

How do animals maintain water balance and eliminate waste?

Lesson 12



How do animals maintain water balance and eliminate waste?

- What happens if you exercise hard on a hot day?
 - You drink fluids to replace the water you lost
- What happens if you drink too much water?
 - You get rid of it by producing more urine
- Your body works to keep a normal balance of water
- Other animals also have ways to maintain, or keep, water balance

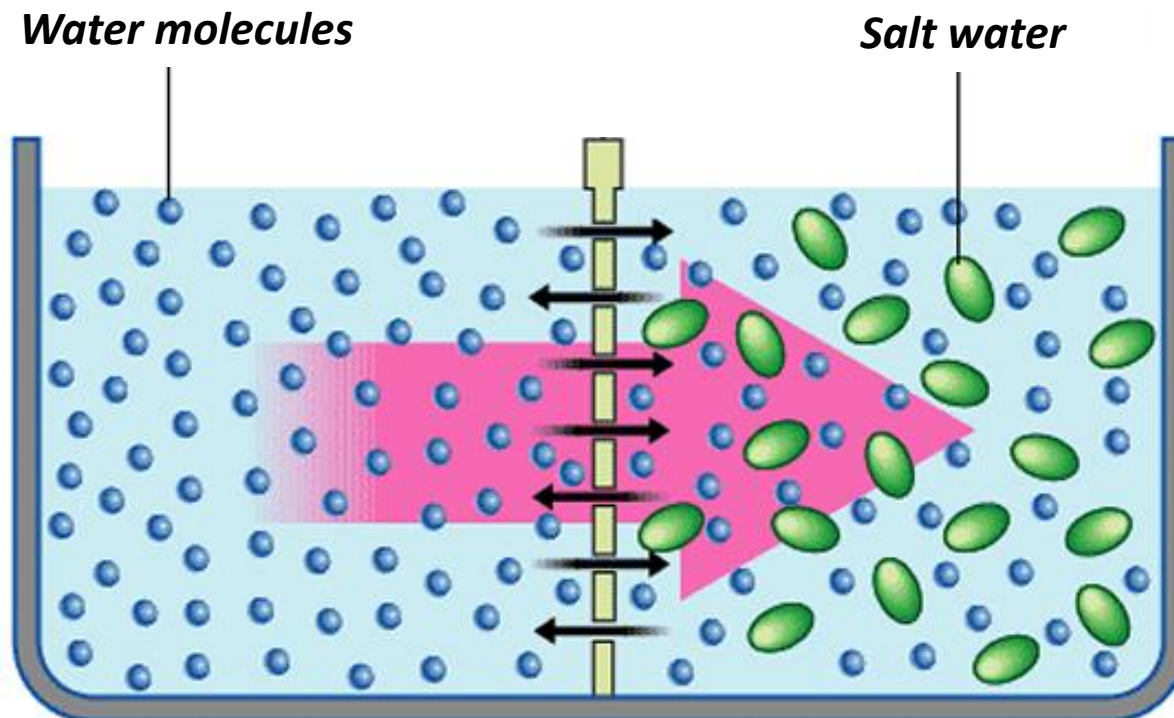


"Sweat is nature's way of showing you that your muscles are crying!"



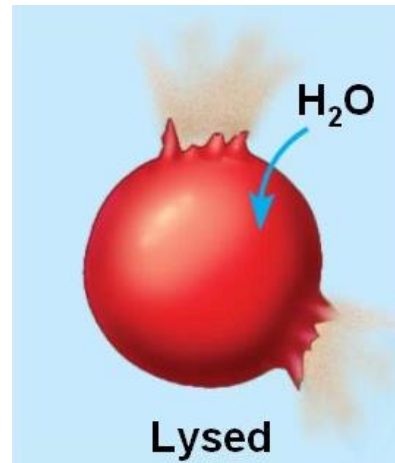
What is osmosis?

