



**Faculty of Biological Science and Technology**  
**Zoology and Botanical Department**  
**Practical Histology**

# **Connective Tissue**

## **Adipose Tissue and Blood**

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## Introduction

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- ▶ When fat cells (adipocytes) accumulate together and form large masses, it is called adipose tissue
- ▶ Adipose cells supported by a delicate network of reticular fiber
- ▶ Adipose tissues have many blood vessels
- ▶ There are two types of adipose tissue
  - ▶ White adipose tissue
  - ▶ Brown adipose tissue

### White adipocyte

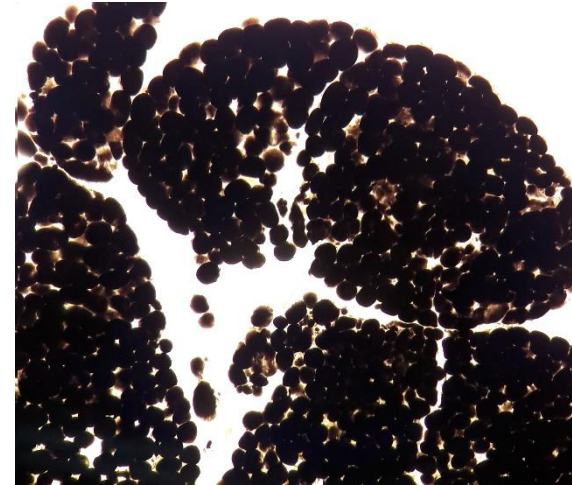
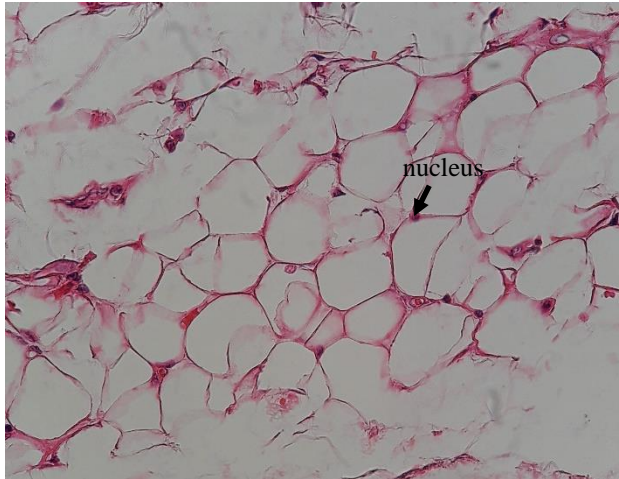
- ▶ White adipocytes are spherical cells, but when pressed together, they appear multifaceted. They contain a single, large lipid droplet. As a result, a thin rim of cytoplasm and a small nucleus are squeezed at the edge of the cell. This appearance makes white adipocytes look like a signet ring
- ▶ Lipid droplet is dissolved by Xylol in the usual histological methods, so adipocytes are seen empty

### Brown adipocyte

- ▶ Brown adipocytes are multifaceted and much smaller than white adipocytes. They contain numerous, small lipid droplets and large mitochondria. The presence of mitochondria and more capillaries gives the tissue its brown colour. Brown adipocyte has a central located nucleus



