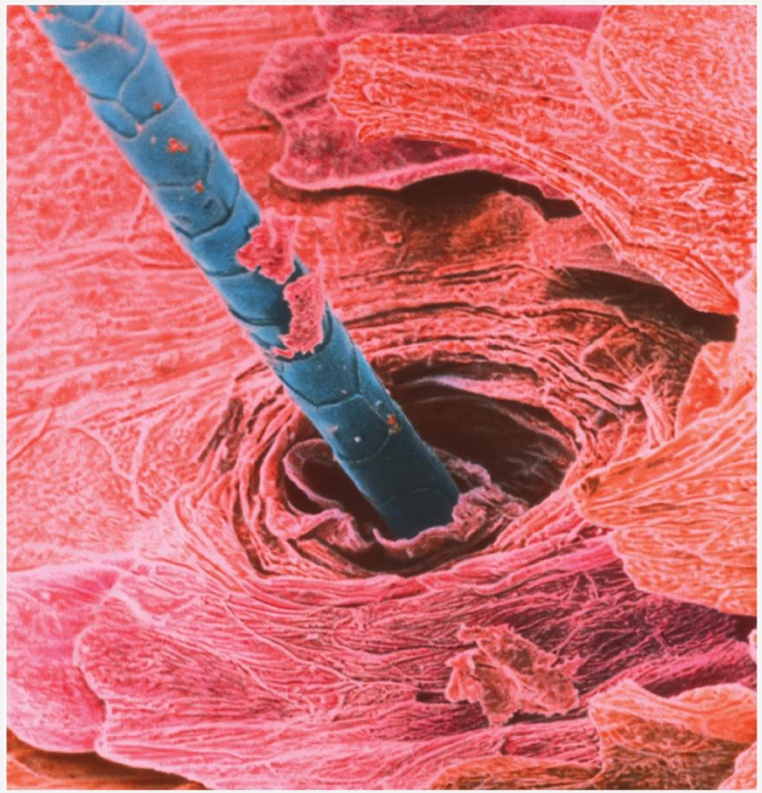
The Integumentary system

Al-Farabi Kazakh National University
Higher School of Medicine



◆PART II

LEARNING OUTCOMES

As a result of the lesson you will be able to:

- *D*escribe the **normal and pathological colors** that the skin can have, and explain their **causes**
- *Describe the* **common markings** *of the skin*
- *N*ame two types of **sweat glands**, and relate the structure and function of each
- *Describe the location, structure, and function of* **sebaceous and ceruminous glands**
- *describe the three most common forms of* **skin cancer**

Before we go on

1. What is the major histological difference between thick and thin skin? Where on the body is each type of skin found?

2. How does the skin help to adjust body temperature?

3. List the five cell types of the epidermis. Describe their locations and functions.

4. List the five layers of epidermis from deep to superficial. What are the distinctive features of each layer? Which layer is often absent?

LOST IN THE DESERT!

