Bio217: Pathophysiology Notes  
Professor Linda Falkow  
Unit X: Musculoskeletal System & Integumentary System  
Chapter 36: Musculoskeletal System  
Chapter 37: Alterations of Musculoskeletal Function  
Chapter 39: Structure, Function & Disorders of the Integumentary System  

Skeletal System  
• Forms the body  
• Supports tissues  
• Permits movement  
  — by providing attachment points for muscles  
• Hemopoiesis (formation of blood)  
• Mineral storage  

Elements of Bone Tissue  
• Rigid connective tissue  
• Constituents  
  — Cells  
  — Fibers  
  — Ground substance  
  — Calcium  

Bone Cells  
• Enable bone to grow, repair, synthesize new bone tissue and resorb old tissue  
  
  ▪ Osteoblast  
    ___________ cell  
  ▪ Osteoclast  
    ___________ bone cell  
  ▪ Osteocyte  
    Transformed osteoblast, maintains matrix  

Bone Tissue  
• Compact (_________) bone  
  — 85% of the skeleton  
  — Haversian system (osteon)  
    • Haversian (central) canal, lamellae, lacunae, osteocyte, and canaliculi  
• Spongy (_________) bone  
  — Lack haversian systems  
  — Trabeculae  
• Periosteum  

Bone Matrix  
extracellular components  
• Collagen fibers – tensile strength  
• Proteoglycans – strengthen bone, transport Ca++  
• Glycoproteins – regulate collagen interactions → fibril formation  
• Bone mineralization – crystals of HAP (hydroxyapatite) (Ca & PO₄)
Bone Tissue
Structure of compact bone & cancellous bone

Bone
• 206 bones
  • Axial skeleton
    – 80 bones
      • Skull, vertebral column, thorax
  • Appendicular skeleton
    – 126 bones
      • Upper and lower extremities, pectoral and pelvic girdle

Bones
• Long bones
  – Upper and lower extremities
• Flat bones
  – Ribs and scapulae
• Short bones (cuboidal bones)
  – Wrist and ankles
• Irregular bones
  – Vertebrae, mandibles, facial bones

Long Bone
Longitudinal section of long bone

Bone Remodeling and Repair
Bone remodeling
  – Maintains internal structure
  – Repair microscopic injuries
Bone Repair
  – Fractures and gross injuries
  – Inflammation/hematoma formation
  – Procallus formation
  – Callus formation
  – Callus replacement
  – Remodeling

Joints
• Joint classifications based on movement
  – Synarthrosis
    • __________
  – Amphiarthrosis
    • Slightly movable
  – Diarthrosis
    • __________
Joints

• Joint classifications based on **structure**
  – Fibrous
    • Joins bone to bone
    • Suture, syndesmosis, gomphosis
  – Cartilaginous
    • Symphysis and synchondrosis
  – Synovial
    • Uniaxial, biaxial, or multiaxial
    • Joint capsule, synovial membrane, joint cavity, synovial fluid, articular cartilage

Joints

A. Synchondrosis
B. Symphysis
C. Symphysis
D. Syndesmosis
E. Suture
F. Ball & socket
G. Hinge
H. Gliding

Knee Joint (synovial)

Body Movements by Synovial Joints

Skeletal Muscles

• Millions of individual muscle fibers (= muscle cells) contract and relax to facilitate movement

• More than 600 in body

• 2 to 60 cm long
**Skeletal Muscles**

- Whole muscle
  - Fascia (3 part CT framework)
    - Epimysium
      - Entire belly of muscle
    - Perimysium
      - Fascicles
        (bundles of muscle fibers)
    - Endomysium
      - Individual muscle fiber

**Muscle**

- Skeletal muscle
  - Voluntary
  - Striated
  - Motor units

**Muscle Fibers**

- Sarcotubular system
  - Transverse tubules
  - Sarcoplasmic reticulum (SR)

- Sarcomere (myofibrils)
  - Muscle proteins
    - Actin
    - Myosin
    - Troponin-tropomyosin complex

- Nonprotein components:
  - Creatine and creatinine
  - Phosphate, chloride, calcium, magnesium, sodium, potassium

