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 (blood cell formation)
- 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**
  - Bone forming cell
- **Osteoclast**
  - Reabsorptive bone cell
- **Osteocyte**
  - Transformed osteoblast, maintains matrix

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 & PO_4)

Bone Tissue

- Compact (cortical) bone
  - 85% of the skeleton
  - Haversian system (osteon)
    - Haversian (central) canal, lamellae, lacunae, osteocyte, and canaliculi
- Spongy (cancellous) bone
  - Lack haversian systems
  - Trabeculae
- Periosteum

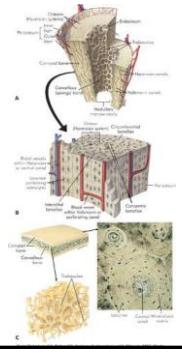
Bone Tissue

Structure of

compact bone

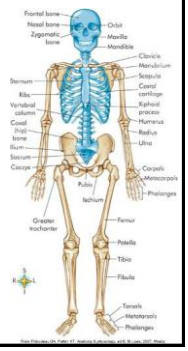
&

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

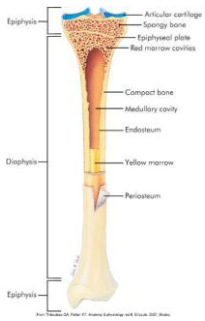


Bones

- 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

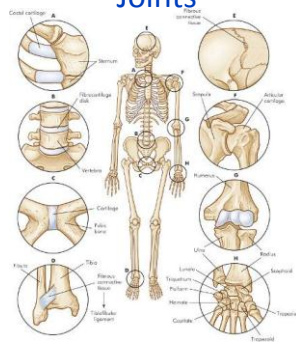
- Joint classifications based on **movement**
  - Synarthrosis
    - Immovable
  - Amphiarthrosis
    - Slightly movable
  - Diarthrosis
    - Freely movable

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

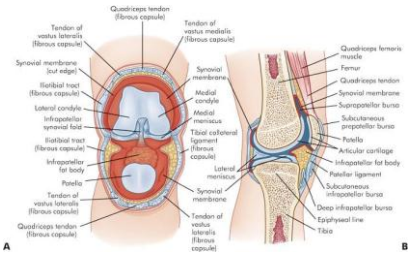
A. Synchondrosis
B. Symphysis
C. Symphysis
D. Syndesmosis



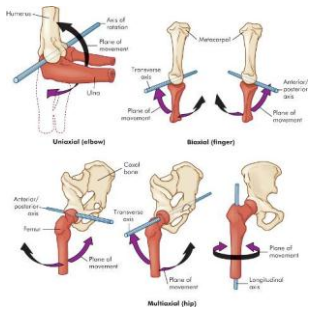
E. Suture
F. Ball & socket
G. Hinge
H. Gliding

Joints

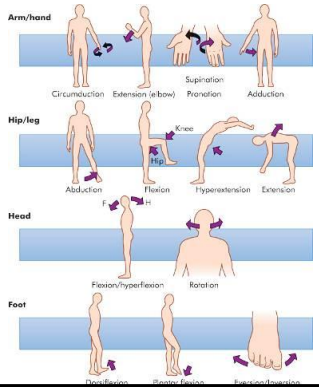
Knee Joint (synovial)



Synovial Joint Movements



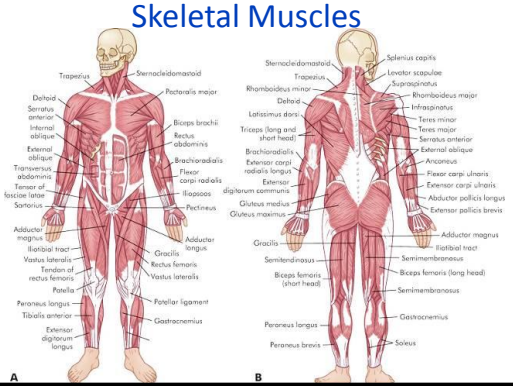
Body Movements by Synovial Joints



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

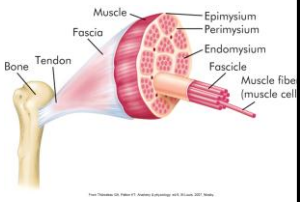
Skeletal Muscles



Skeletal Muscles

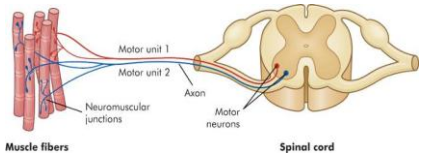
- Whole muscle
  - Fascia (3 part CT framework)
  - Epimysium
    - Entire belly of muscle
  - Perimysium
    - Fascicles