- **Osmosis** is similar to diffusion, but we use the term osmosis when dealing with the movement of water
 - The movement of water from an area of high concentration to an area of low concentration



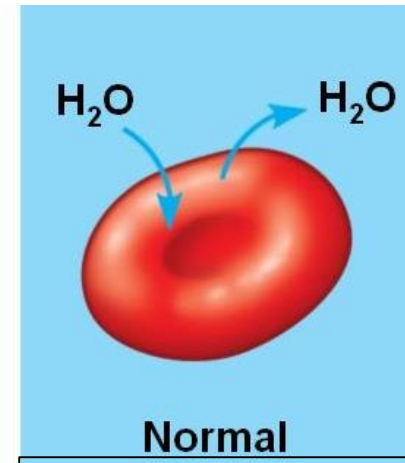
Water Balance in the Sea

- Seawater is water and salt
- The fluids of animals also contain water and salt
- The more salt there is in a fluid, the lower the water concentration in that fluid
- Because of osmosis, problems can occur if too much water gets into an animal or too much water exits an animal
- Organisms are always trying to maintain balance (chemically, temperature, water)



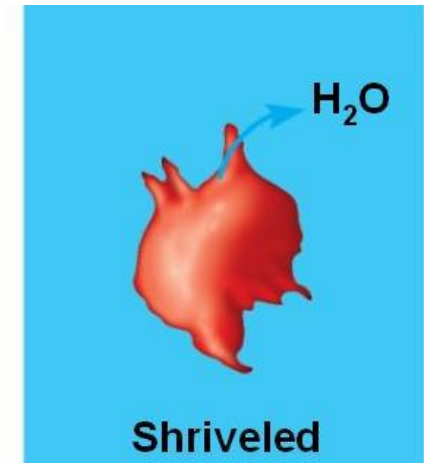
Lysed

Higher water concentration outside cell



Normal

Equal water concentration inside and outside

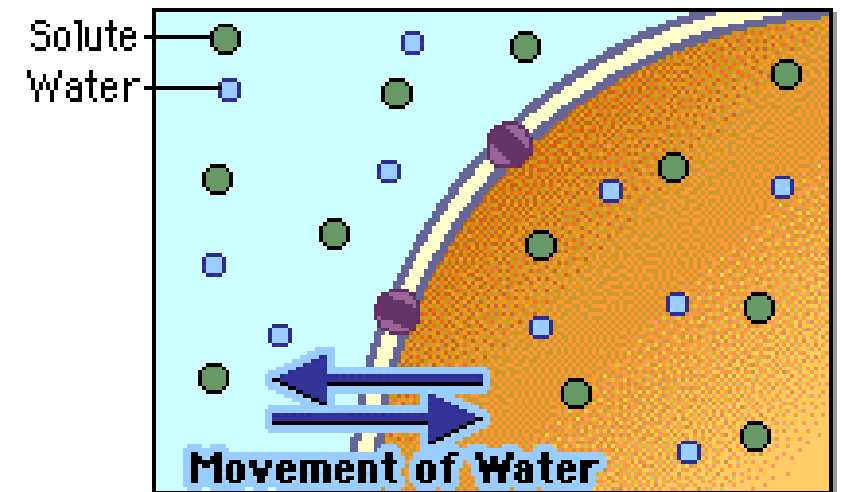
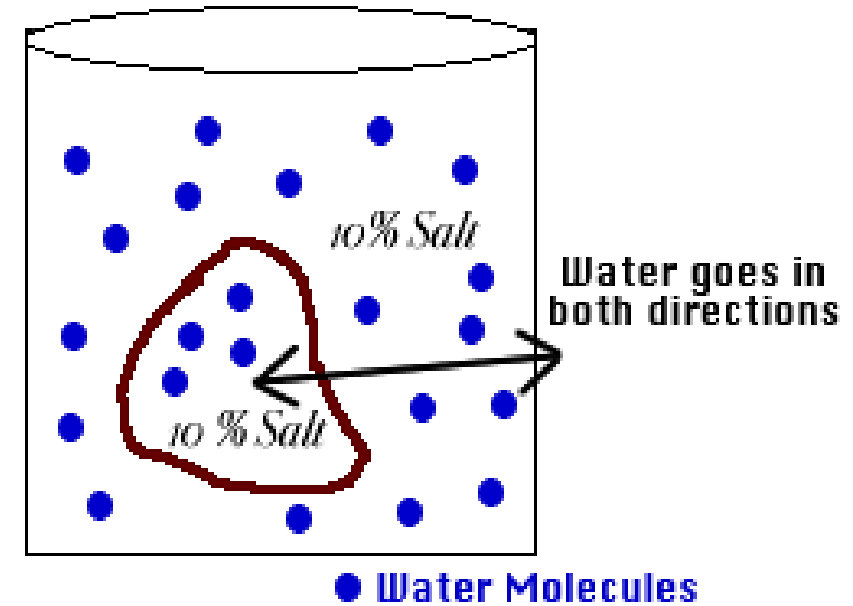


