Epithelial tissue laboratory report 8

Epithelium forms continuous sheets of cells that line internal surfaces and cover the external surface of the body. It is a selective barrier that protects tissues and is often involved in absorption or secretion. A basement membrane separates an epithelium from the underlying connective tissue. Epithelia are classified based on three criteria: Number of cell layers (simple or compound) Shape of surface cells (squamous, cuboidal or columnar) Specializations (cilia, keratin or goblet cells) Fig 008 Classification of Epithelia Epithelial cells are polarized: Apical surface - faces the lumen or the external environment Microvilli, cilia, stereocilia Lateral surface - faces the sides of adjacent cells Tight junctions (zonula occludens), adherens junction (zonula adherens), desmosomes (macula adherens), gap junctions Basal surface - attaches to the basement membrane Basement membrane, hemidesmosomes An epithelium does not contain blood vessels and receives nourishment via diffusion from the underlying connective tissue. Glands are formed by the down growth of an epithelium into the underlying connective tissue (discussed in Chapter 12 - Exocrine Glands). It is not necessary to learn the names of specific tissues for this chapter, but rather learn to recognize variations in epithelia. Simple squamous epithelium consists of a single layer of flattened cells. The thinness of these cells facilitates the transfer of materials (e.g., gases, fluids or nutrients) across the epithelium. Simple cuboidal epithelium consists of a single layer of cuboidal cells. This epithelium is often associated with absorption, secretion, or excretion of waste matter. Simple columnar epithelium consists of a single layer of cells that are taller than they are wide. This epithelium is often associated with absorption or secretion. Pseudostratified epithelium appears to be stratified because the nuclei of the epithelial cells are at different levels. However, every cell is in contact with the basement membrane, but not all cells reach the lumen. Stratified squamous epithelium has multiple layers of cells becoming flattened as they move from the basal layer to the apical layers. It provides protection from abrasion and is keratinized on the external surface of the body. Stratified cuboidal epithelium has multiple layers of cells with an outermost layer of cuboidal cells. Limited distribution - found in the lining of larger ducts. Transitional epithelium (urothelium) is adapted for extensibility and is restricted to the urinary tract. It has multiple layers of cells with an outermost layer of much larger, dome-shaped cells (umbrella cells) that change shape during contraction and distention. MH 018 Transitional Epithelia H&E Copyright © 2005-2021. T. Clark Brelje and Robert L. Sorenson. All rights reserved. Epithelial tissue serves two main functions in the body. It provides linings for external and internal surfaces that face harsh environments. The outer layer of the skin is epithelial tissue, as are the innermost layers of the digestive tract, the respiratory tract, and blood vessels. It forms glands that secrete materials onto epithelial surfaces or into the blood. Sweat glands, salivary glands, mammary glands, adrenal glands, and pituitary glands are examples of glands made of epithelial tissue. Epithelial tissue is often classified according to numbers of layers of cells present, and by the shape of the cells. See Figure 3.1. A simple epithelium is only one layer of cells thick. A stratified epithelium is more than one layer of cells thick. A pseudostratified epithelium is really a specialized form of a simple epithelium in which there appears at first glance to be more than one layer of epithelial cells, but a closer inspection reveals that each cell in the layer actually extends to the basolateral surface of the epithelium. There are three basic shapes used to classify epithelial cells. A squamous epithelial cell looks flat under a microscope. A cuboidal epithelial cell looks close to a square. A columnar epithelial cell looks like a column or a tall rectangle. A few epithelial layers are constructed from cells that are said to have a transitional shape. Transitional epithelial cells are epithelial cells specialized to change shape if they are stretched laterally. They can transition from columnar- and cuboidal-looking shapes in their unstretched state to more squamous-looking shapes in their stretched state. When classifying a stratified epithelial sheet, the sheet is named for the shape of the cells in its most superficial layers. So, a stratified squamous epithelium only necessarily has squamous-shaped cells in its highest layers and might have a different-shaped cell in its lower layers. Under a microscope, epithelial cells are readily distinguished by the following features: The cells will usually be one of the three basic cell shapes – squamous, cuboidal, or columnar. The cells will be closely attached to one another, in either a single layer or in multiple layers, and usually will not have room for extracellular material between the attached cells. The epithelial layer on one side will face an empty space (or, in some organs, it will face a