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**Week 5: Microscopy and Body Tissue (2 different chapters)**

**Part 1: Microscopy**

For the following questions, you may refer to chapter 3 section 1 on pages 45 to 46 of your textbook on cell size and microscopy.

A. Cell Size

1. Use Google to find the size of a typical human squamous epithelial cell. 10 um

Use google to find the size of a typical human egg cell. 100 um

Use Google to find the size of a typical bacterial cell. 0.2-2.0 um

B. Types of Microscopes Used in Biology (corresponds with page 46 of textbook)

1. Describe how a compound light microscope works. What is the typical magnification and resolution of a light microscope (table 3.1)?

A compound light microscope utilizes glass lenses and light rays passing through the object to magnify the objects.

A light microscope has a typical magnification of 1000x and a resolution of 0.0001 mm or 0.1 μm

2. Describe how a transmission light microscope works. What is a typical magnification and resolution of a light microscope (table 3.1).

A transmission light microscope passes light through a substage condenser into an adjustable aperture, through the sample, and into the lenses and eyepiece. Typically reaches up to 1,000x and 0.1um.

3. Describe how a scanning microscope works.

A scanning microscope scans a beam of electrons over the surface of a specimen, which is covered by a thin layer of metal. The secondary electrons from the metal are collected and used to create a television-like image of the surface of the specimen.

C. Bright Field Microscopy: Corresponds with the Connect module “Microscope: Operation of Bright Field microscope”, “

Using information in your module or through google, describe the function of the microscope parts listed below.

A. What is magnification? The process of enlarging the the apparent size of an object, rather than the actual size.

B. What is resolution? The smallest distance at which two objects can still be seen as separate objects.

C. What is contrast?

Contrast is the ability to distinguish objects from the background.

D. What type of ocular lenses are commonly found on bright field microscopes? The objective lens, which is usually the 10x lens, and with a ocular lens of 10x, the magnifications typically range from 40x to 100x.

E. What is a field of view?

The amount of the slide you are able to see through the eyepiece.

F. How do you calculate total magnification?

To calculate the total magnification, you multiply the ocular lens power by the objective lens power.

G. 1. Complete the table below by calculating the total magnification of the bright field microscope used in today’s lab.

|  |  |  |  |
| --- | --- | --- | --- |
| **Objective** | **Ocular Lens** | **Objective Lens** | **Total Magnification** |
| Scanning Power | 4x | 10x | 40x |
| Low-Power | 10x | 10x | 100x |
| High-Power | 40x | 10x | 400x |
| Oil Immersion | 100x | 10x | 1000x |

H. Assign names for the image on the following page, using the following link as a reference:

1. Eyepiece
2. Diopter Adjustment Ring
3. Revolving Nosepiece
4. Objective Lenses
5. Specimen Holder
6. Stage
7. Aperture Iris Diaphragm Knob
8. Condenser
9. Filter Holder

10. head

11. arm

12. Mechanical stage

13. Coarse adjustment

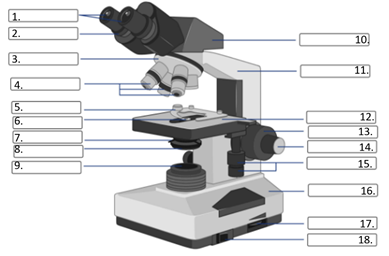
14. Fine adjustment

15. Stage controls

16. Base

17. Brightness adjustment

18. Light switch



<https://www2.hawaii.edu/~johnb/micro/m140/syllabus/week/handouts/m140.2.4.html>

D. The following questions relate to the connect video “oil immersion”

1. Why do you think it necessary to add oil to the slide when it is in between ocular lens positions?

It is necessary to add oil to the slide when it is in between ocular lens positions as it prevents the oil from getting onto the other lenses and damaging them.

2. In conjunction with what objective lens is the requirement that oil is used?

It is required that oil is used with the 100x objective lens.

3. What would be the total magnification utilized when oil immersion is used? 1000x

4. Use google to see why oil is needed to view at this magnification, and what specimen are commonly visualized by this method. It has a high light refractive index, keeping the subject bright and visible.