## White adipocyte

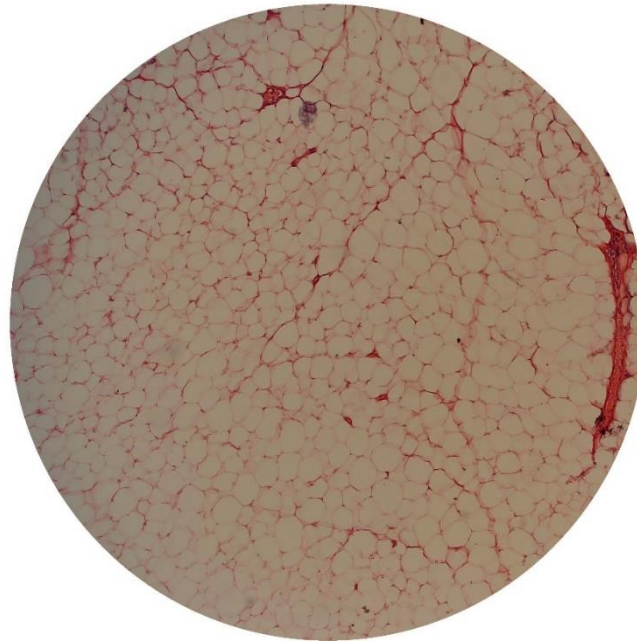


White adipocytes. Left: each adipocyte contain a single lipid droplet and resemble a signet ring. H&E, 40X. Right: special staining shows a single lipid droplet in each adipocyte, while nucleus and other component of cell can not be seen. Black Sudan staining. 10X. These pictures are taken from histological slide in histology laboratory of Isfahan University



## White adipose tissue

- ▶ White adipose tissue is divided into lobules by connective tissue

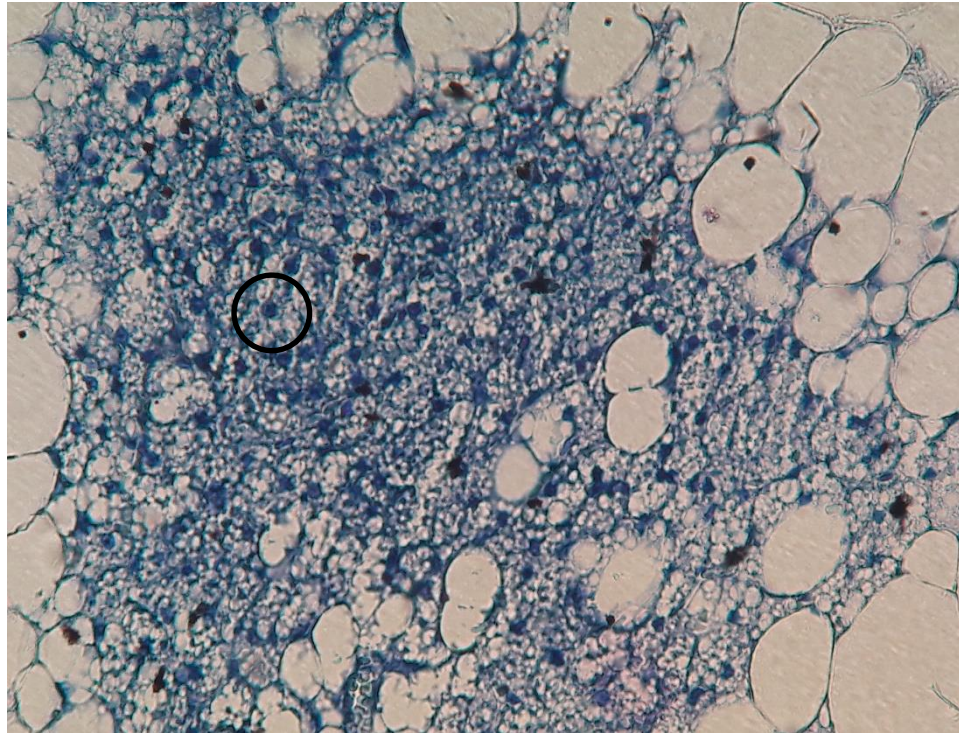


White adipose tissue. Lobules and numerous blood capillaries can be seen. H&E, 4X. This picture is taken from histological slide in histology laboratory of Isfahan University



## Brown adipocyte tissue

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Brown adipose tissue. Black circle depicts a single brown adipocyte. Each adipocyte has numerous, small lipid droplets. H&E, 40X. This picture is taken from histological slide in histology laboratory of Isfahan University



## Blood

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- ▶ Blood is a type of connective tissue in liquid form
- ▶ Blood composed of an extracellular matrix which is called plasma, fibers (fibrin fibers which appears only when blood clotting occur) and cells
- ▶ Blood cells include:
  - ▶ Red blood cells or erythrocytes
  - ▶ White blood cells or leukocytes
    - ▶ Granulocytes or polymorphonuclears including: neutrophils, eosinophils and basophils
    - ▶ Agranulocytes or mononuclears including: lymphocytes and monocytes
  - ▶ Platelets or thrombocytes

