Connective tissue

SUBMITTED TO

DR.ASHUTOSH NIROLA
DR MADHU GUPTA
DR VIKRAM BALI
DR PRIYANKA SHARMA
DR KANIKA SINGLA
DR PRIYANKA SINGLA

SUBMITTED BY

TEJINDER PAL SINGH

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INTRODUCTION

Most widespread and abundant type of tissue in the human body.

Major constituent is extracellular matrix, composed of fibres, ground substance & tissue fluid.

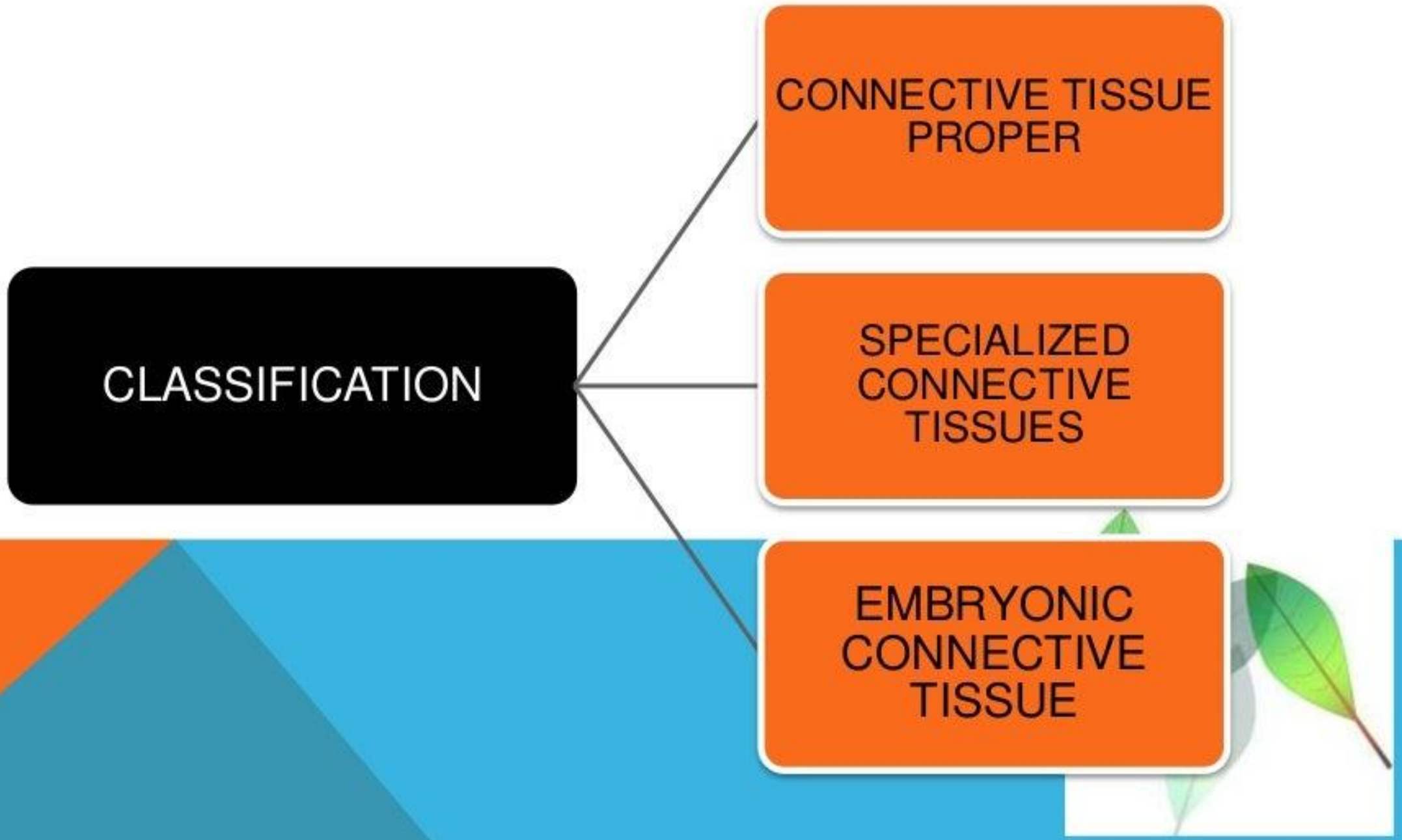
Embedded within the extracellular matrix are the connective tissue cells.

Structurally, connective tissue can be divided into 3 classes: cells, fibres & ground substance.

Forms a vast and continuous compartment throughout the body bounded by basal lamina of epithelia and by basal lamina of muscle, nerves and vascular endothelium.

CLASSIFICATION

Classification is based on the composition and organization of cellular and extracellular components and on special functions.



CONNECTIVE TISSUE PROPER

LOOSE CONNECTIVE TISSUE

DENSE CONNECTIVE TISSUE

SPECIALISED CONNECTIVE TISSUE

- ADIPOSE CONNECTIVE TISSUE
- RETICULAR CONNECTIVE TISSUE
- ELASTIC CONNECTIVE TISSUE

EMBRYONAL CONNECTIVE TISSUE

MESENCHYMAL CONNECTIVE TISSUE

MUCUOS CONNECTIVE TISSUE

FUNCTIONS

Forms capsules that surround the organs of the body & the internal architecture

Makes up tendons, ligaments & areolar tissue that fills the spaces between the tissues.

Bone, cartilage & adipose tissue are specialized types of connective tissue that support the soft tissues of the body & store fat.

