absorb too much water
6. movement of water into the cell
9. water is an example of ....
10. opposite but equal pressure against the cell contents
12. the ability of the cell to absorb too much water
13. salt is an example of ....
15. swollen cell is said to be ....
16. a cell (leaf) that has lost too much water is said to be ....

osmosis and diffusion



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URL: http://www.suite101.com/article.cfm/5839/38355 Suite101.com Inc. <www.suite101.com>

READINGS

About the Kidneys

Author: **Christine O'Connor**
Published on: **May 1, 2000**

The kidneys, located in the middle of you back at the waist and just below your bottom ribs are capable of filtering 200 quarts of blood per day. These bean shaped organs are responsible for removing wastes from the blood, removing excess fluid and maintaining healthy levels of electrolytes such as potassium and sodium.

The kidneys are made up of nephrons. Each kidney contains about one million nephrons. These nephrons contain the glomeruli, little filters, that cleanse the blood, and tubules, which are tubes that carry away the excess fluid and wastes that the body cannot use.

The kidneys also are responsible for making two important hormones. The first hormone being Erythropoeitin. This hormone helps in the production of red blood cells. Another hormone, Renin, is a hormone that helps to regulate blood pressure to a certain degree.

Many things can go wrong in the body when the kidneys do not work properly. The problem is that most symptoms of malfunctioning kidneys do not show up until more than 70% of their functioning is diminished. When 80% function is gone, one is in renal failure, and with only 10% function, a person is in end stage renal failure. It is at this point that renal replacement therapy by either dialysis or a kidney transplant is usually necessary in order for a person to sustain life.

Simple blood tests can determine if your kidneys are working at 100% or not, but if you have no other medical problems, it's unlikely that you will visit your doctor to have your blood drawn for these or any other tests. The blood tests that measure the creatinine level and BUN (blood urea nitrogen) in the blood can determine how well the kidneys are working. These 2 tests are part of a "chem 7" workup.

If during a routine blood work up, it is found that you do not have all of your kidney function, diet, and controlling your blood pressure can help to prolong further decline in your kidney function.

What are some of the symptoms kidney failure brings?

Because the ability to make Erythropoeitin is diminished you may feel tired as your red blood cell count is lowered causing anemia. It may also make you short of breath and easily fatigued and may make you paler than normal.

Because of the buildup of toxins in your blood stream, you may feel nauseous, vomit, or have a bad or metallic taste in your mouth. Your ability to think straight might be compromised.

You might also feel itchy all over as a result of the wastes buildup or as a result of high phosphorus in your blood stream. Dry skin or hair is also common. Bone problems such as easy fracturing or bone pain may occur due to an abnormal calcium/phosphorus ratio.

Your legs may feel jumpy, restless, or cramp, especially when trying to sleep. You may or may not have headaches, and pains in your belly or pain in your sides, also known as flank pain.

You may also get edema (swelling from fluid) in your feet, or hands, legs or face, as your kidneys cannot remove as much fluid and sodium as they use too. Sometimes too much protein being leaked in the urine also causes this.

You may notice you are not urinating as much as before, or in some instances, you may produce more urine than you use to.

Fluid overload may also cause chest pain or tightness and difficulty breathing.

Some people may have a yellow color to their skin.

Blood pressure might be high, as excess fluid or sodium in the blood will add more work for the heart. If your kidneys do not produce enough Renin, that may add to the problem.

Depending on how far along the kidney failure is, will determine what symptoms you may have as well as the severity.

A person with kidney failure may not experience all of these symptoms.

High blood pressure and diabetes are the leading causes of kidney failure. It is extremely important to monitor high blood pressure to prevent kidney failure.

More education to the public about kidney failure is necessary in the hopes of preventing such a devastating disease that effects so many parts of the body, from happening to more and more people.

Why Osmosis is important to scientists!

Current Projects in the Paynter Lab

Osmotic tolerance of Perkinsus marinus, the protozoan which cause Dermo disease in Eastern oysters.