by
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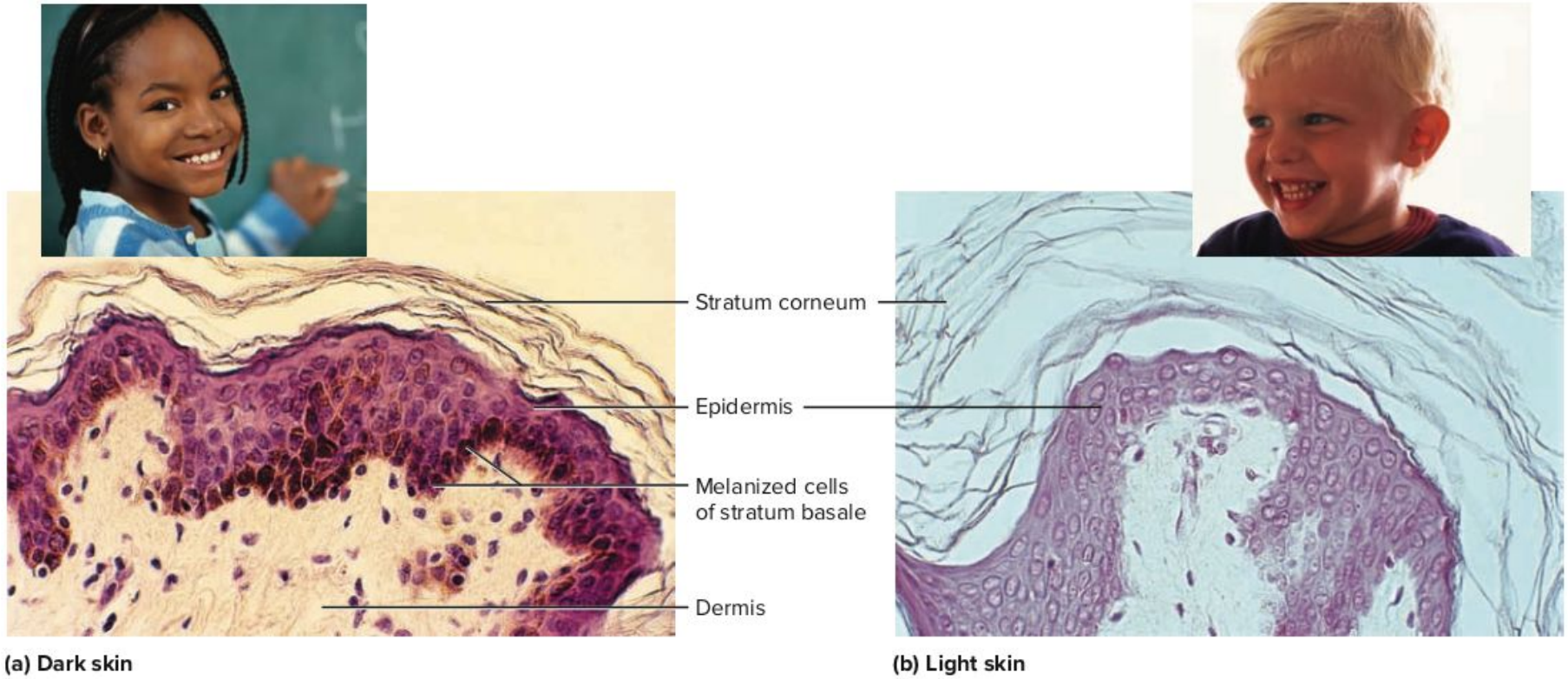
part I: July 13th, AM

1.Define the terms in the case study highlighted in boldface.

heat stroke **first degree burns** **electrolytes** **glucose** **Melanin**

Skin-color



What pigment is responsible for normal skin color?

