Subject Code	BIO 1	Biology 1
Lesson Guide Code	1.0	The Eukaryotes
Lesson Code	1.3	Plant and Animal Tissues
Time Frame		30 minutes

TARGET

After completing this learning guide, you are expected to:

1. identify the major plant and animal tissue categories; and
2. describe the structure and function of the different types of plant and animal tissues.

HOOK

You would not know it until told that you are actually looking at a micrograph of a plant tissue instead of some abstract painting. It is actually a cross section of a root magnified 400X. What you see are cells of the root arranged in symmetrical order in order to perform their functions efficiently.

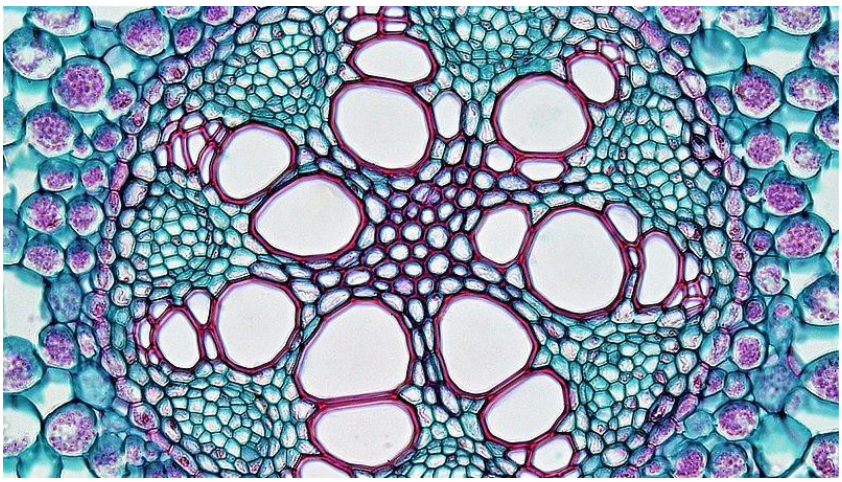


Figure 1. Cross section of a root, by Berkshire Community College Bioscience Image Library (2014), https://commons.wikimedia.org/wiki/File:Monocot_Root_Casparian_Strip_in_Acorus_Vascular_Bundle_(35939627386).jpg. License: CC0 1.0 Universal Public Domain Dedication

At the unicellular stage, the functions of the cell are still simple. As the organism becomes multicellular, the needs of the organism have to be addressed better and all these needs cannot be met by just one cell alone. Having each cell do all the different functions for the organisms is also not efficient. Thus, as the organism becomes multicellular, division of labor has to occur to perform the different processes necessary for the organism to adapt to its environment efficiently and meet the needs of the organism in a more organized manner. This is achieved by the **tissues**, a group of cells that work together to perform one function.

In this learning guide, you will be given an overview of the different types of tissues found in plants and animals. In the later lessons, you will be given a more detailed or in-depth discussion on the tissues in relation to the different biological systems in plants and animals. For now, let's just have a walk-through of the different functions and structures of tissues.

IGNITE

Plants and animals differ in a lot of properties and characteristics. One of them is the type of tissues they possess. There are different types of tissues. Plant tissues vastly differ from animals. However, they all serve the same purpose and that is, to make the organism survive in its environment.

PLANT TISSUES

Plants have three major tissue systems. Each tissue system, the functional unit that connects all of the plant organs, is found in each plant organ (root, stem and leaf).

Types of Plant Tissue Systems:

A. Dermal tissue system
- outer protective covering; forms the first line of defense against damage and pathogens of the plant

B. Vascular tissue system
- carries out the transport of materials between the root and shoot systems of the plant

C. Ground tissue system
- neither dermal or vascular; provides support to the plant and function in storage and metabolism

Plant tissues are also classified based on their ability to generate new cells. There are two major types – meristematic and permanent tissues.