Questions (you may use Google to help)

1. What does compound mean in reference to a compound light microscope?

It is 2 microscopes that work in series with one another.

2. A total magnification of 1000X requires the use of the 10X ocular lens with which objective?

An objective lens of 100X is required in conjunction with the 10X ocular lens to get a total magnification of 1000X.

3. Which parts of a microscope regulate the amount of light?

Substage condenser

4. What does parfocal mean?

Parfocal means that the objective lens can be changed with little to no refocusing.

https://www.microscopeworld.com/t-parfocal\_microscope\_objectives.aspx

5. What adjustment knob is used with high power lenses?

The fine focus knob is used with high power lenses.

6. Why is locating an object more difficult if you start with a high power objective rather than with the low power objective?

The field of view is much lower and takes more fine adjustment to find what is being looked for.

**Part 2: Histology**

To complete this section, please refer to your textbook for all questions that do not mention “histology tutorial.” For histology image questions, please go to the website:<http://www2.yvcc.edu/histologyzoomer/HistologyTutorials/histology_tutorials.htm#Four%20Basic%20Tissue%20Types> . The images that are found on the histology tutorial website have been taken with a bright field, compound light microscope and are viewed at 100x magnification to 1000x total magnification with the aid of oil.

**Section 1 & 2: Four types of tissues found in the human body**

Relevant textbook section: Section 4.1 Types of Tissues (p. 67)

Relevant Histology Tutor sections: Sections I and II.

1. Fill in the chart below:

|  |  |
| --- | --- |
| **Tissue** | **General Function** |
| Epithelial Tissue | Covers body surfaces and lines body cavities |
| Connective Tissue | Binds and supports body parts |
| Muscular Tissue | Moves the body and its parts |
| Nervous Tissue | Receives sensory information and conducts nerve impulses |

2. Look at the Histology Tutor Section 1. Make an observation regarding the types of tissues found in the intestines, skin, lung, and trachea.

The intestines contain 3 of the types of tissues: epithelial, connective, and muscle. Skin has epithelial, muscle, and connective tissues. Lungs have two different types of epithelial tissues as well as muscle tissues. The trachea has connective and epithelial tissues.

**Section 3a: Epithelial Tissue**

Relevant textbook section: Section 4.5 Epithelial Tissue Protects (pp. 73-74)

Relevant Histology Tutor section III

1. What do the epithelial tissues form in the body?

Protective layers over many surfaces and body cavities.

2. What are the three possible shapes cells can take?

Squamous, cuboidal, and columnar are the three possible shapes that cells can take,

3. Describe the following layers of cells:

Simple: Have only a single layer of cells, usually classified according to cell shape.

Stratified: Layers of cells piled on top of one another, only the bottom layer touches the basement membrane.

Pseudostratified: Appears as layered, but does not have layers in function because each layer touches the basement membrane.

4. Epithelium may also have cellular extensions called microvilli or hair like extension called cilia.

Simple Squamous Epithelium

5. Where in the human body might you find simple squamous epithelium?

You may find simple squamous epithelium in the lining of the lungs.

6. Describe how squamous cells look.

Squamous cells look mostly flat.

7. Examine a prepared slide of simple squamous epithelium using the online Histology Tutorial, section III. Draw a cell and label the plasma membrane, cytoplasm, and nucleus.



Simple Cuboidal Epithelium

8. Describe simple cuboidal epithelium. Type of epithelial with cube shaped cells.

9. Where are simple cuboidal epithelium found?

Found in glands, the thyroid, and pancreas.

10. Examine a prepared slide of simple cuboidal epithelium. Are these cells ciliated?

They look like round columns that overlap. Yes they are ciliated.

Simple Columnar Epithelium

11. Describe simple columnar epithelium.

Type of epithelial cell that resembles a rectangular pillar or column.

12. Where can simple columnar epithelium be found?

Simple columnar epithelium can be found in the lining of the small intestine and uterine tubes.