Perkinsus marinus is a parasitic protozoan that infects Eastern oysters eventually leading to the oyster's death; the common name of this disease is Dermo. Although historically Dermo has been restricted to salinities above 15 to 20 parts per thousand (ppt), over the last decade the disease has been detected in all Maryland oyster bars including those at very low salinities. Infections in oysters living in low salinities appear to be less virulent and a higher percentage of infected oysters reach market size before succumbing to the disease. However, the appearance and persistence of **P. marinus** in low salinity regions suggests that the protozoan has the ability to tolerate low osmotic pressure much better than **Haplosporidium nelsoni**, the parasite protozoan that causes MSX disease. **H. nelsoni** is not detected in oysters below 10 ppt and infected oysters can apparently be "cured" of the disease by moving them into low salinity waters. Infections of **P. marinus** persist after the hosts are moved into low salinities.

Drinking Water
Show Number 1413

How do we get the impurities out of drinking water? Where does drinking water come from?

Getting Started

Water has been called the universal solvent because it can dissolve just about anything over time. How does the solubility of water change with temperature? See how much salt you can dissolve in equal volumes of water at different temperatures. How can you use your test results to make predictions about water solubility around the world?

Overview

Each day, millions of Americans use billions of gallons of water without knowing where it comes from or what might be in it. As populations grow, the combination of increased demand and increased pollution means many of us are using sources of water that are less than pristine. Contamination from sediment, bacteria, protozoans, heavy metals, and synthetic organic compounds shows up with alarming frequency. As a result, many municipalities are having to pre-treat drinking water.

The first step in most municipal treatment systems involves gravity. If you've ever let a glass of chocolate milk stand for any length of time, you've probably noticed that much of the chocolate settles to the bottom of the glass. The same is true of sediment in water. When the water is allowed to stand in large pools, many of these suspended particles simply settle to the bottom where they are collected and disposed of.

Next comes flocculation. Here, a chemical is added to the water that causes tiny suspended particles to clump together. Usually, these flocs settle out just like large-sized sediment. But if they escape, they are caught by filters farther down the line.

To kill unwanted microbes, protozoans, and other living organisms, many municipalities chlorinate the water. Chlorine is a chemical that kills microorganisms. In drinking water, the concentrations are low enough that often you can't even taste it.

The final stage in most municipal treatments is filtration and aeration. Water is pumped through large tanks filled with fine sand, called rapid sand filters. As the water flows through the spaces between the sand grains, suspended particles and dead microbes get trapped. Sometimes, crushed anthracite coal is used in addition to sand. Because the coal grains carry a charge on their surface, they act like tiny magnets attracting other charged contaminants. Aeration is exactly what it sounds like - adding air to water. When sprayed through large, fountainlike devices, water not only gains a great deal of oxygen, but any volatile compounds that may have been in the water escape into the atmosphere.

In the end, all the water we use doesn't just go down the drain and disappear. It gets recycled by the evaporative power of the sun. When water evaporates, most of the contaminants stay behind, which in theory means it rains pure water back on the land. Unfortunately, because of gases in the air, much of the water that falls from the sky is coming down pre-polluted, so municipalities are going to have to work even harder in the future to treat the water we drink.

Drinking Too Much Water Can Kill You: Report

July 2
— By Alison McCook
NEW YORK (Reuters Health) - A new review of three deaths of US military recruits highlights the dangers of drinking too much water.

The military has traditionally focused on the dangers associated with heat illness, which has killed a number of healthy, young enrollees, Colonel John W. Gardner of the Office of the Armed Forces Medical Examiner in Rockville, Maryland told Reuters Health. However, pushing the need to drink water too far can also have deadly consequences, he said.

"The risk has always been not drinking enough," Gardner said. "And then people who aren't medically attuned get overzealous," inducing recruits to drink amounts of water that endanger their health, he added.
"That's why we published this paper: to make it clear to people that overzealousness can be dangerous," Gardner explained.

In September 1999, a 19-year-old Air Force recruit collapsed during a 5.8-mile walk, with a body temperature of 108 degrees Fahrenheit. Doctors concluded he had died of both heat stroke and low blood sodium levels as a result of overhydration.