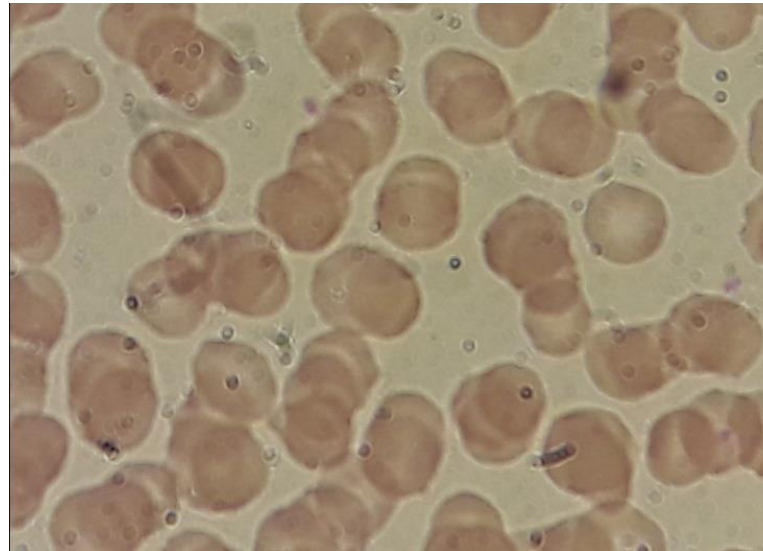




## Red blood cells or erythrocytes

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- ▶ Normal red blood cell is biconcave in shape with flattened center
- ▶ Mature red blood cells don't have nucleus or other cytoplasmic organelles
- ▶ Their diameter is about 7-8  $\mu\text{m}$  and 1.7-2.2  $\mu\text{m}$  thickness

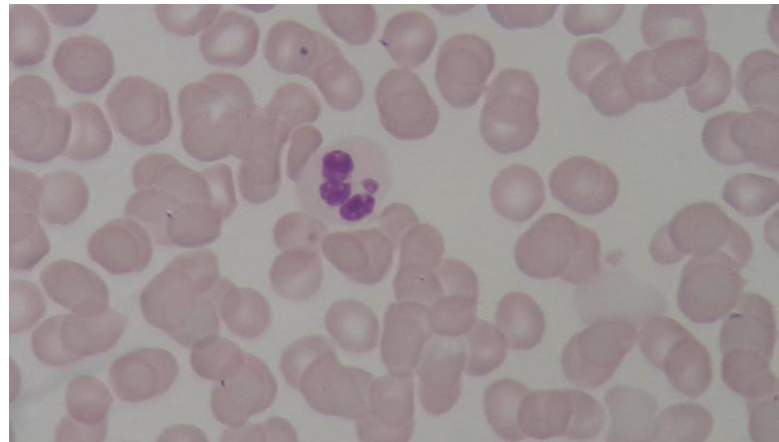


Red blood cells. Gimsa staining, 100X. This picture is taken from histological slide in histology laboratory of Isfahan University



## Neutrophils

- ▶ Neutrophil is a type of granulocyte
- ▶ A mature neutrophil has a segmented nucleus with three to five distinct lobes which are connected by thin filaments. Their multilobed nucleus can show a variety of shapes
- ▶ Neutrophils have an average diameter of 12-15  $\mu\text{m}$
- ▶ Immature neutrophils are called N-band cells and have a nucleus with two segments



