Body Membranes

- A Membrane is an Organ!?!?
- 2 tissues = Membrane
- 2+ tissues = Organ

So, epithelial + connective tissue makes a membrane, which is also an organ.
Why Do We Need Membranes?

- Lining
- Protection
- Secretion
  - Smooth Surfaces
  - Fluid
- Integration
Body Membrane (4 Types)

Lines Cavities
- Serous
- Mucous
- Synovial

Protective Covering
- Cutaneous
Serous Membrane

- **Function:** Secretes serous fluid (watery)
  - Lubricates cavity
  - *Makes walls slippery*

- **Location:** Lines internal body cavities
  - Thorax
  - Abdomen
  - Heart

- **Structure:** simple squamous epithelial
  - loose connective tissue
Serous Membrane

- Outer balloon wall: comparable to parietal serous membrane
- Air: comparable to serous cavity
- Inner balloon wall: comparable to visceral serous membrane

- Heart
- Parietal pericardium
- Pericardial cavity with serous fluid
- Visceral pericardium
Mucous Membrane
Mucous Membrane

- **Function**: Secretes mucus
  - Lubricates cavities and tubes
  - *Makes walls slippery*
- **Location**: Lines cavities and tubes that reach the outside world
  - Mouth and digestive tract
  - Respiratory
  - Urinary
  - Reproductive
- **Structure**: epithelial (various types) loose connective tissue
Synovial Membrane

- **Function**: Secretes synovial fluid (thickest)
  - Lubricates joints
  - *Makes joints smooth and reduces friction*

- **Location**: Lines joints cavities of joints
  - Freely moveable joints

- **Structure**:
  - Fibrous connective tissue
  - Loose connective tissue
  - Adipose tissue
Synovial Membrane

- Synovial Fluid
- Cartilage
- Bone
- Synovial Membrane
Synovial Joint

- Synovial membrane
- Articular cartilage
- Fibrous joint capsule
- Joint cavity filled with synovial fluid
- Ligaments
Synovial Membrane
Cutaneous Membrane (SKIN!)

Function:

- Protects the body
  - Body covering
- Maintains homeostasis
  - Regulates body temperature
  - Slows water loss
  - Houses sensory receptors
  - Excretes wastes
Cutaneous Membrane Structure

- Stratified squamous
- Basement membrane
- Fibrous connective
epithelial
- Smooth muscle
- Nervous tissue
- Blood
Cutaneous Membrane

- Epidermis
- Basement membrane
- Dermis
- Subcutaneous layer (Hypodermis)
Cutaneous Membrane Accessory Organs

Hair Follicle
Sebaceous Gland
Sweat Glands
Additional Structures:
Sensory Receptors
Blood Vessels
Epidermis

- Stratified Squamous
- Lacks Blood Vessels
- Contains **Melanocytes**
  - Produce melanin
- Melanin (dark pigment)
  - Absorbs light energy
  - Shields UV rays from reaching deeper cells
- Cytocrine secretion
  - Pigment secreted into nearby cells
Freckles

Localized concentrations of melanin
Skin Color

- Largely due to melanin
- Same
  - Number of melanocytes
- Different
  - Amount of melanin
  - Size of pigment granules

Additional Variables

- Sunlight, UV sunlamp and x-ray exposure
- Oxygen levels in dermal blood vessels (pink / blue)
How Do We Get Our Skin Color?

https://www.youtube.com/watch?v=VC0TL_IYLm8
Cutaneous Membrane
Skin Layers

- Epidermis
- Dermis
- Subcutaneous (Hypodermis)
Epidermis

- Deep layer of epidermis
  - Close to dermis and blood vessels
  - Well nourished
  - Cells reproduce here
  - Stratum Basale
Epidermis

- Superficial layer of epidermis
  - Stratum Corneum
  - Less nourished and dead cells
  - Flatter
  - Cells undergo keratinization
Keratinization

What is keratinization?
Keratinization

**Definition:** the hardening of older cells

- Cytoplasm fills with *keratin protein*
- **Keratin** is tough, fibrous and *waterproof*.
- Forms tough layer of dead cells
Importance of Keratinization

- Shields against water loss
- Barrier for harmful chemical
- Barrier for pathogens
- Prevents mechanical injury of deeper tissue
Regenerating the Epidermis

- New cells are created in the stratum basale
- Older cells are pushed outward
- Superficial cells in the stratum corneum rub off
Subcutaneous Layer (Hypodermis)

- Insulating layer
  - Adipose Cells
Dermis

Houses accessory organs
Accessory Organs

- Hair
- Sebaceous Glands
- Sweat Glands
  - Eccrine
  - Apocrine
- Nails
Hair Follicles

Sebaceous glands coat hair with sebum oil

Hair root forms here

Cells grow here
What Causes Goose Bumps?

