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THE EXCRETORY SYSTEM

Unit Overview

In this unit you will be exploring the excretory system and learning how your body gets rid of wastes. The four organs responsible for excretion will be covered and you will learn how they operate. Good luck!

The Human Excretory System

What we're dealing with here are the organs in the body that have a role in removing metabolic wastes. Let's clarify what we mean by "metabolic wastes". Metabolic wastes are by-products of metabolism. That's fine and dandy as long as we know what metabolism means.

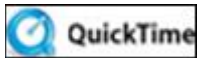
me-tab-o-lism \ma'tab-e-liz-em\ n	the sum total of the chemical reactions that keep an organism alive
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Examples of these "chemical reactions" would be things like synthesis, respiration, hydrolysis, and neutralization reactions. Each of them have a role in keeping a living thing ticking; and in so doing, each produces certain waste products. These waste products are referred to as metabolic wastes.

Let me put it this way: humans must get rid of two types of wastes. Wastes from the digestive system (feces) and wastes from metabolic activities (sweat and urine). Removing digestive wastes (bowel movement) is called egestion. Removing metabolic wastes is called excretion.

Video Information

The following video describes the functions of the **excretory system**, which is critical to survival. The many living cells in the human body produce metabolic wastes, which must be eliminated from the body. These wastes include carbon dioxide, urea, water, water vapor, and salts. The four organs that make up the excretory system are the lungs, kidneys, liver, and skin.



An Introduction to the Excretory System (02:14)

Major Metabolic Wastes

This table summarizes the four types of metabolic wastes produced by humans (and other animals) and the type of chemical reactions that produce them.

METABOLIC WASTE	A BY-PRODUCT OF...
water	dehydration synthesis and respiration
carbon dioxide	cellular respiration
salts	neutralization
urea	protein metabolism, deamination

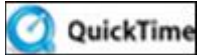
- **dehydration synthesis** = reactions in which small molecules are combined to form large molecules
- **cellular respiration** = chemical reaction that releases energy from organic molecules (usually glucose)
- **neutralization** = reactions between acids and bases
- **deamination** = removal of amino groups from protein molecules

Human Excretory Organs

1. the Lungs
2. the Liver
3. the Skin
4. the Kidneys (Urinary System)

Excretory Organ #1 = The Lungs

Cellular respiration occurs in every living cell in your body. It is THE reaction that provides energy (in the form of ATP molecules) for cellular activities. If respiration stops, the cell no longer has energy for cellular activities and the cell dies. As respiration occurs carbon dioxide is produced as a waste product. As the carbon dioxide accumulates in body cells, it eventually diffuses out of the cells and into the bloodstream, which eventually circulates to the lungs. And here, in the alveoli of the lungs, carbon dioxide diffuses from the blood, into the lung tissue, and then leaves the body every time we exhale. We should note that some water vapor also exits the body during exhalation.

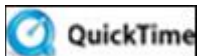


The Lungs (01:27)

Excretory Organ #2 = The Liver

The liver is a large, important organ. In fact it is the largest internal organ in our bodies. Its numerous functions make it "part" of the circulatory, digestive, and excretory systems. You know what? The space below would make a nice spot for a chart summarizing the jobs of the liver.

Excretory Function	Some proteins and other nitrogenous compounds are broken down in the liver by a process called deamination. As a result of these reactions, a nitrogenous waste called urea is formed.
Digestive Function	The liver produces bile, which is temporarily stored in the gall bladder before being released into the small intestine where it helps "emulsify" (break down) lipid molecules.
Circulatory System	The liver removes and breaks down old red blood cells. It is also responsible for maintaining "normal" levels of glucose in the blood. When stimulated by insulin, the liver removes glucose from the blood and converts it to glycogen for storage. When stimulated by the hormone glucagon, the liver does the opposite: it breaks down glycogen, producing glucose, which is released into the bloodstream. The liver is also responsible for removing potentially hazardous chemicals from the blood. It "detoxifies" the blood. For this reason, alcoholics and other types of addicts have a higher incidence of liver disease.