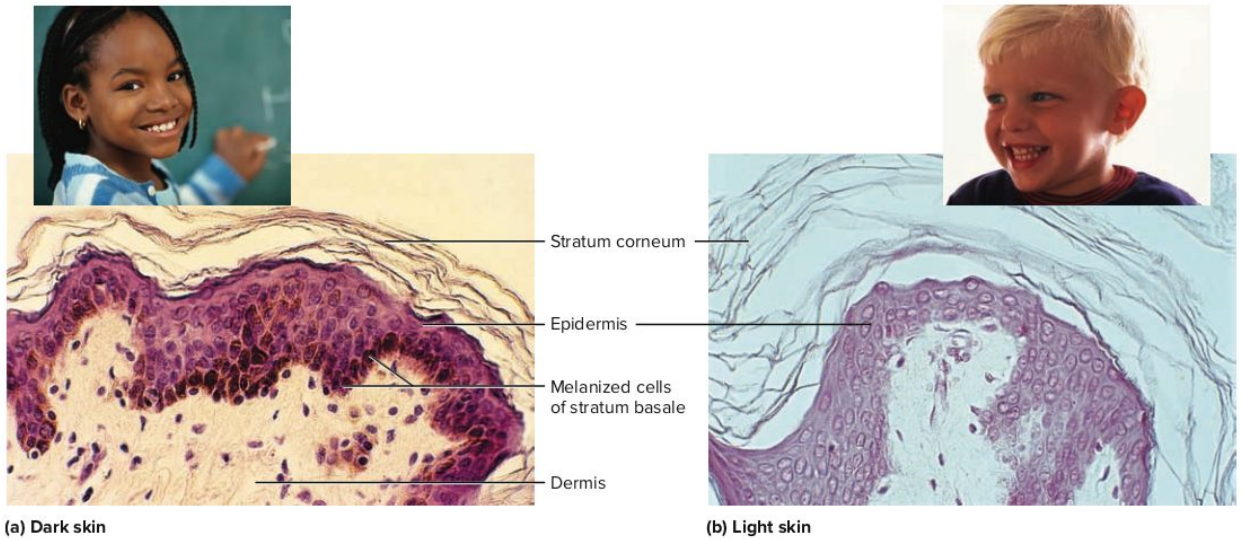
Skin Color

- **melanin** – most significant factor in skin color
  - produced by **melanocytes**
  - accumulate in the **keratinocytes** of stratum basale and stratum spinosum
  - **eumelanin** – brownish black
  - **pheomelanin** - a reddish yellow sulfur-containing pigment

- people of different skin colors have the **same number of melanocytes**

What determine the different skin color ?

Skin-color



- **dark skinned people**
  - produce greater quantities of melanin
  - melanin granules in keratinocytes more spread out than tightly clumped
  - melanin breaks down more slowly
  - melanized cells seen throughout the epidermis

- **light skinned people**
  - melanin clumped near keratinocyte nucleus
  - melanin breaks down more rapidly
  - little seen beyond stratum basale

- \- amount of melanin also varies with exposure to **ultraviolet (UV) rays of sunlight**

Other Factors in Skin Color

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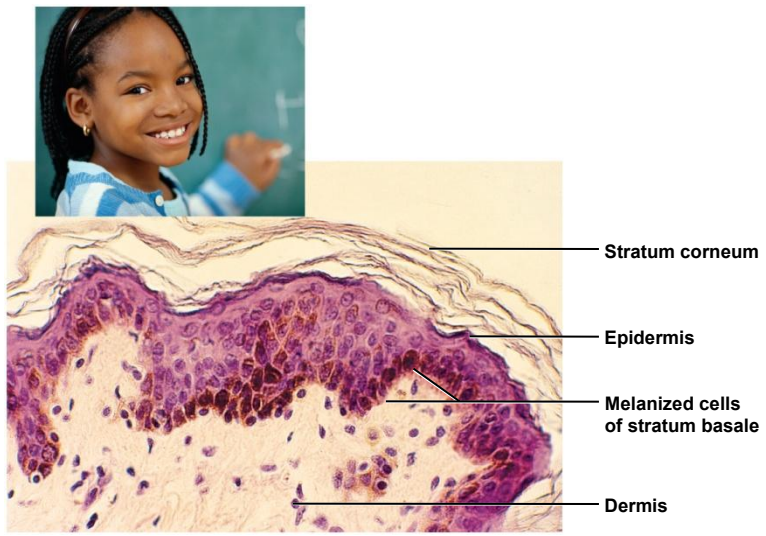

(a) Dark skin

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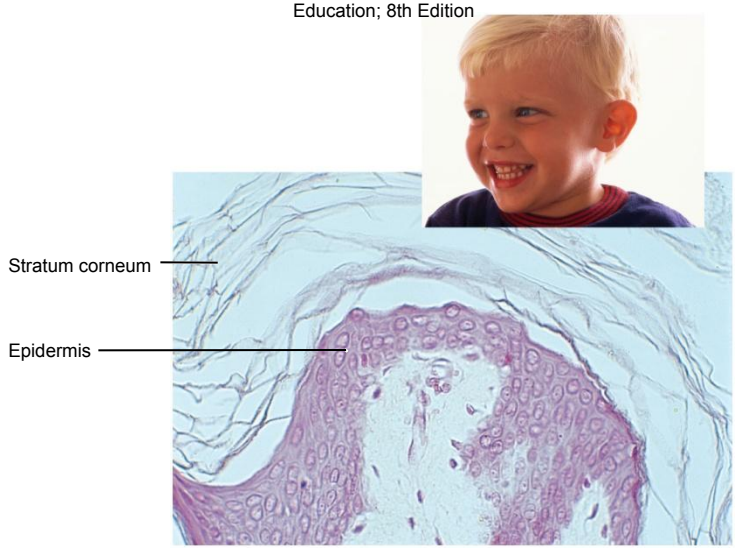

