

## I. Osmoregulation

### 1. What is an osmoconformer?

Osmoconformers are isoosmotic with their surroundings. This means that their internal osmolarity (think concentration) is the same as their environment. These animals tend to live in a stable environment where external osmolarity doesn't change.

### 2. What is an osmoregulator?

Fish who control their internal osmolarity. Some fish live in dehydrating environments. Think about fish who live in salt water. The water is always going to be saltier (a higher concentration) than the fish so the fish will want to lose water to their environment (concentration gradient). The fish overcome this by drinking large amounts of water. But now the fish has taken in salt from the sea water, so they excrete salt ions in urine with only a small amount of water. The drinking of sea water and excretion of small amounts of urine work together to balance the fishes environment.

In comparison, freshwater fishes generally have the opposite problem. Their cells are hyperosmotic to their surroundings because lakes and freshwater have low salt/ion concentrations. The nature of this problem would make freshwater fish tend to take in large amounts of water. To overcome this fish drink only a small amount of water and excrete large amounts of dilute urine

### 3. Why don't animals directly excrete ammonia?

Simple: its harmful to bodily processes! We have a lot of nitrogen from proteins and nucleic acids which are converted first to ammonia. Ammonia can directly interfere with processes (like oxidative phosphorylation), so it is converted to a more tolerable form. Also, because it is so toxic, ammonia has to be excreted with large amounts of water which causes it to be an inefficient process for land animals

### 4. What are the compounds ammonia can be converted into? What is their level of stability?

Urea: used by mammals, sharks, and amphibians, urea has a low toxicity. Urea requires less water to be excreted

Uric Acid: used by snails, reptiles, and birds. It is also less toxic and does not have to be excreted with water. Although it requires little water, this compound is EXPENSIVE to make (costs a lot of ATP)

## II. Excretion

### 1. List the parts of the mammalian excretory system and describe their function

Renal Artery- supplies blood to the kidney

Renal Vein- drains blood from the kidney

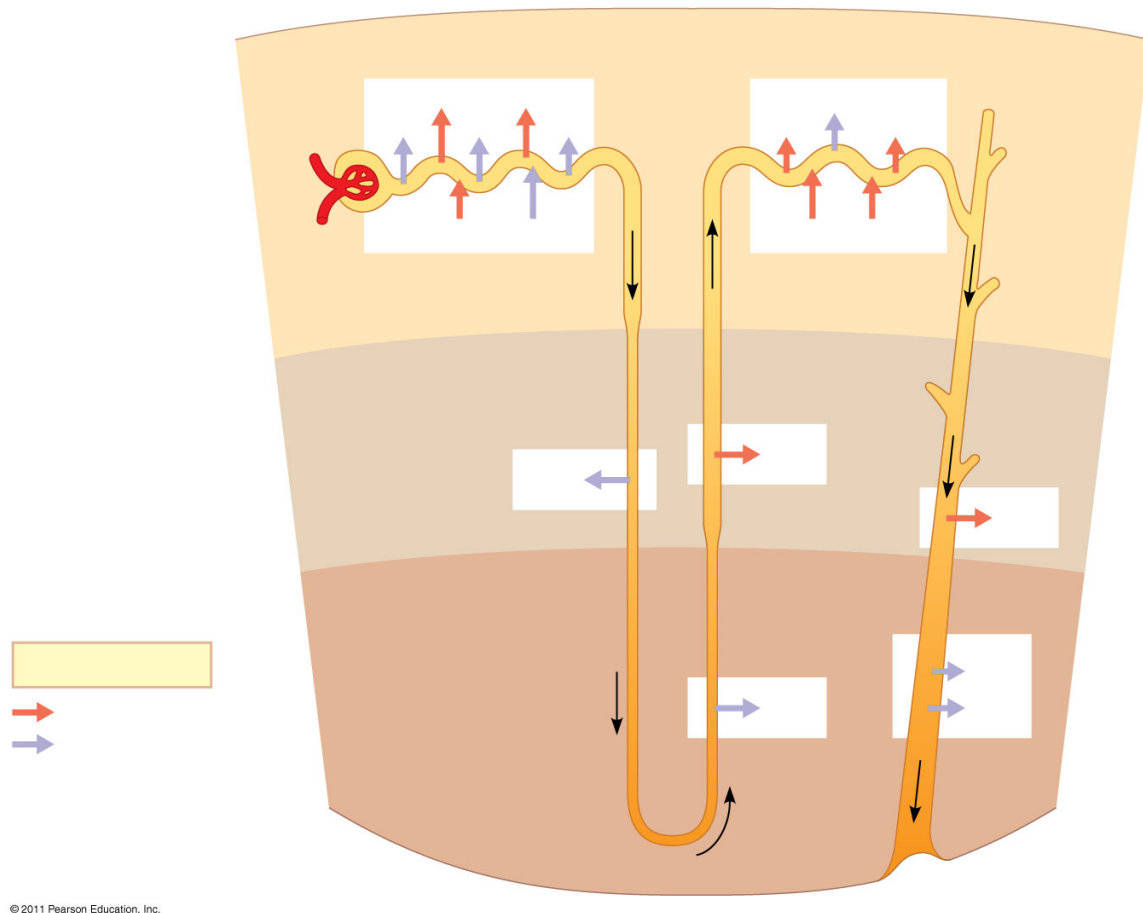
Ureter- transports urine from the kidneys to the bladder