Arrector pili muscle contracts to pull on hair.

This happens when someone is emotionally upset, or very cold.
Hair Follicles – a real slide

- Hair follicle
- Sebaceous gland
- Hair shaft
Hair

Its everywhere except...
Sebaceous Glands

Infected Sebaceous Glands

- Makes Blackheads
- Accumulation of sebum material
Sweat Glands – 2 types

- **Eccrine**
  - Water & electrolytes
  - More numerous

- **Apocrine**
  - Protein & lipids
  - Less numerous
Eccrine

- Water & electrolytes
- Stimulated by heated body
- Has sweat pore
- Helps release body heat
Apocrine

- Protein & lipids
  - Favor bacterial growth (smells)
- Stimulated by
  - Excitement
  - Fear
  - Nervousness
  - Intense emotion
- Connected to hair pore
- Becomes active at puberty
Nails

- Protective covering
- Keratinized stratified squamous epithelials
- Cells form at the nail root.
- Cells grow in the lunula and push older cells outward.
Cutaneous Membrane Functions
Body Temperature and Maintaining Homeostasis

- Regulated by ECCRINE glands!
- Negative Feedback system of regulation

But, it's really more complex…
Decreasing Body Temperature

**Stimulus**
Body temperature rises above normal.

**Control center**
The brain detects the deviation from the set point and signals effector organs.

**Receptors**
Thermoreceptors send signals to the control center.

**Effectors**
Skin blood vessels dilate and sweat glands secrete.

**Response**
Body heat is lost to surroundings, temperature drops toward normal.

**Normal body Temperature**
37°C (98.6°F)

**too high**
Adjusting Body Temperature

- Relies on communication between:
  - Nerves
  - Muscles
  - Blood vessels
  - Eccrine sweat glands
  - Brain
Regulating Body Temperature

- Often depends on sweat evaporation
- Air Humidity affects evaporation rate
  - Humid heat vs. Dry heat

- Heat Exhaustion
  - Occurs when body can’t cool
    - Fatigue
    - Dizziness
    - Headache
    - Nausea
Increasing Body Temperature

Normal body Temperature 37°C (98.6°F)

Stimulus
Body temperature drops below normal.

Response
Body heat is conserved, temperature rises toward normal.

Receptors
Thermoreceptors send signals to the control center.

Effectors
Skin blood vessels constrict and sweat glands remain inactive.

Effectors
Muscle activity generates body heat.

Control center
The brain detects the deviation from the set point and signals effector organs.

If body temperature continues to drop, control center signals muscles to contract involuntarily.
Heat Exhaustion

■ Will a tennis player be more susceptible to her body overheating when playing a match in August in Massachusetts or in Arizona? Why?

■ What can you do to reduce your risk of heat exhaustion?
Skin Wounds

- Scratches
- Scrapes
- Cuts
Healing Wounds

New epithelial cells grow at the stratum basale.

Fibroblasts form collagenous fibers to bind wound edges together.

Platelets clot blood.

Cut into the dermis. Blood vessels are broken, and dilate. Blood spills into wound – bringing $O_2$ and nutrients.
Healing Wounds - Animation

- Visit: Essential Study Partner
  - Tissues – Membranes – video.
Burns

- Usually caused by heat

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<th>FREQUENCY</th>
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<tr>
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<tr>
<td>Radiation</td>
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Burns

- Two factors affect burn severity
  - depth
  - extent of the burned area
- Usually classified by depth: 1\textsuperscript{st} 2\textsuperscript{nd} 3\textsuperscript{rd} 4\textsuperscript{th}

First Second Third
First Degree Burns

- Epidermis is affected
- Redness and pain
- No blisters or swelling
- Pain subsides within 48 to 72 hours
- Damaged skin peels off in a week

Treatments include:
- Cold compresses
- Lotion or ointments
- Acetaminophen or ibuprofen for pain
Second Degree Burns

- Burns into part of the dermis
- Redness, pain, and blisters
- Deeper the burn = more blisters
Second Degree Burns

- Most heal without complications
  - Little scarring
  - 10 to 14 days to heal, usually
- If deep burn heals slowly
  - 30 to 105 days
  - New epidermis is extremely fragile
  - Scarring
Third Degree Burns

- Destroys the entire skin
- Leathery wound surface
  - Brown, tan, black, white, or red
- No pain
Third Degree Burns

- All accessory organs are destroyed
  - pain receptors
  - blood vessels
  - sweat glands
  - sebaceous glands
  - hair follicles
Fourth Degree Burns

- Destroys tissues often below the bone
- Usually fatal
  - Unless limited to a small area
Burn Victim Case Study

A young man is caught in a house fire and experiences third degree burns on 60% of his body.

