The sebum along with the keratin forms a lipid-protein complex or «synapse» that maintains water balance; if one element is missing, it upsets the balance. Insufficient sebum causes superficial dehydration and the skin becomes easily irritated. Excess sebum can be the cause to certain skin conditions.

Sebum

Sebum Composition

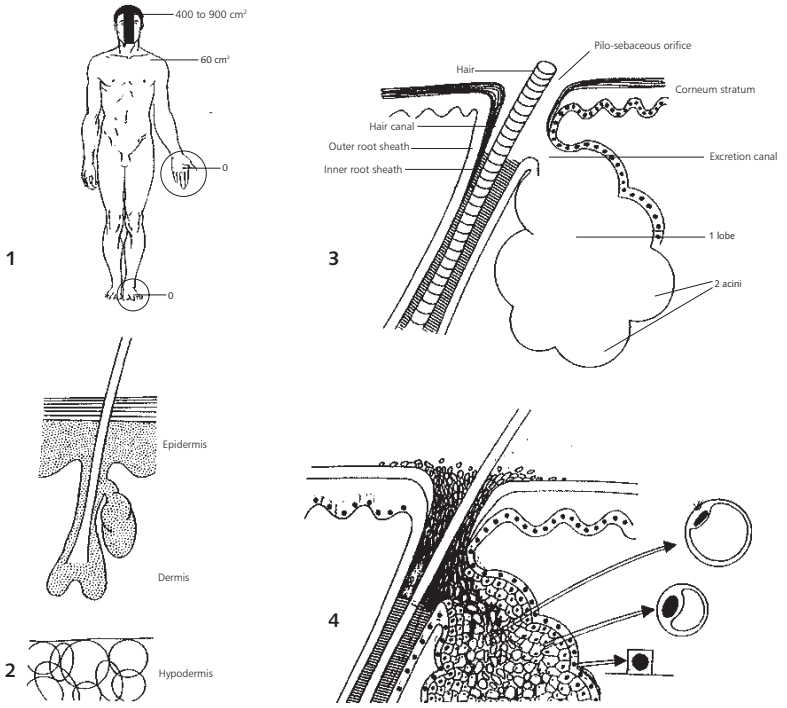
Sebum is secreted in holocrine mode; it contains cellular debris, in addition to the actual secretion. Its chemical components include:

- Triglycerides (43%)
- Waxes (25%)
- Fatty acids (16%)
- Scalene (12%)
- Cholesterol (4%)

Note: Sebum is extremely difficult to isolate from the skin, and experts do not agree on its chemical composition. Some scientists estimate its lipid content at 60 %. Regardless of the exact proportion, the most important chemical characteristic of sebum is its *lipidic nature*.

The Role of Sebum

- Sebum serves several functions on the skin surface:
- **Microbial protection**: its acidic pH contributes in stopping microbial growth.
- **Waterproofing the skin**: sebum contributes to the formation of a lipidic film on the skin surface, and in the lipid-protein synapsis. These two barriers ensure the skin's impermeability.
- **Hair lubrication:** sebum lubricates body and scalp hair, thus preventing them from drying out.
- **Suppleness of the horny layer (stratum corneum)**: its lubricant action helps the horny layer remain supple.



▲ **Figure 3.27** Sebaceous Glands

1. Distribution of sebaceous glands in the skin;
2. The sebaceous gland is located in the middle dermis;
3. The sebaceous gland is a cluster-shaped acinous gland;
4. Cross-section of a sebaceous gland.

Holocrine: the secretion method of exocrine glands where the entire cell is eliminated along with the secretory material.

Sebaceous Secretion

Factors That Influence Sebaceous Secretion

We do not fully understand what controls sebaceous secretion. The following factors are believed to have some influence:

Quality, volume and distribution of glands: the number, size and distribution of glands is genetically determined. Thus, the level of secretion varies from one person to the next.

Hormonal action: the activation of sebum secretion is governed by androgen hormones (dihydrotestosterone (DHT) being the biologically active hormone) generated in the gonads and carried in the bloodstream. It occurs at puberty, and decreases during pregnancy and menopause.

Nervous action: the autonomic nervous system indirectly affects sebaceous secretion when it is subjected to stress or any other psychosomatic disturbance.

Hepatic action: a liver disorder appears to affect the quality of secretion.

Nutritional intake: a carbohydrate-rich diet (sugar) stimulates secretion, whereas vitamins A and B2 (riboflavin) inhibit secretion.

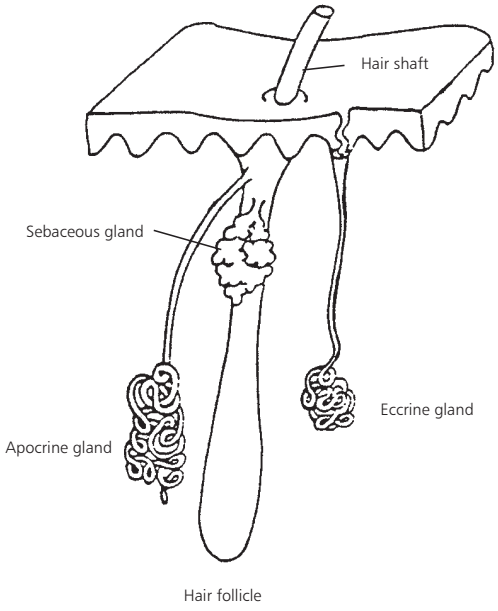
Unsightly Imbalance of Sebaceous Secretion

Hyposecretion or hypersecretion of sebum may lead to unsightly skin ailments.