(b) Light skin

- **hemoglobin** - red pigment of red blood cells
  - adds reddish to pinkish hue to skin
- **carotene** - yellow pigment acquired from egg yolks and yellow/orange vegetables
  - concentrates in stratum corneum and subcutaneous fat

Abnormal Skin Colors

- **cyanosis** - blueness of the skin from deficiency of oxygen in the circulating blood
  - airway obstruction (drowning or choking)
  - lung diseases (emphysema or respiratory arrest)
  - cold weather or cardiac arrest

Abnormal Skin Colors

- **erythema** – abnormal redness of the skin due to dilated cutaneous vessels
  - exercise, hot weather, sunburn, anger, or embarrassment

Abnormal Skin Colors

- **pallor** – pale or ashen color when there is so little blood flow through the skin that the white color of dermal collagen shows through
  - emotional stress, low blood pressure, circulatory shock, cold, anemia

Abnormal Skin Colors

- **albinism** – genetic lack of melanin that results in white hair, pale skin, and pink eyes
  - have inherited recessive, nonfunctional tyrosinase allele

Abnormal Skin Colors

- **jaundice** - yellowing of skin and sclera due to excess of bilirubin in blood
  - cancer, hepatitis, cirrhosis, other compromised liver function

Abnormal Skin Colors

- **hematoma – (bruise)** mass of clotted blood showing through skin

Skin Markings

- **friction ridges –** the markings on the fingertips that leave oily fingerprints on surfaces we touch
  - everyone has a unique pattern formed during fetal development and remain unchanged throughout life
  - not even identical twins have identical fingerprints
  - allow manipulation of small objects
- **flexion lines (flexion creases)** – lines on the flexor surfaces of the digits, palms, wrists, elbows
  - marks sites where the skin folds during flexion of the joints
- **freckles** and **moles** – tan to black aggregations of melanocytes
  - **freckles** are flat, melanized patches
  - **moles** (**nevus**) are elevated melanized patches often with hair
    - moles should be watched for changes in color, diameter, or contour
    - may suggest malignancy (skin cancer)

- **hemangiomas (birthmarks) –** patches of discolored skin caused by benign tumors of dermal blood capillaries
  - some disappear in childhood -- others last for life
  - capillary hemangiomas, cavernous hemangiomas, port-wine stain

LOST IN THE DESERT!

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part I: July 13th, AM

2.Given the conditions, what should Henry do to try to save Mark?

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3.Why isn't he sweating?