      (bundles of muscle fibers)
  - Endomysium
    - Individual muscle fiber



Muscle

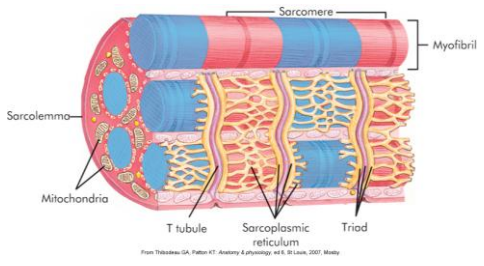
- Skeletal muscle
  - Voluntary
  - Striated
  - Motor units



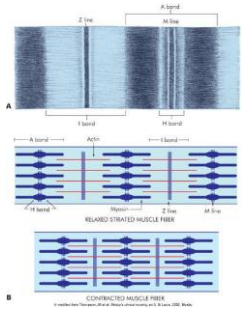
Muscle Fibers

- 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



Myofibrils



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 correc functional/structural relationship?
- A. Amphiarthrosis/fibrous C. Synarthrosis/ synchrondrosis
- B. Diarthrosis/ synovial 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

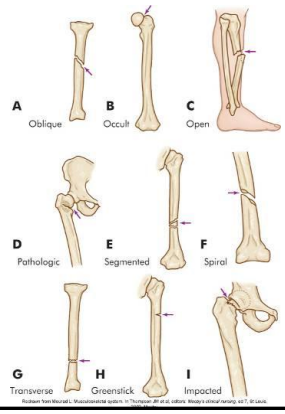
- Alterations of Musculoskeletal Function
- Chapter 37

Musculoskeletal Injuries

- 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 disease (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

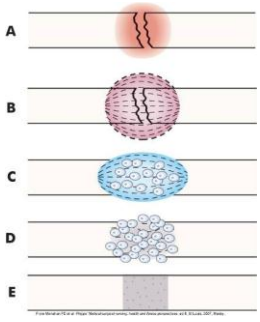
A. Hematoma

B. Fibrous network

C. Ca deposition

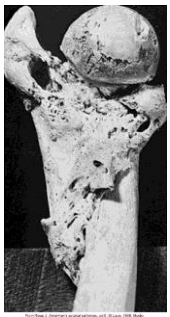
D. Callus fomation

E. Remodeling



Callus Formation

Excessive callus formation



Bone Fractures

⦿Dislocation
- Temporary displacement of two bones
- Loss of contact between articular cartilage

⦿Subluxation
- Contact between articular surfaces is only partially lost

⦿Both caused by trauma

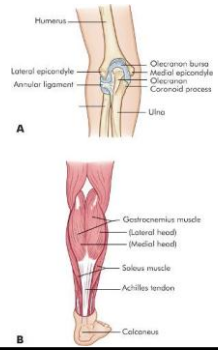
Support Structure Injuries

- **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)

Tendinopathy and Bursitis



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)

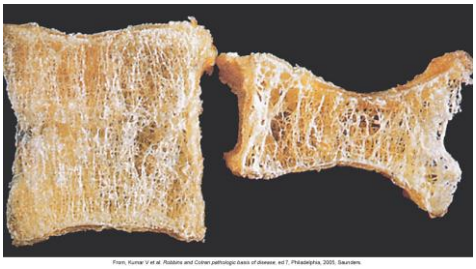
Osteoporosis

- Metabolic bone disorder → decreased bone mass
  (bone resorption >> bone deposition)
- Porous bone
- Poorly mineralized bone
- Bone density
  - Normal bone : 833 mg/cm^2
  - Osteopenic bone : 833 to 648 mg/cm^2
  - Osteoporosis: <648 mg/cm^2