Two major types of plant tissues:

A. Meristematic tissue
- undifferentiated living tissue composed of actively dividing cells that form other types of plant tissues; cells are thin walled with abundant cytoplasm

Types of meristematic tissue:

1. Apical meristem
   - found on growing tips of plants and in buds; makes plants grow taller or longer (known as primary growth)

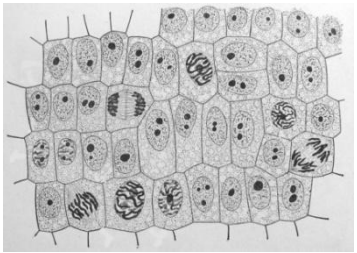


Figure 2. Meristematic cells in the growing tip of the onion from *plant tissues*, https://intl.siyavula.com/read/science/grade-10-lifesciences/plant-and-animal-tissues/04-plant-and-animal-tissues-03. License: Creative Commons Attribution

2. Lateral meristem
   - also known as the vascular cambium and cork cambium; found along the length of roots and stems; makes the plant grow thicker (known as secondary growth)

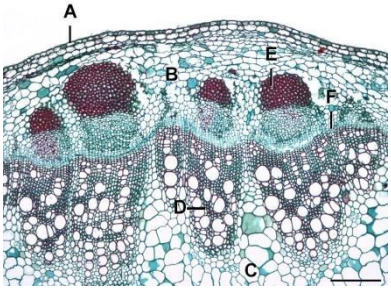


Figure 3. Photomicrograph of a stem (Helianthus). A – epidermis, B- Cortex, C- Pith, D- Xylem, E- phloem fibers, F-Vascular cambium, by Houseman (2014), from https://en.wikipedia.org/wiki/Vascular_cambium#/media/File:Helianthus_stem_2_L.jpg. License: CC BY-SA 4.0

B. Permanent tissue

- non-dividing tissue; composed of tissue that has stopped growing, may be living or dead

Types of permanent tissue:

1. Simple tissues
   - composed of only one type of cells

   Types of simple permanent tissue:

   a. parenchyma
      - living tissue with cells that are thin-walled and with sufficient cytoplasm; performs most of the metabolic functions; synthesizes and stores various organic products; provides support

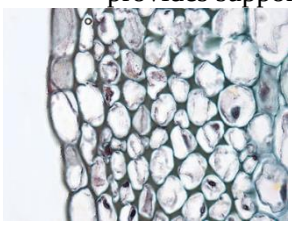


Figure 4. Parenchyma tissue, *Plant tissues*, https://intl.siyavula.com/read/science/grade-10-lifesciences/plant-and-animal-tissues/04-plant-and-animal-tissues-03. License: Creative Commons Attribution

   b. collenchyma
      - with elongated cells that have thick primary walls; provides support to young parts of the plant shoot; also provides flexible support that does not restrain growth

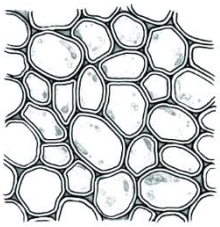


Figure 5. Cross section of collenchyma cells, by Snowman frosty (2010), from https://en.wikipedia.org/wiki/Ground_tissue#/media/File:Plant_cell_type_collenchyma.png. Public Domain

c. sclerenchyma
- with cells that have thick walls containing lignin; mainly provides support; can withstand strains; protects inner cells from damage

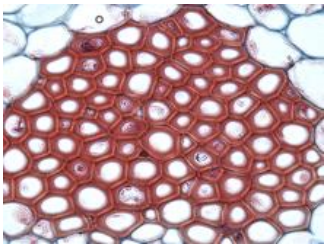


Figure 6. Cross section of sclerenchyma fibers, by Snowman frosty (2010), from https://en.wikipedia.org/wiki/Ground_tissue#/media/File:Plant_cell_type_sclerenchyma_fibers.png. Public Domain

2. Complex tissues
- composed of more than one type of cells that function together as one unit; form a continuous system from root to leaves

Type of complex permanent tissues

a. xylem
- conducting tissue that transports water and minerals from roots to the leaves; composed of mostly dead cells with different structure (see Figure 7)

b. phloem
- conducting tissue that transports food made in the leaves by photosynthesis to different parts of the plants; composed mostly of living cells that also have different structure (see Figure 7)