During January 2000, a 20-year-old trainee in the Army drank around 12 quarts of water during a 2- to 4-hour period while trying to produce a urine specimen for a drug test. She then experienced fecal incontinence, lost consciousness and became confused, then died from swelling in the brain and lungs as a result of low blood sodium.

In March 2001, a 19-year-old Marine died from drinking too much water after a 26-mile march, during which he carried a pack and gear weighing more than 90 pounds. Although he appeared fine during the beginning stages of the 8-hour walk, towards the end he began vomiting and appeared overly tired. He was then sent to the hospital, where he fell into a coma, developed brain swelling and died the next day. It is unclear how much water he drank during the march, but Marines were given a "constant emphasis" on drinking water before and during the activity, Gardner writes in the latest issue of Military Medicine.

In an interview with Reuters Health, Gardner explained that drinking too much water is dangerous because the body cannot excrete that much fluid. Excess water then goes to the bowel, which pulls salt into it from the body, diluting the concentration of salt in the tissues.

Changing the concentration of salt, in turn, causes a shifting of fluids within the body, which can then induce a swelling in the brain. The swollen organ will then press against the bones of the skull, and become damaged.
The researcher added that previous cases of water toxicity have been noted in athletes who consume excessive amounts in order to avoid heat stroke. In addition, certain psychiatric patients may drink too much water in an attempt to wash away their sins, or flush out poisons they believe have entered their bodies.
In 1998, the Army released fluid replacement guidelines, which recommend a certain intake of water but limit it to 1 to 1-1/2 quarts per hour and 12 quarts per day.

It takes a while for these guidelines to get "permeated out" to everybody, Gardner admitted. In the meantime, he suggested that bases take notice of the mistakes of others, and "not wait for somebody to die from (water toxicity) again," he said.

"You can't prevent everything bad from happening," Gardner noted. "But when it does, you have to learn from it."
SOURCE: Military Medicine 2002;167:432-434.


Courtesy Thinkquest

Salt Water Drinking Camel May be Separate Species
February 7, 2001 07:48 CDT

An unusual breed of wild camels that drink salt water are now thought to be a different species from their domesticated cousins, said UN biodiversity officials earlier this week. The wild Bactrian camels have been found in China and Mongolia and have hairier kneecaps and a larger space between their humps than domesticated Bactrians. Wild Bactrians are threatened with extinction by hunters who plant land mines near water holes.

The presence of the two-humped Bactrian camel is by no means a new discovery. However, scientists are only just now learning that it is genetically different from the domesticated breeds after observing the animals drinking salt water. Although DNA testing has not been completed yet, environmentalists say other tests have indicated a significant difference in the genetic makeup of the wild Bactrian from the domesticated Bactrian.

"We cannot say we are 100 percent certain, but all the evidence seems to point toward it being a new species," Rob Hepworth, a senior biodiversity official with the United Nations Environment Program (UNEP), told a news conference in Nairobi.

According to scientists, only about 1,000 of the camels live in Asia, making the species even more endangered than the giant panda. They do believe, however, that at least 600 of the rare breed live in an uninhabited area that was used for nuclear testing in China over the past 41 years and are being killed by hunters who have moved into the region since testing ended in 1996. "We found land mines put by the salt water springs," said John Hare, leader of the expedition and founder of the Wild Camel Protection Foundation. "So when the camels come to drink they step on them, bang! They are blown to pieces and picked up as meat."

Over 300 more of the animals were found in Mongolia's Gobi desert. In 1999, British and Chinese scientists found another 169 in the Kum Tagh sand dunes in northwest China by the Arjin Shan mountains of Tibet.

Original Source: Reuters

Science News

Thirsty? How 'bout a cool, refreshing cup of seawater?

Most of the United States has, or can gain access to, ample supplies of fresh water for drinking purposes. But, fresh water can be in short supply in some parts of the country (and world). And, as the population continues to grow, shortages of fresh water will occur more often, if only in certain locations. In some areas, salt water (from the ocean, for instance) is being turned into freshwater for drinking.

