

# 3.4 Water Study Guide by Hisrich

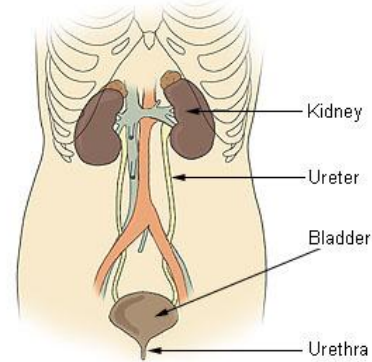
3.4.a. What are the functions of the urinary system?

3.4.b. What are the major organs of the urinary system?

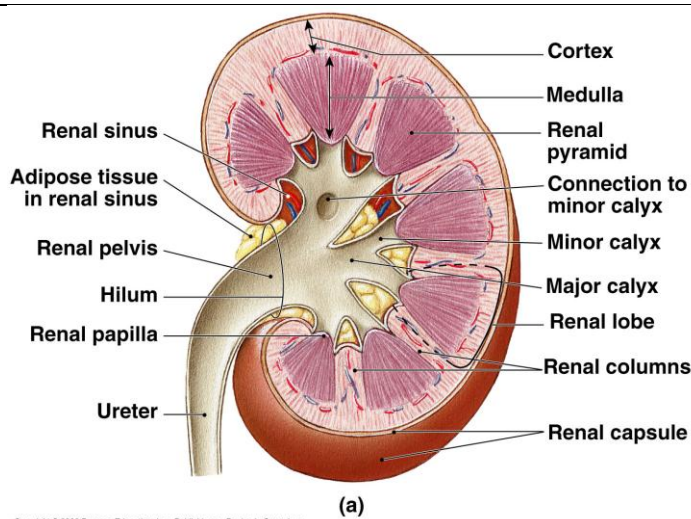
The **urinary system** helps maintain fluid homeostasis (blood volume) in the body. The **kidneys** assist in vitamin D production, maintain blood calcium levels, control extracellular fluid volume and composition (lymph fluids) & assist in control of pH of internal environment. They filter 20% of blood pumped by the heart.

**Urine** is created in the **kidneys** and then passes through the **ureters** into the bladder. The bladder stores the **urine** until the body is ready to release it, at which point a sphincter muscle relaxes and the urine passes out of the body through the **urethra**.

Components of the Urinary System



3.4.c. What is the general structure of the **kidney** and how does this structure relate to kidney function?



The **kidneys** receive blood through the renal artery, process it, and return the processed blood to the body through the renal vein.

The **kidneys** also make a protein (BMP-7) that stimulates bone growth.

The renal capsule is a membrane that protects the organ.

The cortex is the lightly colored outer region and the medulla is the darker colored inner region.

The renal pelvis collects the urine that has formed and directs it into the **ureter**.

3.4.d. How does the **kidney** form **urine**?

3.4.e. What is the relationship between blood and urine?

3.4.f. What is the function of the **nephron**?

The **kidneys** filter 20% of the plasma and non-cell parts of blood, reabsorbing the components the body needs back into the blood and secreting the unwanted portions.

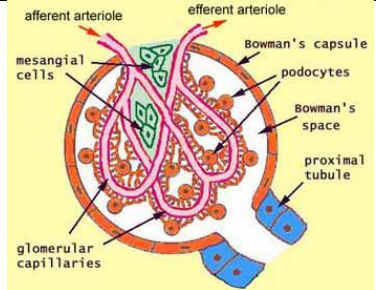
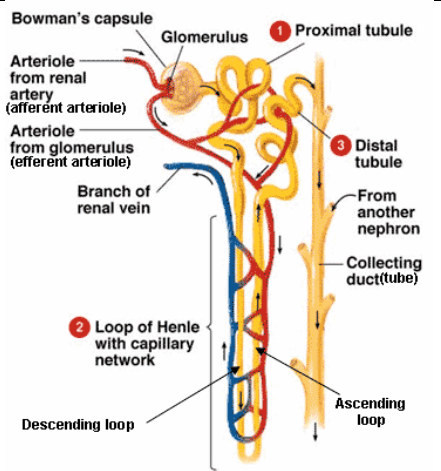
The **nephron** is the basic filtering unit of the **kidney** and there are about a million of them in each **kidney**. They filter every bit of blood about 20-25 times per day!