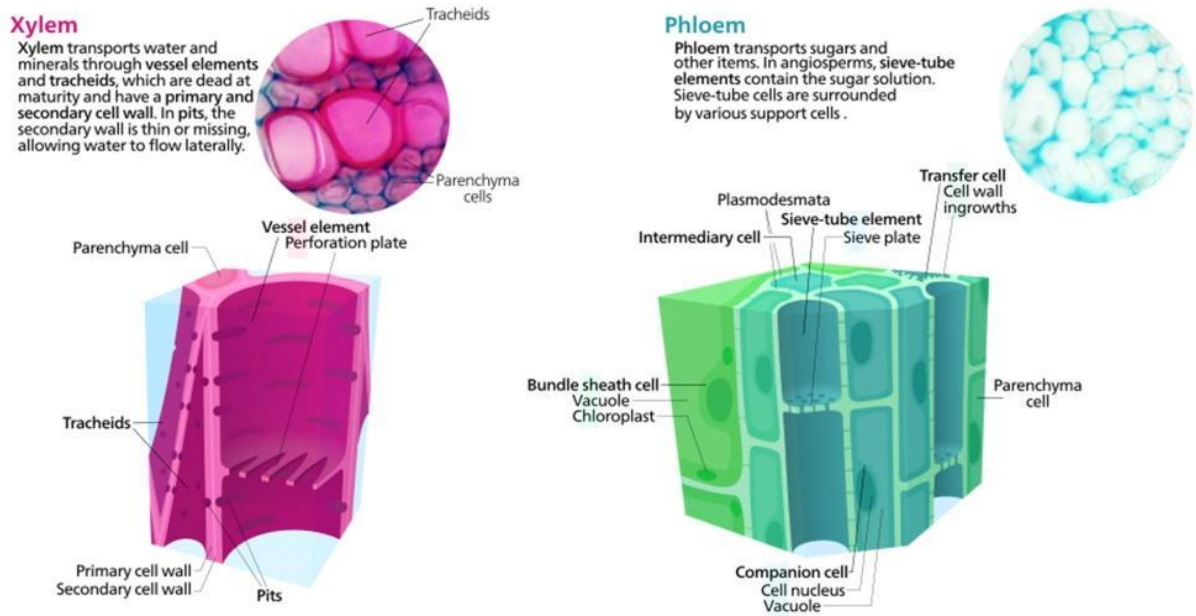


Figure 7. Xylem and phloem tissues, from *Seedless Vascular Plants* from https://courses.lumenlearning.com/wm-biology2/chapter/seedless-vascular-plants/.. License: CC BY-SA: Attribution-ShareAlike

