The Dry Facts About Wet Perspiration

"It's 99% perspiration."
Perspiration

- Physiologically important process that allows for dissipation of body heat through the phase change from liquid water to gas water vapor accompanied by subsequent evaporation.
Sweat Gland Response

→ Focus on mechanisms of axillary perspiration and control.

- Two types
- Temperature controlled
- Both temperature and emotional control
  - Armpits, hands
  - Axillary glands that contribute to underarm wetness
Anatomy of Perspiration

• Two types of sweat glands
  - Eccrine sweat glands
    – 2 to 4 million
    – Concentrated on back, feet
  - Apocrine sweat glands
    – Scent glands
    – Armpits, around eyes, scalp, genitalia
    – Little significance in humans
The Body’s Thermostat

- Eccrine perspiration is produced by the secretory coil in response to acetylcholine (neurotransmitter of the sympathetic nervous system)

Initial fluid released is dilute but sodium and excess water are reabsorbed by the duct creating a hypertonic solution.
Apocrine Perspiration

• Milky, viscous fluid without odor when first secreted
• Bacterial action → odor production
• Secreted in combination with eccrine sweat and has not been isolated
• Emotive stimuli after puberty under control of epinephrine and norepinephrine
Mechanisms of Odor Production

• Sweat is a sterile, odorless, colorless fluid composed of eccrine and apocrine secretions

• Apocrine sweat, although in lower concentration, is responsible for odor
  – Contains organic material ideal for bacterial growth

• Eccrine sweat promotes odor indirectly by dispersing apocrine sweat over a larger area and providing moisture for bacterial growth
Mechanisms of Odor Production

- Axillary hair acts as a collecting site for apocrine secretions and increases surface area suitable for bacterial proliferation

- Odor varies from person to person (bacterial colonization)
  - Combined effect of foods last eaten and physiological state
Mechanisms of Odor Control

• Methods of Reducing Axillary Odor
  1. Reduce apocrine perspiration
  2. Reduce eccrine perspiration
  3. Remove the apocrine and eccrine gland secretions
  4. Decrease bacterial growth
Mechanisms of Odor Control

- If moisture (sweat) does not stay in the armpit, then odor will not evolve.
- Not possible to chemically remove all moisture, since tremendous variations occur in the amount of the secretions.
- Several liters per hour.
- 10 liters per day.
Mechanisms of Odor Control

• Possible to decrease sweating by altering nerve pathways
• Oral medications that are used to control sweating also cause dry mouth, dry eyes, and difficulty with urination
Mechanisms of Odor Control

• Control focused on preventing the sweat from leaving the gland and flowing out on to the skin surface
• This can be accomplished by somehow plugging the gland, which is the mechanism of action of modern antiperspirants
Antiperspirants vs. Deodorants

• Different functions and ingredients
• Deodorants only reduce odor by masking the odor caused by bacterial growth in the armpit
• Destroy bacterial with antibacterial agents (triclosan)
• Antiperspirants can function as deodorant, not the other way around
Mechanism of Antiperspirant Action

• Most commonly used substances to reduce perspiration are metal salts such as aluminum chlorohydrate and aluminum zirconium chlorohydrate

• Several theories try to explain…(1) Kligman, (2) Shelley and Hurley, (3) Holzle
Papa and Kligman

• (1967) Metal salts damaged sweat duct causing the secreted sweat to diffuse into the interstitial space
• This theory has been retracted
Shelley and Hurley

• Metal salts combine with intraductal keratin fibrils to cause eccrine duct closure and formation of a horny plug to obstruct sweat flow to the skin surface
Papa, Holzle, and Kligman

- Aluminum salt-containing antiperspirants alter the physiologic state of the sweat duct by creating an Al-containing cast within the duct
- This creates a physical blockage in the duct preventing the sweat from exiting
- Secreation is reabsorbed by the duct
Regulations of Deodorants and Antiperspirants

• In the US, underarm deodorants are regulated as cosmetics as long as they do not make any drug claims.

• Antiperspirants are drugs and are subject to the current monograph, which is the TFM published in the Federal Register, 1982, Vol 47, pp. 36492-36505
Antiperspirant Efficacy

- Reduce axillary sweating by 20% or more and decrease armpit bacterial colonization
  - Moisture pads
  - Bacterial culture plates
  - Sniff test
## Antiperspirant Effectiveness by Form

US FDA OTC Antiperspirant Review Panel

<table>
<thead>
<tr>
<th>Dosage Form</th>
<th>Average Reduction (%)</th>
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<tbody>
<tr>
<td>Aerosols</td>
<td>20-33</td>
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<tr>
<td>Creams</td>
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<tr>
<td>Sticks</td>
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Summary

• Most individuals, personally and professionally, who aren’t embarrassed or encumbered by underarm wetness, feel more comfortable in their daily activities.

• Antiperspirants are a category of OTC drugs that have a profound impact, even though they are topically applied.