secreted substance like mucus) and on the other side will usually be attached to connective tissue proper. Usually, a slide will have a section of tissue cut out of a larger organ. Slides with epithelial tissues usually have some of the underlying tissue found beneath the epithelial tissue with them. Figure 3.1. The different ways sheets of epithelial cells are categorized. A layer of epithelial cells always serves as an outer layer for some structure, but, when looking at a tissue preparation on a slide, do not assume that just because you have found one end of the tissue sample you are automatically looking at epithelial tissue. Look for the cell characteristics listed above to be sure you are on the epithelial side of a tissue slice. In Figure 3.2, only one edge of the tissue slice has epithelial cells. In Figure 3.2A that edge is indicated with an arrow, but when looking at a specimen under a microscope, you have to figure out for yourself where the edge with the epithelial cells is. Figure 3.2. A slice of a trachea. A. Magnified 1.8x. The arrow indicates which edge in this slice contains the epithelial cells B. Magnified 20x. The arrow indicates an individual columnar epithelial cell. In the tissue slice in Figure 3.2, there are three edges that are not epithelial cells. If you just mindlessly started viewing the first edge you find, you have a good chance of looking as something other than the epithelial cells in the preparation. Be sure what you are looking at has the three visual characteristics of epithelial tissue: The cells will usually be one of the three basic cell shapes – squamous, cuboidal, or columnar. The cells will be closely attached to one another, in either a single layer or in multiple layers, and usually will not have room for extracellular material between the attached cells. The epithelial layer on one side will face an empty space (or, in some organs, it will face a secreted substance like mucus) and on the other side will usually be attached to connective tissue proper. In the following figures are some more epithelial layers. Note that whether the epithelial layer of the specimen is on the top, bottom, right, or left of the slice varies with how the specimen slice was positioned on the slide. In every case, you have to find which edge has the epithelial layer. Figure 3.3. A slice of the colon, 20x. Figure 3.5. A slice of the stomach, 20x. Simple columnar Simple cuboidal Simple squamous Stratified squamous Pseudostratified columnar Transitional Obtain a slide of one of the tissues listed below from the slide box at your table. Follow the checklist above to set up your slide for viewing. View the slide on the objective which provides the best view. Find the representative object. In the circle below the name, draw a representative sample of the tissue, taking care to correctly and clearly draw their true shape in the slide. If it is a stratified epithelium draw all the layers. Draw your structures proportionately to their size in your microscope's field of view. Fill in the blanks next to your drawing. Repeat this for each of the tissue types seen below. A&P Labs. Authored by: Ross Whitwam. Provided by: Mississippi University for Women. Located at: . License: CC BY-SA: Attribution-ShareAlike CC LICENSED CONTENT, SHARED PREVIOUSLY Figure 5-1. The different ways sheets of epithelial cells are categorized.. Provided by: OpenStax College. Located at: . License: CC BY- SA: Attribution-ShareAlike CC LICENSED CONTENT, SPECIFIC ATTRIBUTION Figure 5-2. A slice of a trachea. A. Magnified 1.8x. The arrow indicates which edge in this slice contains the epithelial cells B. Magnified 20x. The arrow indicates an individual columnar epithelial cell.. Authored by: Kent Christensen, Ph.D., J. Matthew Velkey, Ph.D., Lloyd M. Stoolman, M.D., Laura Hessler, and Diedra Mosley-Brower. Provided by: University of Michigan Histology and Virtual Microscopy Learning Resources. Located at: 141.214.65.171/Histology/Basic%20Tissues/Epithelium%20and%20CT/020_HISTO_20X.svs/view.apml. License: CC BY-NC-SA: Attribution-NonCommercial-ShareAlike Figure 5-3. A slice of the colon, 20x.. Authored by: Kent Christensen, Ph.D., J. Matthew Velkey, Ph.D., Lloyd M. Stoolman, M.D., Laura Hessler, and Diedra Mosley-Brower. Provided by: University of Michigan Histology and Virtual Microscopy Learning Resources. Located at: 141.214.65.171/Histology/Basic%20Tissues/Epithelium%20and%20CT/176_HISTO_20X.svs/view.apml. License: CC BY-NC-SA: Attribution-NonCommercial-ShareAlike Figure 5-4. A slice of the esophagus, 10x.. Authored by: Kent Christensen, Ph.D., J. Matthew Velkey, Ph.D., Lloyd M. Stoolman, M.D., Laura Hessler, and Diedra Mosley-Brower. Provided by: University of Michigan Histology and Virtual Microscopy Learning Resources. Located at: 141.214.65.171/Histology/Basic%20Tissues/Epithelium%20and%20CT/153_HISTO_20X.svs/view.apml. License: CC BY-NC-SA: Attribution-NonCommercial-ShareAlike Figure 5.5 A slice of the stomach, 20x.. Authored by: Kent Christensen, Ph.D., J. Matthew Velkey, Ph.D., Lloyd M. Stoolman, M.D., Laura Hessler, and Diedra Mosley-Brower. Provided by: University of Michigan Histology and Virtual Microscopy Learning Resources. Located at: 