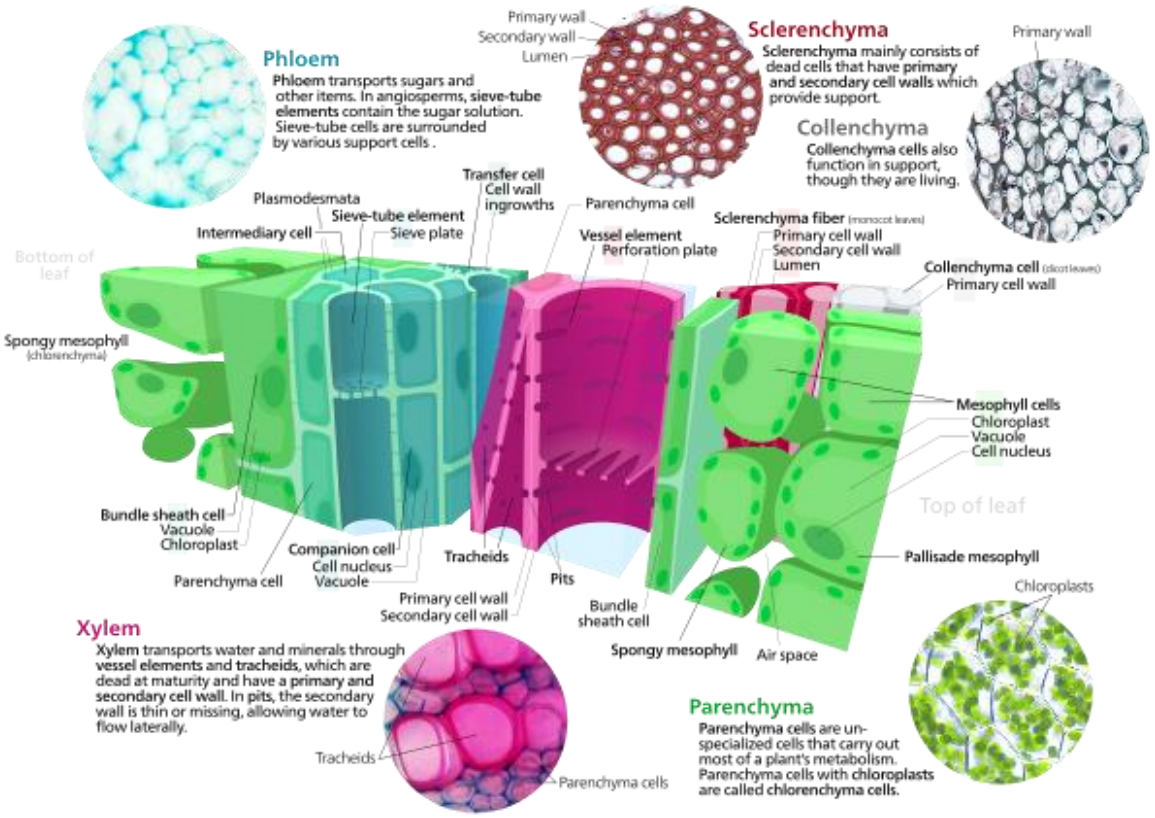


Figure 8. Cross section of a leaf showing various ground tissue types by Kelvinsong (2013), from https://en.wikipedia.org/wiki/Ground_tissue#/media/File:Plant_cell_types.svg. License: CC BY-SA 3.0

ANIMAL TISSUES

Animals generally have four types of tissues.

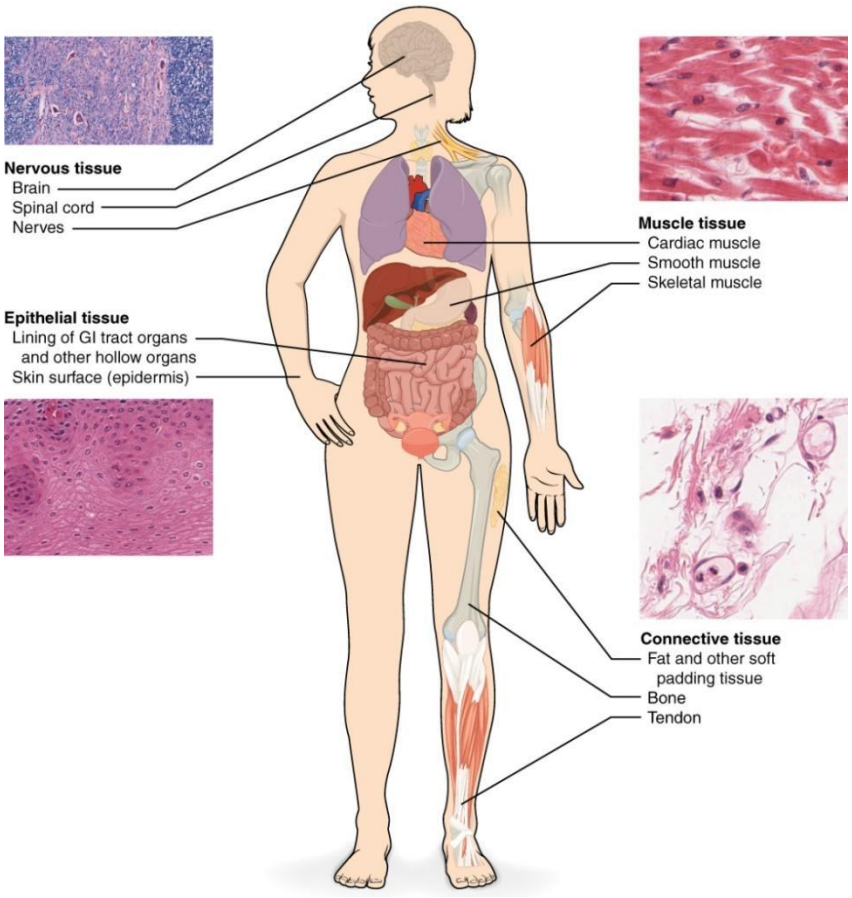


Figure 9. The four primary animal tissue types, from *Anatomy & Physiology* by Biga et al. (n.d.). https://open.oregonstate.education/aandp/chapter/4-1-types-of-tissues/. License: Creative Commons Attribution-ShareAlike 4.0

A. Epithelial tissue

- made of thin cells that cover the body, organs, blood vessels and all the body cavities
- is classified based on number of layers (simple and stratified) and shape of individual cells (squamous, cuboidal and columnar) (see Figure 8); function among the different types may vary (secretory, absorptive, for gas exchange, and mostly for protection)