**Myofibrils**

- Myofibril
  - Sarcomere
  - Mitochondria
  - T tubule
  - Sarcoplasmic reticulum
  - Tread
**Muscle Contraction**

- Excitation
  - Muscle fiber action potential
- Coupling
- Contraction
  - Cross-bridge theory
- Relaxation

**Muscle Metabolism**

- Requires constant supply of ATP and phosphocreatine (CP creatine phosphate)
- Strenuous activity requires oxygen
- Type I fibers can resist fatigue longer than type II fibers

**Concept Check**

1. The skeletal system:
   - A. Supports tissues
   - B. Binds organs together
   - C. Protects CNS structures
   - D. Involved in blood cell production
   - E. Lines body cavities

2. A function of the epiphyseal plate that is not a function of articular cartilage:
   - A. Enable articulation of bones
   - B. Enable bones to increase in length
   - C. Repair damaged bone
   - D. Provide sensory nerves to bone

3. Joints are classified functionally & structurally. Which is a correct functional/structural relationship?
   - A. Amphiarthrosis/fibrous
   - B. Diarthrosis/synovial
   - C. Synarthrosis/synchondrosis
   - D. Diarthrosis/fibrous
   - E. Synarthrosis/cartilaginous

4. Which is not included in a motor unit?
   - A. Muscle fibers
   - B. Motor nerve axons
   - C. Anterior horn cell
   - D. Upper motor neuron

5. Which are correctly matched?
   - A. Sarcomere – unit of contraction
   - B. Sarcolemma – membrane covering the muscle cell
   - C. Sarcoplasmic reticulum – Ca storage and transport
   - D. All of the above are correct

**Musculoskeletal Injuries**

- Alterations of Musculoskeletal Function
  - Chapter 37

- Fractures
  - break in a bone
  - Classifications
    - Complete or incomplete (broken completely through or not)
      - Closed or open (compound) (skin intact or skin is broken)
    - Comminuted - fragmented
    - Linear – break is parallel to long axis of bone
    - Oblique – break at an oblique angle
    - Spiral – encircles bone
    - Transverse – at right angles to long axis
Fracture Classifications

- Greenstick – incomplete break
- Torus - buckling of bone
- Bowing – bending of bone
- Pathologic – due to _________ (osteoporosis)
- Stress – microfracture often due to repeated stress, common in athletes

Bone Fractures

Pathophysiology

- Bleeding at ends of bone → Hematoma formation
- Bone tissue destruction → inflammatory response
  - Procallus formation
  - Callus formation
  - Callus reabsorption
  - Remodeling

Callus Formation

A. Hematoma
B. Fibrous network
C. Ca deposition
D. Callus formation
E. Remodeling

Bone Fractures

Dislocation
- Temporary displacement of two bones
- ________________between articular cartilage

Subluxation
- Contact between articular surfaces is only __________

Both caused by trauma
Support Structure Injuries
- **Strain**
  - Tear or injury to a tendon
- **Sprain**
  - Tear or injury to a ligament
- **Avulsion**
  - Complete separation of a tendon or ligament from its bony attachment site

Tendinopathy and Bursitis
- **Tendinitis**
  - Inflammation of a tendon
- **Bursitis**
  - Inflammation of a bursa
- **Epicondylitis**
  - Inflammation of a tendon where it attaches to bone
  - Tennis elbow (lateral epicondylitis)
  - Golfer’s elbow (medial epicondylitis)

Rhabdomyolysis
- **Rhabdomyolysis** (myoglobinuria) is a life-threatening complication of severe muscle trauma with muscle cell loss
  - Excess myoglobin in urine due to muscle damage
- **Pathophysiology**
  - Wt. of limp extremity → ischemia → edema → necrosis (cell loss)

Osteoporosis
- **Metabolic bone disorder** → bone mass
  - (bone resorption >> bone deposition)
- **Porous bone**
- **Poorly mineralized bone**
- **Bone density**
  - Normal bone: 833 mg/cm²
  - Osteopenic bone: 833 to 648 mg/cm²
  - Osteoporosis: <648 mg/cm²
- **Potential causes**
  - Decreased levels of estrogens and testosterone
  - Decreased activity level
  - Inadequate levels of vitamins D, C, or Mg²⁺
    - (diet or absorption problems)
Osteoporosis