Unwanted materials (ions, small molecules, waste products, extra fluids) turn into filtrate (urine) in the **nephrons** and leave the body. No red blood cells get filtered out, so there should never be blood in the urine.

3.4.h. How do the hormones **ADH** and **aldosterone** affect the **nephron** and the body's overall water balance?

	ADH (antidiuretic hormone, vasopressin)	aldosterone
Made by	Anterior Pituitary	<b>Adrenal Glands</b> (adrenal cortex)
Job	Stimulates reabsorption of water within the <b>nephron</b> & constriction of vessels (raising blood pressure)	Promotes sodium and water reabsorption in <b>nephrons</b>
Both	Hormones that promote fluid retention, thereby increasing blood volume & pressure (act in response to situations like dehydration or high salt levels in blood)	

3.4.g. How do **filtration**, secretion and reabsorption in the nephron help maintain a fluid and electrolyte balance in the body?

Filtration	Secretion	Reabsorption
		<p>Happens in these places:</p> <ul style="list-style-type: none"> <li>Proximal tubule - reabsorbs 65 percent of filtered Na + 2/3 of water most other stuff</li> <li>Loop of Henle - reabsorbs 25 percent of filtered Na.</li> <li>Distal tubule - reabsorbs 8 percent of filtered Na.</li> <li>Collecting duct - reabsorbs the remaining 2 percent only if the hormone <b>aldosterone</b> is present.</li> </ul>
<p>The blood volume undergoes <b>glomerular filtration</b> where it gets filtered under pressure in the <b>glomerulus</b> (capillaries surrounded by Bowman's capsule). The filtrate becomes urine (made of excess fluids and unneeded particles) and passes into the proximal tube.</p>	<p>Waste substances like ammonia, ions (<math>H^+</math>, <math>K^+</math> &amp; <math>HCO_3^{2-}</math>), urea, creatinine, and certain drugs move into the distal and collecting tubules for removal from the body. Secretion is the opposite of reabsorption, moving substances out of the blood and turning them into urine. Secretion helps maintain pH balance by removing excess ions.</p>	<p>This process moves substances back into the blood.</p> <p>Small molecules like glucose, amino acids, vitamin C, and ions (<math>K^+</math>, <math>Ca^{2+}</math>, <math>Cl^-</math> &amp; <math>Na^+</math>) get grabbed by transporter proteins (located in the proximal tubule) and reabsorbed out of the filtrate. Some act passively, but some require active transport. Water is reabsorbed through osmosis. The reabsorption of sodium controls the reabsorption of most other substances (including water).</p> <p>The higher the concentration of a molecule &amp; the slower the rate of flow, the more that is reabsorbed.</p>

3.4.i. What is **urinalysis**? 3.4.j. How can the composition of urine provide clues about problems in other human body systems?

URINARY CHEMSTRIP 10 TEST		
TEST	NORMAL	POSITIVE RESULTS INDICATES
LEUKOCYTES	Negative	Infection, Allergy
NITRITE	Negative	Gram-Negative Bacteria
PROTEIN	Negative	Renal Inflammation, Allergies
GLUCOSE	Negative	Glucose Spill-Diabetes, Allergy
KETONES : *Ketones: The presence of ketones in the urine indicates that the body is utilizing fats as fuel and may also be indicative of abnormal carbohydrate metabolism.	Negative	Energy from fats, not CHO's
UROBILINOGEN	Negative	Compromised conjugation of bile.
BILIRUBIN	Negative	Hemoglobin Destruction
BLOOD	Negative	Infection, Hypertension, Menses
HEMOGLOBIN	Negative	Cell Damage-Oxidation, Allergy

**Urinalysis** measures the products **excreted** from the body via urine & can be used to detect many different diseases in the body (see graphic left).