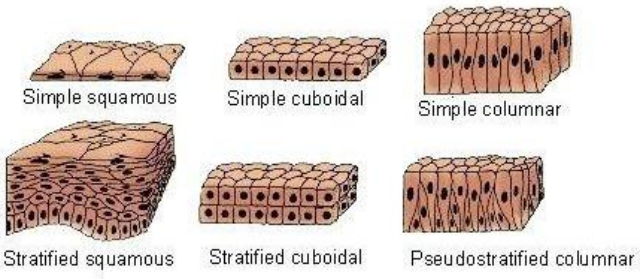


Figure 10. The different types of epithelial tissue found in mammals, from *Animal tissues*, https://intl.siyavula.com/read/science/grade-10-lifesciences/plant-and-animal-tissues/04-plant-and-animal-tissues-04. License: Creative Commons Attribution

B. Connective tissue

- composed of cells that vary widely in form and function but mostly support the body and form the structure; consists mainly of extracellular matrix, composed of protein fibers and ground substance

Types of connective tissue:

1. loose/areolar
   - found throughout the body; holds organs in place and acts as packing material

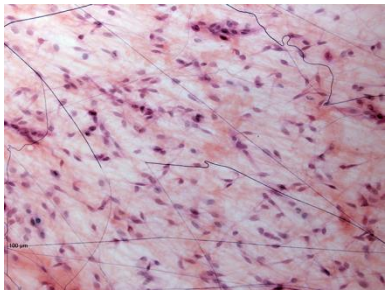


Figure 11. Loose connective tissue, from *Anatomy & Physiology* by Biga et al. (n.d.). (https://open.oregonstate.education/aandp/chapter/4-3-connective-tissue-supports-and-protects/. License: Creative Commons Attribution-ShareAlike 4.0

2. fibrous
   - also referred to as dense connective tissue; mainly made up of collagen fibers and provides resistance to stretching and strength; acts as shock absorber; found in tendons and ligaments

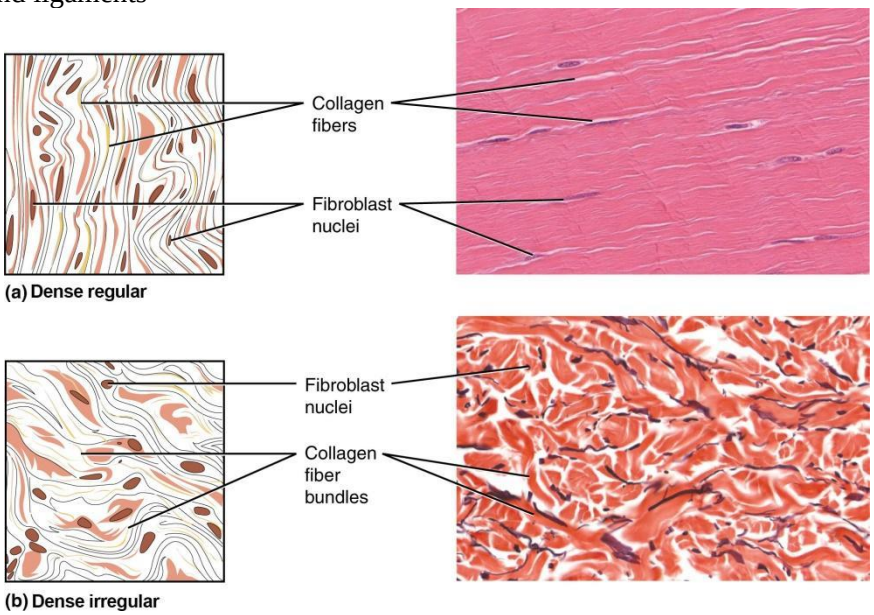


Figure 12. Dense connective tissue, from *Anatomy & Physiology* by Biga et al. (n.d.). (https://open.oregonstate.education/aandp/chapter/4-3-connective-tissue-supports-and-protects/. License: Creative Commons Attribution-ShareAlike 4.0

3. adipose
   - composed of fat storage cells; facilitates energy storage and provides insulation