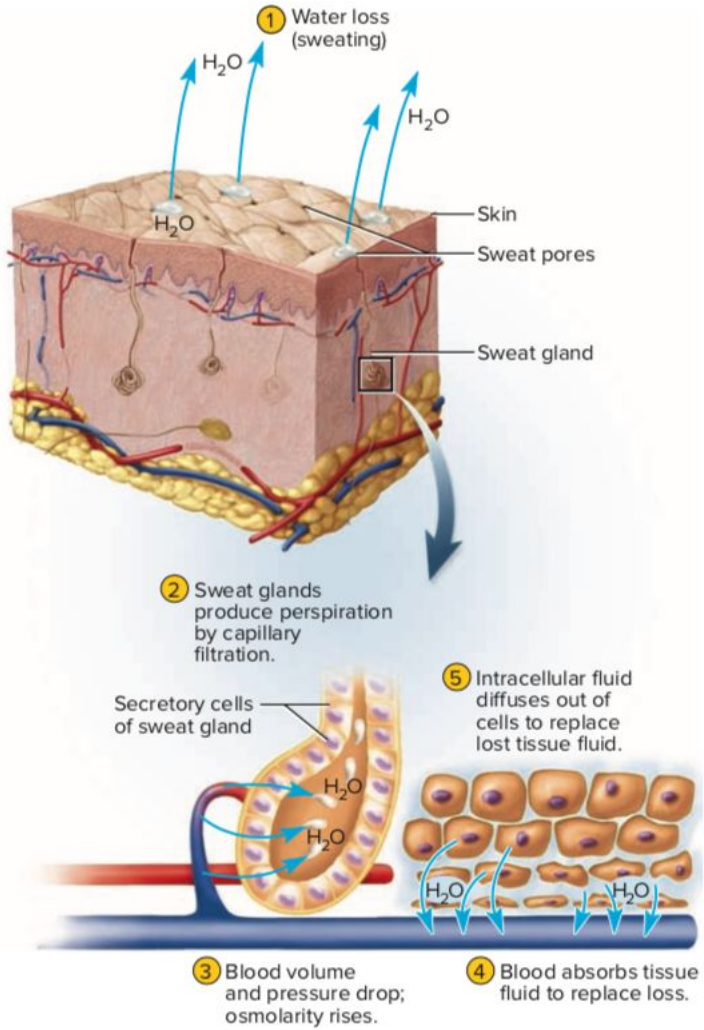

FIGURE 24.5 Effects of Profuse Sweating on the Fluid Compartments. In extreme dehydration, the loss of intracellular fluid can cause cellular shrinkage and dysfunction.

Sweat

- **sweat** - begins as a protein-free filtrate of blood plasma produced by deep secretory portion of gland
  - potassium ions, urea, lactic acid, ammonia, and some sodium chloride remain in the sweat, most sodium chloride reabsorbed by duct
  - some drugs are also excreted in sweat
  - on average, 99% water, with pH range of 4 to 6
    - **acid mantle** – inhibits bacterial growth
  - **insensible perspiration** – 500 ml per day
    - does not produce visible wetness of skin
  - **diaphoresis** – sweating with wetness of the skin
    - exercise – may lose one liter of sweat per hour

Sweat Glands (Sudoriferous)

- two kinds of **sweat (sudoriferous) glands**
  - **merocrine (eccrine) sweat glands**
    - most numerous skin glands - 3 to 4 million in adult skin
    - are simple tubular glands
    - watery perspiration that helps cool the body
    - **myoepithelial cells** – contract in response to stimulation by sympathetic nervous system and squeeze perspiration up the duct
  - **apocrine sweat glands**
    - occur in groin, anal region, axilla, areola, bearded area in mature males
    - ducts lead to nearby hair follicles
    - produce sweat that is thicker, milky, and contains fatty acids
    - scent glands that respond to stress and sexual stimulation
    - develop at puberty
    - **pheromones** – chemicals that influence the physiology of behavior of other members of the species
    - **bromhidrosis** - disagreeable body odor produced by bacterial action on fatty acids

Before we go on

1. How do merocrine and apocrine sweat glands differin structure and function?

2. What other type of gland is associated with hair follicles?How does its mode of secretion differ from that of sweat glands?

Recall our knowledge

TABLE 6.2	Cutaneous Glands
Gland Type	**Definition**
Sudoriferous glands	Sweat glands
Merocrine glands	Sweat glands that function in evaporative cooling; widely distributed over the body surface; open by ducts onto the skin surface
Apocrine glands	Sweat glands that function as scent glands; found in the regions covered by the pubic, axillary, and male facial hair; open by ducts into hair follicles
Sebaceous glands	Oil glands associated with hair follicles
Ceruminous glands	Glands of the ear canal that contribute to the cerumen (earwax)
Mammary glands	Milk-producing glands located in the breasts

- 3 to 4 million in adult skin
- simple tubular glands
- myoepithelial cells – contract in response to stimulation by sympathetic nervous system and squeeze perspiration up the duct

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Mammary glands	Milk-producing glands located in the breasts