Shriveled

Higher water concentration inside cell

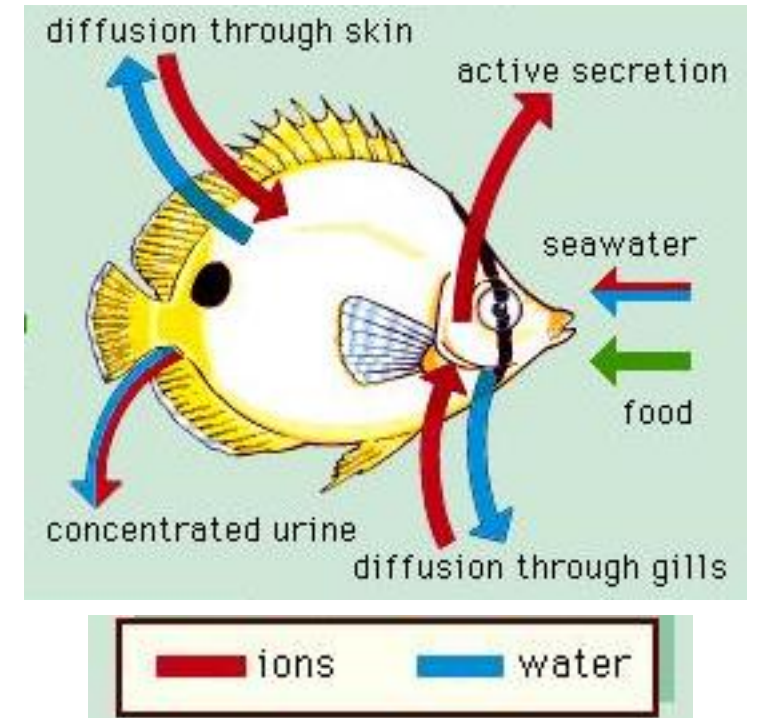
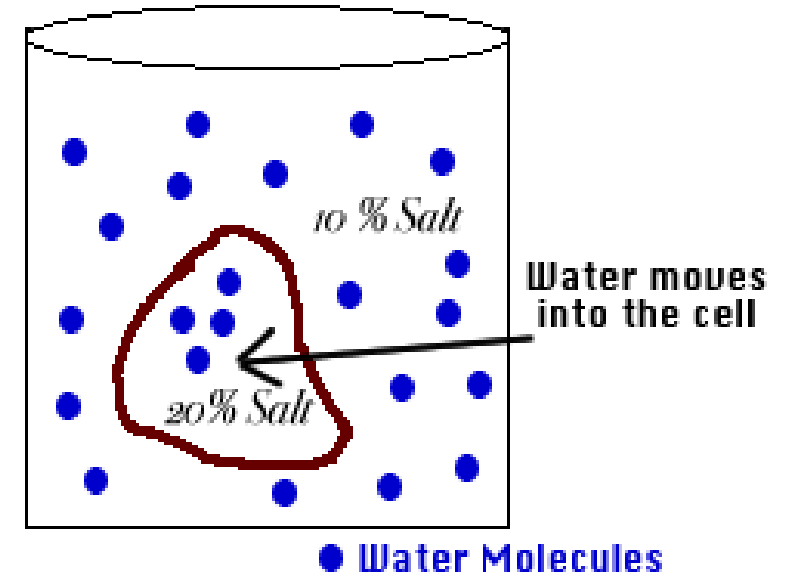
Water Balance in the Sea

- Most sea invertebrates (e.g. jellyfish, octopus, clams etc.) avoid getting too much water in their bodies
- The water concentration in their fluids equals the water concentration in seawater
 - Therefore, water does not move between their bodies and the surrounding seawater
- The same is true for sharks, rays, and skates



