

Connective tissue

Is found throughout the body. It supports or binds other tissues and provides for the metabolic needs of the body organs.

Connective tissue, with the exception of cartilage, is highly vascularized and well nourished. This allows for replication and thus allows for repair of organs.

Connective tissue is embryonically derived from mesoderm. It is also found as cells in a matrix, or meshwork and generally there is more matrix than cells.

Basically, there are 4 types of connective tissue which can be further subdivided.

- A) Embryonic Connective tissue
- B) Connective tissue proper. This is subdivided into 6 categories.
 - 1) loose, or areolar connective tissue
 - 2) dense regular connective tissue
 - 3) dense irregular connective tissue
 - 4) elastic connective tissue
 - 5) reticular connective tissue
 - 6) adipose
- C) cartilage. Cartilage is subdivided into three types.
 - 1) hyaline cartilage
 - 2) fibrocartilage
 - 3) elastic cartilage
- D) Bone
- E) Vascular or blood tissue

Embryonic Connective Tissue

is referred to as mesenchyme. It is derived from mesoderm, and during embryonic development it migrates to the areas where it will be needed to differentiate into specific types of connective tissue.

Some of this type of connective tissue persists in adult life, where it can be used for repair of injured tissue.

Connective Tissue Proper

is made of a loose matrix called ground substance

The most common cell type within this matrix is the fibroblast

A fibroblast is a stellate or star shaped cell, which produces collagenous, elastic, and reticular fibers.

a) collagenous fibers are made of a protein called collagen. This protein is flexible yet very strong.

there are 5 types of collagen.

b) elastic fibers, are made of the protein elastin, which can stretch, giving elasticity to some tissues.

c) reticular fibers are strong fibers which generally form a lattice or reticulum

Loose Connective Tissue

primarily made of fibroblasts, is generally used as a binding and packing material. Some of its functions are:

- 1) holds skin to underlying muscle
- 2) forms fascia - surrounds muscle fibers and groups
- 3) also surrounds vessels and nerves

In loose connective tissue we may find mast cells. Mast cells produce heparin, which is an anticoagulant. They may also produce histamine, which acts as a vasodilator

this type of Connective Tissue is flexible yet provides strength in any direction.

Dense Regular Connective Tissue

Has large amounts of densely packed collagenous fibers arranged parallel to the direction of force.

Dense regular connective tissue generally has a silvery white appearance and thus is sometimes called white, fibrous Connective Tissue.

Dense regular connective tissue forms tendons and ligaments.

Tendons connect muscles to bone

ligaments connect bone to bone within the skeletal system. There are also ligaments that are not related to the skeletal system.

Dense regular connective tissue has a poor blood supply; therefore, it does not heal well. Repair usually requires surgery.

Dense Irregular Connective Tissue

Is made of large amounts of densely packed collagenous fibers interwoven to provide strength in any direction.

Dense irregular connective tissue is found;

in the dermis of skin

in the submucosa of digestive tract

in the fibrous capsules of organs and joints

Elastic Connective Tissue

as its name implies, has a large amount of elastic fibers, irregularly arranged

These fibers can stretch to 1 1/2 their original length and snap back

Elastic connective tissue is found;

in the walls of large arteries

in the larynx

in the trachea and bronchial tubes of the lungs

in intervertebral discs

Reticular Connective Tissue

Is a network of reticular fibers usually in a jellylike matrix

Reticular connective tissue is found;

- in the liver
- in lymph nodes
- in the spleen
- in bone marrow

Cartilage

Is composed of cells called chondrocytes, and a matrix which gives some elasticity to the tissue.

Cartilage forms a precursor to bone

Cartilage is associated with bones at articular surfaces

Cartilage is surrounded by dense fibrous connective tissue called perichondrium, which literally means, around cartilage.

Cartilage is poorly vascularized thus heals very poorly

there are 3 types of cartilage distinguished by their types of fibers.

1) hyaline cartilage - is a homogenous matrix made of collagenous fibers. These fibers are only visible in electron microscopy. In light microscopy the fibers look clear.

Hyaline cartilage is the most abundant cartilage in the body.

Functions of hyaline cartilage:

- covers articular surfaces of bone
- supports the tubular trachea and bronchi in the respiratory system
- reinforces the nose
- forms the costal cartilages between ribs and sternum
- is the cartilage that forms the precursor of most bones.

