Human Anatomy & Physiology I

Chapter 5 - Tissues





Four major tissue types

Epithelial Connective

Muscle Nervous

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TABLE 5.1 Tis

Tissues

Туре	Function	Location	Distinguishing Characteristics
Epithelial	Protection, secretion, absorption, excretion	Cover body surface, cover and line internal organs, compose glands	Lack blood vessels, cells readily divide, cells are tightly packed
Connective	Bind, support, protect, fill spaces, store fat, produce blood cells	Widely distributed throughout the body	Mostly have good blood supply, cells are farther apart than cells of epithelia, with matrix in between
Muscle	Movement	Attached to bones, in the walls of hollow internal organs, heart	Contractile
Nervous	Transmit impulses for coordination, regulation, integration, and sensory reception	Brain, spinal cord, nerves	Cells connect to each other and other body parts

General characteristics -

- cover organs and the body
- line body cavities
- line hollow organs
- have a free surface
- have a basement membrane
- avascular
- cells readily divide
- cells tightly packed
- cells often have desmosomes
- function in protection, secretion, absorption, and excretion
- classified according to cell shape and number of cell layers

Classes of Epithelial Tissue Based on shape and layers



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TABLE 5.4 Epithelial Tissues

Туре	Description	Function	Location
Simple squamous epithelium	Single layer, flattened cells	Filtration, diffusion, osmosis, covers surface	Air sacs of lungs, walls of capillaries, linings of blood and lymph vessels
Simple cuboidal epithelium	Single layer, cube-shaped cells	Secretion, absorption	Surface of ovaries, linings of kidney tubules, and linings of ducts of certain glands
Simple columnar epithelium	Single layer, elongated cells	Protection, secretion, absorption	Linings of uterus, stomach, and intestines
Pseudostratified columnar epithelium	Single layer, elongated cells	Protection, secretion, movement of mucus and substances	Linings of respiratory passages
Stratified squamous epithelium	Many layers, top cells flattened	Protection	Outer layer of skin, linings of oral cavity, throat, vagina, and anal canal
Stratified cuboidal epithelium	2–3 layers, cube-shaped cells	Protection	Linings of larger ducts of mammary glands, sweat glands, salivary glands, and the pancreas
Stratified columnar epithelium	Top layer of elongated cells, lower layers of cube-shaped cells	Protection, secretion	Vas deferens, part of the male urethra, and parts of the pharynx
Transitional epithelium	Many layers of cube-shaped and elongated cells	Distensibility, protection	Inner lining of urinary bladder and linings of ureters and part of urethra
Glandular epithelium	Unicellular or multicellular	Secretion	Salivary glands, sweat glands, endocrine glands

Simple squamous –

- single layer of flat cells
- substances pass easily through
- line air sacs
- line blood vessels
- line lymphatic vessels

Simple cuboidal -

- single layer of cube -
- shaped cells
- line kidney tubules
- cover ovaries
- line ducts of some glands



Simple columnar –

- single layer of elongated cells
- sometimes possess cilia
- sometimes possess microvilli
- often have goblet cells
- line uterus, stomach, intestines

Pseudostratified columnar –

- single layer of elongated cells
- appear striated
- often have cilia
- often have goblet cells
- Ine respiratory passageways



Stratified squamous -

- many cell layers
- top cells are flat
- can accumulate keratin
- outer layer of skin
- line oral cavity, throat, vagina, and anal canal

Stratified cuboidal -

- 2-3 layers
- cube-shaped cells
- line ducts of mammary glands, sweat glands, salivary glands, and the pancreas



Stratified columnar -

- top layer of elongated cells
- cube-shaped cells in deeper layers
- line vas deferens, male urethra, and part of pharynx

Transitional –

- many cell layers
- cube-shaped and elongated cells
- line urinary bladder, ureters, and part of urethra



Glandular Epithelium

Composed of cells that are specialized to produce and secrete substances

Endocrine glands are ductless Exocrine glands have ducts

Unicellular exocrine gland

- composed of one cell
- goblet cell

Multicellular exocrine gland

- composed of many cells
- sweat glands, salivary glands, etc.