Water Balance in the Sea

- In bony fish, their body fluids have a higher water concentration than seawater
 - As a result, water moves from their bodies into the sea (osmosis)
- Like all animals, bony fish need some water
 - If all the water left their bodies, they would shrink and die
- These fish drink seawater to replace the water they lose through osmosis
- Drinking seawater brings a lot of salt into their bodies
 - They **excrete** the extra salt through their gills

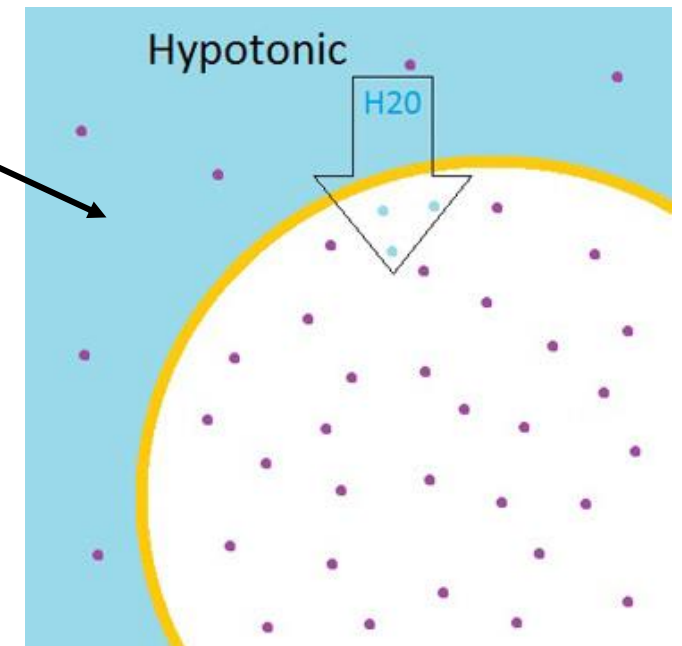


Water Balance in Freshwater

- Animals that live in freshwater have too much water coming into their bodies
 - The concentration of water outside their bodies is higher than the concentration inside, therefore, water constantly moves into them
 - If water is not balanced, the animal can burst