Urinary bladder- stores urine from kidneys

Urethra- drains urine from the bladder

Nephron- the functional unit of the kidney

### 2. Describe the flow of filtrate in the kidney using the diagram. What nutrients stay in the filtrate and which move out?



Blood pressure forces fluid into the nephron

1. At the proximal tubule Na is actively pumped into the interstitial fluid and Cl follows passively. Because salt moves water follows it passively. Nutrients are actively pumped out. Bicarbonate and K are passively pumped out. Nutrients and ions pumped out into the interstitial fluid diffuse into peritubular capillaries to re-enter the blood stream.

2. Next is the descending loop of henle. Water reabsorption continues passively. ONLY water moves out of the descending limb.. so how does water move out passively when no nutrients are moving out? The osmolarity of the fluid increases through the loop of henle. Water moves from high to low as it moves out!

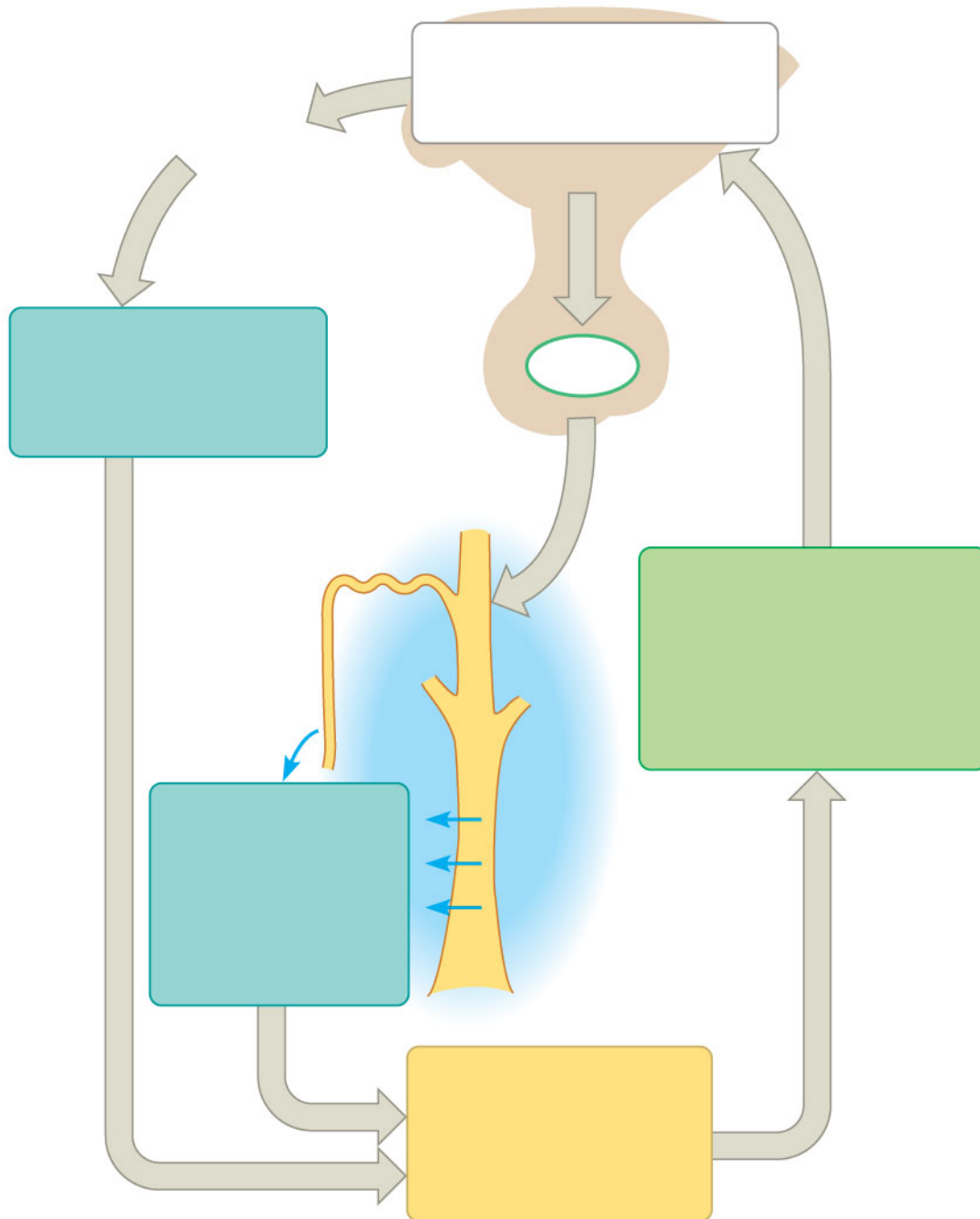
3. Ascending loop of henle is up next. This loop is NOT PERMEABLE to water but instead only permeable to salt. At first NaCl moves out passively (because the concentration inside filtrate is high) and then has to be pumped out actively because concentration gradient has changed (now you need to go from low to high)

4. The distal tubule functions in more reabsorption. K and H are reabsorbed into the filtrate actively and water and bicarb are pumped out passively into the interstitial fluid

5. Lastly is the collecting duct and absorption here depends upon conditions of the body and hormones acting on the kidney. The kidney uses NaCl to control water/ion absorption

\*\*\*\* the distal tubules and collecting duct are used to control reabsorption of what body needs. Amount of things that are absorbed here can change depend upon the body's condition  
i.e: the ADH system when you are thirsty (see below)