In California, the towns of Santa Barbara and Avalon have begun using desalinization methods to remove the salt from seawater and make it suitable for drinking. A promising method to desalinate seawater is the "reverse osmosis" method. Right now, the high cost of desalinization has kept it from being used more often, as it can cost over $1,000 per acre-foot to desalinate seawater as compared to about $200 per acre-foot for water from normal supply sources. Desalinization technology is improving and costs are falling, though, and Tampa Bay, FL is currently desalinizing water at a cost of only $650 per acre foot. As both the demand for fresh water and technology increase, you can expect to see more desalinization occurring, especially in areas, such as California and the Middle East.

What do we mean by "saline water?" Water that is saline contains significant amounts (referred to as "concentrations") of dissolved salts. In this case, the concentration is the amount (by weight) of salt in water, as expressed in "parts per million" (ppm). If water has a concentration of 10,000 ppm of dissolved salts, then one percent (10,000 divided by 1,000,000) of the weight of the water comes from dissolved salts.

Here are our parameters for saline water:

- Fresh water - Less than 1,000 ppm
- Slightly saline water - From 1,000 ppm to 3,000 ppm
- Moderatly saline water - From 3,000 ppm to 10,000 ppm
- Highly saline water - From 10,000 ppm to 35,000 ppm

By the way, ocean water contains about 35,000 ppm of salt.

Some of this information came from the Water Education Foundation and from the Corpus Cristi TAMU-CC Public Administration.

Related Topics

Saline water ◆ Uses of saline water

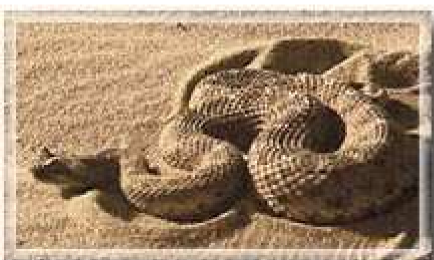
The extremes of summer in Death Valley pose the ultimate test of survival for wildlife. Animals must have special adaptations of both their bodies and their habits to thrive in the severe climate. The Kangaroo Rat, Sidewinder and Pupfish are among the most successful, but each in their own unique way.


Kangaroo Rat

Kangaroo Rats

Kangaroo Rats are perfectly adapted to the dryness and heat of Death Valley's summer. In this place famous for its lack of water, Kangaroo Rats can live their entire lives without drinking a drop of liquid. All of the water they need to survive can be metabolized within their bodies from starch and fats in the dry seeds they eat. They are also masters at conserving moisture; their kidneys have the ability to concentrate urine 4 to 5 times that of humans.

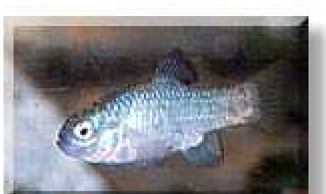
Kangaroo Rats avoid the intense heat of the day, as most desert animals do, by restricting their activity to the night. Days are spent deep underground in burrows that are both cooler and higher in humidity than outside. The water vapor contained in the humid air is reclaimed by special membranes in their nasal passages, and is also absorbed by the food stored within the den. They may even plug the burrow's entrance with dirt to keep out heat and intruders.


Sidewinder

Sidewinders

The Sidewinder may be one intruder the Kangaroo Rat is trying to keep out of its den. This small rattlesnake is best known for its odd looping motion as it travels, but it, too, is well adapted to the extremes of Death Valley's climate. Like the Kangaroo Rat, the Sidewinder does not need to drink water.

All the moisture it requires comes from the juicy animals it eats. The Sidewinder also is nocturnal and spends the hot days in underground dens. Rather than digging its own burrow, it simply moves into one previously occupied by the unlucky rodent it ate for dinner. Like all reptiles, the Sidewinder is cold-blooded (ectothermic). Warm-blooded (endothermlc) animals such as Kangaroo Rats and humans metabolize body heat from food, but ectothermic animals must absorb heat from their environment. Deserts have lots of heat, but little food, so ectothermic animals such as reptiles are excellent as desert dwellers.



