Cell Aging:

- Wear and tear theory.
- Mitochondrial theory.
- Immune system disorders.
- Genetic theory (telomeres).

Interdependence of Body Cells:

- Humans are multicellular:
  * To function, we must keep individual cells alive.
  * All cells depend on organ systems to stay alive.

Tissue – The Living Fabric:

- Individual body cells are specialized:
  - Each type of cells performs specific functions that maintain life
- Tissue:
  - Groups of cells similar in structure that perform common or related function
- Histology:
  - Study of tissues & their cellular organization (fixed, sliced, stained)

Primary Tissue Types (P.116 F.4.1) :

1- Nervous tissue: Controls (internal communication):
• Brain
• Spinal cord
• Nerves

2- Muscle tissue: Contracts to produce movement:
• Muscles attached to bones (skeletal).
• Muscles of heart (cardiac).
• Muscles of walls of hollow organs (smooth).

3-Epithelial tissue: Covers to form boundaries between different environments, protects, secretes, absorbs, filters.
• Lining of digestive tract organs & other hollow organs.
• Skin surface (epidermis).

4-Connective tissue: Connects to support, protect & bind other tissues together

- Bones.
- Tendons.
- Fat and other soft padding tissue.

Embryonic Development:(P.146 F.4.13)

Nervous Tissue (P.139 F.410):

- Main component of nervous system
  - Brain, spinal cord, nerves to regulate & control body functions.
- Neurons: generate & conduct nerve impulses.
- Neuroglia: support, insulate & protect neurones.

Muscle Tissue (P137-138 F.4.9):

- Highly vascularized.
- Responsible for most types of movement.

Skeletal muscle tissue.
Cardiac muscle tissue.
Smooth muscle tissue.

Epithelial Tissue (Epithelium):

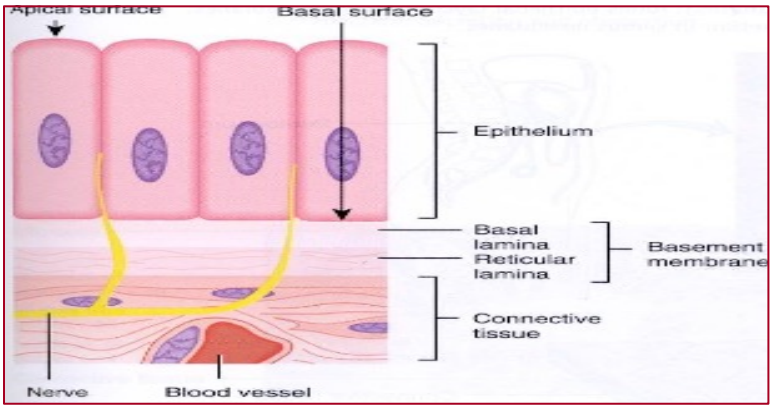
- Form boundaries

Protection
Absorption
Filtration
Excretion
Secretion
Sensory reception

- Two main types (by location)
  - Covering & lining epithelia on external & internal surfaces
  - Glandular epithelia secretory tissue in glands

Characteristics of Epithelium:

- Polarity (apical-basal).
- Supported by connective tissues.
- Specialized contacts (tight junctions & desmosomes).
- Avascular, but innervated.
- Regeneration.



Shape of Epithelial Cells (P.118 F.4.2 b):

- ❖ Classification indicates
- ➢ Squamous cells
  - – Flattened and scalelike
  - – Nucleus flattened
- ➢ Cuboidal cells
  - – Boxlike
  - – Nucleus round
- ➢ Columnar cells
  - – Tall, column shaped
  - – Nucleus elongated

Number of Cell Layers (P.118 F.4.2 a):

- ❖ Classification indicates:
- ➢ Simple epithelia = *single layer of cells*
- ➢ Stratified epithelia = *two or more layers of cells*
  - * shape can change in different layers
  - * classified by cell shape in the apical layer

-Simple Squamous Epithelium (P.119 F.4.3 a).
-Simple Cuboidal Epithelium (P.119 F.4.3 b).
-Simple Columnar Epithelium (p.120 F.4.3 c).
-Pseudostratified Epithelium (P.121 F.4.3 d).
-Stratified Squamous Epithelium (P.122 F.4.3 e).
-Transitional Epithelium (P.122 F.4.3 f).

Glandular Epithelium:

- ❖ Gland: Cells that produce & secrete an aqueous fluid (a secretion: *protein, lipids or steroids*)
- ➢ Endocrine versus Exocrine:

- Endocrine glands: ductless, produce hormones
- Exocrine glands: ducts, non-hormonal substances (mucous, sweat, sebaceous, salivary glands & liver, pancreas)

➢ unicellular versus multicellular:
-(P.124 F.4.4) (P.125 F.4.5)

Modes of Secretion:(P.125 F.4.6):

➢ Merocrine: secrets their products by exocytosis.

➢ Apocrine: apex pinches off.

➢ Holocrine: accumulate their products until they rupture.

Connective Tissues:

➢ Binding & supporting

➢ Protecting

➢ Insulating

➢ Storing reserve fuel

➢ Transporting substances

CT Characteristics:

Different from other primary tissues

➢ Common mesenchyme origin

➢ Varying degrees of vascularity (blood supply)

➢ Extracellular matrix

✓ CT - largely *nonliving* extracellular matrix (<u>not</u> composed mainly of cells) So can bear weight, withstand tension, endure abuse.