Osteoporosis

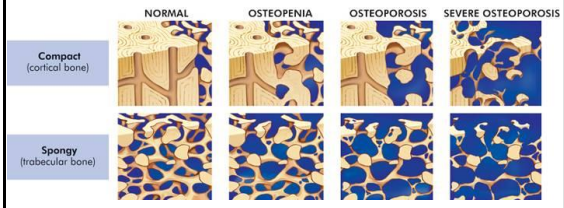
- Potential causes
  - Decreased levels of estrogens and testosterone
  - Decreased activity level
  - Inadequate levels of vitamins D, C, or Mg^{++}
    (diet or absorption problems)

Osteoporosis



Vertebral body – normal on left;
compression fractures of osteoporosis on right

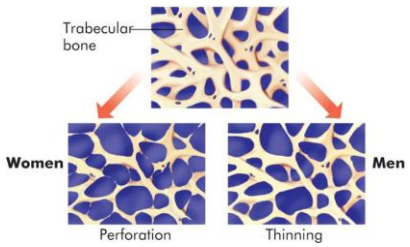
Osteoporosis



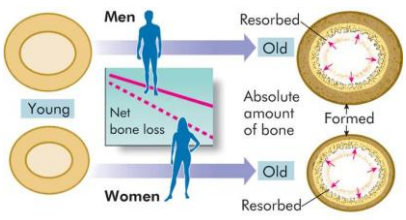
Osteoporosis

- Iatrogenic osteoporosis
  - Patients on heparin (→ bone resorption)
- Regional osteoporosis
  - Disuse of body region, or weightlessness → uniform dist. of bone loss
- Postmenopausal osteoporosis
  - Decreased level of estrogens, or hyperparathryoidism
- Glucocorticoid-induced osteoporosis (cortisone→ incr. bone resorption, decr. formation)
- Age-related bone loss –begins in 4th decade

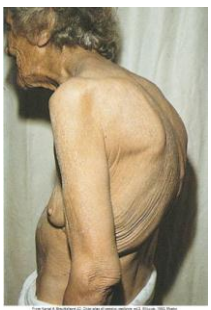
Osteoporosis



Osteoporosis



Osteoporosis



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 remodeling - 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
  - → hearinig loss
- Idiopathic, viral ?

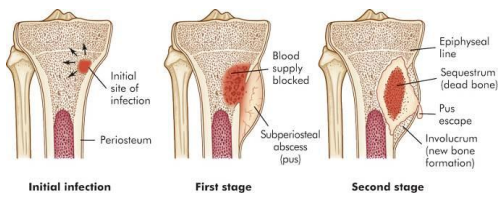
Osteomyelitis

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

Osteomyelitis

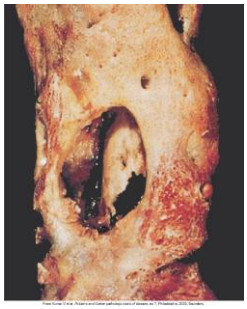
- Pathophysiology:
  - Bone infection → inflammatory response
    - (vascular engorgement, edema incr. WBCs, abcess formation
  - Exudate can seal canaliculi , extend into metaphysis and marrow
- Manifestations
  - Acute and chronic inflammation, fever, pain, necrotic bone
- Treatment
  - Antibiotics,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

Osteomyelitis



Osteomyelitis showing sequestration and involucrum

Osteomyelitis



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)

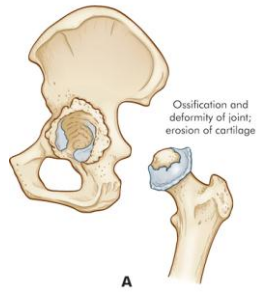
- Most common form of arthritis
- → erosion of articular cartilage → bone spurs (osteophytes)
- Age related
- Affects mostly hips and knees, can affect any joint
- Primary disease is idiopathic (metabolic factors, genetics, chemical & mechanical factors)