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TABLE 5.2 Types of Exocrine Glands

Туре	Characteristics	Example
Unicellular glands	A single secretory cell	Mucous-secreting goblet cell (see fig. 5.3)
Multicellular glands	Glands that consist of many cells	
Simple glands	Glands that communicate with surface by means of unbranched ducts	
 Simple tubular gland 	Straight tubelike gland that opens directly onto surface	Intestinal glands of small intestine (see fig. 17.3)
2. Simple coiled tubular gland	Long, coiled, tubelike gland; long duct	Eccrine (sweat) glands of skin (see fig. 6.9)
 Simple branched tubular gland 	Branched, tubelike gland; duct short or absent	Mucous glands in small intestine (see fig. 17.3)
 Simple branched alveolar gland 	Secretory portions of gland expand into saclike compartments along duct	Sebaceous gland of skin (see fig. 5.12)
Compound glands	Glands that communicate with surface by means of branched ducts	
 Compound tubular gland 	Secretory portions are coiled tubules, usually branched	Bulbourethral glands of male (see fig. 22.1)
2. Compound alveolar gland	Secretory portions are irregularly branched tubules with numerous saclike outgrowths	Salivary glands (see fig. 17.12)

Structural Types of Exocrine Glands



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TABLE 5.3

Types of Glandular Secretions

Type Description of Secretion Example

Merocrine glands	A fluid product released through the cell membrane by exocytosis	Salivary glands, pancreatic glands, sweat glands of the skin
Apocrine glands	Cellular product and portions of the free ends of glandular cells pinch off during secretion	Mammary glands, ceruminous glands lining the external ear canal
Holocrine glands	Entire cells laden with secretory products disintegrate	Sebaceous glands of the skin

Types of Glandular Secretions

Merocrine glands

- fluid product
- salivary glands
- pancreas
- sweat glands

Apocrine glands

- cellular product
- portions of cells
- mammary glands
- ceruminous glands

Holocrine glands

- secretory products
- whole cells
- sebaceous glands



General characteristics -

- most abundant tissue type
- many functions
 - bind structures
 - provide support and protection
 - serve as frameworks
 - fill spaces
 - store fat
 - produce blood cells
 - protect against infections
 - help repair tissue damage
- have a matrix
- have varying degrees of vascularity
- have cells that usually divide

Connective Tissue Major Cell Types

Fibroblasts

- fixed cell
- most common cell
- large, star-shaped
- produce fibers

Mast cells

- fixed cell
- release heparin
- release histamine

Macrophages

- wandering cell
- phagocytic
- important in defense

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TABLE 5.6 Components of Connective Tissue			
Component		Characteristic	Function
Fibroblasts		Widely distributed, large, star-shaped cells	Secrete proteins that become fibers
Macrophages		Motile cells sometimes attached to fibers	Clear foreign particles from tissues by phagocytosis
Mast cells		Large cells, usually located near blood vessels	Release substances that may help prevent blood clotting and promote inflammation
Collagenous fibers	s (white fibers)	Thick, threadlike fibers of collagen with great tensile strength	Hold structures together
Elastic fibers (yello	w fibers)	Bundles of microfibrils embedded in elastin	Provide elastic quality to parts that stretch
Reticular fibers		Thin fibers of collagen	Form supportive networks within tissues



Connective Tissue Fibers

Collagenous fibers

- thick
- composed of collagen
- great tensile strength
- abundant in dense CT
- hold structures together
- tendons, ligaments

Reticular fibers

- very thin collagenous fibers
- highly branched
- form supportive networks

Elastic fibers

- bundles of microfibrils embedded in elastin
 - fibers branch
 - elastic
- vocal cords, air

passages

Connective tissue proper

- loose connective tissue
- adipose tissue
- reticular connective tissue
- dense connective tissue
- elastic connective tissue

Specialized connective tissue

- cartilage
- bone
- blood

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TABLE 5.7 **Connective Tissues** Description Function Location Type Cells in fluid-gel matrix Binds organs together, Loose connective Beneath the skin, between muscles, holds tissue fluids beneath epithelial tissues tissue Beneath the skin, around the kidneys, behind Adipose tissue Cells in fluid-gel matrix Protects, insulates, and stores fat the eyeballs, on the surface of the heart Walls of liver, spleen, and lymphatic organs Cells in fluid-gel matrix Reticular connective Supports tissue Dense connective Cells in fluid-gel matrix Binds organs together Tendons, ligaments, dermis tissue Provides elastic quality Connecting parts of the spinal column, in Elastic connective Cells in fluid-gel matrix walls of arteries and airways tissue Cells in solid-gel matrix Ends of bones, nose, and rings in walls of Hyaline cartilage Supports, protects, provides framework respiratory passages Cells in solid-gel matrix Framework of external ear and part of larvnx Elastic cartilage Supports, protects, provides flexible framework Between bony parts of spinal column, Fibrocartilage Cells in solid-gel matrix Supports, protects, absorbs shock parts of pelvic girdle, and knee Cells in solid matrix Supports, protects, Bone Bones of skeleton, middle ear provides framework Transports gases, defends Throughout the body within a closed system of Blood Cells and platelets in fluid matrix against disease, clotting blood vessels and heart chambers