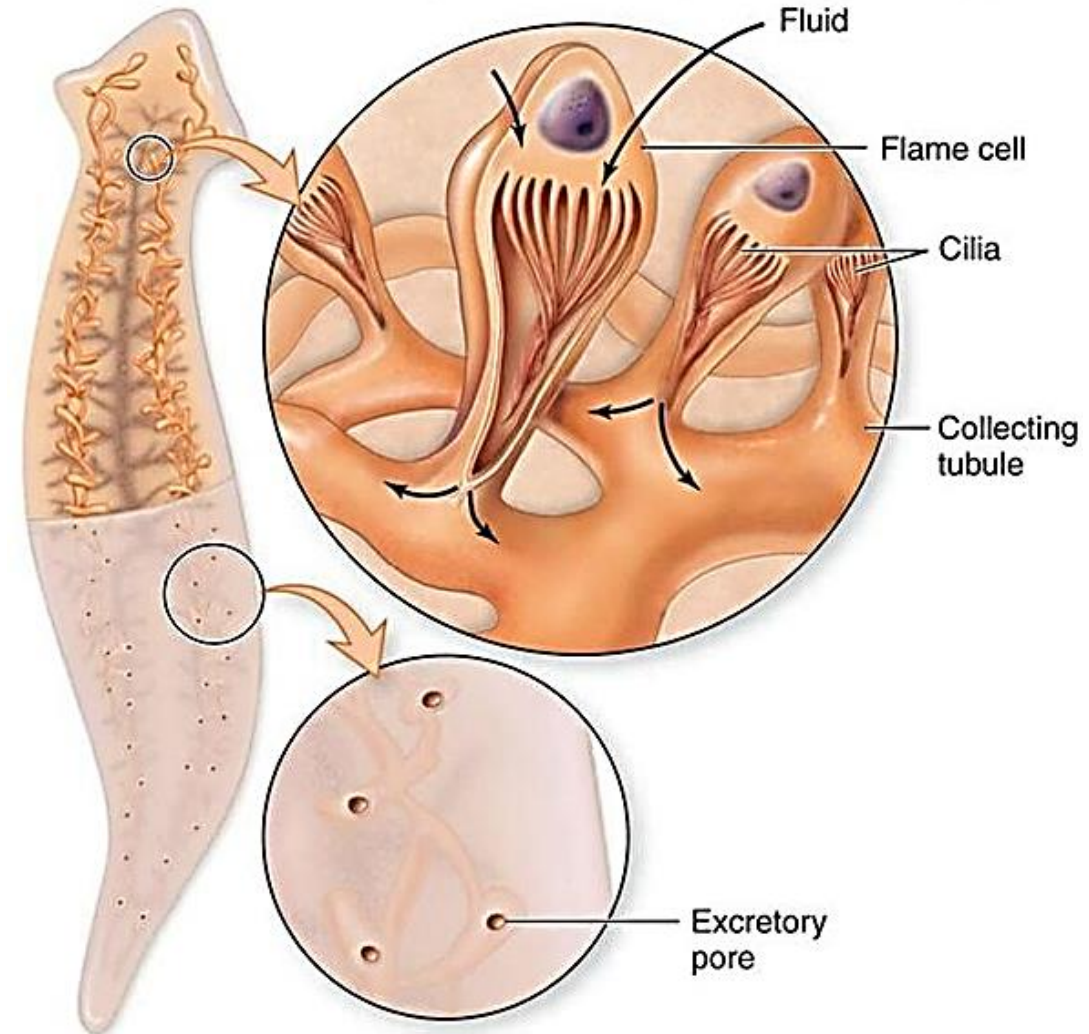


Higher concentration
of water outside the
animal



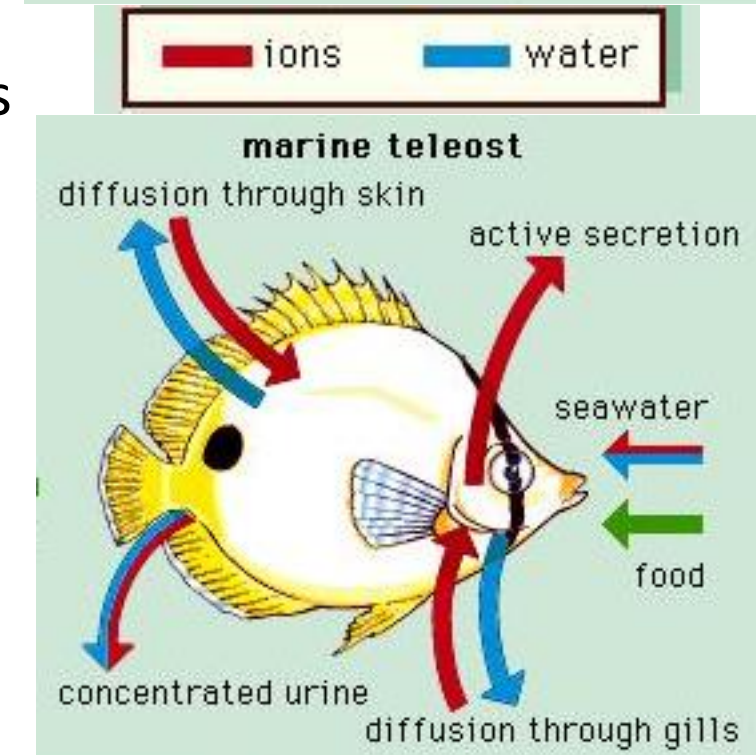
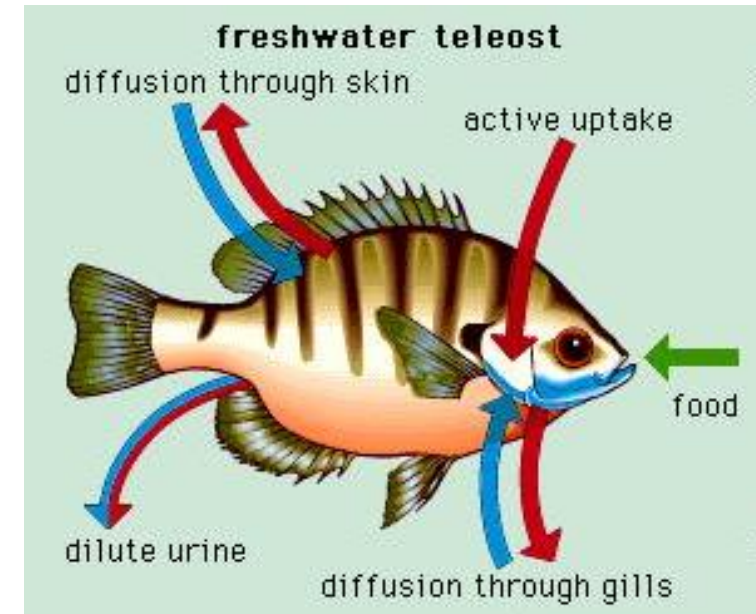
Water Balance in Freshwater

