

Deodorants and Antiperspirants

- **Anatomy and Physiology of Human Sweat Glands**
- Sweating is an important body **temperature regulator**, especially in warm and humid weather climates, stress situations, or during heavy exercise.
- It also functions to **remove waste and toxic** by-products from the body.
- Most people have several **million sweat glands** distributed over their bodies, providing plenty of opportunity for **underarm odors** to develop.

- Sweat glands found in human skin are classified into two different types: **eccrine glands and apocrine glands**
- Their secretory portion is found deep in the dermis, from which a duct leads **directly onto the skin surface**.
- They function continuously and are known as the “**true**” sweat glands since their main function is to **control body temperature and electrolyte balance** through the evaporation of water from sweat on the body surface.
- Eccrine glands exist and start function **from birth**. These glands are found **all over the body**.

- **Apocrine glands** are primarily **limited to certain body** parts, such as the axilla, anus, and breast.
- These are also found in the dermis; however, these are larger than eccrine glands and their ducts **open into the hair follicle duct**.
- Apocrine glands also **exist at birth**; however, they become **functional at puberty**
- They are usually **triggered by** emotions, such as excitement, anger, and fear.

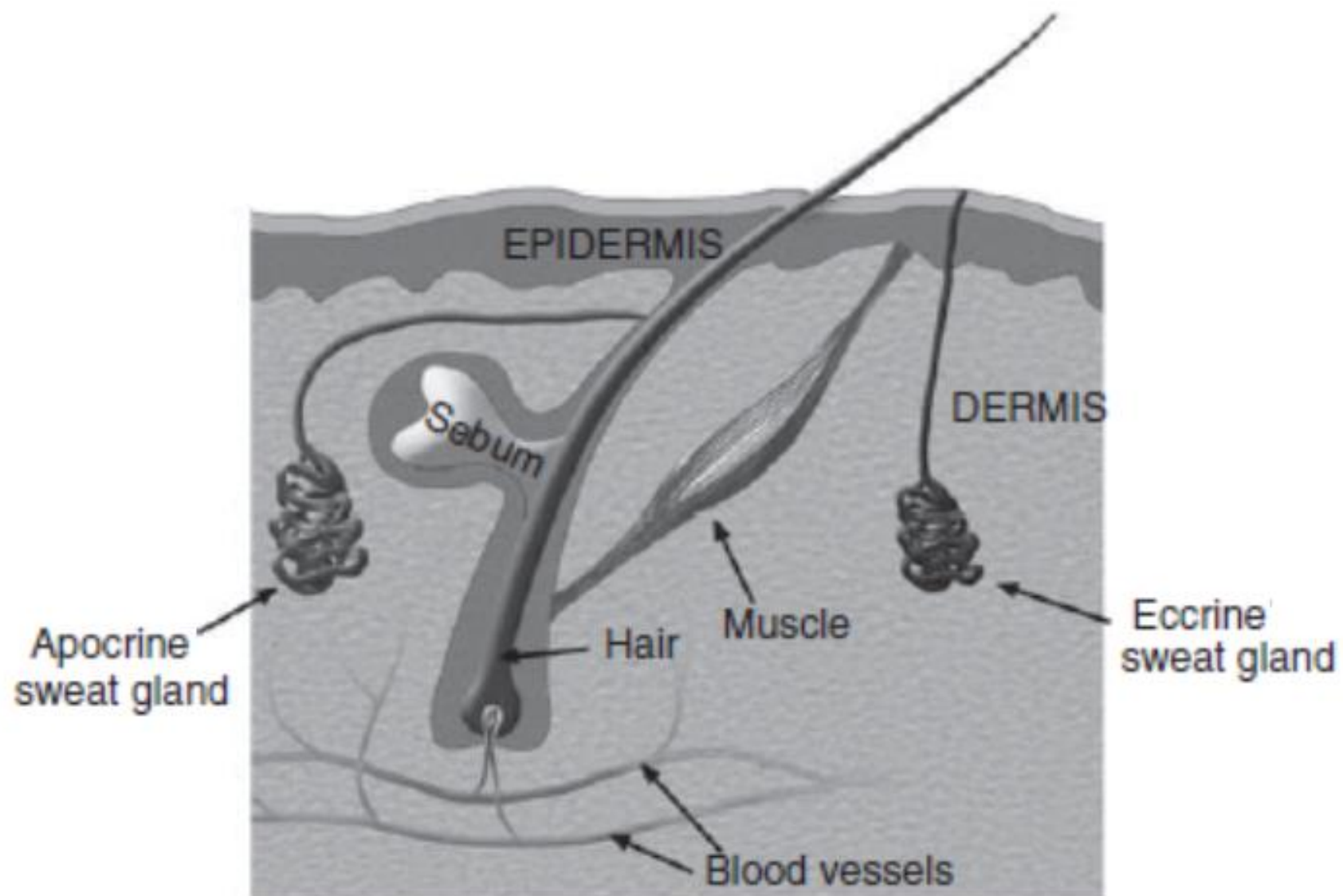


Figure 3.31 Eccrine and apocrine sweat glands.

- **Sweat by itself is odorless.** A characteristic odor develops by the activity of bacterial flora on the skin surface.
- **Bacteria break down** various chemicals in sweat, resulting in volatile by-products, which have an unpleasant odor
- The human scent is **genetically controlled and systemically influenced by** dietary and medicinal intake, as well as by the application of fragrance products

Types and Definition of Products Reducing Body Odor

- **Deodorants** reduce or mask unpleasant body odors **by reodorization and/or antibacterial action**. However, they do not interfere with the delivery of sweat gland secretions.
- **Antiperspirants** reduce underarm wetness **by inhibiting perspiration** that is secreted by the eccrine glands
- **Antiperspirants** usually contain aluminum-based or aluminum–zirconium-based compounds that can form a temporary plug within the sweat duct and stop the flow of sweat to the skin surface.

- It should be noted that a, “**deodorant**” is not an “**antiperspirant**” but an “**antiperspirant**” can be a “**deodorant**.”
- The reason for this is that aluminum salts have **bactericidal properties**, rapidly reducing the indigenous bacterial population when applied on a regular basis.

Hyperhidrosis