- **Iatrogenic osteoporosis**
  - Patients on heparin ($\rightarrow$ bone resorption)

- **Regional osteoporosis**
  - Disuse of body region, or weightlessness $\rightarrow$
    uniform dist. of bone loss

- **Postmenopausal osteoporosis**
  - Decreased level of estrogens, or hyperparathyroidism

- **Glucocorticoid-induced osteoporosis** (cortisone $\rightarrow$ incr. bone resorption, decr. formation)

- **Age-related bone loss** $\rightarrow$ begins in 4th decade
Osteomalacia

- Metabolic disorder → inadequate mineralization (aka adult rickets)
- Deficiency of vitamin D lowers the absorption of Ca from the intestines
- Bone formation progresses to osteoid formation but calcification does not occur → soft bones
  - Pain, bone fractures, vertebral collapse, bone malformation

Paget Disease

- Abnormal __________ - irregular resorption and deposition of bone
  - (aka osteitis deformans)
- Disorganized, thickened, but soft bones
- Most often affects the axial skeleton
  - Skull thickens → compresses brain tissue
  - → cranial nerves impacted
  - → hearing loss
- Idiopathic, viral?

Osteomyelitis

- Infectious bone disorder
  Caused by a staphylococcal infection
- Most common cause is open wound (exogenous); also can be from bloodstream (endogenous) infection

Osteomyelitis

- Pathophysiology:
  - Bone __________ → inflammatory response
    - (vascular engorgement, edema incr. WBCs, abscess formation
    - Exudate can seal canaliculi, extend into metaphysis and marrow
- Manifestations
  - Acute and chronic inflammation, fever, pain, necrotic bone
- Treatment
  - Antibiotics, debridement, surgery, hyperbaric oxygen therapy

Osteomyelitis

Osteomyelitis showing sequestration and involucrum
Osteoarthritis

- aka Inflammatory Joint Disease
- Characterized by inflammatory damage or destruction in the synovial membrane or articular cartilage and by systemic signs of inflammation
  - Fever, leukocytosis, malaise, anorexia, and hyperfibrinogenemia

Osteoarthritis (OA)

- Most common form of arthritis
- erosion of articular cartilage → bone spurs (osteoophytes)
- Age related
- Affects mostly hips and knees, can affect any joint
- Primary disease is idiopathic (metabolic factors, genetics, chemical & mechanical factors)

Osteoarthritis

- OA characterized by local areas of damage and loss of articular cartilage, new bone formation of joint margins, subchondral bone changes, mild synovitis and thickening of the joint capsule
- Manifestations
  - Pain, stiffness, enlargement of the joint, tenderness, limited motion, and deformity

Degeneration of cartilage of hip joint

Rheumatoid Arthritis (RA)

- Chronic, progressive, systemic, inflammatory disorder of joints
- Systemic autoimmune damage to CT, primarily in the joints (synovial membrane)
- Affects symmetrical joints
- Similar symptoms to osteoarthritis

Nodes form in proximal and distal joints of fingers
**Rheumatoid Arthritis**

- Presence of rheumatoid factors (RA or RF test)
  - Antibodies (IgG and IgM) against antibodies
- Synovitis → edema and inflammed synovial membrane

**Rheumatoid Arthritis**

- Pathogenesis
  - CD4 T helper cells and other cells in the synovial fluid become activated and release cytokines
  - Recruitment and retention of inflammatory cells in the joint sublining region
  - Cycle of altered cytokine and signal transduction pathways

**Rheumatoid Arthritis**

- Evaluation
  - Four or more of the following:
    - Morning joint stiffness lasting at least 1 hour
    - Arthritis of three or more joint areas
    - Arthritis of the hand joints
    - Symmetric arthritis
    - Rheumatoid nodules
    - Abnormal amounts of serum rheumatoid factor
    - Radiographic changes

