



Sweat

Reference Books:

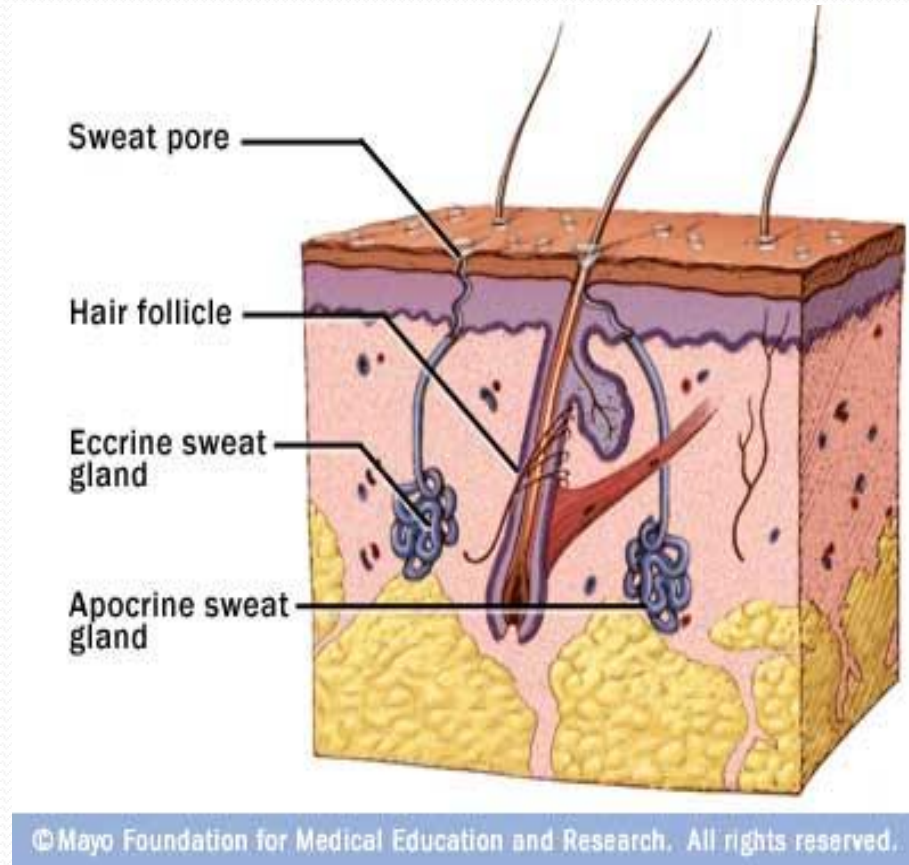
- **Text Book of Medical physiology** (Guyton and Hall)
Eleventh edition

Sweat:

It is a body secretion which is considered as an important means of getting rid of body heat since heat is used in evaporation (one of the ways we regulate our body temperature) produced and excreted by the sweat gland in process called **Perspiration, sweating, transpiration, or diaphoresis** .

- Sweat helps to keep our skin moist.
- Na^+ and Cl^- are the major electrolytes and other mineral composition varies depending on the person's activity.
- Sweat contains a natural antibiotic (dermaicidin), that helps to destroy bacteria on the skin.
- Women lose 180 g of sweat per hour, when men lose 250 g

Sweat glands



There are two types of sweat glands

Apocrine sweat glands:

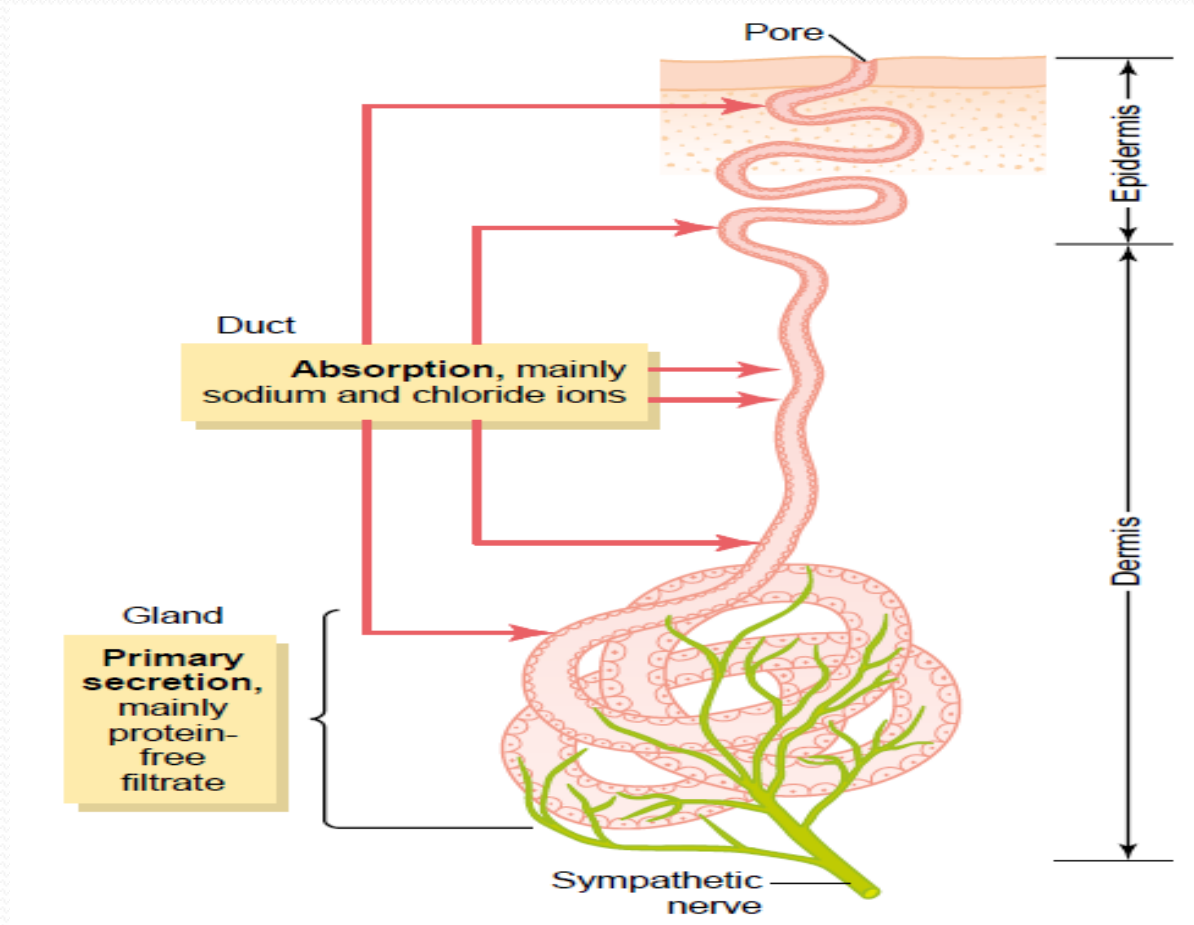
- found mainly in the armpits and near the anus. We each have about 1 million of these glands. They are really scent glands.
- larger in size compared to the eccrine sweat glands.
- Become active with the onset of puberty.
- Associated with hair follicles and open up at the hair follicles.
- Produce a thick fluid, which in contact with bacteria on the skin's surface and produces a characteristic potent "body odor".