Structure Elements (P.127 F.4.7):

Three elements

➢ Ground substance
- Interstitial fluid
- Cell adhesion proteins
- Proteoglycans

➢ Fibers

➢ Cells

Vary in different CT

Cell Types:

CT TYPE	"BLAST"	"CYTE"
CT proper	fibroblast	fibrocyte
Cartilage	chondroblast	chondrocyte
Bone	osteoblast	osteocyte
Blood	hemocytoblast	RBCs, WBCs, platelets

Connective Tissue Proper:

- All CTs except bone, cartilage & blood
  - Loose connective tissues
    - Areolar
    - Adipose
    - Reticular
  - Dense connective tissues (fibrous CT)
    - Dense regular
    - Dense irregular
    - Elastic

Loose CT - Areolar (P.129 F.4.8):

Universal packing material between other tissues

- Most widely distributed
- Supporting & binding body parts
- Reservoir of body fluid
- Defense (anti infection)
- Nutrients storage (fat)
-

- ❖ Fibroblasts
- ❖ Loose packed of fibers
- ❖ Ground substance (open)
- ❖ Inflamed soaks up fluid → edema

Loose CT – Adipose Tissue (P.130 F4.8):

- ➢ White fat
  - – Similar to areolar but greater nutrient storage
  - – Abundant adipocytes
  - – Richly vascularized
  - – Sparse matrix
  - ➢ Nutrient storage
  - ➢ protection
  - ➢ insulation
- ➢ Brown fat
  - – Rich in mitochondria
  - – Use lipid fuels

    to heat bloodstream

    to warm the body

    (rather than to make ATP)

Loose CT - Reticular (P.131 F.4.8):

- ➢ Resembles areolar, networks of reticular fibers.
- ➢ Fibroblasts called reticular cells.
- ➢ Forms stroma (the internal framework) in lymph nodes, the spleen, & bone marrow to support free blood cells.

Dense Regular CT (P.132 F4.8):

- ➢ Closely packed bundles of collagen fibers

  parallel to direction of pull (make up tendons and ligaments)
  - – White structures with great resistance to pulling
  - – Fibers slightly wavy so stretch a little
- ➢ Fibroblasts manufacture fibers & ground substance
- ➢ Few cells
- ➢ Poorly vascularized

Dense Irregular CT(P.132 F4.8):

- ➢ Same structural elements as dense regular, but bundles of collagen thicker, arranged irregularly
- ➢ Resists tension from many different directions
  - – Dermis
  - – Fibrous joint capsules
  - – Fibrous coverings of some organs

Dense CT - Elastic (P.133 F4.8):

- More stretchy than dense regular
  (some ligaments very elastic
  - those connecting adjacent vertebrae)
- Many of larger arteries have in walls

Cartilage (P.134-135 F.4.8):

- Tough yet flexible
- Chondrocytes
- Up to 80% water
  (can rebound after compression)
- Lacks nerve fibers
- Avascular
  Receives nutrients from
  surrounding membrane
- Three types
  - Hyaline cartilage
  - Elastic cartilage
  - Fibrocartilage

Bones (P.136 F.4.8):

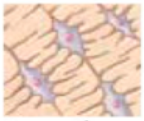
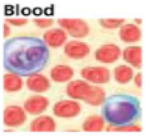
- Osseous tissue
- Supports and protects body structures
- Stores calcium, fat, & synthesizes blood cells in cavities
- More collagen than cartilage
- Calcified matrix
-
- ✓ Osteoblasts produce matrix
- ✓ Osteocytes maintain matrix
- ✓ Richly vascularized

- ❑ Osteoclasts: a large multinucleate bone cell that absorbs bone tissue during growth and healing.

Blood(P.136 F.4.8):

- Most atypical CT (fluid matrix)
- RBC, the most common cell type
- Also WBC & platelets
- Fibers - soluble proteins
  precipitate during blood clotting
- Transport vehicle

The Classification:

TISSUE CLASS AND EXAMPLE	SUBCLASSES	COMPONENTS: CELLS	COMPONENTS: MATRIX	GENERAL FEATURES
Connective Tissue Proper  *Dense regular connective tissue*	1. Loose connective tissue ▪ Areolar ▪ Adipose ▪ Reticular 2. Dense connective tissue ▪ Regular ▪ Irregular ▪ Elastic	Fibroblasts Fibrocytes Defense cells Adipocytes	Gel-like ground substance All three fiber types: collagen, reticular, elastic	Six different types; vary in density and types of fibers Functions as a binding tissue Resists mechanical stress, particulary tension Provides reservoir for water and salts Nutrient (fat) storage
Cartilage  *Hyaline cartilage*	1. Hyaline cartilage 2. Elastic cartilage 3. Fibrocartilage	Chondroblasts found in growing cartilage Chondrocytes	Gel-like ground substance Fibers: collagen, elastic fibers in some	Resists compression because of the large amounts of water held in the matrix Functions to cushion and support body structures
Bone Tissue  *Compact bone*	1. Compact bone 2. Spongy bone	Osteoblasts Osteocytes	Gel-like ground substance calcified with inorganic salts Fibers: collagen	Hard tissue that resists both compression and tension Functions in support
Blood 	See Chapter 17 for details on blood cell formation and differentiation.	Erythrocytes (RBC) Leukocytes (WBC) Platelets	Plasma No fibers	A fluid tissue Functions to carry O_2, CO_2, nutrients, wastes, and other substances (hormones, for example)

Covering & Lining Membranes (P.142 F.4.11):

Composed of at least two primary tissue types

- ➢ An epithelium bound to underlying CT proper

❖ Cutaneous / Mucous / Serous membranes

Epithelium Regeneration (P.144 F.4.12).