2. Describe how ADH is used to regulate the kidneys



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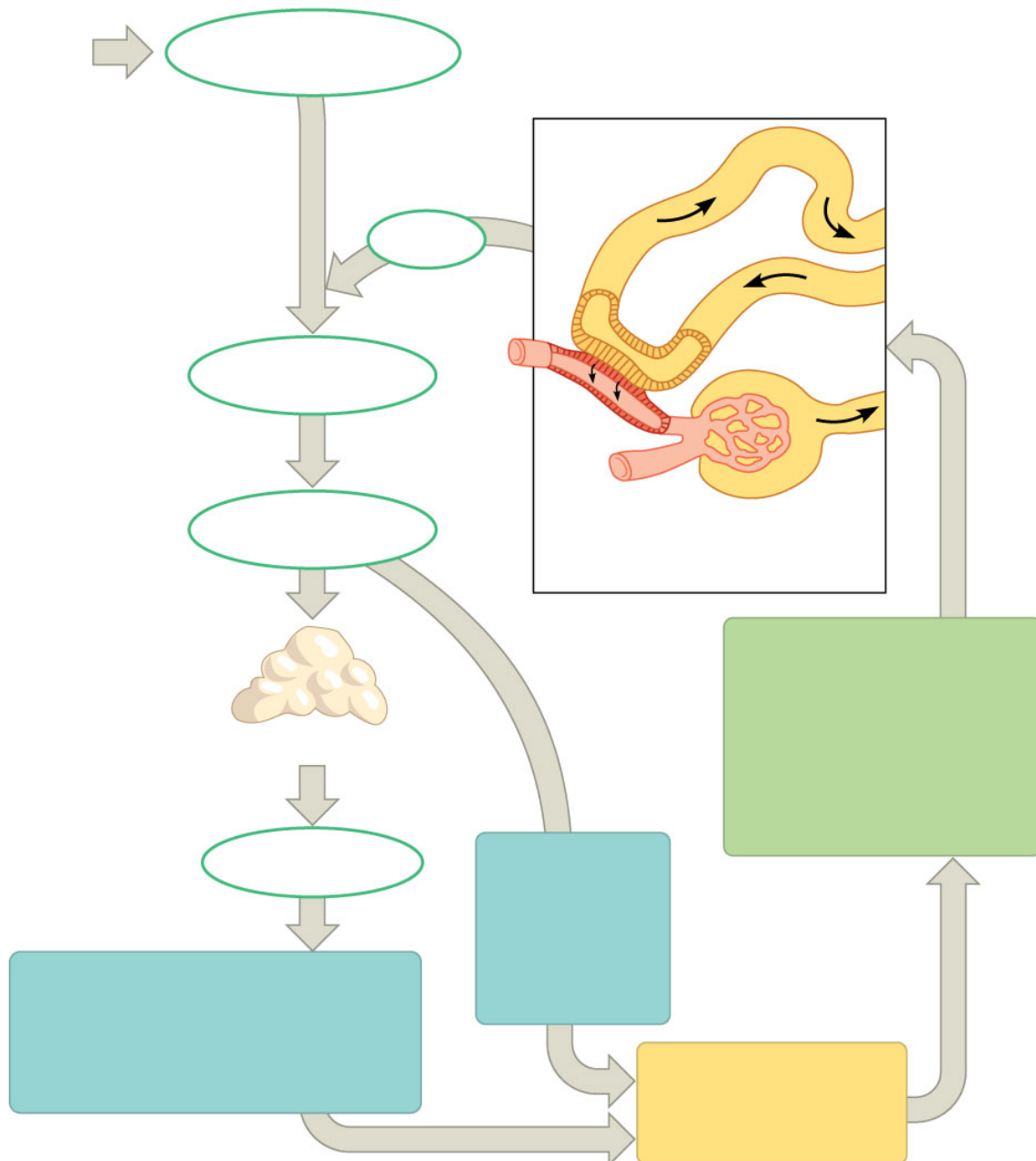
1. Blood osmolarity (thickness) increases and triggers osmoreceptors in the hypothalamus to trigger the posterior pituitary to release ADH. ADH tells your body KEEP WATER

2. ADH causes increased permeability in the distal tubules and collecting ducts so more water can be absorbed. ADH also causes you to be thirsty which allows more water to be taken in

3. ADH binds to receptors on collecting duct cells and activates cAMP to create aquaporin channels to allow more water to come in

What are aquaporin channels? These allow water to be transported across the cell membrane. Increased permeability to water is caused by the formation of these channels and their incorporation into the membrane

### 3. Explain the Renin-Angiotensin-Aldosterone System



1. When blood pressure or blood volume drops the JGA releases renin. Renin converts angiotensinogen into angiotensin I
2. ACE converts angiotensin I into angiotensin II
3. Angiotensin II causes arteriole constriction, which decreases blood flow to kidneys. Ang. II causes the adrenal gland to release aldosterone.
4. Aldosterone acts on distal tubules and causes them to reabsorb Na and water to increase blood volume and pressure

4. What is atrial natriuretic peptide?

Released by walls of atria in response to an increase in blood pressure or volume. It inhibits release of renin, inhibits NaCl reabsorption in collecting ducts, and reduces aldosterone release