The Liver (01:51)

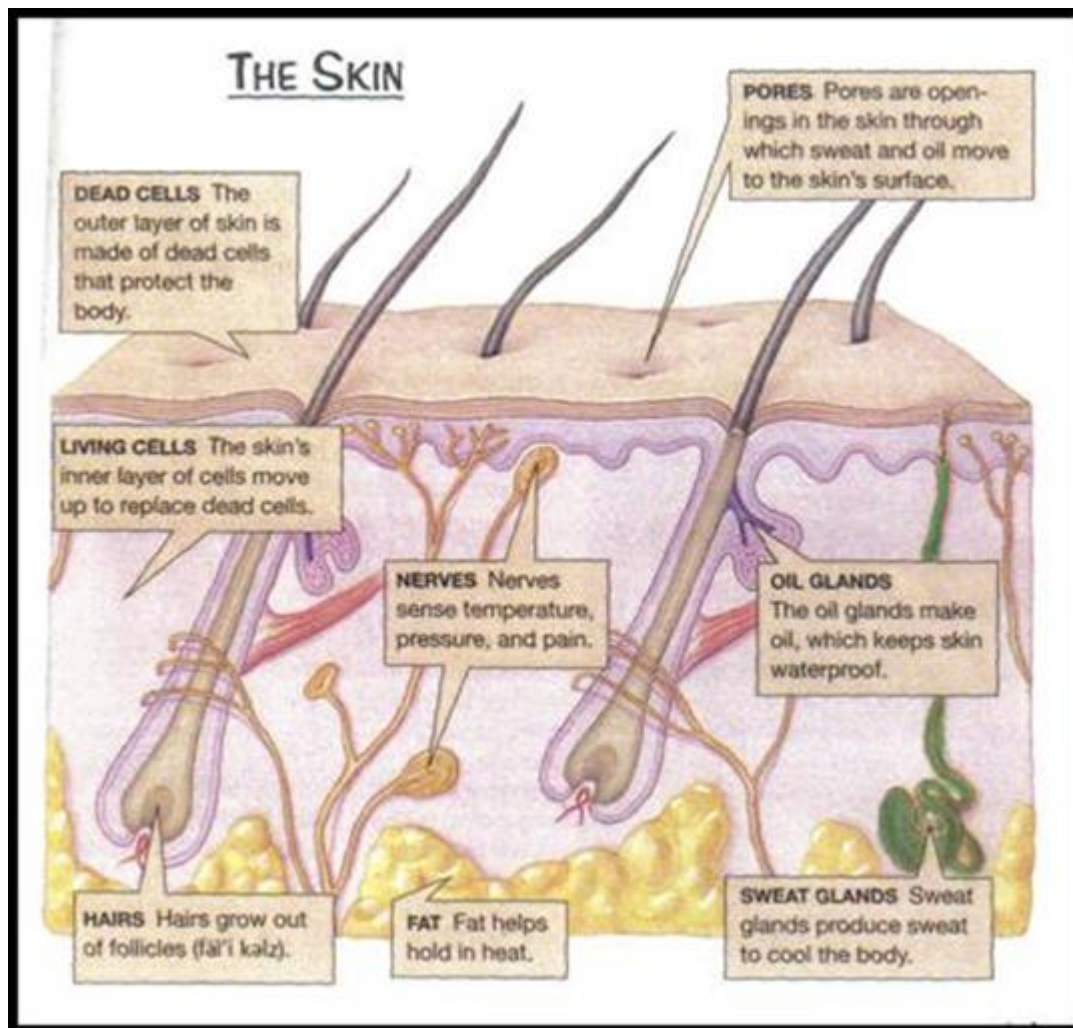
Excretory Organ #3 = The Skin

As you already know, sweat comes out of pores in your skin. As you may not know, sweat is a mixture of three metabolic wastes: water, salts, and urea. So as you sweat, your body accomplishes two things:

- 1) sweating has a cooling effect on the body
- 2) metabolic wastes are excreted.

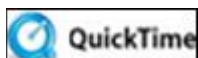
So, how does the sweat form? Ah, good question. Let's look at a picture and picture the sweat-making process.

I've colored the sweat gland and the duct (tube) leading to the skin surface a nice bright green so that they stand out.



What you should notice about the skin is that there are two layers, the thin epidermis at the top, and the thicker dermis below. The inner layer of skin (dermis) is where we find oil glands, hair follicles, fatty layers, nerves, and sweat glands.

Notice that the sweat gland is a tubular structure tangled with capillaries (the smallest of blood vessels). This close association of tubes allows wastes (namely water, salts and urea) to diffuse from the blood and into the sweat gland. And then, when body temperature rises, the fluid (sweat) is released from the gland, travels through the tube (duct), and reaches the skin surface through openings called pores.