Role in defending the organism due to the phagocytic & immuno-competent cells

Phagocytic cells engulf inert particles & micro-organisms that enter the body.

Specific proteins called antibodies are produced by plasma cells in the connective tissue.

Provide a physical barrier

Plays role in cell nutrition.

Serves as a medium through which nutrients & metabolic wastes are exchanged between cells & their blood supply.

CONNECTIVE TISSUE COMPONENTS

All connective tissue possess three basic components :

Ground Substance

Fibers

Cells

GROUND SUBSTANCE

A complex mixture of glycoproteins & proteoglycans

Participate in binding cells to the fibers of connective tissues

Colorless & transparent.

Fills the space between cells & fibers

Viscous

Acts as both a lubricant & a barrier to the penetration of foreign particles.

Granular in appearance

Consistency varies from fluid to gel

GLYCOPROTEINS

Glycoproteins are proteins that contain oligosaccharide chains (glycans) covalently attached to polypeptide side-chains. The carbohydrate is attached to the protein in a cotranslational or posttranslational modification.

The major types of adhesive glycoproteins are **fibronectin**, **laminin**, and **entactin**.

VARIOUS GLYCOPROTEINS/ PRESENT ARE

FIBRONECTIN:

- **Is a glycoprotein synthesized by fibroblasts and some epithelial cells.**
- **Binds with collagen**
- **Connects collagen fibers to cells of connective tissue.**

FIBRILLIN:

- **Forms elastic fibers in CT.**
- **Responsible for adhesion of different extracellular components to one another.**

LAMININ:

- **Present in basement membrane.**
- **Laminin helps in adhesion of epithelial cells to basal lamina**

ENTACTIN:

Adhesive glycoprotein

Seen in embryonic tissue.

Play a role in cell migration .

CHONDRONECTIN & OSTEOPONTIN:

Chondronectin and osteonectin are similar to fibronectin.

Chondronectin **has binding sites for type II collagen, chondroitin sulfates, hyaluronic acid, and integrins of chondroblasts and chondrocytes.** ***Osteonectin*** **possesses domains for type I collagen, proteoglycans, and integrins of osteoblasts and osteocytes.**

Type	Tissue Distribution	Functions
Fibronectin	Widely distributed in extracellular structures; cell surface, especially fibroblasts; basal laminae; external laminae of muscle	Cell adhesion (to integrins), collagen-binding (I, II, IV), heparan sulfate- and hyaluronic acid-binding
Laminin	Basal laminae, external laminae of muscle	Binds to epithelial and muscle cells, to type IV collagen, and to heparan sulfate
Entactin (nidogen)	Basal laminae	Binds to laminin and type IV collagen
Thrombospondin	Blood plasma, platelets, fibroblasts, endothelium, smooth muscle cells	Secreted by platelets during blood clotting, binds to fibrinogen, etc.; in muscle, skin and blood vessels, binds to collagen, heparin and fibronectin
Chondronectin	Cartilage	Chondrocyte-binding, collagen (type II)-binding, proteoglycan-binding
Osteopontin	Bone	Promotes cell adhesion to extracellular matrix, including osteoclasts to bone

GLYCOSAMINOGLYCANS/ MUCOPOLYSACCHARIDES

-Are linear polysaccharides formed by repeating disaccharide units

-Composed of a uronic acid and a hexosamine.

-Hexosamine can be glucosamine or galactosamine

-Uronic acid can be glucuronic acid or iduronic acid.

-Linear chains are bound covalently to a protein core

GAGs are long, inflexible, unbranched polysaccharides composed of chains of repeating disaccharide units.

In cartilage, the proteoglycan molecules are bound to a hyaluronic side chain

Because of the abundance of hydroxyl, carboxyl & sulfate groups, the proteoglycans are hydrophilic & act as polyanions.

Type	Tissue Distribution	Functions
Hyaluronic acid	Widely distributed, found in variable amounts in all tissues and fluids in adults; loose connective tissue; skin; umbilical cord; vitreous; synovial fluid; cartilage	Resists compressive forces in tissues and joints; space filler during embryonic development; facilitates cell migration during tissue morphogenesis and repair
Chondroitin sulfate	Hyaline and elastic cartilage, bone	Mechanical support; forms large aggregations with hyaluronic acid
Dermatan sulfate	Dermis, tendons, ligaments, heart valves, organ capsules, sclera, fibrocartilage, arteries (adventitia), nerves (epineurium)	Binds to type I collagen fibrils
Keratan sulfate	Bone, cartilage, cornea	Mechanical support
Heparan sulfate	Fibroblast and epithelial cell surface, basal and external laminae	Cell adhesion; binds FGF; structural and filtering function in basal laminae

PROTEOGLYCANS

- **When sulfated GAG's form covalent bonds with a protein core , they form a family of macro molecules known as proteoglycans.**

- **Look like a bottle brush, with the protein core resembling the wire stem and the various sulfated GAGs projecting from its surface in three dimensional space, as do the bristles of the brush.**

- **Proteoglycans have numerous functions. By occupying a large volume, they resist compression and retard the rapid movement of microorganisms and metastatic cells.**

- **In addition, in association with the basal lamina, they form molecular filters of varying pore sizes and charge distributions that selectively screen and retard macromolecules as they pass through.**

- **Proteoglycans also possess binding sites for certain signaling molecules, such as various growth factors. By binding these signaling molecules, proteoglycans can either impede their function by preventing the molecules from reaching their destinations or enhance their function by concentrating them in a specific location.**