CELLS TO SYSTEMS – CONNECTIVE TISSUES

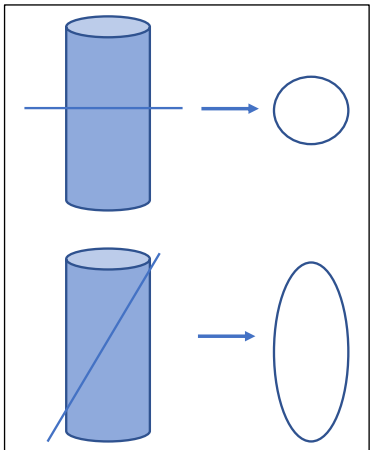
INTRODUCTION

Histology: Microscopic anatomy, i.e. the study of the structure of tissues

- light microscope
- electron microscope

Importance:

- Helps to understand normal function
- Provides basis for understanding of pathology



Relationship of three-dimensional structure to appearance of section

Methods for examination of tissues:

- fixation (e.g. formalin)
- embedding (e.g. paraffin wax)
- sectioning (~ 5 µm thick)
- staining, e.g. haematoxylin and eosin (H&E)
- mounting

Problems:

- Two-dimensional representation of three-dimensional structure
- Artefacts - postmortem change, variation in staining, folding of sections, air bubbles, shrinkage, etc

Terminology:

Staining characteristics: eosinophilic (pink), basophilic (haematoxylin: blue – taken up by nucleic acids, e.g. DNA in nucleus and RNA in ribosomes in cells actively synthesizing proteins)

Cells: - blast (not fully differentiated), -cyte (fully differentiated, mature)

Types of tissue:

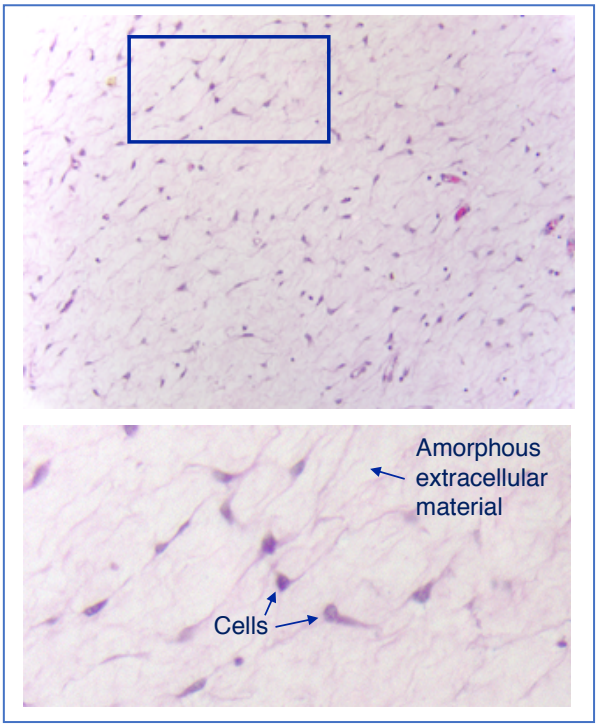
All organs are comprised of combinations of four basic tissue types:

1. Connective tissue
2. Epithelial tissue
3. Muscular tissue
4. Nervous tissue

CONNECTIVE TISSUE

COMPOSITION:

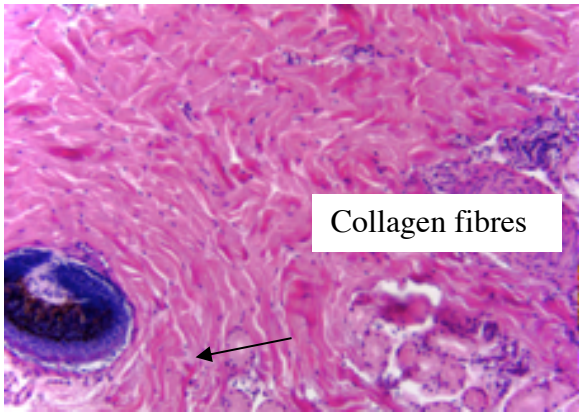
Composed of **cells** and **extracellular (intercellular) material**.