141.214.65.171/Histology/Basic%20Tissues/Epithelium%20and%20CT/160_HISTO_40X.svs/view.apml. License: CC BY-NC-SA: Attribution-NonCommercial-ShareAlike Figure 5-6. A slice of the urinary bladder, 10x.. Authored by: Kent Christensen, Ph.D., J. Matthew Velkey, Ph.D., Lloyd M. Stoolman, M.D., Laura Hessler, and Diedra Mosley-Brower. Provided by: University of Michigan Histology and Virtual Microscopy Learning Resources. Located at: 141.214.65.171/Histology/Urinary%20System/212_HISTO_40X.svs/view.apml. License: CC BY- NC-SA: Attribution-NonCommercial-ShareAlike Information Connective tissue is found throughout the body, usually in association with other tissues. As its name indicates, it often serves to connect different tissues together, but it also can serve as a wrapper (in locations where a tough epithelial wrapping is not required), a structural support, cushioning, a storage repository, a protective layer, or a transport medium. Connective tissue has the most types of subcategories and the most varied functions of all the four major tissue types (epithelial, muscular, nervous, and connective tissues.) Bone and cartilage are connective tissues, as are blood and lymph, fat, ligaments, and tendons. Epimysium, the connective tissue wrapping around skeletal muscles, and periosteum, the connective tissue wrapping around bones, are both connective tissues. The different types of connective tissue are so diverse, there is no one set of characteristics that encompasses all the different types. However, there are three characteristics that we consider diagnostic of most connective tissue types. The cells are dispersed. Connective tissues generally have cells that are not tightly connected to each other, the way the cells in epithelial and muscular tissues usually are. There is usually a fair amount of space between the connective tissue cells. An exception to this is adipose tissue (also known as fat), the rare type of connective tissue in which the cells are packed tightly together. The tissue has more extracellular material than cells. Most connective tissues are solid (blood and lymph are the exceptions) because all the volume between the dispersed cells is filled with an extracellular matrix of viscous ground substance and protein fibers. An extensive network of protein fibers is found in the extracellular matrix. Protein fibers are complexes of millions of individual proteins threaded into long fibrous structures that provide strength and elasticity to the tissue as a whole. The protein fibers are so large, they are longer than the cells they surround and enmesh. Blood and lymph, being liquid connective tissues, do not have these enmeshing protein fibers, but they still have an extensive liquid extracellular matrix. A common way of classifying the many different types of connective tissue is to subdivide it into three main sub-categories, and further divide those subcategories into specific types of connective tissue. The three main sub-categories of connective tissue are: Connective tissue proper. These are the types of connective tissue that typically have all three of the defining characteristics listed above. It is further subdivided into dense connective tissue proper, in which the extracellular protein fibers predominate, and loose connective tissue proper, in which the extracellular protein fibers are not so densely woven. Supporting connective tissue. Bones and cartilage are the two types of connective tissue in this sub-category. They both have all three of the defining characteristics listed above, but their extracellular matrix is tougher, denser, and more solid than the various types of connective tissue proper. Fluid connective tissue. Blood and lymph are the two types of connective tissue in this sub-category. Both are fluid, rather than solid, and both lack the network of extracellular protein fibers found in the other types of connective tissue. A&P Labs. Authored by: Ross Whitwam. Provided by: Mississippi University for Women. Located at: . License: CC BY-SA: Attribution-ShareAlike Information Connective tissue proper encompasses the types of connective tissue that usually show all three of the defining cellular characteristics of connective tissue with the fewest deviations from those characteristics. Dispersed cells More extracellular material than cells. Extensive protein fibers in the extracellular matrix. Nonetheless there is still a great variety among the subcategories of connective tissue proper. Some are classified as dense connective tissue proper and have a dense arrangement of extracellular protein fibers that give the tissue strength and toughness. Tendons connecting muscles to bone and ligaments connecting bone to bone are examples of dense connective tissue proper. Other tissues are classified loose connective tissue proper and have fewer extracellular protein fibers and more ground substance (the extracellular material surrounding the protein fibers), making the tissues spongier but more fragile. Areolar tissue, found in the hypodermis of the skin and below the epithelial layers of the digestive, respiratory, and urinary tracts, is a loose connective tissue proper, as is adipose tissue, also known as fat. Table .1 lists some of the subcategories of connective