**Ankylosing Spondylitis**

- Inflammatory joint disease of spine or sacroiliac joints causing stiffening and fusion of joints
- Systemic, immune inflammatory disease
Ankylosing Spondylitis

- Primary proposed site is the enthesis – Site where ligaments, tendons, and joint capsule are inserted into bone
- Cause unknown, but strong association with HLA-B27 antigen

- Begins with inflammation of fibrocartilage of vertebrae and sacroiliac joint
- Inflammatory cells infiltrate and erode fibrocartilage
- As repair begins, scar tissue ossifies & calcifies; joint eventually fuses

Ankylosing Spondylitis

- Early symptoms
  - Low back pain, stiffness, pain, and restricted motion
  - Patient demonstrates loss of normal lumbar curvature

Ankylosing Spondylitis

- Gout
  - Metabolic disorder
    - Disrupts the body’s control of ________ production or excretion
  - High levels of uric acid in blood and other body fluids
  - Uric acid crystals are deposited in CT
  - When these crystals occur in the synovial fluid, inflammation is known as “gouty arthritis”

- Mechanisms for crystal deposition
  - Lower body temperatures, decreased albumin or glycosaminoglycan levels, changes in ion concentration and pH, and trauma

- Clinical stages
  - Asymptomatic hyperuricemia
  - Acute gouty arthritis
  - Tophaceous gout
Gout

- Chronic widespread ________________
- Vague symptoms
  - Increased sensitivity to touch, absence of inflammation, fatigue, and sleep disturbances

Fibromyalgia

- Possible factors
  - Flulike viral illness, chronic fatigue syndrome, HIV infection, Lyme disease, medications, physical or emotional trauma
- Scientific studies are unclear

Bone Tumors

- Osteosarcoma
  - 38% of bone tumors
  - Predominant in adolescents and young adults; occurs in seniors if history of radiation therapy
  - Contain masses of osteoid
    - "Streamers": noncalcified bone matrix and callus
  - Located in the metaphyses of long bones
    - 50% occur around the knees

Osteosarcoma

- Synthesis
- Metabolism
- Elimination

- Dietary purine
- Purine synthesis
- Body purine nucleotides
- Purines
- Tissue nucleic acids
- Uric acid
- Intestinal excretion
- Renal excretion

- Possible factors
  - Possible factors
  - Flulike viral illness, chronic fatigue syndrome, HIV infection, Lyme disease, medications, physical or emotional trauma
- Scientific studies are unclear
Concept Check

1. In a complete fracture:
   A. Fracture crosses the entire width of bone
   B. more than 2 bone fragments present
   C. separation of ligament exits
   D. the surface opposite break is intact.

2. Which is a definite sign of fracture?
   A. abrasion
   B. Shock
   C. Muscle spasm
   D. unnatural alignment

Matching:

3. subluxation a. Compound fracture
4. tennis elbow b. Common in elderly & children
5. open fracture c. Lateral epicondylitis
6. greenstick fracture d. Partial loss of contact between bone surfaces

Matching:

7. OA e. Buildup of uric acid
8. RA f. Staph infection in bone
9. Osteomyelitis g. Affects wt.-bearing joints, bone spurs form
10. Gout h. Inflam., autoimmune, affects hands

Structure, Function, and Disorders of the Integument
Chapter 39

Regions of the Skin

- Epidermis
- Dermis
- Hypodermis - lies deep to skin

Regions

- Dermal appendages
  - Nails
  - Hair
  - Sebaceous glands
  - Eccrine and apocrine sweat glands
- Blood supply
  - Papillary capillaries
Nails

Aging and Skin Integrity
- Integumentary system reflects numerous changes from genetic and environmental factors
  - Skin becomes thinner, drier, wrinkled, and demonstrates changes in pigmentation
  - Shortening and decrease in number of capillary loops
  - Fewer melanocytes and Langerhans cells
  - Atrophy of the sebaceous, eccrine, and apocrine glands
  - Changes in hair color
  - Fewer hair follicles and growth of thinner hair