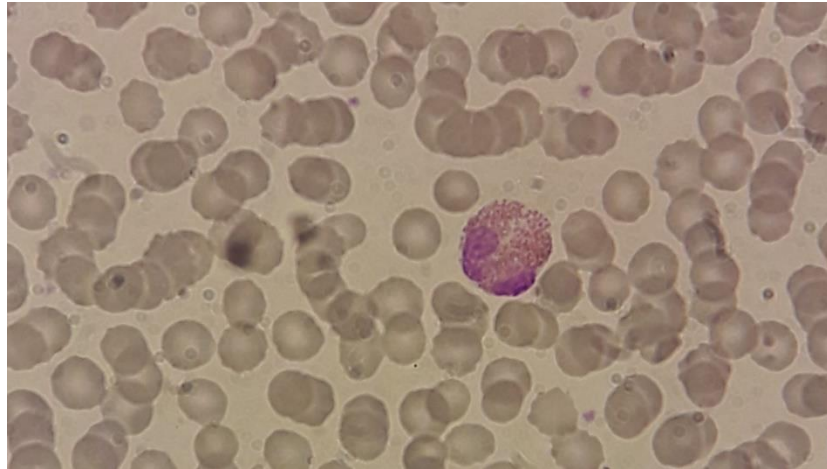
Neutrophil. Gimsa staining, 100X. This picture is taken from histological slide in histology laboratory of Isfahan University





## Eosinophils or acidophils

- ▶ Eosinophil is a type of granulocyte
- ▶ An eosinophil has a segmented nucleus with two distinct lobes and many red granules in cytoplasm
- ▶ They are the same size as neutrophils

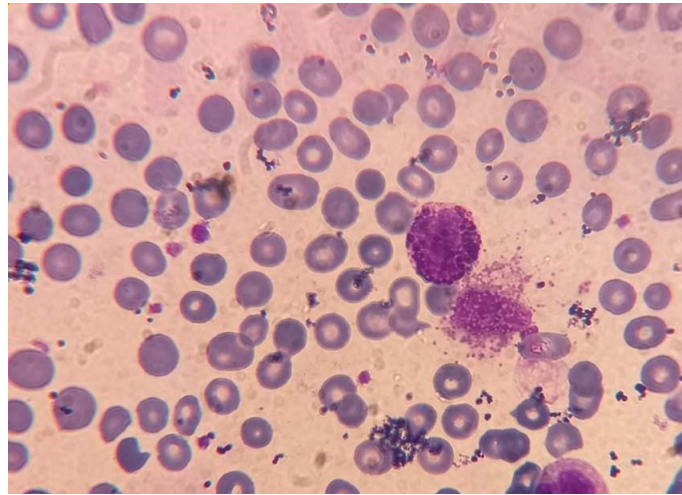


Eosinophil. Gimsa staining, 100X. This picture is taken from histological slide in histology laboratory of Isfahan University



## Basophils

- ▶ Basophil is a type of granulocyte
- ▶ A Basophil has a segmented nucleus with two to four distinct lobes and numerous purple granules in cytoplasm. Granules usually cover the nucleus
- ▶ They are the same size as neutrophils

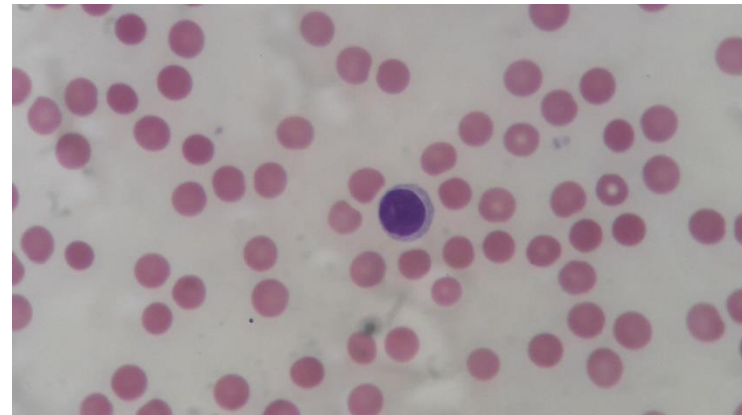
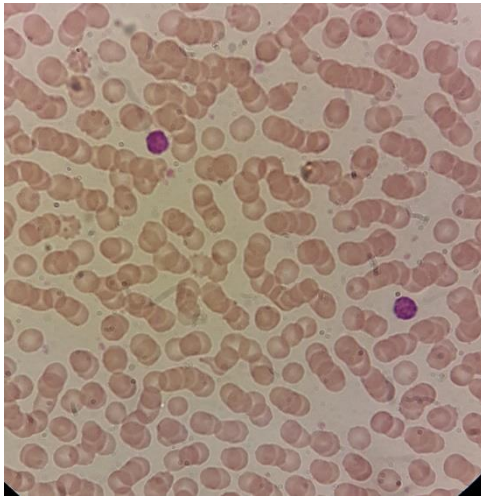