- Freshwater animals use special organs to remove excess, or too much, water
- For example, flatworms have a system of tiny tubes all through their bodies called *flame cells*
 - Flame cells collect excess water inside the flatworm and push the water along the tubes and out pores, or openings, in the body wall



Water Balance in Freshwater

- Another example, freshwater bony fish have the opposite problem of saltwater bony fish
 - In a lake or stream, water enters through the gills of a fish at all times
 - To get rid of the excess water, the fish use their kidneys to excrete urine
 - The excreted urine is mostly water, but it also contains some salt
 - The fish must replace the salt that is lost through excretion by absorbing salt with its gills

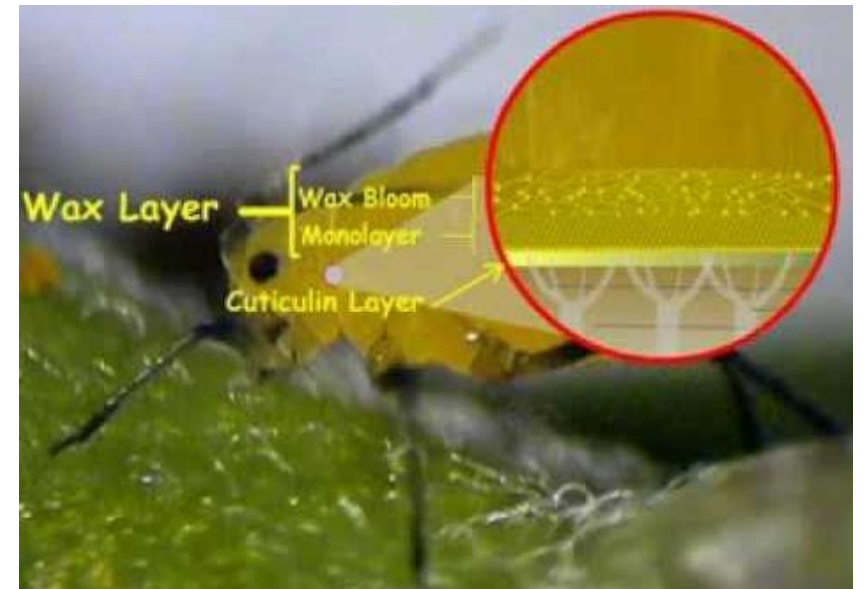


Water Balance on Land

- In land animals, the biggest problem with water balance is drying out
- Animals have ways to limit water loss