Desert Pupfish

The tiny Pupfish found in Salt Creek on Death Valley's arid floor are also ectothermic, yet they cannot escape the high temperatures of solar-heated pools. Pupfish are among the most heat tolerant of all fishes. They have been known to survive in water temperatures of 112 degrees F.

Some Pupfish species in the Death Valley area actually live in hot springs. The Pupfish of Salt Creek are so adapted to warm water, they must burrow into the mud and become dormant when the shallow stream becomes cold in the winter.

DRINK TO WIN!

Fluid loss affects performance. It is therefore important to drink an adequate amount of fluid at all times. Thirst is actually a poor indicator of hydration and by the time you get thirsty you are partially dehydrated already. You must drink plenty of fluids before, during and after exercise. This will prevent dehydration and speed up physical recovery.

Dehydration leads to adverse physiological changes. Your pulse rate and body temperature rise and your performance becomes less efficient.

Various types of drinks are available to combat dehydration. Some are more efficient in replacing fluid and energy than others.

Hypotonic drinks, such as water and diluted fruit juice, contain very low levels of carbohydrates and electrolytes or none at all.

Isotonic drinks, such as most sports drinks, contain 6-8% carbohydrates, plus a low level of electrolytes.

Hypertonic drinks such as colas and other fizzy, sugary drinks have a high carbohydrate content.

Drinking fluids containing a small amount of sodium and carbohydrate during exercise is the most effective way to maintain and recover adequate hydration. During exercise, fluid needs to be absorbed quickly and too much carbohydrate slows this absorption. These drinks also supply energy for optimal muscle function. Such drinks are now available commercially - **Lucozade sport, Gatorade, Isostar, Boots isotonic drink** - but you can also prepare them at home.

Drinking alcohol, tea, coffee and sugary drinks should be kept to a minimum as all these drinks can lead to dehydration. Drink plenty of water and fruit juice at mealtimes. You should not generally use salt supplements as these can also contribute to dehydration. Sufficient salt is usually obtained from food in a normal diet. A very small amount of salt in sports drinks speeds up fluid absorption.

How to make your own isotonic drink

You often see tennis players in tournaments sipping strange coloured liquids from a water bottle with no label. They probably all have secret formulas for success. You can prepare a simple isotonic sports drink by adding 60g of glucose powder and 1g (small pinch) of salt to 1 litre of water. Alternatively mix 500ml of unsweetened fruit juice with 500ml of water and add a tiny amount of salt.

Dr. J Austera
Reviewed Jun 2001

Dehydration

webmountainbike.com

This condition is caused by the loss of both water and salt, with deficits of other ions as well such as potassium, and also with the frequent disruption of the acid-base equilibrium of the body.

There are three major groups of dehydration:
1) Loss of water
2) Loss of salt
3) Isotonic losses of salt and water

In loss of water, failure to drink is the most common cause. Also, ingesting abnormally large amounts of protein can cause excessive excretion of water by the kidneys and lead to a water deficit. In this case urine output is high, and this aggravates the water loss. Diabetes insipidus may also be responsible for large deficits of water, and these patients must be extra cautious concerning dehydration when exercising. The most common cause of water loss dehydration is SWEATING, and this is of concern to the mountainbiker, especially in hot and humid weather. Your thirst will tell you if this condition is developing.

In loss of salt, the body does not get enough sodium, chloride, potassium, magnesium and other electrolytes to replace what is lost or excreted. There can also be a water deficit, but the risks here are associated with the loss of electrolytes, the acid-base balance, and the associated muscle weakness or cramping. Water loss dehydration, if not remedied, can progress to the loss of these necessary salts.

In loss of both water and salt, the dehydration can be classified as severe and life threatening if not reversed in time. Don't ever let it get to this point! A few simple steps can eliminate this concern. Replenish both water and electrolytes frequently in hot weather or where dehydration is a problem (i.e. vomiting or diarrhea).

If temperature or humidity is high, you will lose a lot of water and salts by sweating and respiration. This can be increased by strenous exercise and overheating. Fever, hyperthyroidism, and increased respiration will also aggravate water loss from your body.

