

Handout for Tissue Identification

Biology 109

This handout is to help you understand tissue slides. This is not all encompassing and we will add more notes in lecture. Study this sheet before lab next time (you will have a quiz on it) and it will dramatically help your understand of what you are seeing.

What is a tissue? A group of similar cells that perform a specialized function.

Four general types of tissue:

1. epithelial
2. connective
3. nervous
4. muscle

Some characteristics of epithelial tissue (Think about these when identifying tissue):

1. Epithelial cells are always anchored to connective tissue by a thin, non-living layer called the basement membrane.
2. Cells are tightly packed together, very little space between adjacent cells.
3. Cells are always exposed to an open surface- some of the cells will be adjacent to a clear area always.
4. Epithelial cells can be characterized by their shape and the number of layers of cells there are:
 - a. layers
 1. simple- a single layer of cells
 2. stratified- more than one layer of cells
 - b. shape
 1. squamous- thin flattened discs

 2. cuboidal- cube-like cells

 3. columnar- elongated cells, look that columns
5. You will name epithelial tissues by combining the layer and the shape of the cell.
E.g., simple squamous, stratified cuboidal, simple columnar

Some characteristics of connective tissue:

1. Very diverse tissue, types will look very different and will conduct many different functions.
Examples: blood, tendons, adipose tissue (stores fat), bone, elastic connective tissue
2. Cells are NOT densely packed, space between cells is filled with a non-living material produced by connective tissue called matrix. This matrix is produced by some of the cells that live in the tissue.
Matrix can be:
 - a. fluid (e.g., blood plasma)
 - b. solid (e.g., bone matrix)
 - c. semi-solid (e.g., matrix of cartilage)
3. Tissue contains a number of different cell types that look very different. This is NOT true of epithelial tissue. Each different connective tissue type will have different cells that perform different functions.
4. Cells called fibroblasts will produce fibers that are deposited into the matrix. These fibers are usually

very long (much larger than cells).

- a. collagenous fibers- large, pink or red fibers that give the matrix strength
- b. elastic fibers- thin, black fibers that give the matrix a certain elasticity
- c. reticular fibers- thin, black collagenous fibers (look similar to elastic, be careful).

5. Cell types and where they will be found:

a. Fibroblasts- found in dense regular and irregular connective tissue, areolar tissue, elastic connective, reticular connective

b. Chondrocytes - always found in small visible chambers within the matrix called lacunae. Chondrocytes are always found in cartilage.

c. Osteocytes- found in lacunae and always found in bone tissue.

* The presence of lacunae indicates either cartilage or bone.

6. Hints to identification:

- a. The word “dense” means that the tissue contains lots of fibers.
- b. The word “loose” means that the tissue has very few fibers.
- c. The word “regular” means the fibers are arranged in parallel.
- d. The word “irregular” means the fibers are arranged in many directions.
- e. If lacunae are seen in the tissue, the tissue must be a cartilage or bone.
- f. If the tissue is cartilage then:
 1. Elastic cartilage will have short, black elastic fibers
 2. Fibrocartilage will have red or pink collagen fibers
 3. Hyaline cartilage will not have any visible fibers

Some characteristics of muscle tissue:

1. Three types of muscle tissue:

- a. skeletal - moves bones, some skin.
- b. smooth - found in hollow organs, blood vessels
- c. cardiac - found only in the heart

2. How do you tell them apart:

a. skeletal muscle:

1. has very large cylindrical cells
2. multiple nuclei found along the edge of the cell (near the membrane)
3. striations present- a repeated banding pattern found inside the cell
4. cells are found in parallel

b. smooth muscle:

1. small cells, tapered at both ends
2. one centrally located nuclei
3. NO striations
4. cells don't always run in parallel

c. cardiac muscle:

1. small cells, branched
2. one nuclei centrally located
3. striations present
4. cells don't always run in parallel
5. presence of intercalated disks- black lines connecting the short-ends of cells

Some characteristics of nervous tissue:

1. Two cell types:

- a. neurons- very large cells
- b. neuroglia (support cells)- much smaller, but more numerous cells

List of tissues for this exercise

This is a list of tissues and their parts that you are responsible for on the practical.

A. Epithelial Tissue

1. Simple squamous (look at lung tissue)- notice simple arrangement and flattened cells; find nuclei
2. Simple cuboidal- notice simple arrangement and cuboidal shape; find CT layer, open surface next to cells, basement membrane, nuclei of each cell
3. Simple columnar (see proliferative uterus section)- notice simple arrangement and columnar cells; find CT layer and open surface next to cells, nuclei of each cell located close to CT layer
4. Pseudostratified columnar (trachea section with cilia)- notice columnar shape and simple arrangement, but notice that nuclei are randomly distributed; find CT layer, open surface, and cilia
5. Stratified squamous- notice the stratification; find examples of squamous cells; find CT layer, open surface and nuclei of cells
6. Transitional epithelium- notice that this is stratified, but the cells are irregular in shape (not true cubes or squamous cells). Find the CT layer and open surface and the nuclei of each cell.

B. Connective Tissue (CT)

1. Loose fibrous CT (areolar)- notice the irregular arrangement of the sparse fibers; find two types of fibers (collagen, and elastic), fibroblast nuclei, matrix
2. Adipose- notice that these large, nearly clear cells are tightly packed together. find the dark brown (black) nucleus of each cell and notice that it is squeezed to the side of the cell.
3. Dense regular CT (look at the tendon slide)- notice the large, pink (red) fibers that are running in parallel; find the blue dots, these are nuclei of fibroblasts
4. Dense irregular CT - (look at the dermis of skin of human scalp with hair)- notice the lightly stained collagen fibers running in irregular patterns; the blue (purple?) dots are nuclei of fibroblasts
5. Elastic CT- notice the densely packed, curvy, black elastic fibers
6. Reticular CT- notice the short, curved reticular fibers (black); find the “organ” cells found embedded within the tissue
7. Hyaline cartilage (see trachea section)-notice the large white lacunae with stained chondrocytes. There are no fibers, but only matrix.
8. Fibrocartilage- find the pink stained collagen fibers; notice the large white lacunae with chondrocytes
9. Elastic cartilage- find the black elastic fibers; notice the large white lacunae with chondrocytes.

C. Muscle

1. Skeletal- notice the very large, cylindrical cells; find striations, multiple nuclei for each cell, and parallel network of cells. the clear area around each cell is actually a CT sheath.

2. Smooth- notice that it is very difficult to determine one cell from another. These cells are tightly packed and form a uniform pink sheet with purple dots (nuclei; only one nucleus per cell).

3. Cardiac- notice that this is more irregular and broken when compared with smooth muscle. Individual cells can be spotted here and are irregular rectangles. Each cell is joined to another cell by the intercalated disk (thin, vertical black line). Only one nucleus per cell.

D. Nervous tissue will be examined later in the semester.