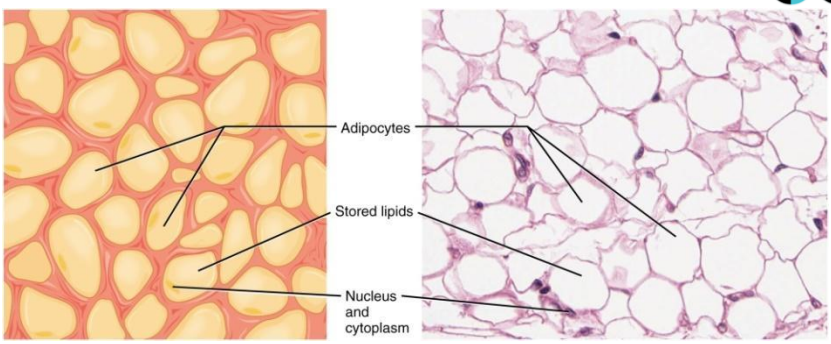


Figure 13. Adipose tissue, from *Anatomy & Physiology* by Biga et al. (n.d.).
(https://open.oregonstate.education/aandp/chapter/4-3-connective-tissue-supports-and-protects/. License: Creative Commons Attribution-ShareAlike 4.0

4. bone
   - hardest connective tissue; provides protection, strength and support