- There is a condition called **hyperhidrosis or excessive sweating**.
- The excessive sweat leads to **unpleasant body odor** that can **adversely affect** the person's ability to attain a normal and healthy QoL.
- **The treatment of hyperhidrosis usually starts with OTC antiperspirants.** However, none of today's OTC antiperspirants are specifically designed or claimed to have a beneficial effect on excessive sweating.

Hyperhidrosis

- **Additional treatment options** include prescription antiperspirants, oral medications, topical injections, and surgery.
- Prescription antiperspirants contain **higher doses of aluminum chloride**, which can cause irritation and damage clothing.
- FDA approved **Botox (botulinum toxin type A)**, to treat severe **underarm sweating** (not for other sites) that cannot be managed by topical agents.

- **Side effects**
- Minor negative effects may occur.
- **Skin irritation and allergies.** One of the major causes can be the use of products on **broken skin** (e.g., from shaving). This irritation can be avoided if the product is not used after such procedures. They are most commonly related to the **fragrances**.
- Antiperspirants can **stain** the clothes, which is a distinct negative effect from consumers' perspective.

- Consumers have concerns that antiperspirants may interfere with the body's natural cooling process, leading to **overheating**.
- Studies show that this is **not true** for several reasons:
 1. The axillary region is **more involved with apocrine sweating**, which is triggered by emotional arousal, than eccrine sweating, which regulates the body temperature.
 2. Even when eccrine sweating happens, the sweat **cannot efficiently evaporate and cool** the body due to the occluded nature of the underarm region.
 3. The surface area affected by the use of antiperspirants is relatively small.

Types of Ingredients

- **Odor masking** ingredients reduce the perception of odor through blending with underarm odor and masking it. **Examples** for such ingredients are fragrances.
- **Odor neutralizing** ingredients chemically neutralize odorous compounds, yielding odorless components. **Examples include** sodium and potassium bicarbonate and zinc carbonate.

- **Odor quenching** ingredients bind to the odorous chemicals and form complexes with these materials. **Examples include** zinc ricinoleate, certain metal oxides such as zinc oxide, Hydroxyapatite
- **Odor absorbing/adsorbing** ingredients physically neutralize odorous molecules formed in the axilla via absorption or adsorption. This results in the **immobilization** of those molecules, **decreasing their volatility** and thus decreasing the perceived odor. **Range of silicones** and silicates are claimed to offer odor absorption benefits.