Clinical Manifestations of Skin Dysfunction

- Flat Lesions
  1. Macule – flat, circumscribed, discolored lesion, < 1 cm; freckle, nevus, petechia, measles
  2. Patch – flat, irregular lesion, > 1 cm; vitiligo, port wine stains
  3. Petechiae – circumscribed area of blood < 0.5 cm; thrombocytopenia
  4. Purpura – circumscribed area of blood > 0.5 cm; bruises
  5. Telangiectasia – fine, irregular red lines due to dilated superficial blood vessels; RA, rosacea

- Elevated Lesions
  6. Papule – elevated, firm area, < 1 cm; wart, elevated moles, lichen planus
  7. Plaque – elevated, firm, rough lesion with flat top > 1 cm; psoriasis, eczema
  8. Nodule – elevated, firm lesion, deeper in dermis than papule, 1-2 cm; lipoma, Ca deposits
  9. Wheal – transient, well defined and often changing borders; hives, insect bites, allergic reaction
  10. Vesicle and bulla – fluid-filled, thin walled lesion, bulla > 1 cm; blisters, herpes zoster, 2nd burns
  11. Pustule – lesion containing WBC exudates; acne, impetigo

- More Elevated Lesions
  12. Comedo – plugged hair follicle; blackhead, whitehead
  13. Scale – accumulation of stratum corneum; psoriasis
  14. Crust – accumulation of dried blood or serum; eczema, impetigo
  15. Lichenification – thick, tough skin due to rubbing or itching; chronic dermatitis
  16. Cyst – encapsulated mass of dermis, solid or fluid filled; sebaceous cyst
  17. Tumor – solid lesion > 2 cm; fibroma, lipoma, melanoma
  18. Scar – thin or thick fibrous tissue; healed laceration, burn or incision

- Depressed Lesions
  19. Atrophy – thinning of epidermis or dermis due to decreased CT; thin skin of elderly
  20. Ulcer – loss of epidermis and dermis; pressure sores, basal cell carcinoma
  21. Excoriation – loss of epidermis w/ exposed dermis; scratches
  22. Fissure – crack or break exposing dermis; Athlete’s foot, crack in corner of mouth
  23. Erosion – moist, red break in epidermis after rupture of vesicle or bulla, larger than fissure; Chickenpox, diaper dermatitis
Pressure Ulcers

- Result from any unrelieved pressure on skin, causing underlying tissue damage
  - Pressure
  - Shearing forces
  - Friction
  - Moisture

Pressure Ulcers

- Stages
  - Nonblanchable erythema of intact skin
  - Partial-thickness skin loss involving epidermis or dermis
  - Full-thickness skin loss involving damage or loss of subcutaneous tissue
  - Full-thickness skin loss with damage to muscle, bone, or supporting structures

Pressure Ulcers

Progression of decubitis ulcer: Compressed tissue over bony prominence → ischemia → necrosis

Pruritus

- Most common symptom of primary skin disorders
  - Itch is carried by specific unmyelinated C-nerve fibers and is triggered by a number of itch mediators
  - The CNS can modulate the itch response
    - Pain stimuli at lower intensities can induce itching
    - Chronic itching can result in infections and scarring due to persistent scratching

Keloids

- Elevated, rounded, and firm
- Clawlike margins extend beyond original injury site
- Excessive ________ formation during dermal CT repair
- Common in darkly pigmented skin types and burn scars
- Type III collagen is increased

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Disorders of the Skin

- Inflammatory disorders
  - Most common inflammatory disorder of skin is dermatitis or eczema
  - Various types of dermatitis exist
  - Disorders are generally characterized by pruritus, lesions with indistinct borders, and epidermal changes
Inflammatory Disorders

• Allergic contact dermatitis
  – Caused by a hypersensitivity type IV reaction
  – Allergen comes in contact with skin, binds to a carrier protein to form sensitizing antigen; Langerhans cells process antigen and carry it to T cells, which become sensitized to the antigen

  Manifestations
  • Erythema, swelling, pruritus, vesicular lesions
  A. Poison Ivy on knee
  B. Poison Ivy dermatitis

Inflammatory Disorders

• Irritant contact dermatitis
  – Nonimmunologic inflammation of the skin
  – Chemical irritation from acids or prolonged exposure to irritating substances (soaps, detergents, industrial agents)
  – Symptoms similar to allergic contact dermatitis
  – Treatment—remove stimulus