13. What does simple columnar epithelium allows for?

Microvilli help to expand the surface area of columnar epithelium to aid in absorbing the products of digestion. Columnar epithelium also allows for the egg to be propelled towards the uterus.

14. Examine a prepared slide of simple columnar epithelium as seen . Draw a line for the basement membrane and 4 to 5 cells that are attached. Label the plasma membrane, cytoplasm and the nucleus. Look for a goblet cell and incorporate the cell into your diagram.



Stratified Squamous Epithelium:

15. Examine a prepared slide of stratified squamous epithelium. Approximately how many layers of cells do you see?

Approximately 15 layers of cells stacked on eachother in order to create a protective padding around organs.

16. Stratified squamous layers of cells are often tough to identify due to their variety of shapes. Which layers of cells seem to be squamous epithelium?

The outermost layer of cells seems to be squamous epithelium.

Pseudostratified Ciliated Columnar Epithelium

17. Pseudostratified ciliated columnar epithelium appears to be layered, though actually all cells touch the basement membrane.

18. Where would many of the cilia be found on pseudostratified ciliated columnar epithelium?

The tissue is typically covered in cilia, so it can usually be found where there is pseudostratified ciliated columnar epithelium.

19. Examine a prepared slide of pseudostratified ciliated columnar epithelium. Concentrate on the part of the slide that contains the cilia. Draw a diagram of what you observe.



20. Where do you find stratified squamous epithelium (go back to p. 75 of section 4.5)?

Stratified squamous epithelium can be found in the lining of the nose, mouth, esophagus, anal cavity, and vagina.

Transitional Epithelium

Where is Transitional Epithelium found, and what is its role?

The lining of the urinary bladder, ureters, and part of the urethra. It is able to change in response to changes in tension.

**Section IIIb: Skin and Stratified Epithelium**

Relevant textbook section: Section 4.6 Integumentary System (pp. 76-78)

1. What are the two skin regions found in humans’ integumentary system?

The epidermis and dermis

2. Using figure 4.9 on pg 76 list structures that can be found in the dermis.

Capillaries, oil glands, arrector pili muscles, free nerve endings, hair follicles, hair roots, sweat glands, arteries, and veins.

3. What type of tissue makes up the epidermis?

Stratified squamous epithelium

4. What protein accumulates as cells move toward the surface and become flattened?

Stratus Granulosum

**Section IV: Connective Tissue**

Relevant sections:

Textbook Section: Section 4.2 Connective Tissue Connects and Supports (p.68-70)

Section IV of Histology Tutor

A. Connective Tissue

1. What are the four general classes of connective tissue, and what are the distinguishing features? Connective tissue, blood, bone, cartilage.

2. The matrix that surrounds all types of connective tissue usually contains what?

Ground substance, living and nonliving cells.

B. Loose and Dense Fibrous Connective Tissue

3. Examine a slide of loose (areolar) connective tissue on Histology Tutor and compare it with the image in your textbook. What is the function of loose fibrous connective tissue?

Loose fibrous connective tissue helps to cushion organs and it underlies epithelia.

4. Examine a slide of dense regular connective tissue (Tendon Slide) and compare it with the image in your textbook. What two types of structures in the body contain dense fibrous connective tissue?

Dense fibrous connective tissue is in tendons and ligaments.

5. Draw dense regular connective tissue.



6. Examine a slide of dense irregular connective tissue.

7. Draw dense irregular connective tissue.



D. Cartilage

8. Study the diagram of hyaline cartilage in your textbook. Then study a prepared slide of hyaline cartilage from histology tutor. Draw a diagram of what you observe and label the matrix and lacunae.



9. Study the diagram of elastic cartilage in your textbook. Then study a prepared slide of elastic cartilage from histology tutor. Draw a diagram of what you observe and label the matrix and lacunae.



10. Study the diagram of fibrocartilage in your textbook. Then study a prepared slide of fibrocartilage from histology tutor.

Compact Bone

11. Examine a prepared slide of compact bone in histology tutor. Draw a diagram of what you observe. Label the central canal, lacunae and canaliculi, using your textbook as a reference.