- **Esterase inhibitors** act by directly inhibiting certain enzymes of the underarm bacteria, which results in odor reduction. **An example** is zinc glycinate. **Another option to inhibit enzymes is to shift the pH optimal** for the development of underarm odor (pH 6) to the acidic range. **Lipophilic derivatives of citric acid are examples for such ingredients.**

- **Antiperspirants** reversibly block sweat gland excretion by **forming a temporary, gelatinous plug** in the eccrine duct that reduces, but do not stop, the flow of axillary perspiration.
- These blockages **prevent sweat from reaching the skin surface** in the axilla.
- They can remain within the sweat duct for **7–14 days**, depending on the rate of skin desquamation, user's hygiene regimen, activity type, and quality.

- **Antimicrobial** prevent underarm odor formation by inhibiting or deactivating the bacteria.
- **Examples include** ethanol; triclosan; quaternary ammonium salts; glyceryl fatty acid esters, and sucrose fatty acid esters.
- **Essential oils**, such as thyme and clove oil, can also have antimicrobial benefits, in addition to masking bad odor.
- Antiperspirant active ingredients also have antimicrobial properties

- The active ingredients can be divided into two groups:
- **Aluminum-based** agents, such as aluminum chloride, aluminum chlorohydrate, aluminum sesquichlorohydrate, aluminum dichlorohydrate, and aluminum sulfate.
- **Aluminum–zirconium-based** agents, such as aluminum zirconium tri-, tetra-, penta-, and octachlorohydrate.

- ***Most Common Dosage Forms for Deodorants and Antiperspirant:***

- 1. Roll-ons**
- 2. Solid sticks**
- 3. Extrudable clear gels**
- 4. Extrudable soft solids**
- 5. Aerosols.**

- **Roll-Ons:**

- Nonoily feel and good spreadability
- There are **various types** of roll-ons differing in their vehicle:
 - **Water-based** roll-ons are usually **opaque O/W emulsions**.
- The active ingredient is typically formulated into the **external phase to provide better efficacy**.
- These systems are usually based on **nonionic surfactants**, as well as emollients, humectants, hydrophilic thickeners, antioxidants, chelating agents, texturizers (such as talc or corn starch for a soft skin feel), preservatives, and fragrances.

- **Hydroalcoholic roll-ons** have a **shorter drying time** and offer a refreshing feeling upon application.
- Only **alcohol-soluble actives** can be used in this system.
- These products are usually **thickened with** a hydrophilic polymer, such as cellulose derivatives or carrageenan.
- **Emollients and silicones** can also be incorporated using proper emulsifiers.

- **Silicone-based roll-ons** can be formulated as **anhydrous products** where the actives are suspended in volatile silicone oils, such as cyclomethicone.
- To prevent **sedimentation** of the powder as well as thicken the silicone-based formulation, usually **non-surfactant suspending agents** are used.
 - The **smaller the particle size**, the slower the settling rate
 - Silicone-based roll-ons can also be formulated as **W/Si emulsions**, which are very popular due to **the dry, non-tacky feel they provide**.

- **Solid Sticks**

- **Deodorant sticks** are typically based on **sodium stearate** as the gelling agent.
- The deodorizing agents and fragrances are usually dissolved in the **hydrophilic vehicle**, which is primarily a mixture of **water and propylene glycol and/or dipropylene glycol**.
- Products with **alcohol** are also available; however, **they are not as popular** as glycol-based formulations.

- **Nonionic surfactants** can be employed to provide **transparency** to the formulations; examples include PPG-3 myristyl ether and isosteareth-20. **Sodium stearate** can also contribute to the **clarity of the formulas**.
- **Also contain** preservatives, antioxidants, and chelating agents
- **Neutralizing agents** may be needed to adjust the product's pH
- **Colors** can also be added to these formulations.

- **Antiperspirant sticks** are usually **anhydrous suspensions** containing the suspended antiperspirant actives in a **silicone-based vehicle**.
- Examples for such silicones include **cyclopentasiloxane** and **cyclomethicone**, which provide **quick drying** without being tacky or oily.
 - Sticks usually contain various **waxy and liquid emollients** for a soft skin feel and glideability
 - **Nonionic surfactants**, such as PPG-4 butyl ether, are often employed as **dispersing agents** for the antiperspirant actives.