- How will this affect his lifestyle?
- What will he need to do to his environment to compensate for the damaged and destroyed skin?
Inflammation

- **Redness**
  - Blood vessels dilate = more blood to area

- **Heat**
  - Increased metabolic activity in tissues
  - Movement of white blood cells

- **Swelling**
  - Increased intercellular fluid
  - Resulting from increased white blood cells

- **Pain**
  - Swelling puts pressure on nerve endings
Inflammation – Splinter Example
Inflammatory Response:
Second Line of Defense Against Pathogens

- Damaged tissue releases histamines (mast cells do this)
- Histamines cause capillaries to leak. Macrophages and platelets release into the wound.
- Macrophages engulf bacteria, dead cells, and cellular debris
- Platelets move out of capillary to seal the wounded area
Inflammation and Scabbing

- Why is it important that clotting factors from the circulatory system have access to the injured area?
- What role do white blood cells play?
- What are the side effects of numerous white blood cells at the site of the injured area?
- Why is swelling painful?
Aging

- Wrinkles result when skin loses its elasticity.
Common Skin Disorders
Acne

- Disease of sebaceous glands
- Overactive & inflamed glands get plugged
- Blackheads
- Pimples
Athlete’s foot

- Fungal infection
- Toes
- Soles of foot
Birthmark

- Vascular tumor
  - Skin tissue
  - Subcutaneous tissue
- Visible at birth, usually

“Bummer of a birthmark, Hal.”
Boil

- Bacterial infection
  - Hair follicle
  - Sebaceous gland
Cyst

- Liquid-filled sac
Dermatitis

■ Skin Inflammation
Eczema

- Noncontagious skin rash
- Itches
- Blisters
- Scales
Erythema

- Reddening of skin
- Dilation of dermal blood vessels
  - Injury
  - Inflammation
Mole

- Fleshy skin tumor
- Brown to black color
Skin Cancer

- Cutaneous Melanomas
- Looks like an unusual mole

- Most common in fair-skinned people who were severely sunburned once as a child
Psoriasis

- Chronic skin disease
- Red patches
- Silvery scales
Scabies

- Disease results from mite infestation
Ulcer

- Open sore
Decubitus Ulcer (Pressure Ulcer)

- Bedsore
- Body weight cuts off skin’s blood supply
  - Epidermal cells die
  - Tissue breaks down
- Prevention:
  - Change body positions
  - Massage skin above bony prominences
    - For blood circulation
Wart

- Flesh-colored
- Raised area
- Cause is a viral infection
Skin Cancer

- Cancer—abnormal cell mass
- Classified two ways
  1. Benign
     - Does not spread (encapsulated)
  2. Malignant
     - Metastasizes (moves) to other parts of the body
- Skin cancer is the most common type of cancer
Skin Cancer Types

- Basal cell carcinoma
  - Least malignant
  - Most common type
  - Arises from stratum basale
Skin Cancer Types

- Squamous cell carcinoma
  - Metastasizes to lymph nodes if not removed
  - Early removal allows a good chance of cure
  - Believed to be sun-induced
  - Arises from stratum spinosum
Skin Cancer Types

- Malignant melanoma
  - Most deadly of skin cancers
  - Cancer of melanocytes
  - Metastasizes rapidly to lymph and blood vessels
  - Detection uses ABCD rule
ABCD Rule

- **A** = Asymmetry
  - Two sides of pigmented mole do not match
- **B** = Border irregularity
  - Borders of mole are not smooth
- **C** = Color
  - Different colors in pigmented area
- **D** = Diameter
  - Spot is larger than 6 mm in diameter
Developmental Aspects of Skin

- In youth, skin is thick, resilient, and well hydrated
- With aging, skin loses elasticity and thins
- Skin cancer is a major threat to skin exposed to excessive sunlight
- Balding and/or graying occurs with aging; both are genetically determined; other factors that may contribute include drugs and emotional stress