Integumentary System

• Study of the Skin
Skin is used to:

- Maintain homeostasis
- Provide a protective covering
- Slow down water loss from deeper tissues
- House sensory receptors
- Synthesize various biochemicals
- Excrete small quantities of waste
Skin Layers:

1. Epidermis (outer layer)
2. Dermis (inner layer)
3. Hypodermis/ Subcutaneous Layer (beneath dermis)
   - NOT a true layer of the skin
   - Loose connective and adipose tissue that binds the skin to the underlying organs
1. Epidermis (outer layer)

- Composed of stratified squamous epithelium
- Lacks blood vessels
- Nourished by dermal blood vessels
  - What happens if interference in blood flow occurs?
  - When/how might this occur?
- 5 Layers of the Epidermis
  - Stratum Corneum (uppermost)-dead cell layer
  - Stratum Lucidum – dying; not in all body skin
  - Stratum Granulosum – mature cells
  - Stratum Spinosum – maturing cells
  - Stratum Basale/Basement Membrane (innermost) –
    Also known as Stratum Germinativum
    Active mitotic layer
5 Layers of the Epidermis

- Stratum corneum
- Stratum lucidum
- Stratum granulosum
- Stratum spinosum
- Stratum basale
1. Epidermis (cont.)

- Most body areas only have 4 layers (corneum, granulosum, spinosum, basale)
- Stratum Lucidum is the thickened skin of the palms and soles
- Cell division increases where skin is rubbed or pressed regularly causing calluses or corns

Other body areas???
2. Dermis (inner layer)

- Composed largely of dense connective tissue (i.e., epithelial tissue, smooth muscle, blood)
- Thicker than the epidermis
- Nerve cell processes, hair follicles, sebaceous glands and sweat glands are scattered throughout
- Dermal blood vessels supply nutrients to all skin cells
- Basement membrane anchors the epidermis to the dermis and separates the 2 layers
3. Hypodermis/Subcutaneous Layer

- NOT a true layer of the skin
- Found beneath the skin/dermis
- Masses of loose connective and adipose tissues that bind the skin to the underlying organs
Basic Races of Humans Based on Skin Color
Skin tones
Melanocytes

- Specialized cells in the epidermis (produce melanin)
- Lie in the deepest layer of the epidermis
- Can be a site of skin cancer
- Contain long, pigment containing cellular extensions that pass upward between epidermal cells
  - Extensions transfer melanin granules
Melanocyte Extensions

(a) Pigment granule, Nucleus, Cell membrane

(b) Cellular extension of melanocyte, Pigment granules, Golgi apparatus, Melanocyte nucleus, Basement membrane, Epidermis, Dermis
Melanin

- Dark pigment that provides skin color
- Absorbs UV radiation in sunlight, preventing mutations in DNA of skin cells and other damaging effects
Melanocytes and Melanin
History of Tanning
Skin Color

- Due largely to melanin
- Darker people don’t have more melanocytes, their melanocytes just produce more melanin!
- More melanin = Darker skin
- Environmental and physiological factors too
  - UV exposure
  - Pink? Anemia?
  - Bluish? Cyanosis
What about Michael Jackson?
Michael Jackson?

• Vitiligo?
  – Genetic disease?
  – A pigmentation disorder where melanocytes in the epidermis are destroyed
  – Causes white patches on the skin that can spread
  – 1-2 million people in the United States
  – Half develop it before 20
  – Most develop it before 40

• Depigmentation to dark areas if it’s severe? Jackson?
Neurons (Sensory Receptors) in Skin

- Five basic types exist
- Pain, light touch, deep pressure, hot and cold
Skin Sensory Neurons

- Pacinian Corpuscle (Deep Pressure)
- Free nerve endings (pain)
- End-bulb of Krause (cold)
- Ruffini's end organ (heat)
- Meissner's corpuscle (tactile)
- Light Touch
Nails

• Each consists of a **nail plate** that overlies a surface of skin called the **nail bed**
• The **lunula** at the base of the nail plate covers the most actively growing region of the nail
• Keratinocytes are responsible for generating the hair and nails
• Which nail grows the fastest? Slow...
Hair Follicles/Hair

• Present on all skin surfaces except the palms, soles, lips, nipples and parts of external reproductive organs
• Extend from skin surface into the dermis and contain the hair root
• Hair is composed of dead epidermal cells
• Arrector pili muscle (bundle of smooth muscle cells) attaches to each hair follicle
  – What happens when it contracts?
Hair
Hair: Myth or Fact