The Skin (02:00)

Excretory Organs #4 = The Urinary System

Ah, the process of making urine is not as simple as you might think:

The urinary system (pictured here) is composed of two kidneys, two tubes called ureters, one urinary bladder, and another tube called the urethra.

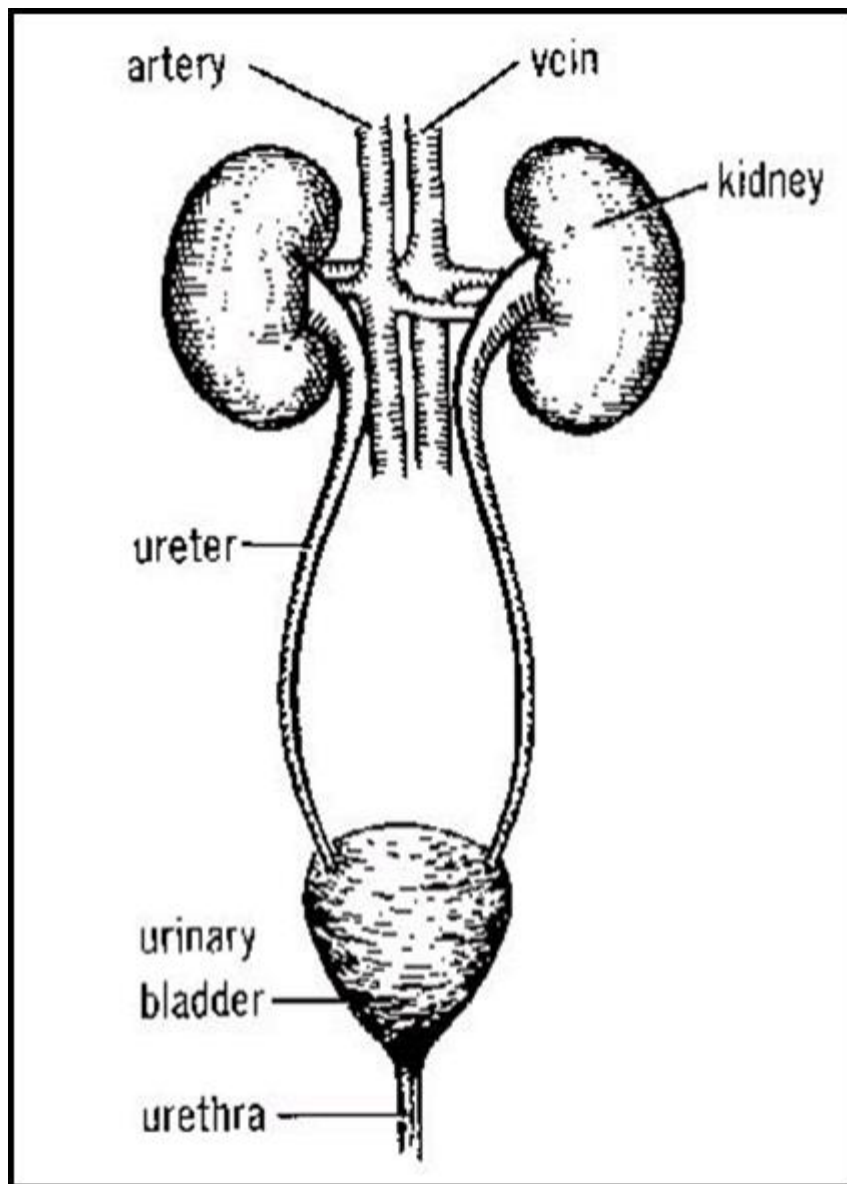
You probably know that the kidneys filter blood, so it's no surprise that there are a couple of blood vessels attached directly to each kidney. The full names of these vessels are the renal artery and the renal vein.

Three of the four major metabolic wastes produced by the body are filtered from the blood by the kidneys. Any idea which ones? They are water, salts, and urea (the 4th, carbon dioxide, is excreted by the lungs, remember?). These are the same three wastes that sweat glands filter and excrete. So, yes, sweat and urine are made basically from the same ingredients (except in different concentrations).

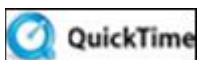
Each kidney (which can be thought of as BIG filters) are made up of thousands of tiny filtering sub-units called nephrons.

The ureters are simply tubes that carry urine from the kidneys to the urinary bladder.