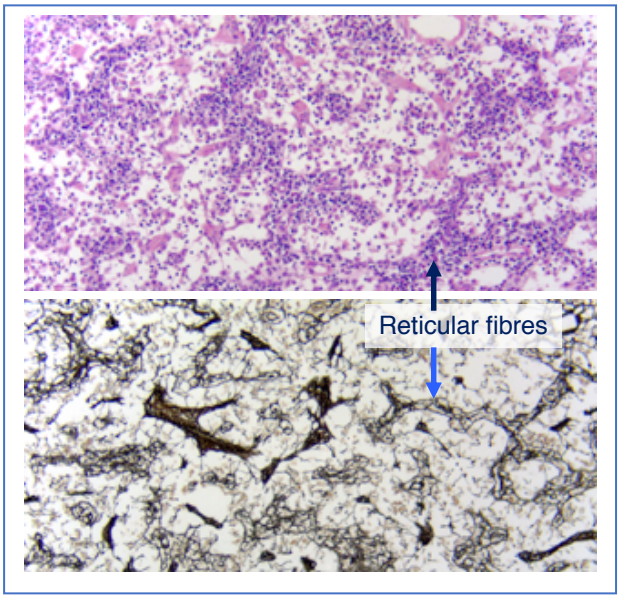
- extracellular material:

  - **amorphous** (shapeless; = 'ground substance')
    - fluid (blood, lymph)
    - jelly-like (vitreous humour)
    - solid (cartilage, bone)

  - **fibrous**
    - 'collagen', 'reticular', 'elastic'

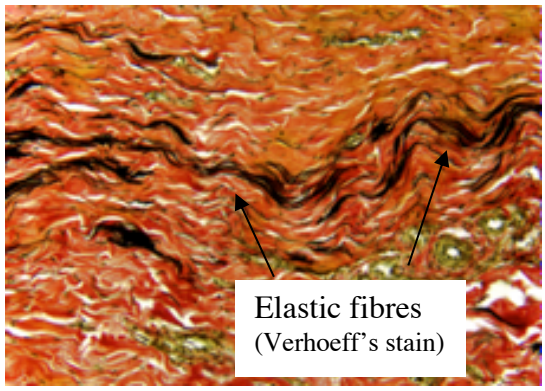


Collagen fibres:
- strong, flexible
- white fibrous tissue
- eosinophilic in H&E
- mostly type I collagen, but variations in specialized tissues



Reticular fibres:
- fine network
- poorly stained in H&E, black in reticulin stain
- composed of varying combinations of collagens and extracellular matrix glycoproteins

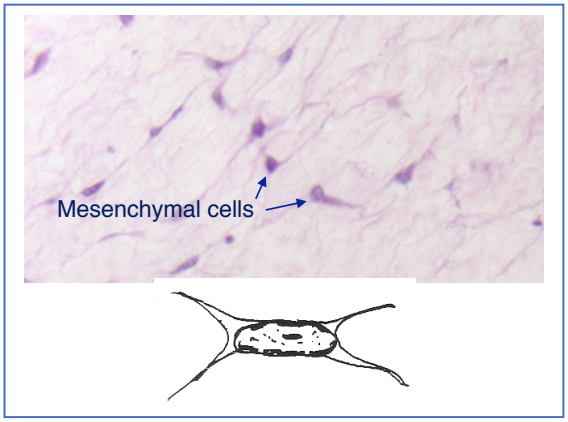
Elastic fibres:
- stretchable, elastic
- yellow fibrous tissue
- eosinophilic in H&E; black in Verhoeff's stain



CONNECTIVE TISSUE PROPER

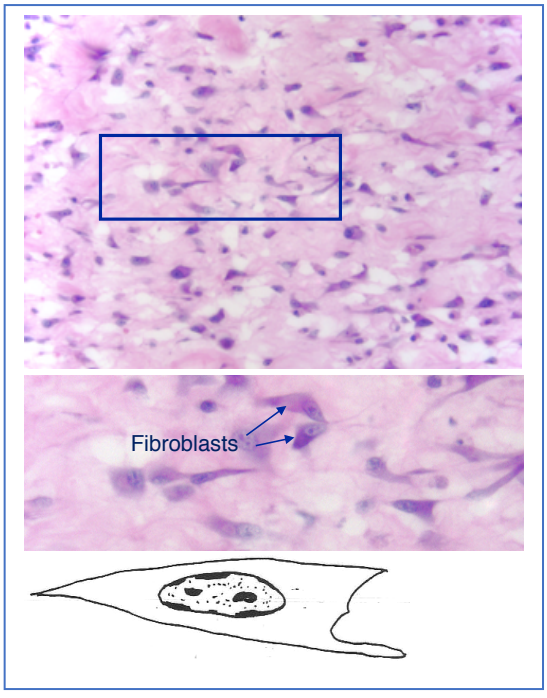
Functions:
- support
- protection
- connections within locomotor system
- holds tissues together
- energy storage