• Cutting your hair will make it grow thicker?
  – MYTH

• Blow Drying and Frequent Washing Causes Hair Loss?
  – MYTH

• You lose 100 strands of hair a day?
  – MYTH

• Wearing Hats Can Cause Hair Loss
  – MYTH
Sebaceous Glands

- Contain groups of specialized epithelial cells and are usually associated with hair follicles
- Secrete oily mixture (fatty material and cellular debris) called sebum through small ducts into the hair follicles

What about acne?
Acne

• Failure of hair follicle to properly shed/draw cells to the skin’s surface
• Puberty – increased oil production
• Result: clogged pores
• Bacterial infection
• Treatment?
Sweat Glands

• 2 Main Types
  – Eccrine/Merocrine Glands (most numerous)
    • Respond throughout life to elevated body temp.
    • Common on forehead, neck, and back
    • Open directly onto skin surface
  – Apocrine Glands (become active at puberty)
    • Respond when a person is emotionally upset, frightened or in pain
    • Most numerous in armpits and groin
    • Usually open into hair follicles
    • Gives you your ‘natural scent’ because of proteins and fatty acids
• Why don’t little kids have BO?
• Your body also has various modified sweat glands
  – How would your body use these glands?
Glands
Regulation of Body Temperature

• What happens when body temperature rises?
  – Blood vessels?
  – Glands?

• What happens when body temperature drops?
  – Muscles?
  – Blood vessels?
  – Glands?
  – What is shivering? Why do we do it?
Hypo/hyper-thermia

• Hypothermia
  – Core body temperature?
  – Symptoms as it gets worse?
  – Can it be fatal?

• Hyperthermia
  – Core body temperature?
  – Symptoms?
  – Can it be fatal?
Other Skin Diseases

• Hypertrichosis
  – What is it?
  – Genetic Disease
  – Fetal lanugo (downy layer) remains after birth and grows long
Psoriasis

• Several Types…most common is Plaque Psoriasis
  – Causes dry, red skin lesions covered with silvery scales
  – Lesions may itch, burn or feel sore
  – Can occur anywhere on the body
  – Mild cases are usually only a nuisance.
  – Usually goes through cycles
  – What causes it?
  – What are the symptoms?
  – What are possible treatments?
Human Papilloma Virus

- HPV
- Causes Warts
- Can occur to genitals – genital warts
- Cancer?
- Can lead to cervical cancer in females
- Vaccine?
Extreme HPV infection – of face and nails
Burns to the Skin

Burns can be caused by UV radiation, heat and chemical exposure

- 1\textsuperscript{st} degree
- Symptoms?
- Red, warm to touch, pain, edema = swelling
- Damage limited to epidermis

- 2\textsuperscript{nd} degree
- Symptoms?
- Same as 1\textsuperscript{st} degree; add blisters
- Some damage to dermis
• 3rd degree
• Symptoms?
• Depends on cause
• Skin can be pale and lifeless or black, charred; little to no pain at first
• Usually involves partial/total destruction of both epidermis and dermis
• Physiological problems?
• Water loss, infection
• Usually results in permanent scarring
• May involve a need for skin grafts
Third Degree Burn Photos
Rule of “9” – estimating skin surface area

Adult
Head + neck = 9%
Each hand, arm, shoulder = 9% (18%)
Each foot, leg up to butt = 18% (36%)
Front chest = 18%
Posterior chest and butt = 18%
Child - head takes up a higher percentage
Bringing it all together
Basic Races of Humans Based on Skin Color
Map of Skin Color Distribution

Higher numbers represent darker skin color:
- 1-12: 21-23
- 12-14: 24-26
- 15-17: 27-29
- 18-20: 30+

Human Skin Color Distribution
Primitive Humans
Human Skin Evolution – Possible Theories

- Color and Hair Loss/Retention
  1. Human origins – Africa
  2. First humans – Color? Amount of hair?
  3. Brain evolution and hair loss
  4. Hair retention on top of head, axillary, groin and in males?
  5. Continued hair growth on top of head? Female breasts fatty? Finger and toe webbing?
  6. Pigment increase
  7. Human migration out of Africa – twice
  8. European loss of pigment
  9. Continued world-wide migration
  10. Excess pigment return in American Indians and Hispanics
Map of Skin Color Distribution
Human Migration Routes