tissue proper, along with some of their characteristics and properties. Table 3.1 Summary of the properties of the major types of connective tissue proper. In drawing images of connective tissue proper preparations seen under the microscope, it is important to simplify the visuals. Connective tissue preparations are often messy with a number of blotches and shapes irrelevant to the main components of the tissue, which are the cells and the extracellular protein fibers. Especially with connective tissue slides, it is important to make sure you know what you are looking for, find those components, and draw only them in as simple a form as possible, usually with just lines and with minimal shadings or hatchings. Leave out the unnecessary and irrelevant stuff on the slide. For instance, Figure 3.7 A shows a section of connective tissue taken from just below (deep to) the epithelial layer of the stomach, magnified 40x. Figure 3.7 B illustrates how you should represent that view as a line drawing. Figure 3.7. A photomicrograph, A, and a drawing from the photomicrograph, B, of the connective tissue in the wall of the stomach, just below the epithelial layer. Notice that in the line drawing not every single thick collagen fiber, nor every single thin elastic fiber, not every single fibroblast was drawn. Also notice that some of the out-of-focus, blurry fibers were not drawn at all, rather than draw fuzzy blotches. The key is to get the important structures (once you know what those are) and leave out distracting, non-essential messiness. Table 3.1 lists six categories of connective tissue proper. Use the information in that table to identify which category each of the following samples belong to. Under each picture, list the evidence that points to the category you choose. The key identifying features to look for in each picture are: the type(s) of protein fibers present, the type of cells present, and whether there are significant amounts of ground substance present. Collagen protein fibers are thick. Elastic protein fibers are thin. Reticular protein fibers are thin but form a web-like arrangement. If there is abundant space between protein fibers, the tissue is likely one of the loose connective tissues. If there is little space between protein fibers, the tissue is likely one of the dense connective tissues. Adipose is mainly large adipocyte cells containing a large droplet of lipids and nucleus and cytoplasm crammed into one corner of the cell. There are more adipocytes than extracellular material in adipose. The protein fibers in regular dense connective tissue proper will largely parallel each other, but they are often undulate in a wave-like arrangement while being parallel. Source: Stomach wall Category: Evidence: Joint Capsule Category: Evidence: Source: Lymph node Source: Fat Category: Evidence: Source: Aorta Wall Source: Tendon Category: Evidence: Obtain a slide of connective tissue proper/areolar CT from the slide box. View the slide on an appropriate objective. Fill out the blanks next to your drawing. In the circle below, draw a representative sample of key features you identified, taking care to correctly and clearly draw their true shapes and directions. Draw your structures proportionately to their size in your microscope's field of view. Obtain a slide of dense irregular connective tissue from the slide box. View the slide on an appropriate objective. Fill out the blanks next to your drawing. In the circle below, draw a representative sample of key features you identified, taking care to correctly and clearly draw their true shapes and directions. Draw your structures proportionately to their size in your microscope's field of view. Obtain a slide of a spleen or lymph node with reticular connective tissue from the slide box. View the slide on an appropriate objective. Fill out the blanks next to your drawing. In the circle below, draw a representative sample of key features you identified, taking care to correctly and clearly draw their true shapes and directions. Draw your structures proportionately to their size in your microscope's field of view. Obtain a slide of adipose connective tissue from the slide box. View the slide on an appropriate objective. Fill out the blanks next to your drawing. In the circle below, draw a representative sample of key features you identified, taking care to correctly and clearly draw their true shapes and directions. Draw your structures proportionately to their size in your microscope's field of view. Obtain a slide of a large artery with elastic connective tissue from the slide box. View the slide on an appropriate objective. Fill out the blanks next to your drawing. In the circle below, draw a representative sample of key features you identified, taking care to correctly and clearly draw their true shapes and directions. Draw your structures proportionately to their size in your microscope's field of view. Obtain a slide of a tendon with dense regular connective tissue from the slide box. View the slide on an appropriate objective. Fill out the blanks next to your drawing. In the circle below, draw a representative sample of key features you identified, taking care to correctly and clearly draw their true shapes and directions. Draw your structures proportionately to their size in your microscope's field of view. LICENSES AND ATTRIBUTIONS CC LICENSED CONTENT, ORIGINAL A&P Labs. Authored by: Ross Whitwam. Provided by: Mississippi University for Women. Located at: . License: CC BY-SA: Attribution-ShareAlike CC LICENSED CONTENT, SPECIFIC ATTRIBUTION Figure 3-1A photomicrograph, A, and a drawing from the photomicrograph, B, of the connective tissue in the wall of the stomach, just below the epithelial layer.. Authored by: Kent Christensen, Ph.D., J. Matthew Velkey, Ph.D., Lloyd M. Stoolman, M.D., Laura Hessler, and Diedra Mosley-Brower. Provided by: University of Michigan Histology and Virtual Microscopy Learning Resources. 