12. What is the function of the central (Haversian) canal of the osteon, using your textbook as a reference?

The central canal of the osteon allows nerve fibers to carry nerve impulses and blood vessels to carry nutrients to renew the bone itself.

13. Compare the slides of compact bone and hyaline cartilage. Which of these types connective tissue is more organized? Compare and contrast their features.

Compact bone is more organized than hyaline cartilage. There is no standard formation of hyaline cartilage while compact bone creates a circular feature of cells.

Adipose Tissue

14. Examine a prepare slide of adipose tissue on histology tutor. Why is the nucleus pushed to one side?

The nucleus is pushed to one side because adipose tissue is composed primarily of lipids.

15. Where in the body can you find adipose tissue?

Under the skin, around the kidneys, and on the surface of the heart

16. What are the functions of adipose tissue at the different sites?

The body uses the stored fat for energy, insulation, and organ protection. Adipose tissue also releases a hormone to regulate the brain’s appetite control center.

Blood

17. Examine the blood smear slide. Draw a diagram of what you observe. Label the red blood cells and white blood cells.



**V Nervous Tissue**

1. Where is nervous tissue found in the body?

Nervous tissue is found all throughout the body, especially within the brain.

2. Nervous tissue is composed of two types of cells. Give the name of each and a description.

Neurons: cell that transmits nerve impulses

Neuroglia: non-conductive nerve cells that function as support

3. Using the image of the neuron smear in histology tutor and your textbook, explain the appearance and function of the part of a motor neuron. Draw the motor neuron, and draw some neuroglia nearby as a size comparison.

Dendrites:

Cell Body:

Axon:



4 From histology tutor, what does a nerve consist of?

A nerve consists of a bunch of axons.

5. From histology tutor, what is the role of a Schwann cell? What is its relationship to a neuron?

Schwann cells are glial cells that make up the myelin that extends around each axon.

**VI. Muscular Tissue**

Textbook section 4.3 Muscular Tissue Moves the Body

1. Name the three types of muscular tissue.

Skeletal, cardiac, and smooth

2. What ability do all muscular tissue share?

Muscle tissue is excitable and contractile

Skeletal Muscle

3. Where does skeletal muscle occur?

Skeletal muscle is attached to bones by tendons

4. What type of contraction (voluntary or involuntary) does skeletal muscle have?

Voluntary

5. What are the striations caused by in skeletal muscle?

The placement of actin and myosin filaments

6. Examine a prepared slide of skeletal muscle (muscle tissue slide) using histology tutor. Draw a diagram of your observations of skeletal muscle.



Cardiac Muscle

7. Cardiac muscle is only found in the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Wall of the heart

8. What type of contraction does cardiac muscle have (voluntary or involuntary)?

Involuntary

9. Where are the muscle fibers branched and bound together at?

Intercalated discs

10. Examine a prepared slide of cardiac muscle (muscle tissue slide) in histology tutor. Draw a sketch of your observations of cardiac muscle.



Smooth Muscle

11. What type of contraction (voluntary or involuntary) does smooth muscle have?

Involuntary muscle

12. Where do you find smooth muscle?

In the walls of viscera (bladder, intestine, other organs)

13. Examine a prepared slide of smooth muscle (muscle tissue slide). Draw a sketch of your observations of smooth muscle.



**VII. Questions for application:**

Use Google to help you respond.

1. What type of tissue accounts for the movement of food along the digestive tract?

Smooth muscle tissue

3. In the lining of the small intestine you would find what type of epithelium?

Simple columnar epithelium

4. Give an example of where you would find pseudostratified ciliated columnar epithelium.

Respiratory airways

Link to source: http://medcell.med.yale.edu/histology/epithelia\_lab/pseudostratified.php#:~:text=Pseudostratified%20columnar%20epithelia%20are%20most,cilia%20on%20their%20apical%20surface.

5. Walking to class is an example of what type of muscle contraction?

Voluntary as walking to class utilizes skeletal muscles