- **sebum** – oily secretion produced by sebaceous glands
- flask-shaped glands with **short ducts opening into hair follicle**
- type of **holocrine gland** – secretion is broken-down cells
- keeps skin and hair from becoming dry, brittle, and cracked
- **lanolin** – sheep sebum

- **Ceruminous Glands** found **only in external ear canal**
- their secretion combines with sebum and dead epithelial cells to form earwax (cerumen)
- keeps eardrum pliable
- waterproofs the canal
- kills bacteria
- makes guard hairs of ear sticky to help block foreign particles from entering auditory canal

Cutaneous Glands

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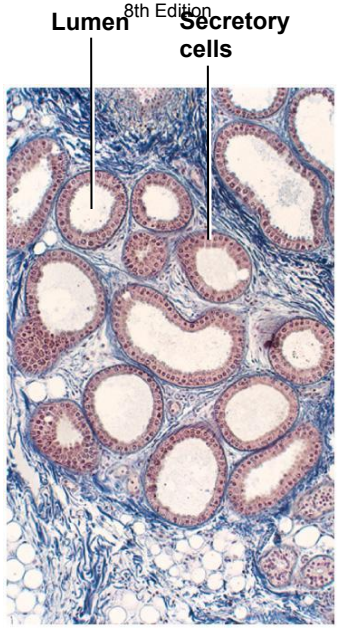
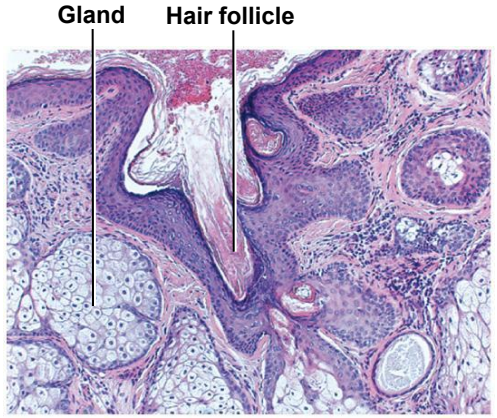


(a) Apocrine gland

Figure 6.11a

the skin has five types of glands

- merocrine sweat glands
- apocrine sweat glands
- sebaceous glands
- ceruminous glands
- mammary glands



(c) Sebaceous gland

Figure 6.11c

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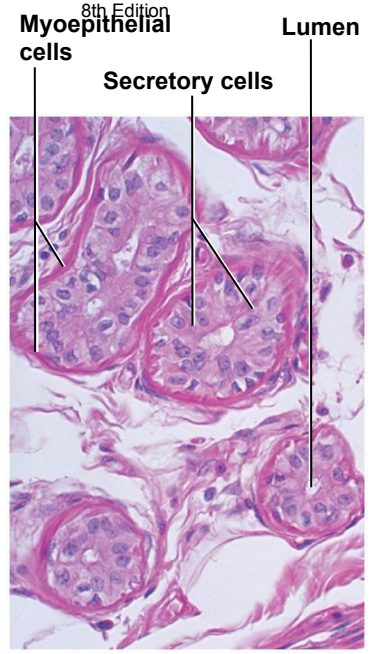

(b) Merocrine gland

Figure 6.11b

Sebaceous Glands

- **sebum** – oily secretion produced by sebaceous glands
- flask-shaped glands with short ducts opening into hair follicle
- **holocrine gland** – secretion consists of broken-down cells
  - replaced by mitosis at base of gland
- keeps skin and hair from becoming dry, brittle, and cracked
- **lanolin** – sheep sebum

Ceruminous Glands

- found only in **external ear canal**

- their secretion combines with sebum and dead epithelial cells to form **earwax (cerumen)**
  - keep eardrum pliable
  - waterproofs the canal
  - kills bacteria
  - makes guard hairs of ear sticky to help block foreign particles from entering auditory canal

- simple, coiled tubular glands with ducts that lead to skin surface

Mammary Glands

- **breasts (mammae)** of both sexes contain very little glandular material

- **mammary glands** – milk-producing glands that develop only during pregnancy and lactation
  - modified apocrine sweat gland
  - richer secretion released by ducts opening into the nipple