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License: CC BY-NC-SA: Attribution-NonCommercial-ShareAlike Exercise 3.1 C. Source: Lymph node. Authored by: Kent Christensen, Ph.D., J. Matthew Velkey, Ph.D., Lloyd M. Stoolman, M.D., Laura Hessler, and Diedra Mosley-Brower. Provided by: University of Michigan Histology and Virtual Microscopy Learning Resources. Located at: 141.214.65.171/Histology/Basi...0and%20CT/028- 2_HISTO_40X.svs/view.apml. License: CC BY-NC-SA: Attribution-NonCommercial-ShareAlike Exercise 3.1 D. Source: Fat. Authored by: Kent Christensen, Ph.D., J. Matthew Velkey, Ph.D., Lloyd M. Stoolman, M.D., Laura Hessler, and Diedra Mosley-Brower. Provided by: University of Michigan Histology and Virtual Microscopy Learning Resources. Located at: 141.214.65.171/Histology/Basi...0and%20CT/019- 2_HISTO_20X.svs/view.apml. License: CC BY-NC-SA: Attribution-NonCommercial-ShareAlike Exercise 3.1 E. Source: Aorta Wall. Authored by: Kent Christensen, Ph.D., J. Matthew Velkey, Ph.D., Lloyd M. Stoolman, M.D., Laura Hessler, and Diedra Mosley-Brower. Provided by: University of Michigan Histology and Virtual Microscopy Learning Resources. Located at: 141.214.65.171/Histology/Cardiovascular%20System/036_HISTO_20X.svs/view.apml%20%20. License: CC BY-NC- SA: Attribution-NonCommercial-ShareAlike Exercise 3.1 F. Source: Tendon. Authored by: Kent Christensen, Ph.D., J. Matthew Velkey, Ph.D., Lloyd M. Stoolman, M.D., Laura Hessler, and Diedra Mosley-Brower. Provided by: University of Michigan Histology and Virtual Microscopy Learning Resources. Located at: 141.214.65.171/Histology/Basic%20Tissues/Epithelium%20and%20CT/74.svs/view.apml. License: CC BY-NC-SA: Attribution-NonCommercial-ShareAlike Information Supporting connective tissue comprises bone and cartilage. We will examine those tissues in greater detail in Lab 5 The Appendicular Skeleton & Lab 6 The Axial Skeleton. In both bone and cartilage, as in the different types of connective tissue proper, there are extracellular protein fibers embedded in a viscous ground substance. However, in bone and cartilage, the ground substance is so viscous as to be very hard and tough solids. Both bone and cartilage use mainly collagen and elastic protein fibers in their extracellular matrix, but cartilage uses a ground substance rich in the carbohydrate hyaluronan and bone uses a ground substance rich in a mineralized calcium phosphate compound known as hydroxyapatite. The carbohydrate hyaluronan (sometimes known as hyaluronic acid or hyaluronate) binds up huge numbers of water molecules in the extracellular matrix of cartilage. This helps solidify the ground substance around the collagen and elastic fibers of cartilage. As a result, it is often difficult to see the protein fibers in cartilage when viewing preparations under the microscope. They hydroxyapatite that surrounds the mostly collagen protein fibers in the ground substance of bone is not soluble in water and forms a mineral solid in which both the bone cells and the collagen fibers are embedded. As with cartilage, it is usually difficult to see the collagen fibers in the extracellular matrix of bone due to the density of the ground substance that surrounds them. There is only one type of cell in cartilage, chondrocytes. They secrete and maintain the extracellular matrix of the tissue. Chondrocytes arise from mesenchymal stem cells, just like the fibroblasts of connective tissue proper do, but chondrocytes are specialized to produce just cartilage. The extracellular matrix produced by the chondrocytes is so tough and durable, the chondrocytes are in danger of being crushed by it. This is why chondrocytes always leave a region around themselves free of the cartilaginous extracellular matrix that makes up the rest of the tissue. These non-cartilaginous pockets around each chondrocyte are called lacunae and are clearly visible when examining cartilage under the microscope. There are four types of bone cells, osteoprogenitor cells, osteoblasts, osteoclasts, and osteocytes, but the osteocytes are the most abundant and the only ones found throughout the bone. Osteocytes are found in concentric circles of mineralized extracellular matrix. Each circle is called a lamella (plural: lamellae) and the osteocytes are found along the edges of each lamellae. In compact bone, groups of lamellae and osteocytes are arranged into individual osteons, the cylindrical arrangement of material that makes up the fundamental building block of the compact bone. Each osteon has