  • Stasis dermatitis
  – Occurs in legs as a result of venous stasis, edema, and vascular trauma
  – Sequence of events: erythema, pruritus, scaling, petechiae, ulcerations

Inflammatory Disorders

• Seborrheic dermatitis
  – Inflammation of the skin involving scalp, eyebrows, eyelids, nasolabial folds, and ear canals
  – Scaly, white, or yellowish plaques

Papulosquamous Disorders

• Psoriasis
  – Chronic, relapsing, proliferative skin disorder
  – T cell immune-mediated skin disease
  – Scaly, thick, silvery, elevated lesions, usually on scalp, elbows, or knees caused by a high mitotic rate in basal layer
  – Shows evidence of dermal and epidermal thickening
  – Epidermal turnover goes from 26-30 days to 3-4 days
  – Cells do not have time to mature or adequately keratinize

Psoriasis
  – Guttate Psoriasis after Strep infection
Papulosquamous Disorders

• **Pityriasis rosea**
  - Benign, self-limiting inflammatory disorder
  - Usually occurs during the winter months
  - Herald patch
    • Circular, demarcated, salmon-pink, 3- to 4-cm lesion

Papulosquamous Disorders

• **Lichen planus**
  - Benign, inflammatory disorder of the skin and mucous membranes
  - Unknown origin, but T cells, adhesion molecules, inflammatory cytokines, and antigen presenting cells are involved
  - Nonscaling, violet-colored, 2- to 4-mm lesions
  - Wrists, ankles, lower legs, genitalia

Papulosquamous Disorders

• **Acne vulgaris**
  - Inflammatory disease of the pilosebaceous follicles
  - **Acne rosacea**
    - Inflammation of the skin that develops in adulthood
    - Lesions
      - Erythematotelangiectatic, papulopustular, phymatous, and ocular
      - Associated with chronic, inappropriate VD resulting in flushing and sensitivity to sun

Papulosquamous Disorders

• **Lupus erythematosus**
  - Inflammatory, autoimmune disease with cutaneous manifestations
    - Discoid lupus erythematosus
      • Restricted to the skin
      • Photosensitivity
      • Butterfly pattern over the nose and cheeks
    - Systemic lupus erythematosus

Vesiculobullous Disorders

• **Pemphigus**
  - Rare, chronic, blister-forming disease of skin and oral mucous membranes
  - Blisters form in deep or superficial epidermis
  - Autoimmune disease caused by circulating IgG autoantibodies
Vesiculobullous Disorders

- **Pemphigus**
  - Tissue biopsies demonstrate autoantibody presence
  - Types
    - Pemphigus vulgaris (severe)
    - Pemphigus foliaceus
    - Pemphigus erythematosus

- **Bullous pemphigoid**
  - More benign disease than pemphigus vulgaris
  - Bound IgG and blistering of the subepidermal skin layer
  - Subepidermal blistering and eosinophils distinguish pemphigoid from pemphigus

Vesiculobullous Disorders

- **Erythema multiforme**
  - Acute, recurring disorder of the skin and mucous membranes
  - Associated with allergic or toxic reactions to drugs or microorganisms
  - Caused by immune complexes formed and deposited around dermal blood vessels, basement membranes, and keratinocytes

- **Erythema multiforme**
  - "Bull's-eye" or target lesion
  - Erythematous regions surrounded by rings of alternating edema and inflammation
  - Bullous lesions form erosions and crusts when they rupture
  - Affects the mouth, air passages, esophagus, urethra, and conjunctiva

Infections

- **Bacterial infections**
  - Folliculitis
  - Furuncles
  - Carbuncles
  - Cellulitis
  - Erysipelas
  - Impetigo

- **Viral infections**
  - Herpes zoster and varicella
### Warts
- Benign lesions caused by the human papillomavirus (HPV)
- Diagnosed by visualization
- Condylomata acuminata
  - Venereal warts

