I. Introduction

- tissue: group of cells that are closely associated, similar in structure and function, and perform a common or related function.

- four primary tissues: epithelial tissue, connective tissue, muscle tissue, nervous tissue.

II. Epithelial tissue: cell layers are arranged in sheets.

A. General comments: epithelial tissues form the membranes and the glands of the body.

1. Membranes: covering and lining epithelium; sheets of cells that cover external surfaces or line internal surfaces; functions include protection, absorption, filtration, excretion, secretion.

2. Glands: composed of cells mostly specialized for secretion; can be unicellular or multicellular; multicellular glands originally develop as down growths of epithelial membranes into underlying connective tissue; secretions can be mucous or aqueous.

B. Classification of epithelium: by number of cell layers present and by shape of the superficial cell layers.

1. Number of cell layers:

a. Simple epithelium: single layer of cells; important in diffusion, filtration, secretion, and absorption.

b. Stratified epithelium: two or more cell layers; important for protection in high abrasion areas.

c. Pseudostratified epithelium: simple epithelium in disguise; all cell touch basement membrane on which they grow

- important in secretion and protection.

2. Shape:

a. Squamous : flattened cells with flattened nuclei

b. Cuboidal: cube-like cells with spherical nuclei

c. Columnar: column-shaped, rectangular cells with oval nuclei

C. Types of epithelium:

1. Simple Epithelium:

a. Simple squamous epithelium:

- single layer of flattened cells; located in air sacs of lungs
- found lining inside of blood vessels, air pocket in lungs
- function involves permitting easy passage of materials by simple diffusion where protection not critical

b. Simple cuboidal epithelium:

- single layer of cube-like cell
- found in secretory portions of small glands, linings of ducts
- functions in secretion and absorption

c. Simple columnar epithelium:

- single layer of tall cells
- found lining most of the digestive tract (stomach to anus), and regions of uterus
- functions in secretion of mucous and enzymes, and absorption

2. Stratified epithelium

- Stratified squamous epithelium:
  - thick membrane composed of several layers of cells where basal cells are cuboidal or columnar and metabolically active, and surface cells are squamous and often dead
  - forms top layer of skin, the epidermis, lining of mouth, esophagus
  - functions in protection

3. Pseudostratified epithelium

- important in secretion and protection
- found lining of parts of respiratory tract

III. Connective tissue - found everywhere in the body

- most abundant and widely distributed of primary tissues
- amount of connective tissue varies greatly from organ to organ

A. Structural elements of connective tissue

- in any type of connective tissue there are two basic types of elements:
  - cells -- produce extracellular matrix (ECM)
  - ECM -- produced by cells
    - fibers
    - ground substance -- watery soup that surrounds fibers and cells

- the type of connective tissue depends on the type of cell that predominates, and the types, density, and arrangement of fibers

C. Types of connective tissue -- soft connective tissues and specialized connective tissues

1. Soft connective tissues

a. Loose connective tissue

- cell is fibroblast
- few collagen fibers, a lot of ground substance
- found under skin, cushioning organs
- functions are cushioning, protection

b. Dense regular connective tissue

- cells are fibroblasts
- collagen fibers predominate over cells, little ground substance
- fibers arranged in parallel
- found in tendons ligaments
- functions are strength, support along one plane

c. Dense irregular connective tissue

- cells are fibroblasts
- collagen fibers predominate over cells, little ground substance
- fibers irregularly arranged in many planes
- present in lower layers of skin (dermis)
- function is withstanding tension from many directions

d. Cartilage

- cells are chondrocytes
- collagen fibers present but invisible in preparation
- lot of ground substance -- high in water
- found in ends of long bones, nose, ear, parts of airways
- functions are support and flexibility where resiliency needed

2. Specialized connective tissues

a. Bone

- cells are osteocytes
- collagen fibers present
- ground substance is calcified
- present in bones of skeleton
- functions are support and movement

b. Adipose tissue

- cells are adipocytes -- modified fibroblasts, specialize in storing triglycerides
- very few collagen fibers and ground substance -- most of space taken by cells
- found under skin, surrounding some organs
- functions are energy storage, padding, protection

c. Blood

- cells are RBC, WBC
- matrix and fibers comprise plasma
- functions are transport of gases, nutrients and protection

IV. Muscle Tissue

- made up of cells specialized for movement, contractile cells

- types of muscle

A. Skeletal muscle

- found attached to bones
- long, cylindrical cells with alternating light and dark bands (striations)
- voluntary -- bone movement

B. Smooth muscle:

- found in walls hollow tubes of body (digestive tract, uterus, blood vessels, parts of respiratory tract)
- spindly shaped cells
- involuntary -- movement of internal organs

C. Cardiac muscle:

- found in walls of heart
- branched cells
- junctions between cells visible as dark areas -- intercalated disks
- involuntary -- pump blood

V. Nervous tissue

- makes up the nervous system which controls body functions
- cell types present in neural tissue are predominantly supporting (glial) cells and neurons
- neurons are highly variable in shape -- have central area with many processes