a hollow central canal in its center that blood vessels and nerves can travel through. In spongy bone, groups of lamellae are arranged into trabeculae (singular: trabecula), which are the individual projections of spongy bone. Trabeculae do not have central canals. Osteocytes, like chondrocytes, are protected from the extracellular matrix that surrounds them by being housed in lacunae, which are spaces free of mineralized extracellular matrix. Osteocytes, unlike chondrocytes, have numerous cytoplasmic extensions that project off of the main cell body. These extension connect up with the extensions from other near-by osteocytes. These projections, like the osteocyte cell body, are in tiny spaces free of the mineralized extracellular matrix. These spaces (but not the cytoplasmic projections themselves) are called canaliculi (singular: canaliculum) because, under the microscope, they look like tiny little canals. In the photomicrograph below of cartilage tissue, find and label the indicated structures. In the photomicrograph below of compact bone tissue, find and label the indicated structures. Obtain a slide of hyaline cartilage connective tissue from the slide box. View the slide on an appropriate objective. Fill out the blanks next to your drawing. In the circle below, draw a representative sample of key features you identified, taking care to correctly and clearly draw their true shapes and directions. Draw your structures proportionately to their size in your microscope's field of view. Obtain a slide of ground compact bone connective tissue from the slide box. View the slide on an appropriate objective. Fill out the blanks next to your drawing. In the circle below, draw a representative sample of key features you identified, taking care to correctly and clearly draw their true shapes and directions. Draw your structures proportionately to their size in your microscope's field of view. LICENSES AND ATTRIBUTIONS CC LICENSED CONTENT, ORIGINAL A&P Labs. Authored by: Ross Whitwam. Provided by: Mississippi University for Women. Located at: http:www.muw.edu. License: CC BY-SA: Attribution-ShareAlike CC LICENSED CONTENT, SPECIFIC ATTRIBUTION Exercise 3.3. 1. In the photomicrograph below of cartilage tissue, find and label the indicated structures.. Authored by: Kent Christensen, Ph.D., J. Matthew Velkey, Ph.D., Lloyd M. Stoolman, M.D., Laura Hessler, and Diedra Mosley-Brower. Provided by: University of Michigan Histology and Virtual Microscopy Learning Resources. Located at: 141.214.65.171/Histology/Basic%20Tissues/Cartilage%20and%20Bone/044H_HISTO_20X.svs/view.apml. License: C C BY-NC-SA: Attribution-NonCommercial-ShareAlike Exercise 3.3. 2. In the photomicrograph below of compact bone tissue, find and label the indicated structures.. Authored by: Kent Christensen, Ph.D., J. Matthew Velkey, Ph.D., Lloyd M. Stoolman, M.D., Laura Hessler, and Diedra Mosley-Brower. Provided by: University of Michigan Histology and Virtual Microscopy Learning Resources. Located at: 141.214.65.171/Histology/Basic%20Tissues/Cartilage%20and%20Bone/051xc_HISTO_40X.svs/view.apml. License: C C BY-NC-SA: Attribution-NonCommercial-ShareAlike Information Muscular tissue is the third of the four major categories of animal tissue. Muscle tissue is subdivided into three broad categories: skeletal muscle, cardiac muscle, and smooth muscle. The three types of muscle can be distinguished by both their locations and their microscopic features. Skeletal muscle is found attached to bones. It consists of long multinucleate fibers. The fibers run the entire length of the muscle they come from and so are usually too long to have their ends visible when viewed under the microscope. The fibers are relatively wide and very long, but unbranched. Fibers are not individual cells, but are formed from the fusion of thousands of precursor cells. This is why they are so long and why individual fibers are multinucleate (a single fiber has many nuclei). The nuclei are usually up against the edge of the fiber. There are striations in skeletal muscle. These are alternating dark and light bands perpendicular to the edge of the fiber that are present all along the fiber. Cardiac muscle is only found in the heart. Its fibers are longer than they are wide, and they are striated, like skeletal muscle fibers. But, unlike skeletal muscle fibers, cardiac muscle fibers have distinct ends to them, called intercalated discs. These are dark lines that run from one side of the fiber to the other. The intercalated discs are not much thicker than the striations, but they are usually darker and so distinct for that reason. One cardiac muscle fiber is the material between two intercalated discs. Cardiac muscle fibers are mononucleate, with only one nucleus per fiber, and they can sometimes be branched. Smooth muscle is found in the walls of internal organs, such as the organs of the digestive tract, blood vessels, and others. It consists of mononucleate fibers with tapered edges. No striations are visible in smooth muscle under the microscope. Because smooth muscle often is wrapping around the organ it is associated with, it can be hard to find an entire smooth muscle fiber in profile in a tissue slice on a microscope slide. Most of the