- **Hardening agents** are generally **waxy solids**, such as stearyl alcohol, and hydrogenated castor oil, which **give structure** to the stick and act as **lubricants**.
- **Thickeners** commonly used which help keep the suspended particles in a suspended state and **slow down settling**.
- **Talc and silica** can also be used since they are effective suspending agents and can also provide lubricity for the formulation.
- **Additional ingredients** can include colorants, titanium dioxide (as an opacifying agent), fragrance, buffers, and antioxidants.

Extrudable Clear Gels

- Extrudable gel sticks are **transparent** formulations
- often associated by consumers with a **lack of white residue** on the skin. Therefore, they are also quite popular.
- These formulations are usually **W/Si emulsions**
- similar to silicone-based **roll-ons** with a **higher viscosity**.

Extrudable Clear Gels

- contain the antiperspirants actives **dissolved in water** in the internal phase.
- The internal phase may also contain **alcohol and humectants**, such as propylene glycol.
- **Commonly used silicones** include cyclopentasiloxane, dimethicone, cyclomethicone, and trisiloxane.
- **They may also contain** thickeners, electrolytes for stability, and fragrances.

- **Extrudable Soft Solids**

- Extrudable soft solids are usually **white anhydrous silicone** suspension pastes.
- the powder active ingredient is suspended in **the silicone and/or hydrocarbon vehicle**.
- The paste is **thickened** to the desired viscosity with **waxes**

- **may also contain** preservatives, chelating agents, antioxidants, color additives, and fragrances.
- These products **rub in quickly**, are **non-tacky**, leave **little or no visible residue on skin**, and **deliver high levels of antiperspirant protection**.
- **the smaller the particle size**, the **slower the sedimentation** and the greater the stability of the system.

- **Aerosols**

- Aerosols are **popular** delivery systems for consumers who prefer a **hygienic** and **easy-to-use** product form.
- **Deodorant aerosols** typically contain a **solution of a deodorant** ingredient, which is **blended with a liquefied propellant**.
- **Propane, butane, and isobutane** are the most commonly used propellants.
- They condense to form a **clear, colorless, and odorless liquid**.

- **Antiperspirant aerosols** are also **anhydrous formulations**, similar to deodorant aerosols.
- **Difference between an antiperspirant aerosol and a deodorant aerosol:** antiperspirant actives are suspended in the product concentrate and are not solubilized.
 - The vehicle usually consists of **volatile silicone oils**, such as cyclomethicone, or a mixture of ester oils and silicones.
 - **Agglomeration** of solid particles and **settling** of actives can be minimized by using **suspending agents**, such as clays (bentonite and hectorite)

- These systems generally contain the **same propellants** as deodorant aerosols.
- In addition, they can contain **emollients; fragrances; and preservatives.**
- **sedimentation is a potential concern** for them, despite the application of thickeners.
- Therefore, most antiperspirant aerosol sprays have **directions on shaking** the can before use in order to homogenize the product.

- **Ingredients Causing Safety Issues**

- ***Aluminum***

- **breast cancer–antiperspirant** concerns (“myths” as the FDA refers to them)
- **The false information suggests that:**
 1. Antiperspirants can **absorb** through razor nicks from underarm shaving and **deposit in the lymph nodes**.
 2. As antiperspirants prevent sweating, **users cannot sweat out toxins**, but they remain in the body, leading to cancer.

- Most studies performed showed **no link between breast cancer and the aluminum** content or antiperspirants
- The **actual amount of aluminum absorbed** would be much **less than what would be expected to be absorbed from the foods** a person eats at the same time.
- Additionally, it seems that breast cancer tissue **does not contain more aluminum** than normal breast tissue.

- Now the FDA requires all antiperspirant products to have a warning statement that advises **people with kidney disease to consult a physician before using the product.**
- The kidneys play a large role in **eliminating aluminum** from the body, and therefore, patients with impaired kidney function may have **a higher level of aluminum exposure.**

- Additional health concern regarding the use of aluminum containing antiperspirants and **Alzheimer's disease**.
- **studies have failed to replicate** the results of that particular study performed in the 1960s and confirm the role of aluminum in causing Alzheimer's.
- There are **ongoing studies** investigating this topic.
- Currently, the research community is generally convinced that **aluminum is not a key risk factor** in developing Alzheimer's disease.

➤ Zirconium

- Zirconium is used as a **complexing agent** to form various complexes.
- Concerns arose regarding the carcinogenic potential of aerosolized zirconium complexes through inhalation.
- Today, no zirconium-containing active ingredients can be incorporated into aerosolized antiperspirant formulations.