Loose connective tissue

- mainly fibroblasts
- fluid to gel-like matrix
- collagenous fibers
- elastic fibers
- bind skin to structures
- beneath most epithelia
- between muscles

Adipose tissue

- adipocytes
- cushions
- insulates
- store fats
- beneath skin
- behind eyes
- around kidneys and heart







Reticular connective tissue

- composed of reticular fibers
- supports
- walls of liver, spleen, lymphatic organs

Dense connective tissue

- packed collagenous fibers
- elastic fibers
- few fibroblasts
- bind body parts together
- tendons, ligaments, dermis
- poor blood supply





Elastic connective tissue

- abundant in elastic fibers
- some collagenous fibers
- fibroblasts
- attachments between vertebrae
- walls of large arteries, airways, heart

Bone

- solid matrix
- supports
- protects
- forms blood cells
- attachment for muscles







Cartilage

- rigid matrix
- chondrocytes in lacunae
- poor blood supply
- three types
 - hyaline
 - elastic
 - fibrocartilage

Hyaline cartilage

- most abundant
- ends of bones
- nose, respiratory passages
- embryonic skeleton

Elastic cartilage

flexible
external ear, larynx

Fibrocartilage

- very tough
- shock absorber
- intervertebral discs
- pads of knee and pelvic girdle

Three types of cartilage





Blood

- fluid matrix called plasma
- red blood cells
- white blood cells
- platelets
- transports
- defends
- clotting
- throughout body in blood vessels
- heart

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Muscle Tissues

General characteristics

- muscle cells called muscle fibers
- contractile
- three types
 - skeletal
 - smooth
 - cardiac

Skeletal muscle

- attached to bones
- striated
- voluntary

Smooth muscle

- walls of organs
- skin
- walls of blood vessels
- involuntary
- not striated

Cardiac muscle

- heart wall
- involuntary
- striated
- intercalated discs

Muscle Tissues





Nervous Tissues

- found in brain, spinal cord, and peripheral nerves
- basic cells are neurons
- neuroglial cells are supporting cells
- sensory reception
- conduction of nerve impulses



TABLE 5.8Muscle and Nervous Tissues

Туре	Description	Function	Location
Skeletal	Long, threadlike	Voluntary	Muscles usually
muscle	cells, striated,	movements of	attached to
tissue	many nuclei	skeletal parts	bones
Smooth	Shorter cells,	Involuntary	Walls of hollow
muscle	single, central	movements	internal
tissue	nucleus	of internal organs	organs

Туре	Description	Function	Location
Cardiac muscle tissue	Branched cells, striated, single nucleus	Heart movements	Heart muscle
Nervous tissue	Cell with cytoplasmic extensions	Sensory reception and conduction of nerve impulses	Brain, spinal cord, and peripheral nerves

Types of Epithelial Membranes

Serous

- line body cavities that lack openings to outside
- reduce friction
- inner lining of thorax and abdomen
- cover organs of thorax and abdomen
- secrete serous fluid

Mucous

line tubes and organs that open to outside world
lining of mouth, nose, throat, etc.
secrete mucus

Cutaneous

- covers body
- skin

Clinical Application

Collagen Disorders

Chondrodysplasia

- collagen chains too wide
- stunted growth
- deformed joints

Hereditary osteoarthritis

- change in amino acid in collagen
- painful joints

Dystrophic epidermolysis bullosa

- breakdown of collagen that attaches skin layers
- stretchy skin
- lax joints



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TABLE 5.5 Collagen Disorders

Disorder	Molecular Defect	Symptoms
Chondrodysplasia	Collagen chains are too wide and asymmetric	Stunted growth; deformed joints
Dystrophic epidermolysis bullosa	Breakdown of collagen fibrils that attach skin layers to each other	Stretchy, easily scarred skin; lax joints
Hereditary osteoarthritis	Substituted amino acid in collagen chain alters shape	Painful joints
Osteogenesis imperfecta type I	Too few collagen triple helices	Easily broken bones; deafness; blue sclera (whites of the eyes)
Stickler syndrome	Short collagen chains	Joint pain; degeneration of retina and fluid around it

Gary Stretch – Collagen Disorder?



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