- **Hyposecretion**: makes the skin dehydrated, hair dull, dry and brittle.
- **Hypersecretion**: makes the sebum alkaline, the hair and skin oily. May also lead to seborrhea (gland hypertrophy), comedones and sebaceous cysts (lipidic masses).

Sudoriferous Glands

Sudoriferous glands are exocrine glands that secrete an aqueous substance, sweat. They are simple tubular glands, and most have an eccrine (or merocrine) secretion mode, although a small number of glands secrete in apocrine mode.



▲ **Figure 3.28** Sweat Glands and Sebaceous Glands

Eccrine Sudoriferous Glands

Characteristics of Eccrine Glands

- They are the most common;
- They function throughout your entire lifetime;
- They are connected to the epidermis by an excreting duct that reaches the surface through a pore;
- The secreting portion is located deep within the dermis and the hypodermis;
- They secrete a milky and alkaline perspiration;
- They emit an odor.

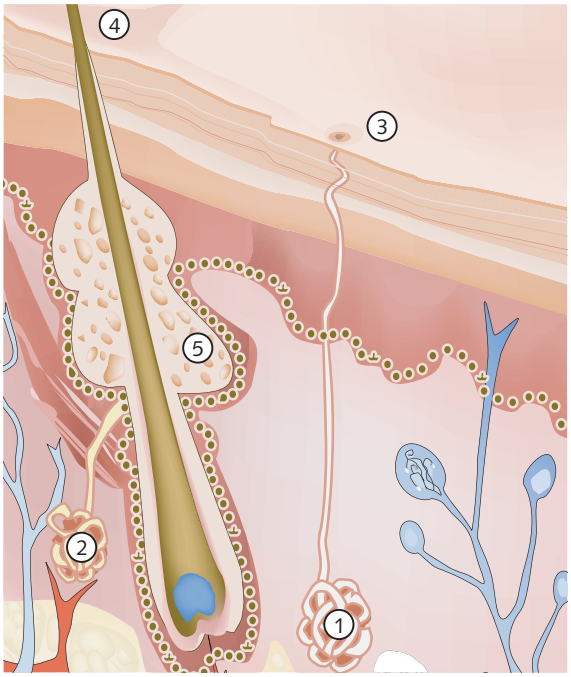
Eccrine Gland Structure

Secreting portion: it consists of a coiled tube. The walls of the tube consist of a single layer of cells, resting on a very thick basal membrane. Between the cells and the basal membrane are stellar muscular cells that can contract to help expel the secretion. These cells are called **myoepithelial** cells.

Excreting portion: the excreting duct, formed of two layers of cells, runs straight up to the dermal papilla. As it goes through the epidermis, it becomes spiral-shaped and reaches the surface through a pore, which provides some protection from foreigh objects (microbes, dust).

Innervation: eccrine glands are innervated by autonomic nerve fibres that govern the contraction of myoepithelial cells.

Vascularization: the secreting portion of the gland is fed by a number of capillaries, from which the sweat is extracted.



▲ **Figure 3.29** Sweat Glands

1. Eccrine Sweat Glands
2. Apocrine Sweat Glands
3. Pore
4. Ostium
5. Sebaceous Gland

Apocrine Sudoriferous Glands

Characteristics of Apocrine Glands

- They occur in the axillar and perianal areas;
- They develop during puberty, along with hairs in these areas;
- Their excreting duct does not reach the skin surface directly, but rather empties into a hair follicle from an ostium;
- They secrete a milky and alkaline perspiration;
- They emit an odor.

Structure of Apocrine Glands

Secreting portion: it is larger than in eccrine glands. Furthermore, myoepithelial cells occur in greater numbers.

Excreting portion: the excreting duct is formed of a single layer of cells. It empties into a hair follicle without a spiral-shaped segment, which increases the risk of infection.

Innervation and vascularization: similar to eccrine glands.

Sweat

Chemical Composition of Sweat

Water: sweat is a very diluted aqueous solution, composed of 99% water, the remaining 1% being organic matter (0.5%) and mineral salts (0.5%). It is much less concentrated than urine, the body's main excretion fluid.

Mineral salts: the main mineral salts present in sweat are chlorine, sodium and potassium, with traces of phosphate, calcium and magnesium.

Organic matter: urea is the most important organic substance found in sweat. It also contains a few amino acids and lactic acid. The latter is a waste product released by muscles, especially after intense muscular activity.

Exogenous substances: elimination of medication in particular, through sweat.

Differences Between Eccrine and Apocrine Sweat

pH: eccrine sweat is acidic (pH of 3.8 to 5.6), whereas apocrine sweat is more alkaline (pH of 5 to 6.5). This alkalinity may be partly responsible for common infections in the underarm and pubic areas. When sudation is very abundant, eccrine sweat may also become alkaline.

Fatty acids: apocrine sweat contains volatile fatty acids which give it its characteristic odour. Fatty acids (and odour) vary for each individual and race.

Consistency: apocrine sweat often has a milky aspect, and does not form droplets, it leaves a viscous residue as it dries. Eccrine sweat is more water-rich, transparent and evaporates easily.

Functions of Sudoriferous Glands

The increase in temperature of blood, thus the «core temperature», is an indication of an augmentation in cellular metabolism or an increase in the ambient temperature which elevates the temperature of the skin. These are essentially the two stimuli that affect the sweat glands.

The four main functions of sudoriferous glands are:

- **Stimuli**: higher blood temperature, therefore higher **core** temperature, sends the message that cellular metabolism is greater, or that the ambient temperature is rising, thereby increasing the skin temperature. The latter are the two essential stimuli that affect sudoriferous glands.
- **Elimination** of water and toxins (ex: urea)
- **Thermoregulation**, evaporation of sweat constitutes a loss of heat for an overheated body;
- **Moisture and softness** of the horny layer (stratum corneum).