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

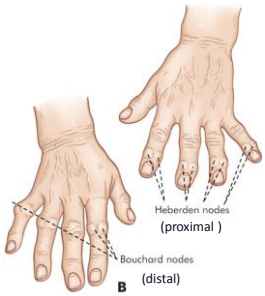
Osteoarthritis

Degeneration of cartilage of hip joint



Osteoarthritis

Nodes form in proximal and distal joints of fingers



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

Rheumatoid Arthritis

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

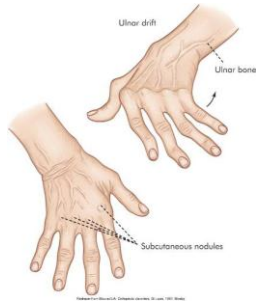
Rheumatoid Arthritis

- 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

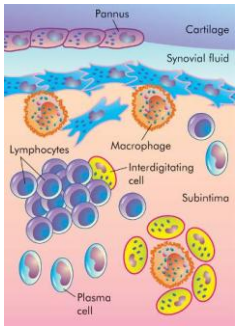
Rheumatoid Arthritis

- 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

Rheumatoid Arthritis



Rheumatoid Arthritis



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

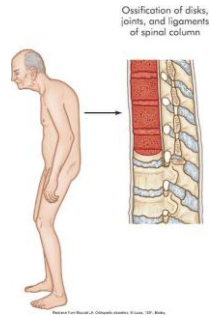
Ankylosing Spondylitis

- 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



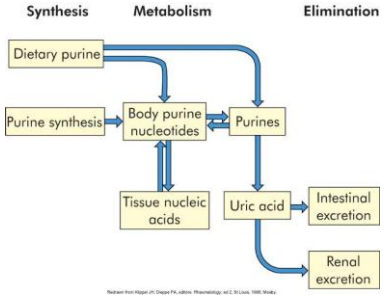
Gout

- Metabolic disorder
  - disrupts the body's control of uric acid 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"

Gout

- 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



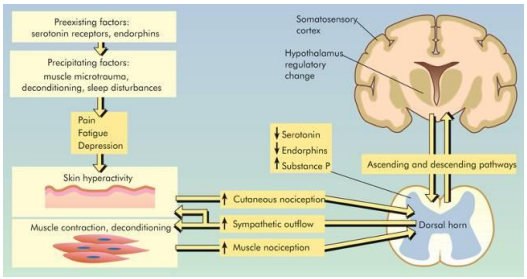
Fibromyalgia

- Chronic widespread joint and muscle pain
- 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

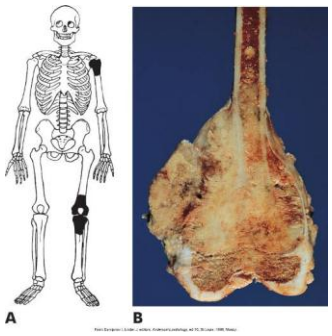
Fibromyalgia



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



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
- 4. tennis elbow
- 5. open fracture
- 6. greenstick fracture

a. Compound fracture
b. Common in elderly & children
c. Lateral epicondylitis
d. Partial loss of contact between bone surfaces

Matching:

7. OA
8. RA
9. Osteomyelitis
10. Gout

e. Buildup of uric acid
f. Staph infection in bone
g. Affects wt.-bearing joints, bone spurs form
h. Inflam., autoimmune, affects hands

Matching:

- 11. ankylosing spondylitis
- 12. fibromyalgia
- 13. osteosarcoma
- 14. rhabdomyolysis

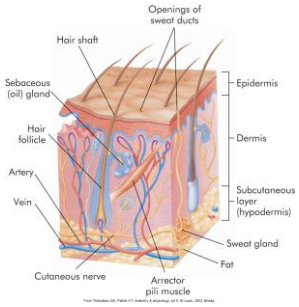
a. Muscle damage → myoglobinuria
b. Malignant bone tumor
c. Fatigue and muscle pain, sensitive to touch
d. Ossification & fusion of vertebral column