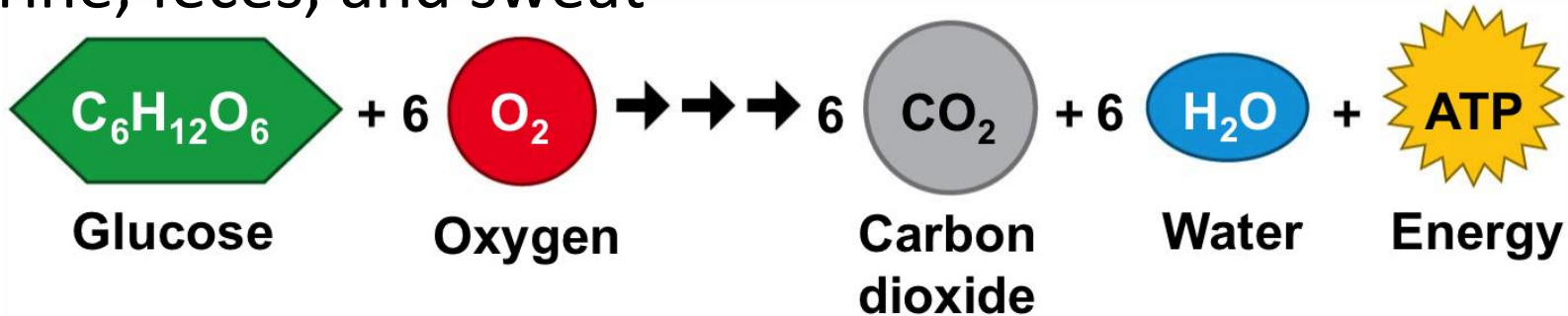
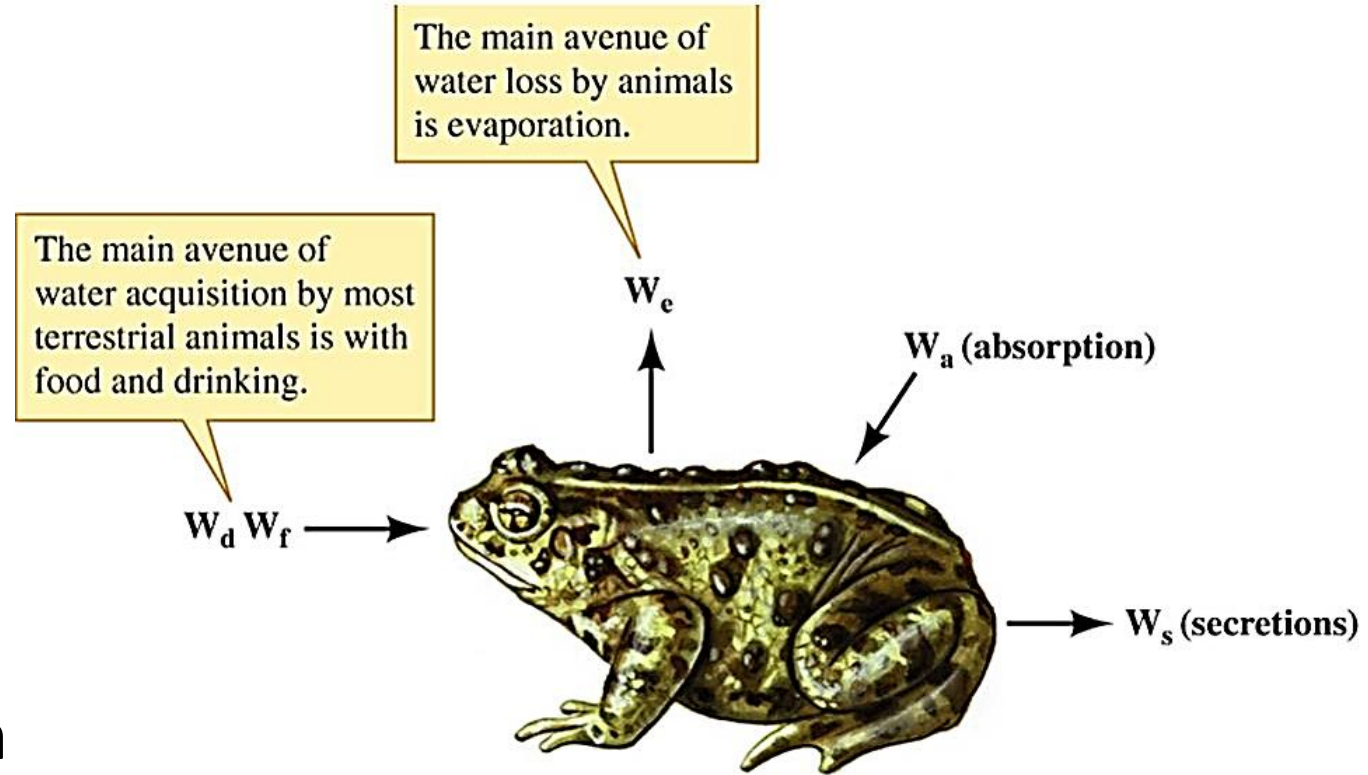
Examples:

