Integumentary System

Human Skin

Functions of the Skin

1. Protection of deeper tissue from:
   - chemicals, bacteria, bumps, and drying
2. Regulation of body temperature
3. Synthesis of Vitamin D
   - calcium absorption
Structures of the Skin

- **Epidermis**
  - Stratified squamous epithelium
    - keratin
      - keratinization
    - melanocytes
      - dark/light skin
      - melanin
  - Superficial epidermis
    - Flatter, much keratin, dead
    - Keratinization
      - process of keratin deposition
        - begins in deep epidermis
          - Deep epi $\rightarrow$ superficial epi (most keratin)

  - Blister

- **Dermis**
  - Dense connective tissue
  - Sense receptors
    - pain, touch, pressure, hot, and cold
Appendages of the Skin

1. Cutaneous glands - exocrine
   - Sebaceous (oil) glands
     - hair follicles
     - palms & soles
   - Sweat glands
     - eccrine and apocrine
2. Hairs and hair follicles
3. Nails

Deodorants & Antiperspirants

Deodorants – odor absorber
- Inhibit growth of odor causing bacteria
  - antibacterial & masking

Antiperspirants – sweat blocker
- Clog sweat gland ducts ( pores )
  - inhibit release of sweat
  - contain aluminum compounds

Hairs & Hair Follicles

- derived from basal epidermis
- extends into dermis
- palms and soles
  - penis, labia minora, eyelids, nipples, lips
- Hair shaft
  - much keratin, dead
- Functions
  - head warmth/cushion
  - sweat band
  - debris barrier
Hair Facts

Follicles grow ~ 20 new hairs in a lifetime
Hairs grow for ~3–7 years
- ~1 meter max length
- growth rate ~1 cm/month
- falls out eventually replaced
- number of hairs decreases with age
  - Newborn ~1,100 follicles/sqcm
  - Age 50 ~ 300 follicles /sqcm
  - genetics

Phases of Hair Growth Cycle

- anagen (growing) phase ~1000 days (or more)
  - hair bulb lies deep inside the scalp as new hair grows
  - ~3-7 years of active hair growth
- catagen (intermediate) phase ~10 days
  - hair bulb rises towards the surface
  - melanin production stops
  - no hair growth
- telogen (shedding) phase ~100 days
  - hair is shed
  - new hair grows from follicle

Hair Shaft

Cuticle (bark)
- tough, colorless outer layer
- intact cuticle cells are smooth and glossy, and reflect light from their surfaces
  - younger vs older hair

Cortex
- keratinized center of hair
- bends light to give hair color
- melanin made in hair bulb
- elasticity, curl and strength
Greasy & Dry Hair

Greasy (Oily) hair
- due to buildup of sebum
  - from follicle to shaft
  - Puberty

Dry hair
- Usually due to a weathered/porous cuticle
  - Cortex unable to retain water
  - Conditioners protect edges of cuticle scales

Styling & Perming Hair

Styling hair
- weak H-bonds in cortex broken by water
  - reformed in new shape as water evaporates

Perming hair
- Strong disulfide linkages chemically broken and reformed in new shape
  - repeated perms
    - original disulphide cross-link broken/re-formed so many times that few may remain

Hair Coloring

Coloring Gray hair & Highlights
- small molecules dyes
  - easier to pass through cuticle into cortex
  - tend to lighten/fade over time

Lightening hair
- changing part or all of the melanin in cortex into a colorless substance
  - use oxidizing agents (ex: hydrogen peroxide)
    - may permanently lift scales/damage cuticle
      - increase porosity of hair
Skin Color

Determined by:
- melanin
- carotene
- blood flow

Tattoo Application
- insoluble ink (pigment) inserted into dermis
- solid needle punctures epidermis
  - ~1mm
  - metal salts
- Dermis
  - Cells less metabolically active
  - permanent

Tattoo Removal
- Difficult Methods
  - dermabrasion
    - “sanding”
  - excision
    - surgical removal with a scalpel
  - laser
    - selectively absorbed by tattoo pigment
Burns

Partial thickness burn
- first degree burn
- second degree burn

Full thickness burn
- third degree burn

Imbalances of the Skin
- cold sores
- impetigo
- psoriasis

Skin Cancer
- basal cell carcinoma
- squamous cell carcinoma
- malignant melanoma
DETROIT — Lee Thomas' skin is betraying him. His once brown, even complexion is now mottled with pale patches around his eyes and mouth, along his nose and on his ears, his arms, shoulders and chest are speckled and blotched.

"I'm a black man turning white on television and people can see it," says Thomas, an anchor and entertainment reporter for the local Fox Broadcasting Company affiliate. "If you've watched me over the years, you've seen my hands completely change from brown to white."

Thomas has vitiligo, a disorder in which pigment-making cells are destroyed. White patches appear on different parts of the body, tissues in the mouth and nose, and the retina.

"There is no cause. There is no cure, and it's very random," Thomas says. "I could turn all the way white or mostly white."

Argyria: The relatively profuse vascular networks in the dermis are accounted for this distribution of silver. Silver granules are absent in the epidermis.

Fourteen years ago, Paul Karason developed a bad case of dermatitis, which results in swollen, reddened and itchy skin. He started self-medicating, using a treatment called colloidal silver, which is made by extracting silver from metal.

Looking for relief, Karason drank the concoction and rubbed it on his skin — something the FDA does not recommend.