Here are some simple steps to follow to prevent dehydration:

Drink plenty of fluids before riding on hot and humid days at least an hour before you ride. These should contain valuable electrolytes as well as water. Drinks with sodium, potassium, chloride, and magnesium are good. Also insure an adequate intake of plain water. You must force these fluids even if you are not thirsty. Several liters of fluid can be consumed at this stage. This may be especially important if you consumed alcoholic beverages the night before.
Avoid drinks with caffeine or alcohol.
Replenish your supply while on the trail every 20 minutes or so. Try to avoid direct sunlight or overheating yourself when you feel dizzy or exhausted. Cooling off in a stream or lake can stop the water and electrolyte loss from sweating. Also, it is important to take frquent rest stops.
Make sure you carry a more than adequate supply of water before you start your summer rides.
Keep in mind that your body will dehydrate faster at higher altitudes, mainly because of increased loss of moisture thru a higher respiration rate. Plan accordingly...
Use an hydration system like a Camelback in addition to water bottles. Place it in the refrigerator the night before you ride, and add some ice cubes right before you leave to ride if it is hot outside.
Stock up on electrolytes by drinking fluids high in these, such as cytomax pre-formance, powerade or gatorade, etc... several hours before you ride.
Carry a water filtration device on rides when you can't carry enough water to drink if you know water sources are available.
Plan a hot summer ride to include a swim, or replenishment from a known safe water source while on the trail. Some mountains have naural springs which can have better quality water than you normally drink. Use these to full advantage.
Hydrate fully on return from your ride. This is usually instinctive, but we thought we would remind you of it's importance. Especially true if you are doing a repeat ride the next day. Now is your chance to guzzle to the max.

Sea mammals create water

Q: What do whales, porpoises, dolphins, manatees and other sea-dwelling mammals drink?

A: Sea mammals mostly get their water from the food they eat. They break down carbohydrates and fat using oxygen to form water, carbon dioxide, and energy (a process called metabolism).

NOAA
Humpback whales in the singing position.

People have seen seals, sea lions, common dolphins, and sea otters drink seawater on occasion. When they do, they rid their bodies of the extra salt by passing salty urine-up to 2.5 times saltier than seawater and 7 or 8 times saltier than blood.

Normally, though, fish-eating marine animals have no extra salt to eliminate since the fish salt content is the same as their own blood. A study of California sea lions shows that these animals, feeding on fish, can live without any fresh water at all.

"Marine mammals can swim into fresh water habitats without any real complications (unlike most species of [salt-water] fish), but there is no evidence that they do so just to get a drink," says Dave Rugh, wildlife biologist at the U.S. National Oceanic and Atmospheric Administration's (NOAA) National Marine Mammal Laboratory in Seattle.

Manatees (a plant eater) will drink from a garden hose left out along the brackish waterways in Florida. Some seals eat snow to get fresh water.

"For most whales and dolphins, however, we simply do not know how they get their water, because it is difficult to observe these animals," says Robert Kenney, marine biologist at the University of Rhode Island.

"Their mouths are sometimes open," Rugh says, "when not eating, but it is not evident how often they swallow sea water."

(*Answered by April Holladay, science correspondent, Jan. 9, 2002)*

Why do Most Sharks Live in Salt Water?

Recently, my 5 year-old daughter asked me why most sharks live in salt water. Can you help me give her an answer?

Miguel
Oakville, Ont.

Another terrific question!

In order to carry out the complex chemical reactions that sustain life, all living things -- including sharks and people -- have a supply of water and salts in their bodies. Although skin and other living tissue looks solid, it actually has tiny pores in it. Small molecules such as water and salts can pass readily back and forth through the skin. But if there is more of one kind of molecule on one side of the skin than on the other, some of the molecules will move from an area of higher concentration to an area of lower concentration, through a natural process called 'diffusion'. Diffusion will occur until the concentration of that molecule is equal on either side of the skin. Diffusion is the same process that allows a sugar cube to completely dissolve in a cup of tea or coffee: the sugar molecules spread out from an area of high concentration (the cube) to an area of low concentration (the tea or coffee); eventually, all parts of the tea or coffee are equally sugary.