- Land snails withdraw into their shells
- Insects have a waxy layer that covers their outside skeleton to stop water from evaporating
- Reptiles, birds, and mammals have a watertight skin



Water Balance on Land

- The entire body of a land animal cannot be watertight
- Animals have to respire
- They give off water when oxygen and carbon dioxide are exchanged
- Land animals also lose water in their urine, feces, and sweat



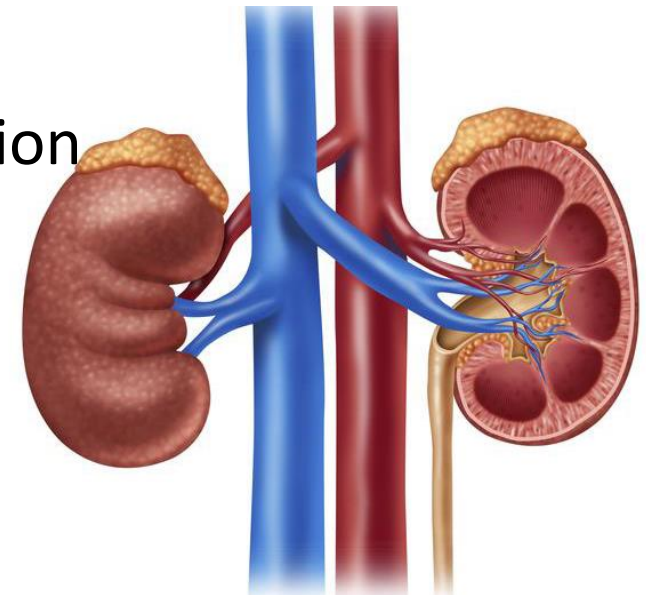
Water Balance on Land

- Most land animals can maintain water balance by drinking water
- If open water is scarce, animals may get water by eating leaves, fruits, or roots
- Some animals are especially suited for getting water from food
 - For example, the kangaroo rat of the American Southwest never drinks water. It gets water from seeds and other plant matter.



Water Balance on Land

- Kidneys are the main organs in keeping water balance in mammals and birds
- Suppose too much water gets into the body
 - The kidneys excrete urine with a high water concentration to remove excess water in the body
- Suppose the water concentration in the body is too low
 - The kidneys excrete urine with a low water concentration
 - This keeps more water in the body



Side Note!

WHAT WOULD
HAPPEN IF YOU
DIDN'T DRINK
WATER?



WHAT THE COLOR OF YOUR URINE SAYS ABOUT YOUR HEALTH:



TRANSPARENT

Sign of overhydration. A person has been drinking a little too much water.



BROWNISH ORANGE

Sign of dehydration or a possible sign of liver disease.



PALE YELLOW

Means a person is healthy and hydrated.



PINKISH RED

Possibly a sign of kidney disease, UTI or tumor.



TRANSPARENT YELLOW

Normal.



BLUE OR GREEN

Sign of a rare genetic disease.



DARK YELLOW

Normal but needs to drink more water.



FOAMY

Sign of kidney disease.

Excreting Waste

If an animal needs to save water, why does it produce urine?

- Producing urine does more than maintain water balance
- Producing urine also removes dangerous wastes from the body
- One type of waste is ammonia
 - It is formed when proteins break down
 - It is poisonous to cells
 - Animals need to get rid of it



=



Excreting Waste

- In most animals that live in water the ammonia moves out into the water
 - The ammonia does not build up inside the body
- Animals that live on land must get rid of ammonia in another way
 - They change ammonia into chemicals that are less poisonous and then excrete these chemicals in their urine



Summary

- Animal of all various environments need to maintain water balance in order to survive
- **Osmosis**, with regards to water balance, is the movement of water from areas of **higher concentration** to areas of **lower concentration**
- Too much water and too little water inside an organism can cause problems



Questions for homework

Instructions: Copy the questions and answer (in your own words) on a separate piece of paper. Answer in full sentences.

1. How do most sea invertebrates maintain water balance?
2. What is the function of the flame cells?
3. How do freshwater fish maintain water balance?
4. List three ways some land animals limit water loss.
5. Why is the breakdown of proteins a problem for animals?