2) fibrocartilage - has collagenous fibers and is capable of withstanding tension and compression

Fibrocartilage is found;

- in the symphysis pubis
- in intervertebral discs
- in the medial and lateral menisci of the knee and menisci of some other joints

3) Elastic cartilage, -is much like hyaline cartilage but, it has a high proportion of elastic fibers, thus it is flexible yet strong.

Elastic cartilage is found;

- in the outer ear
- in portions of the larynx

in the auditory canal

Bone, also known as osseous connective tissue

Bone has a very rich vascular supply

Bone is composed mainly of calcium and hydroxyapatite crystals

There are two types of bone

1) Compact, or dense bone

This type of bone is hard, and the outer layer of bone is covered by periosteum. Periosteum literally means, around bone

Compact bone provides for attachment of muscles as well as provides protection

2) Spongy, or cancellous bone.

This type of bone is porous. The highly vascular inner portion of this bone makes the bone lighter, and provides a space for marrow

Compact Bone

In compact bone, osteocytes (bone cells) are arranged in concentric layers (lamellae) around a central canal (the haversian canal) which serves as a route for the vascular and nerve supply

Each osteocyte is located within a space called a lacuna. From these lacunae we find many smaller canals radiating to adjacent lacuna, these are called canaliculi.

An Osteon -consists of a central canal, surrounded by concentric lamellae, with lacunae containing osteocytes. The lacunae are interconnected by canaliculi. The osteon is considered to be the functional unit of bone.

Vascular Connective Tissue

Blood - is a highly specialized, viscous connective tissue

Blood is made of formed elements. These are the Red Blood Cells, White Blood Cells, and platelets, suspended in the liquid plasma

Blood plays a role in maintaining internal body homeostasis.

Generally, there are three types of formed elements

- 1) erythrocytes
- 2) leukocytes
- 3) thrombocytes

A) Erythrocytes, also called red blood cells

These are made in the bone marrow and spleen

They are non-nucleated

They are shaped like a biconcave disc

They transport respiratory gases. The red color of blood is due to oxygenated hemoglobin within the erythrocytes

B) Leukocytes, also called white blood cells

These defend against microorganisms
They are made in bone marrow and lymphatic tissue, ie., spleen, thymus

There are 5 types of leukocytes

1) neutrophils, 2) eosinophils, 3) basophils, 4) lymphocytes, 5) monocytes

C) Thrombocytes, also known as platelets

Platelets are not cells, but rather are pieces that have broken off a large cell known as a megakaryocyte.

Platelets are involved in the formation of a thrombus, or blood clot.
This is covered in depth in the lecture about blood.

Muscle Tissue

is responsible for movement. This can be movement for body locomotion, movement for material through the body, or movement within the body.

muscle fibers react (contract) in response to stimuli.

Muscle is derived from mesoderm

there are 3 types of muscles

1) Smooth muscle, which is non-striated muscle. The muscle fibers are usually long, spindle shaped cells with a single nucleus. This type of muscle is usually found in flattened sheets which can form a muscle wall

Smooth muscles is found;

- in the wall of the digestive tract
- in the walls of arteries and large veins
- in the walls of respiratory passages
- in the urinary and reproductive ducts

Smooth muscle is often incorrectly referred to by some as slow reacting muscle. if this type of muscle is slow reacting, how can we explain the speed of vasoconstriction, ejaculation, etc.?

This type of muscle is innervated by the autonomic (involuntary) nervous system

2) Cardiac muscle is made up of branched cells. These cells usually have a single, centrally located nucleus, although they may be bi-nucleated. These cells are connected to each other via intercalated discs.

Cardiac muscle is striated

Cardiac muscle exhibits rhythmic involuntary contractions

3) Skeletal muscle, is made up of elongated cells often referred to as muscle fibers. These cells are multinucleated, with the nuclei located along the periphery of the cell.

Skeletal muscle is striated and under voluntary nervous control

Nervous Tissue

Is composed of neurons which respond to stimuli, and conduct impulses to and from all body organs and muscles

Nervous tissue also has neuroglia, which are cells that support and bind neurons

neurons have:

- 1) a cell body, or soma. Sometimes referred to as a perikaryon
- 2) an axon, which carries an impulse away from the cell body
- 3) dendrites, which carry incoming impulses to the cell body

A nerve fiber is an axon and its surrounding sheath.

Neurons are derived from ectoderm

Neurons cannot reproduce

After an injury, neurons may regenerate