Basophil. Gimsa staining, 100X. This picture is taken from histological slide in histology laboratory of Isfahan University



## Lymphocytes

- ▶ Lymphocyte is a type of agranulocyte
- ▶ They are small B or T cells by 5-8  $\mu\text{m}$  diameter or large natural killer cells by 12-15  $\mu\text{m}$  diameter. Generally, T and B cells are indistinguishable from their size or appearance
- ▶ Despite their cell sizes, the ratio of nucleus to cytoplasm is quite high
- ▶ In light microscopy, small lymphocytes have large spherical nucleus with dense heterochromatin. The nucleus is surrounded by a thin rim of cytoplasm with dark blue colour

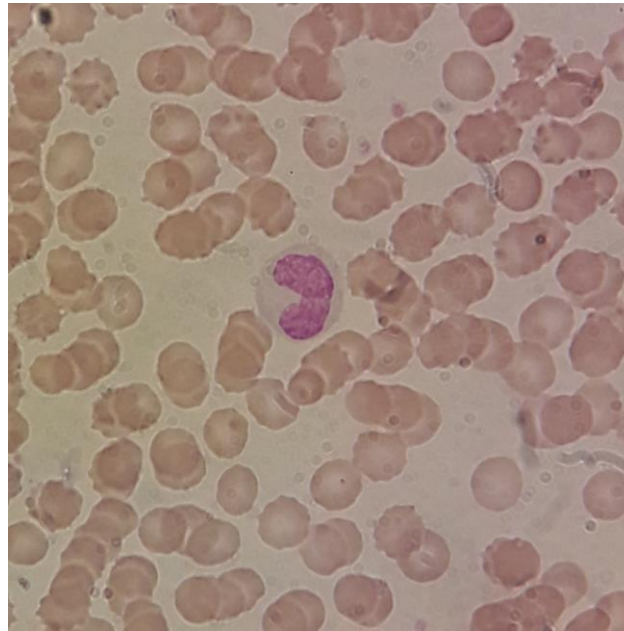


Lymphocytes. H&E, 100X. These pictures are taken from histological slide in histology laboratory of Isfahan University



## monocytes

- ▶ Monocytes is a type of agranulocyte
- ▶ The appearance of cell is somewhat irregular. A monocyte has a bean-shaped or kidney-shaped nucleus
- ▶ With 15-22  $\mu\text{m}$  diameter, they are the largest white blood cell in peripheral blood circulation

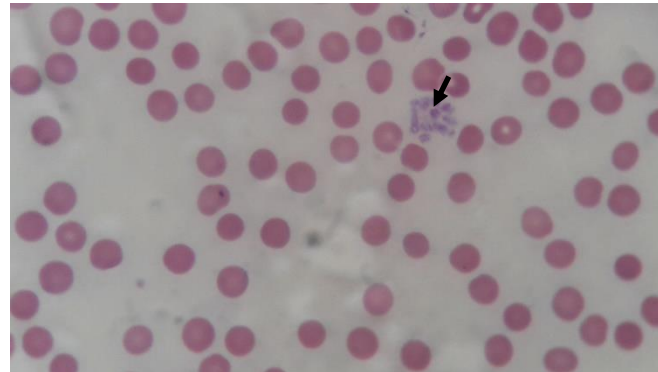


Elastic cartilage. Black arrows show elastic fibers. H&E, 72X. This picture is taken from histological slide in histology laboratory of Isfahan University



## Platelets or thrombocytes

- ▶ Platelets are the smallest blood cell with 2-4  $\mu\text{m}$  diameter. They are small cytoplasmic fragments of a bone marrow precursor, megakaryocyte
- ▶ Resting platelets have a disc shape



Black arrow depicts a few platelets. H&E, 100X. This picture is taken from histological slide in histology laboratory of Isfahan University