The sea is composed mostly water, but dissolved in the water are also various salts. The concentration of salts in seawater is usually about 3 to 4%. The living tissue of human beings and most fishes are considerably less salty than this. As a result, there is more fresh water inside the human or fish than outside in the sea. In response, water naturally diffuses from the body across the skin, as though attempting to dilute the outside sea. (The diffusion of water across a semi-permeable membrane is a special case of diffusion, usually termed 'osmosis'; in the interests of simplicity, I'll continue to use diffusion here.) Human skin is relatively water-tight, but fish skin in rather leaky. As a result, the bodies of most marine fishes are constantly losing fresh water to the surrounding sea. But all living things need a supply of water inside their bodies in order to function properly. What most fishes must do to restore the water their bodies need is drink lots and lots of seawater You've heard the expression, "Drinks like a fish"? Well, it's true: marine fishes drink seawater almost constantly. In order to get rid of the excess salt contained in the seawater, many fishes have specialized salt-secreting structures in their gills called "chloride cells".

But sharks have hit upon a different strategy. Instead of being less salty than the sea, sharks store certain metabolic wastes (namely, urea and trimethylamine oxide, or TMAO for short) so that their overall 'saltiness' is actually slightly **greater** than that of the sea. As a result, sharks do not continually lose their bodily supply of freshwater to the sea. Instead, any fresh water they need diffuses gently into their bodies through the mouth, gills, and other exposed membranes. Any excess water in a shark's body is filtered by the kidneys and excreted out an opening called the 'cloaca', located between the pelvic fins (the rearmost paired fins, behind the shark's belly). It's a very elegant solution to a significant environmental challenge. But it has its limitations.

If a typical sharks were to swim its very 'salty' body into fresh water, so much fresh water would diffuse into its tissues that the kidneys would have to work overtime in order to get rid of it all. This is a very energy-demanding process, and explains why most sharks do not enter fresh water: it's simply too much effort to keep excreting all that freshwater. But some sharks, such as the Bull Shark (*Carcharhinus leucas*), are able to enter fresh water for prolonged periods. They achieve this neat trick by greatly reducing their bodily concentrations of urea and TMAO. Even so, a Bull Shark in fresh water is slightly saltier than its surrounding environment, so that it must continually excrete excess water in the form of dilute urine. In total, some 43 species of sharks and rays (which are essentially flattened sharks) spend at least part of their lives in fresh water. But one family of South American stingrays -- the so-called River Stingrays (Potamotrygonidae) -- evolved from a marine ancestor to become thoroughly adapted to living in fresh water. So much so, in fact, that their bodies have lost the ability to manufacture urea and -- if placed in full-strength seawater, they quickly die. These freshwater stingrays are thus trapped by their biochemistry.

Sometimes, you can't go home again.

Menu of Online Rubrics

Appetizers:

Science Rubrics To Save Us Time
http://www.usd305.com/staffdev/hs/sci/scirubrics.htm

Science Generic Rubrics
http://www.bconnex.net/~drussell/rubrics.htm

Soup and Salad:

Kathleen Schrock's Varied Choice of Rubric Weblinks
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The Main course

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Odyssey of Rubrics
http://www.odyssey.on.ca/~elaine.coxon/rubrics.htm

Holistic and Analytic Generic Rubrics
http://www.gsu.edu/~mstnrhx/457/rubric.htm

Portfolio, Performance, and Project Rubrics
http://www.milwaukee.k12.wi.us/audubon/Pages/ScienceRubrics.html

Assessing Your Rubric with a Rubric
http://www.idecorp.com/assessrubric.pdf

Dessert:

What is a rubric?
http://www.geocities.com/Athens/Delphi/1993/rubrics/teresa/rubrics.htm#6

Rubric for the Advanced Inquiry-Based Biology, Chemistry, or Physics Student to be given around the middle of the school year. [NOTE: Please print in "landscape" mode.]
http://www.exemplars.com/science_rubric_k-2.html