Types:
- loose (higher ratio of cells to fibres)
- adipose (many fat cells)
- dense (lower ratio of cells to fibres)
  - regularly arranged
  - irregularly arranged

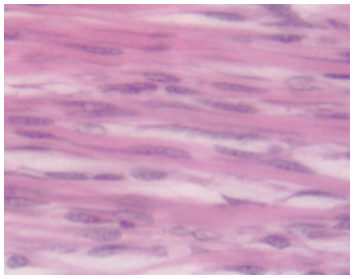


Cells:
- **mesenchymal cell**
  - in embryonic tissues
  - stellate (star-shaped) - many cytoplasmic processes
  - oval/round nucleus

- **fibroblast**
  - stellate or spindle-shaped
  - ovoid nucleus
  - abundant basophilic cytoplasm
  - synthesizes and secretes collagen and other extracellular matrix components
  - differentiates into fibrocyte

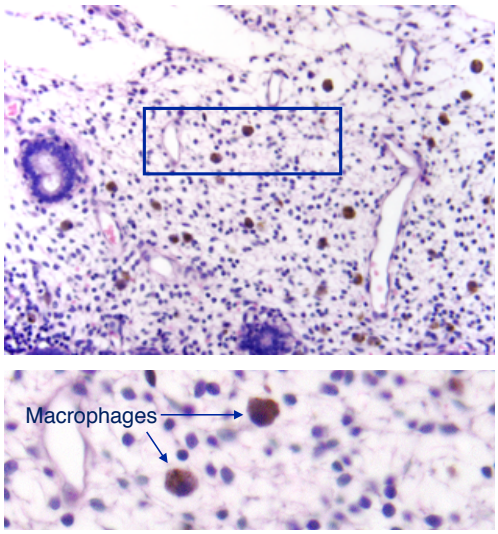


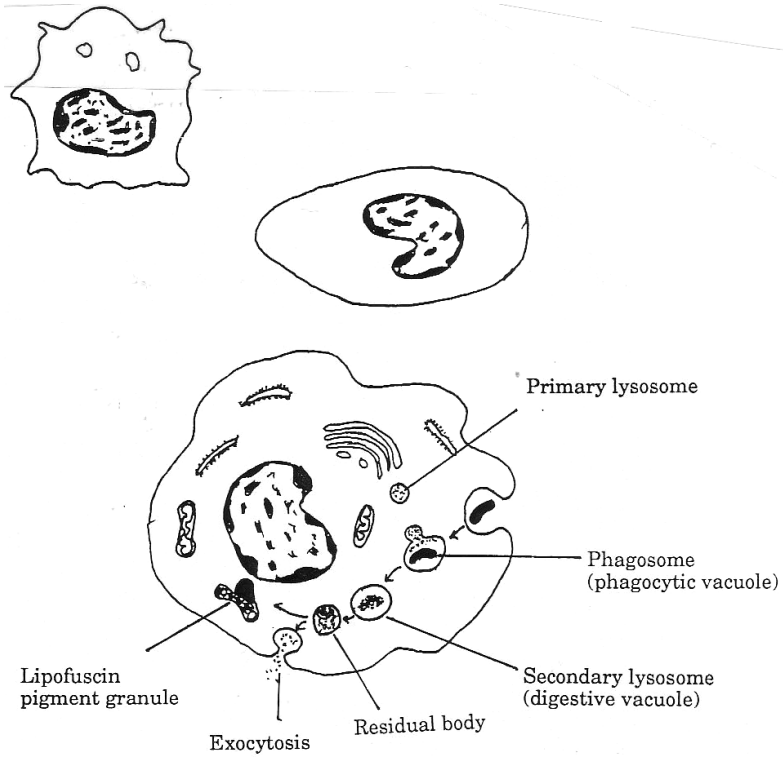
- **fibrocyte**
  - small flattened elongated cell
  - elongated nucleus
  - very little cytoplasm
  - less active in secretion than fibroblast