fibers will be sectioned at angles or will be difficult to get into a single plane of focus, but a little bit of searching can usually turn up some with all of the defining characteristics visible. In each of the three photomicrographs below, identify which type of muscle is present. List the defining visual characteristics of that type of muscle, and draw arrows to features on the photograph that illustrate each characteristic. Type of muscle tissue: Type of muscle tissue: Obtain a slide of cardiac muscle tissue from the slide box. View the slide on an appropriate objective. Fill out the blanks next to your drawing. In the circle below, draw a representative sample of key features you identified, taking care to correctly and clearly draw their true shapes and directions. Draw your structures proportionately to their size in your microscope's field of view. Obtain a slide of skeletal muscle tissue from the slide box. View the slide on an appropriate objective. Fill out the blanks next to your drawing. In the circle below, draw a representative sample of key features you identified, taking care to correctly and clearly draw their true shapes and directions. Draw your structures proportionately to their size in your microscope's field of view. Obtain a slide of smooth muscle tissue from the slide box. View the slide on an appropriate objective. Fill out the blanks next to your drawing. In the circle below, draw a representative sample of key features you identified, taking care to correctly and clearly draw their true shapes and directions. Draw your structures proportionately to their size in your microscope's field of view. A&P Labs. Authored by: Ross Whitwam. Provided by: Mississippi University for Women. Located at: . License: CC BY-SA: Attribution-ShareAlike CC LICENSED CONTENT, SPECIFIC ATTRIBUTION Exercise 3.4 A. Authored by: Kent Christensen, Ph.D., J. Matthew Velkey, Ph.D., Lloyd M. Stoolman, M.D., Laura Hessler, and Diedra Mosley-Brower. Provided by: University of Michigan Histology and Virtual Microscopy Learning Resources. Located at: 141.214.65.171/Histology/Cardiovascular%20System/098HE_HISTO_40X.svs/view.apml. License: CC BY-NC-SA: Attribution-NonCommercial-ShareAlike Exercise 3.4 B. Authored by: Kent Christensen, Ph.D., J. Matthew Velkey, Ph.D., Lloyd M. Stoolman, M.D., Laura Hessler, and Diedra Mosley-Brower. Provided by: University of Michigan Histology and Virtual Microscopy Learning Resources. Located at: 141.214.65.171/Histology/Basic%20Tissues/Muscle/058L_HISTO_40X.svs/view.apml. License: CC BY-NC-SA: Attribution-NonCommercial-ShareAlike Exercise 3.4 C. Authored by: Kent Christensen, Ph.D., J. Matthew Velkey, Ph.D., Lloyd M. Stoolman, M.D., Laura Hessler, and Diedra Mosley-Brower. Provided by: University of Michigan Histology and Virtual Microscopy Learning Resources. Located at: 141.214.65.171/Histology/Basic%20Tissues/Muscle/169_HISTO_40X.svs/view.apml. License: CC BY-NC-SA: Attribution-NonCommercial-ShareAlike Information Nervous tissue is the last of the four major categories of animal tissue. Nervous tissue comprises neurons, the cells specialized for the propagation of electrochemical signals, and neuroglia, the so-called "supporting cells" of nervous tissue. There are multiple types of neuroglia cells (sometimes called just glial cells), and most of them do assist neurons, but recent research has discovered that some of the neuroglia cells play an active role by themselves in the proper functioning of the central and peripheral nervous systems. It is turning out that neuroglia do more than just support neurons. We will leave investigation of the neuroglia for later labs. In this lab, we will just focus on the structural features of neurons as they are visible under microscopic examination. A neuron is typically represented as having the following features. A large cell body (sometimes known as the soma) in which the nucleus and other major organelles are found. Dendrites, which are usually represented as numerous small projections extending from the cell body. A single axon, which is usually represented as a large single projection extending from the cell body, much longer than any of the dendrites. Multiple axon terminals that branch off at the end of the axon. Figure 3.7 shows a typical drawn neuron showing all these features. Figure 3.7. A typical diagrammatic representation of neuron. All of these features are important to the functioning of neurons. The cell body is where most of the cellular processes of the neuron take place: protein synthesis, metabolism, etc. The dendrites contact and pick up signals coming in from other cells (other neurons or sensory cells). The axon propagates the neuron's electrical signal to its various targets. And the axon terminals actually contact (synapse with) those targets and send chemical signals to the targets to trigger changes in them. However, most neurons in the body do not look as clear-cut as the neuron in Figure 3.7. Some neurons have short axons. Others have dendrites that are almost as large as the axon. Others have two axons connected to the same cell body. Many have dendrites and axon terminals that are too thin and small too see clearly. Cell bodies tend to come in all sorts of