- **mammary ridges or milk lines**
  - two rows of mammary glands in most mammals
  - primates kept only anterior most glands

- additional nipples (**polythelia**)
  - may develop along milk line

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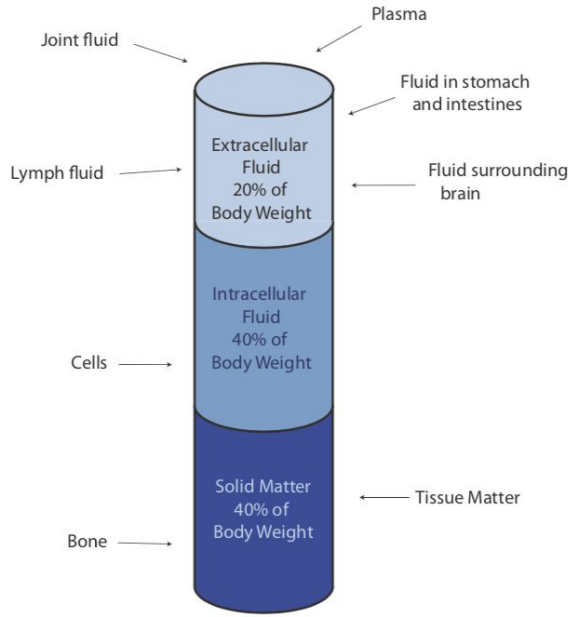
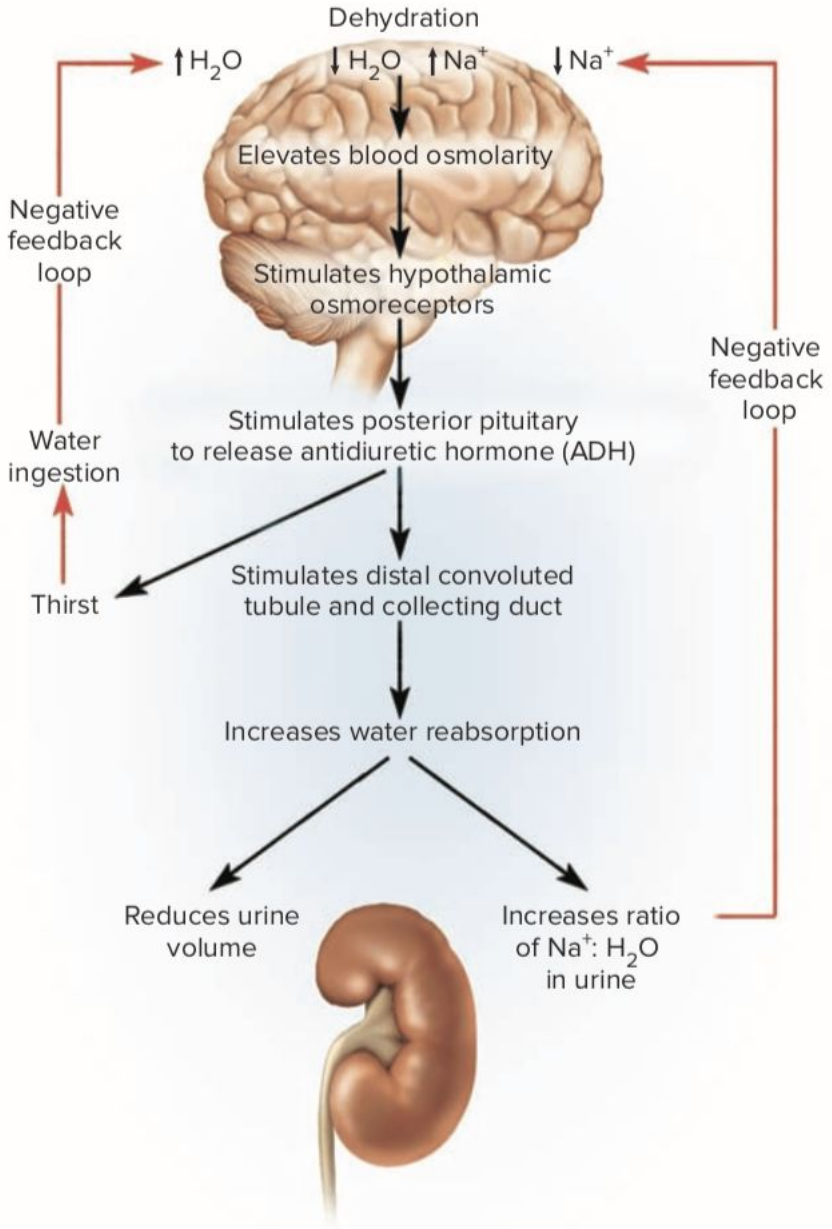
part I: July 13th, AM