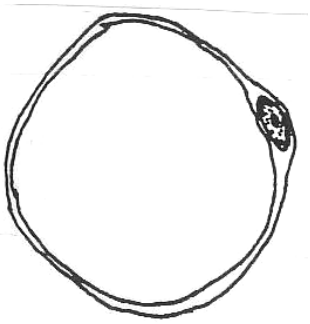
Fibrocytes

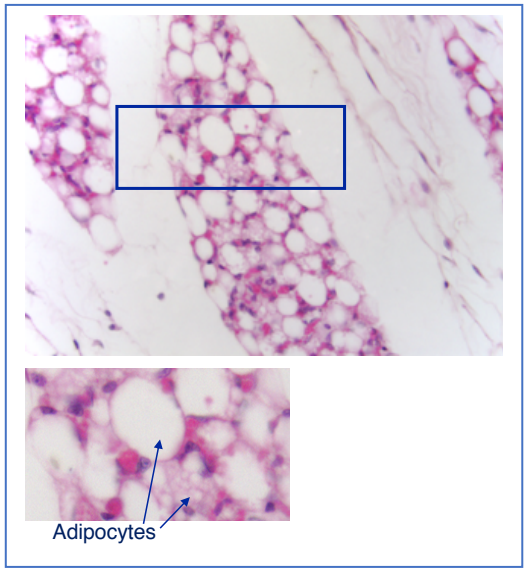
- **macrophage**
  - large cell
  - derived from blood monocyte
  - phagocytic cell (engulfs particulate matter including microorganisms and dead tissue)
  - produces lysosomal proteases (protein-degrading enzymes), cytokines, prostaglandins (substances that mediate inflammatory reactions



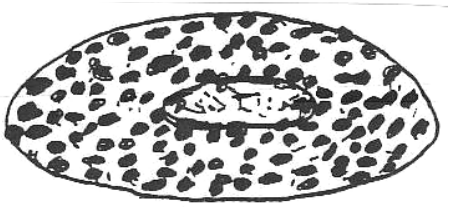


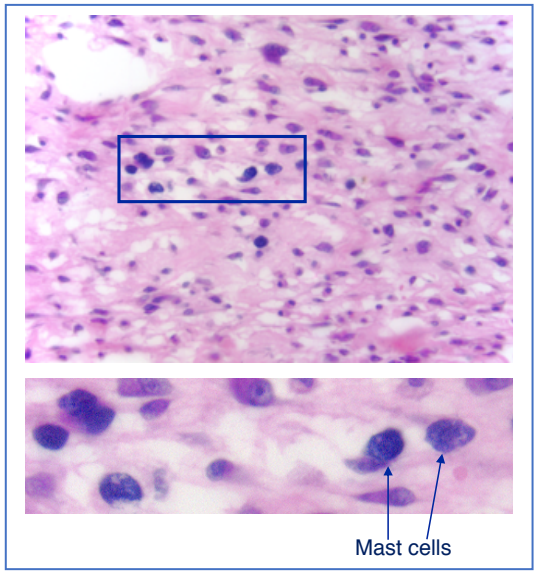
- **fat cell (adipocyte)**
  - accumulate fat droplets in cytoplasm
  - fat droplets coalesce to form single large fat droplet, displacing nucleus to side of cell
  - energy storage, insulation and protection



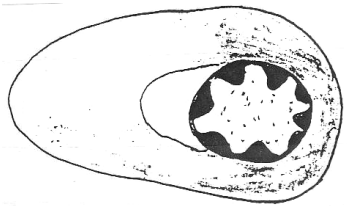


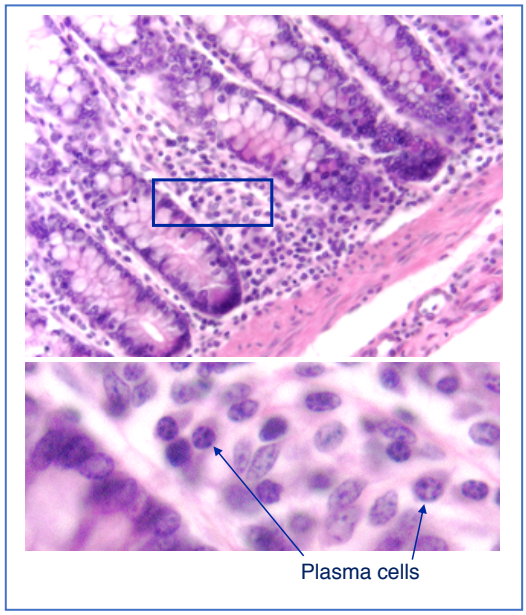
- **mast cell**
  - scattered, in low numbers in most connective tissues (often close to blood vessels)
  - cytoplasm filled with granules containing heparin (anticoagulant), histamine (increases blood vessel permeability), serotonin (vasoconstrictor) and proteases
  - degranulate when tissue damaged





- **plasma cell**
  - B lymphocyte actively producing antibody
  - eccentrically placed round nucleus with chromatin radially arranged
  - abundant basophilic cytoplasm
  - negative image (Golgi apparatus) prominent





- **melanocyte**
  - pigment cell

- occasional other cells, e.g. leucocytes