Eccrine sweat glands:

- They are responsible for sweating when we are hot. We each have about 3 million of these glands.
- Located over the entire body surface except for the lips, nipples and part of the external genital,
- Innervated by sympathetic nerves.
- The tiny ducts of the eccrine glands pass through the dermis and epidermis, open up and empty directly on to the skin .
- They are active since birth producing an odorless, clear fluid which is sweat and is mainly a mixture of water and salts.

Sweating control

- Stimulation of the anterior hypothalamus-preoptic area in the brain either electrically or by excess heat causes sweating. The nerve impulses from this area that cause sweating are transmitted in the autonomic pathways to the spinal cord and then through sympathetic outflow to the skin everywhere in the body.
- Sweat glands are stimulated in response to:
 - 1-high temperature .
 - 2-exercise.
 - 3-hormones (epinephrine or norepinephrine).
 - 4-emotional stress



Sweat gland innervated by an acetylcholine-secreting sympathetic nerve. A *primary protein-free secretion* is formed by the glandular portion, but most of the electrolytes are reabsorbed in the duct, leaving a dilute, watery secretion.

Mechanism of Sweat Secretion.

- The sweat gland is shown to be a tubular structure consisting of two parts: (1) a deep subdermal coiled portion that secretes the sweat, and (2) a duct portion that passes outward through the dermis and epidermis of the skin.
- The secretory portion of the sweat gland secretes a fluid called the **primary secretion or precursor secretion**; the concentrations of constituents in the fluid are then modified as the fluid flows through the duct.

- The composition of the precursor secretion is similar to that of plasma, except that it does not contain plasma proteins.
- Sodium 142 mEq/L - chloride 104 mEq/L, with much smaller concentrations of the other solutes of plasma. As this precursor solution flows through the duct portion of the gland, it is modified by reabsorption of most of the sodium and chloride ions. The degree of this reabsorption depends on the rate of sweating as follows.

- When the sweat glands are stimulated only slightly, the precursor fluid passes through the duct slowly. In this instance, essentially all the sodium and chloride ions are reabsorbed, and the concentration of each falls to as low as 5 mEq/L. This reduces the osmotic pressure of the sweat fluid to such a low level that most of the water is also reabsorbed, which concentrates most of the other constituents. Therefore, at low rates of sweating, such constituents as urea, lactic acid, and potassium ions are usually very concentrated.

- When the sweat glands are strongly stimulated by the sympathetic nervous system, large amounts of precursor secretion are formed, and the duct may reabsorb only slightly more than half the sodium chloride; the concentrations of sodium and chloride ions are then a maximum of about 50 to 60 mEq/L, slightly less than half the concentrations in plasma. Furthermore, the sweat flows through the glandular tubules so rapidly that little of the water is reabsorbed.

- Therefore, the other dissolved constituents of sweat are only moderately increased in concentration—urea is about twice that in the plasma, lactic acid about 4 times, and potassium about 1.2 times.

- The heat-regulatory function of the hypothalamus is affected by inputs from temperature receptors in the skin.
- The sweating response to a rise in hypothalamic ('core') temperature is larger than the response to the same increase in average skin temperature.
- The process of sweating decreases core temperature, whereas the process of evaporation decreases surface temperature

Mechanism for body cooling

Sweating

- When your body is hot, sweat glands are stimulated to release sweat.
- The liquid sweat turns into a gas (it evaporates)
- To do this, it needs heat.
- It gets that heat from your skin.
- As your skin loses heat, it cools down.

Vasodilation

- Blood carries most of the heat energy around body.
- There are capillaries underneath skin that can be filled with blood if you get too hot.
- This brings the blood closer to the surface of the skin so more heat can be lost.