4.Assuming that Mark lost around 4 liters of water, what percentage of his body water did he lose? Would you expect his urinary volume to decrease or increase during his trek? Please explain your answer.



- Dehydration, loss of blood volume, and rising blood osmolarity stimulate arterial baroreceptors and hypothalamic osmoreceptors. In response, the posterior pituitary gland secretes ADH. ADH makes the collecting duct more permeable to water, so water in the tubular fluid reenters the tissue fluid and blood rather than being lost in the urine.
- thus helping to maintain **a homeostatic state of water balance.**



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5.Why was Mark's blood pressure so low? Would his pulse rate decrease or increase? Please explain.

Why was Mark dizzy and disoriented?

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part II: July 13th, PM

6. Why did Mark become disoriented? How would you test your ideas to see if you are right? What does your group think based on the information in the text?

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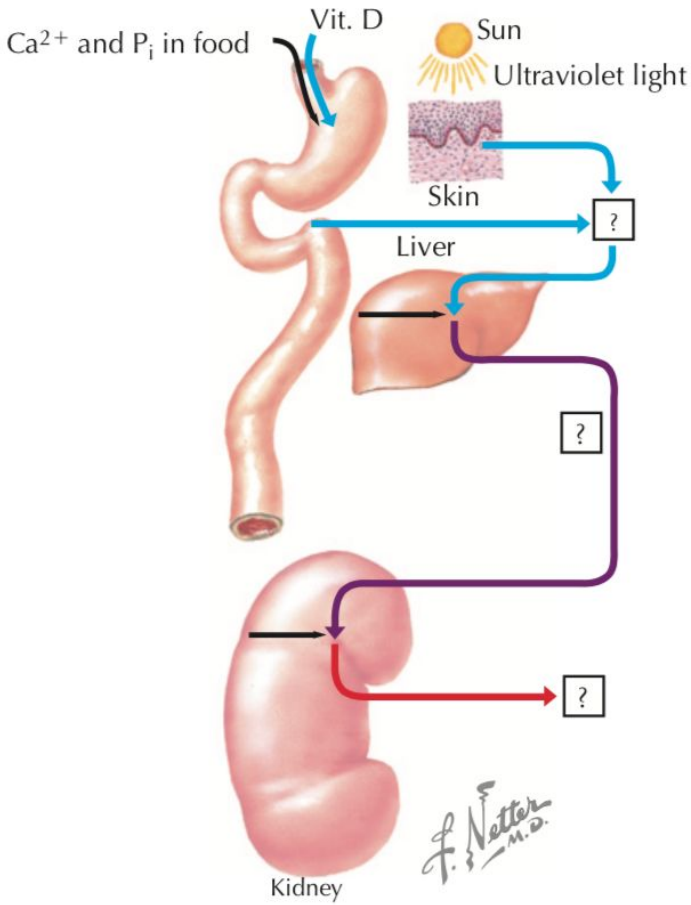
part II: July 13th, PM

7.What vitamin would Mark have in greater amounts in his body after that day?



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Part III: Subsequent Months

8.What should Mark be concerned with regarding these moles? He talked to dermatologist Dr.

Charles Culp about the moles.