Structure, Function, and Disorders of the Integument

Chapter 39

Regions of the Skin

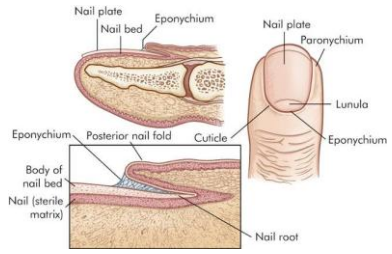
- Epidermis
- Dermis
- Hypodermis
  -lies deep to skin



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;
  - ➢ blister, herpes zoster, 2^{o} 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

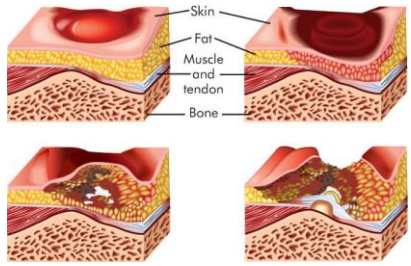
Depressed Lesions

- 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
- 22. 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

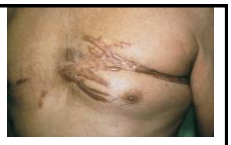


Progression of decubitis ulcer: Compressed tissue over bony prominence → ischemia → necrosis

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

Keloids



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

Pruritus

- Itching
- 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

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

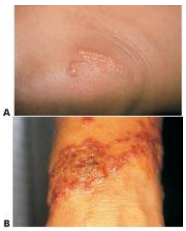
- Allergic contact dermatitis
  - Caused by a hypersensitivity type IV reaction
  - Allergen comes in contact with skin, binds to a carrier protein to form sensitizing antigen; Langerhans cells process antigen and carry it to T cells, which become sensitized to the antigen

Inflammatory Disorders

- Allergic contact dermatitis
  - Manifestations
    - Erythema, swelling, pruritus, vesicular lesions

A. Poison Ivy on knee

B. Poison Ivy dermatitis

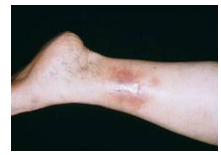


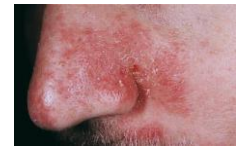
Inflammatory Disorders

- **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





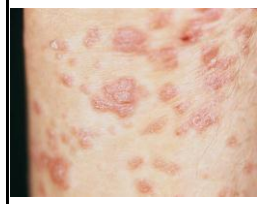
Stasis and Seborrheic Dermatitis

Papulosquamous Disorders

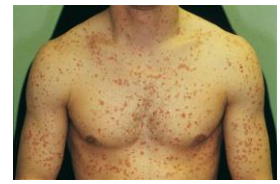
- **Psoriasis**
  - Chronic, relapsing, proliferative skin disorder
  - T cell immune–mediated skin disease
  - Scaly, thick, silvery, elevated lesions, usually on scalp, elbows, or knees caused by a high mitotic rate in basale layer
  - Shows evidence of dermal and epidermal thickening
  - Epidermal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

Papulosquamous Disorders

Psoriasis



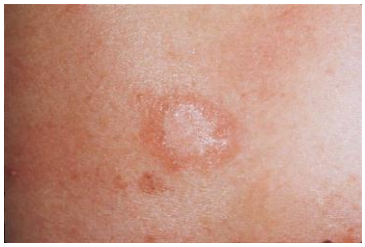
Guttate Psoriasis after Strep infection



Papulosquamous Disorders

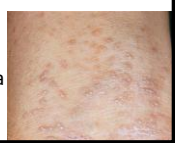
- **Pityriasis rosea**
  - Benign, self-limiting inflammatory disorder
  - Usually occurs during the winter months
  - Herald patch
    - Circular, demarcated, salmon-pink, 3- to 4-cm lesion

Papulosquamous Disorders



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



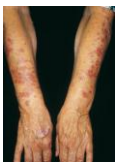
Papulosquamous Disorders

- 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

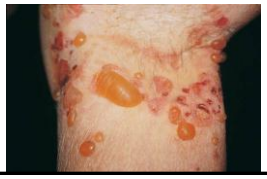
- Pemphigus
  - Rare, chronic, blister-forming disease of skin and oral mucous membranes
  - Blisters form in deep or superficial epidermis
  - Autoimmune disease caused by circulating IgG autoantibodies