sizes and shapes, and are not always bulbous lumps readily distinguished from the rest of the cell. What's more, nervous tissue is delicate and fragile. In creating preparations for slides to viewed under a microscope, some of the cells are smushed together, damaged, truncated, or torn. Other times, the nervous tissue cells are simply too densely packed together to make out individual details. Much of what is visible is not useful to the student looking to find an intact and well-defined neuron. However, a bit of searching will often reveal some intact neurons. Often these are found at the edges of the preparation where the material is least dense. Keep in mind, you will often see neurons shaped distinctly different from those shown in textbooks and if Figure 3.7. Figure 3.8 shows two different locations in the same slide. Figure 3.8 A shows a mass of neurons (stained black) in which it is difficult to distinguish the shape of even one neuron clearly. Figure 3.8 B shows a different area from the same slide, where the neurons are not so crowded, and where one neuron in particular (outlined in red) shows many of the structures we are interested in. So, keep in mind, it is important to know what you want to find in a particular slide, and it is important to search around the slide to find the best example of what you are looking for. Figure 3.8 Two different areas from the same slide of a nervous tissue preparation. In A, the neurons are too crowded to see any one neuron clearly. In B, the neuron outlined in yellow illustrates a typical dendrite-cell body-axon arrangement. Type of nerve tissue: LICENSES AND ATTRIBUTIONS CC LICENSED CONTENT, ORIGINAL Obtain a slide of nervous tissue from the instructor. Use any nervous tissue except peripheral nerve, there are no nerve cell bodies in a peripheral nerve section. View the slide on the second-highest objective. Search carefully until you find a clear, representative neuron in your field of view. In the circle below, draw the neuron you found. Only draw the single neuron. Do not draw any of the other material. Draw your structures proportionately to their size in your microscope's field of view. Label any neural parts you can clearly recognize. A&P Labs. Authored by: Ross Whitwam. Provided by: Mississippi University for Women. Located at: . License: CC BY-SA: Attribution-ShareAlike CC LICENSED CONTENT, SHARED PREVIOUSLY Figure 3-2. A typical diagrammatic representation of neuron.. Authored by: Jonathan Haas. Located at: commons.wikimedia.org/w/inde...curid=18271454. License: CC BY-SA: Attribution-ShareAlike CC LICENSED CONTENT, SPECIFIC ATTRIBUTION Figure 3-3. Authored by: Kent Christensen, Ph.D., J. Matthew Velkey, Ph.D., Lloyd M. Stoolman, M.D., Laura Hessler, and Diedra Mosley-Brower. Provided by: University of Michigan Histology and Virtual Microscopy Learning Resources. Located at: 141.214.65.171/Histology/Central%20Nervous%20System/13270.svs/view.apml. License: CC BY-SA: Attribution- ShareAlike 0 1 Name 2 major components of Connective Tissue: 0 3 Name 2 components of Extracellular Matrix: 0 4 Name 3 major connective tissue fibers: 0 6 Name the 3 types of muscle tissue: 0 8 Name the 2 major cell types in neural tissue: Name the 3 basic shapes of epithelial cells 0 2 0 5 Epithelia can be divided into two basic groups based on the number of cell layers. These are: 0 Name two epithelia that can be considered an exception: 7 Name two epithelia that can be considered an exception: 1 IDENTIFY THE TISSUES SHOWN (AND MARKED DETAILS) 3 2 Name the 4 major types of tissue: 1) 2) 3) For easy grading, please use 1 of The space 4) .these 4 wherever it says "major type" (abbreviations OK if you define them) 6 The cell Major type: Specific type: Major type: Specific type: Fuzzy border 5 4 Major type : Specific type: Major type : Specific type: Major type : Specific type: IDENTIFY THE TISSUES SHOWN: 7 9 Major type : Specific type: Major type : Specific type: Major type : Specific type: 10 11 12 Major type : Specific type: Major type : Specific type: Major type : Specific type: 7 1 6 1 18 5 1 14 IDENTIFY THE TISSUES SHOWN: 13 fiber fiber The cell Major type : Specific type: Major type : Specific type: Major type : Specific type: Major type : Specific type: Major type : Specific type: Major type : Specific type: IDENTIFY THE TISSUES SHOWN: T he cell 19 21 T 24 Major type : Specific type: 22 Major type : Specific type: 20 Major type : Specific type: 23 Major type : Specific type: he cell Major type : Specific type: n/a Major type : Specific type: 5 (of When storing a microscope, you should always follow this list: Remove any slide found on the stage and return it to the slide box. Rotate the smallest lens or no lens into place above the stage. Lower the stage a few turns. Loosely coil the cord in your hand starting near the microscope and working toward the plug. Hang the coiled cord over one ocular lens. Look at the number on the back of the microscope, return that scope to its numbered box. If there's already a microscope in that numbered box, check its number and move it. If it is not numbered simply push it to the back of the box and place yours closer to the front. We have a few extra microscopes which we store in this fashion.