The bladder temporarily stores urine. And the urethra is the tube through which urine leaves the body when you urinate.



Layers of the Kidney



The Kidneys (03:47)

➤ #1 - The Cortex

This layer is jam-packed with lots and lots of those nephrons that I just mentioned.

We'll get to the specifics on those in just a second.

Think of the cortex as the filtering layer of the kidney.

➤ #2 - The Medulla

The middle layer. Think of it as the collecting layer.

Tubes carrying filtered wastes travel from the cortex, through the medulla towards the pelvis.

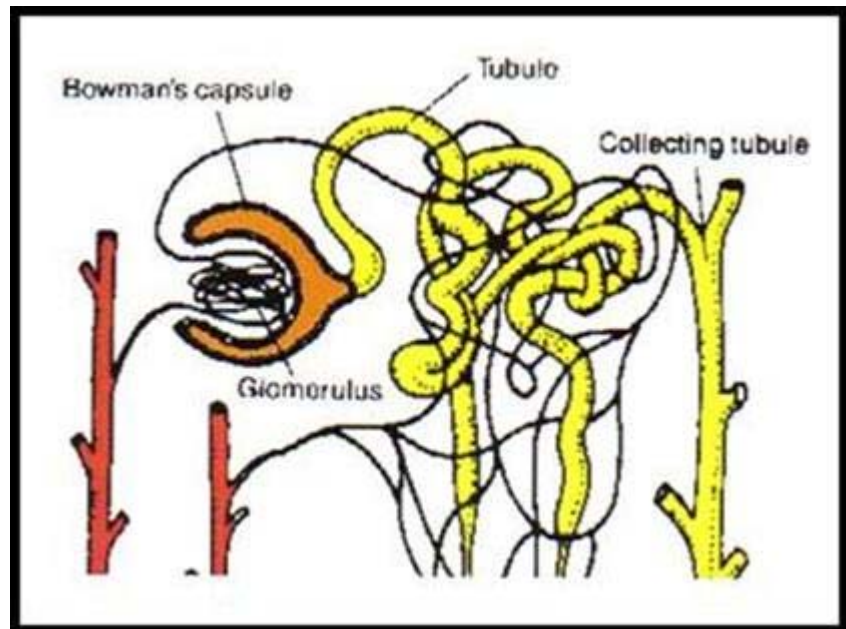
➤ #3 - The Pelvis

This is the area where all of the collecting tubules come together

and connect with the ureter (which is structure #4).
The ureter transports the wastes (urine) to the urinary bladder.

The Nephron - the structural units of the Kidney

The outermost layer of the kidneys, the cortex, is composed of approximately 1,250,000 structural units called nephrons. Blood is carried to the kidneys by the renal arteries, which branch into smaller arteries inside the cortex and then lead to clusters of capillaries called glomeruli. Each glomerulus is surrounded by a "C"-shaped structure called the Bowman's Capsule. It is here that materials such as urea, salts, water, glucose, and others pass from the blood into the nephron.

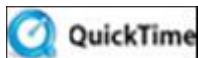


These materials (referred to as the "filtrate") pass through the

tubule, also known as the loop of Henle. As the filtrate travels through the tubule, useful substances are reabsorbed into the surrounding capillaries (which connect to veins that will transport the "clean" blood back to the heart via the renal vein).

About 180 liters of filtrate is produced each day, but only 1.5 liters of urine. So as you can see, most materials that initially enter the nephron are reabsorbed, leaving only the urea, salts, and some water in the tubule. These metabolic wastes form urine, which is transported to the urinary bladder by the collecting tubule.

There you have it, the Human Excretory System.



Summary of the Excretory System (00:51)

Very important in helping to maintain (my favorite word) homeostasis.

Homeostasis is the property of an open system, especially living organisms, to regulate its internal environment to maintain a stable, constant condition, by means of multiple dynamic equilibrium adjustments, controlled by interrelated regulation mechanisms.

If we didn't excrete our metabolic wastes they would reach toxic levels and it would be "curtains". So next time you sweat, urinate, or exhale, be sure to say "thanks kidneys (or lungs or sweat glands) for saving my life". Just make sure nobody hears you.



Now answer questions 1 through 12.



Below are additional educational resources and activities for this unit.

[Unit 4 Excretory System Cloze](#)

[Unit 4 Excretory System Trivia](#)

[Unit 4 Excretory System Cloze Key](#)