Vesiculobullous Disorders

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

Vesiculobullous Disorders

- **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

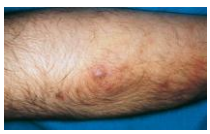
- **Erythema multiforme**
  - Acute, recurring disorder of the skin and mucous membranes
  - Associated with allergic or toxic reactions to drugs or microorganisms
  - Caused by immune complexes formed and deposited around dermal blood vessels, basement membranes, and keratinocytes

Vesiculobullous Disorders

- 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

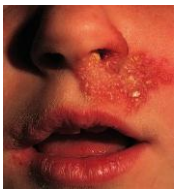
Infections

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

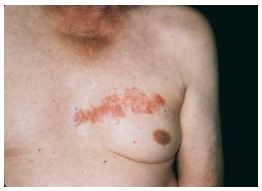


Infections

- Viral infections
  - Herpes zoster and varicella



Herpes Simplex Virus



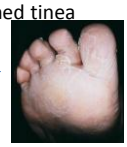
Herpes Zoster

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 the 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 the 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

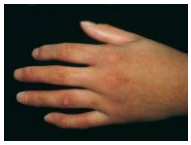
- **Urticaria**
  - Caused by type I hypersensitivity reactions to allergens
  - Histamine release causes endothelial cells of skin to contract
    - Causes leakage of fluid from the vessels
  - Treatment
    - Antihistamines and steroids

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

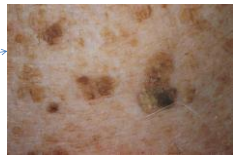


Insect Bites

- Bees
- Mosquitoes
- Flies

Benign Tumors

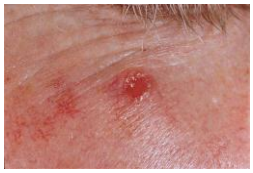
- Seborrheic keratosis
- Keratoacanthoma
- Actinic keratosis
- Nevi (moles)



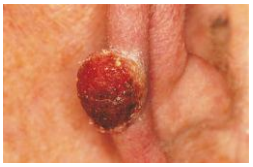
Cancer

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

Cancer

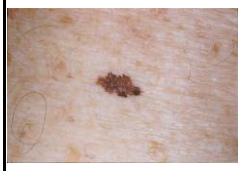


Basal Cell Carcinoma

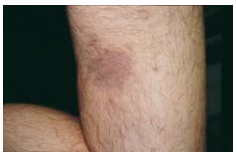


Squamous Cell Carcinoma on ear

Cancer

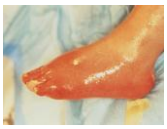


Lentigo Malignant Melanoma

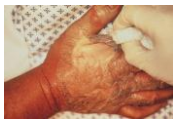


Karposi Sarcoma

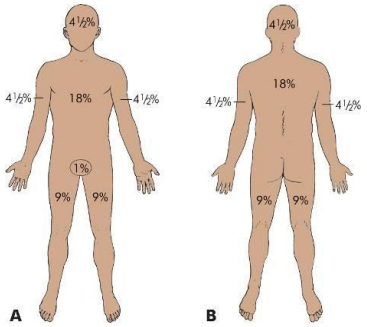
Burns



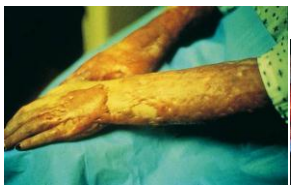
- Partial-thickness burns
  - First degree
- Superficial and deep partial
  - Second degree
- Full-thickness burns
  - Third degree
- "Rule of nines"



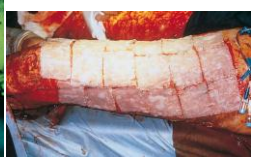
Rule of Nines



Burns



Hypertrophic Scarring
due to deep partial-thickness injury



Autograph of Cultured Epithelial cells

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 androgens
  - 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. Luicidum
  - 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:

3. Macule	A. hives
4. Nodule	B. psoriasis
5. Scale	C. lipoma
6. Wheal	D. freckle

- 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