### Fungal Infections
- Fungi causing superficial skin lesions are called dermatophytes
- Fungal disorders are called mycoses; mycoses caused by dermatophytes are termed tinea
  - Tinea capitis (scalp)
  - Tinea pedis (athlete's foot)
  - Tinea corporis (ringworm)
  - Tinea cruris (groin, jock itch)
  - Tinea unguium (nails) or onychomycosis

#### Fungal Infections
- **Candidiasis**
  - Caused by *Candida albicans*
  - Normally found on the skin, in the GI tract, and in vagina
  - *C. albicans* can change from a commensal organism to a pathogen
  - **Local environment of moisture and warmth, systemic administration of antibiotics, pregnancy, diabetes mellitus, Cushing’s disease, debilitated states, age < 6 months, immunosuppression, and neoplastic diseases**

### Vascular Disorders
- **Cutaneous vasculitis**
  - Results from immune complexes in small blood vessels
  - Develops from drugs, bacterial infections, viral infections, or allergens
  - Lesions
    - Palpable purpura progressing to hemorrhagic bullae with necrosis and ulceration

#### Vascular Disorders
- **Urticaria**
  - Caused by type I hypersensitivity reactions to allergens
  - Histamine release causes endothelial cells of skin to contract
    - Causes leakage of fluid from the vessels
  - Treatment
    - Antihistamines and steroids

#### Vascular Disorders
- **Scleroderma**
  - Sclerosis of the skin that can progress to internal organs
  - The disease is associated with several antibodies
  - Lesions exhibit massive deposits of collagen with inflammation, vascular changes, and capillary dilation
  - Skin is hard, hypopigmented, taut, and tightly connected to underlying tissue
Vascular Disorders

- Scleroderma
  - Facial skin becomes very tight
  - Fingers become tapered and flexed; nails and fingertips can be lost from atrophy
  - Mouth may not open completely
  - 50% of patients die within 5 years

Insect Bites

- Bees
- Mosquitoes
- Flies

Benign Tumors

- Seborrheic keratosis
- Keratoacanthoma
- Actinic keratosis
- Nevi (moles)

Cancer

- Basal cell carcinoma
- Squamous cell carcinoma
- Malignant melanoma
- Kaposi sarcoma

Cancer

- Basal Cell Carcinoma
- Squamous Cell Carcinoma on ear

Cancer

- Lentigo Malignant Melanoma
- Kaposi Sarcoma
Burns

- Partial-thickness burns
  - First degree
- Superficial and deep partial
  - Second degree
- Full-thickness burns
  - Third degree
- “Rule of nines”

Rule of Nines

Frostbite

- Skin injury caused by exposure to extreme cold
- Usually affects fingers, toes, ears, nose, and cheeks
- The “burning reaction” is caused by alternating cycles of vasoconstriction and vasodilation
- Inflammation and reperfusion are both part of the pathophysiology

Disorders of the Hair

- Male-pattern alopecia
  - Genetically predisposed response to androgen-sensitive and androgen-insensitive follicles

- Female-pattern alopecia
  - Associated with elevated levels of the serum adrenal androgen dehydroepiandrosterone sulfate
  - No loss of hair along the frontal hairline

Disorders of the Hair

- Alopecia areata
  - Autoimmune T cell–mediated inflammatory disease against hair follicles that results in baldness
- Hirsutism
  - Androgen-sensitive areas
    - Abnormal growth and distribution of hair on the face, body, and pubic area in a male pattern that occurs in women
Concept Check:

1. Which layer of the epidermis contains dead keratinocytes?
   - A. Corneum
   - B. Lucidum
   - C. Granulosum
   - D. Spinosum
   - E. Germinativum (Basale)

2. The dermis is composed of all of the following except:
   - A. Melanocytes
   - B. Collagen
   - C. Elastin
   - D. Apocrine sweat glands
   - E. Sebaceous glands

Match the lesion with the example:

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<td>psoriasis</td>
<td>lipoma</td>
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7. Which are most likely to undergo malignant transformation?
   - A. Seborrheic keratosis
   - B. Nevi
   - C. Actinic keratosis
   - D. B and C are correct

8. A burn that destroys the epidermis and dermis is:
   - A. 1st degree
   - B. 2nd degree
   - C. 3rd degree