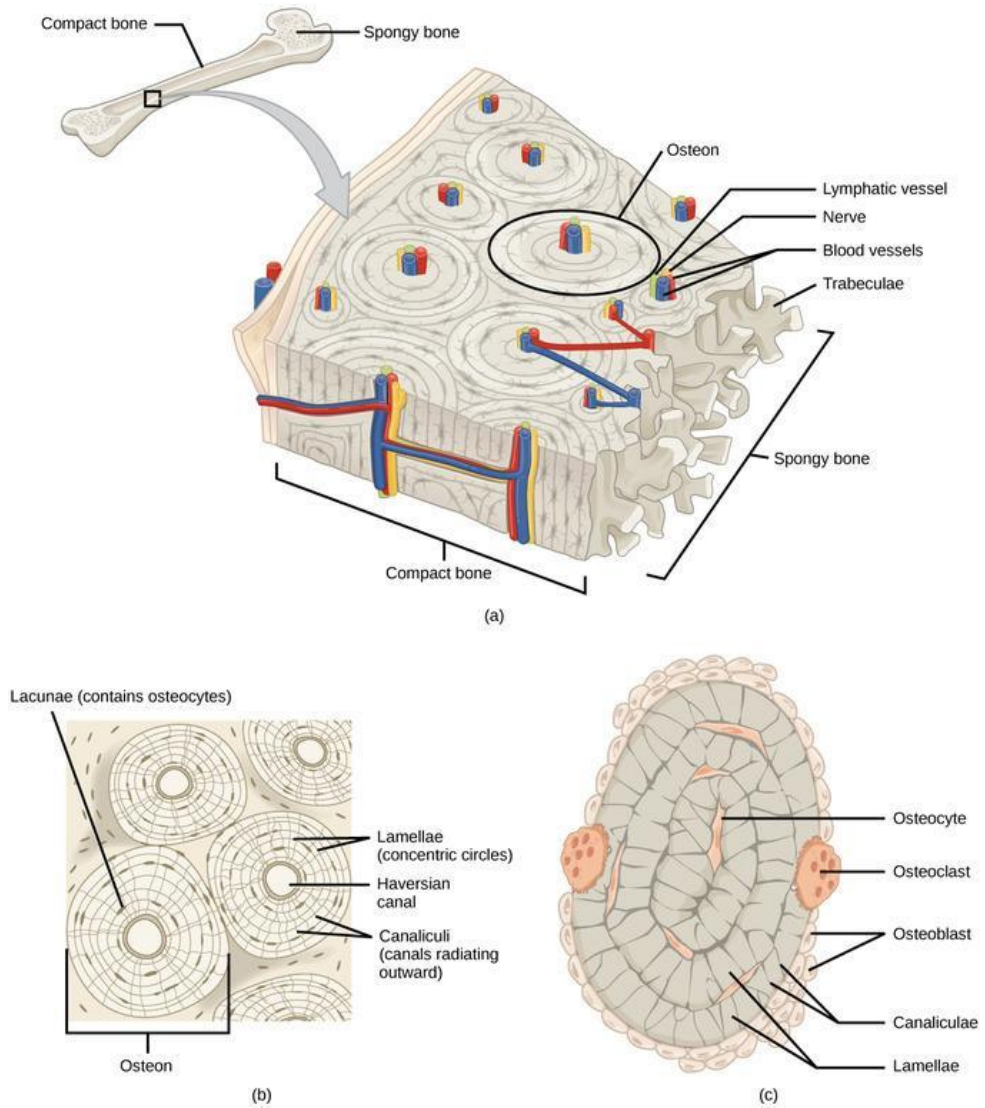


Figure 14. Bone structure, by Boundless (2020), from https://bio.libretexts.org/Bookshelves/Introductory_and_General_Biology/Book%3A_General_Biology_(Boundless)/33%3A_The_Animal_Body%3A_Basic_Form_and_Function/33.2%3A__Animal_Primary_Tissues/33.2C%3A_Connective_Tissues%3A_Bone%2C_Adipose%2C_and_Blood#:~:text=Bone%2C%20or%20osseous%20tissue%2C%20is,of%20collagen%20and%20elastic%20fibers. License: CC BY-NC-SA

5. cartilage
   - composed of collagen fibers that are embedded in a rubbery protein-carbohydrate complex; reduces friction between bones; provide support, structure and strength

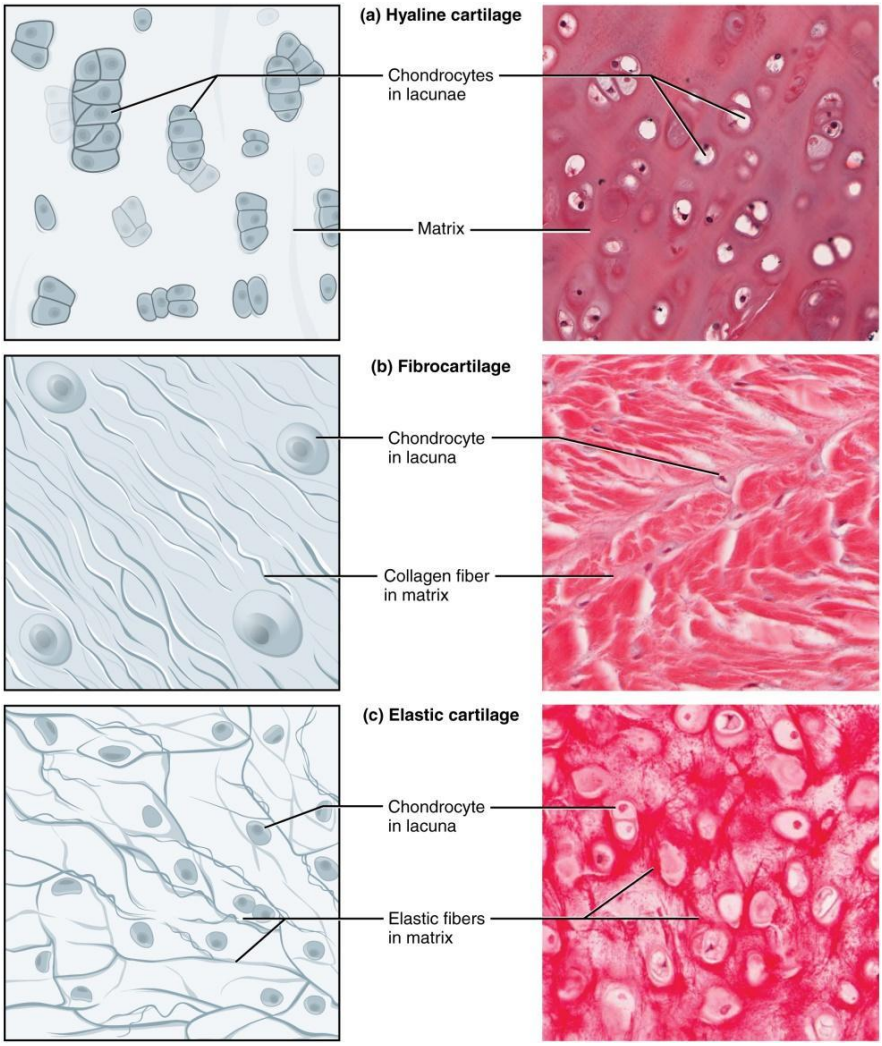


Figure 15. Types of cartilage, from *Anatomy & Physiology* by Biga et al. (n.d.). (https://open.oregonstate.education/aandp/chapter/4-3-connective-tissue-supports-and-protects/. License: Creative Commons Attribution-ShareAlike 4.0

6. blood
   - also called fluid connective tissue including the lymph; transports oxygen, carbon dioxide and nutrients; responsible for defense against harmful microorganisms

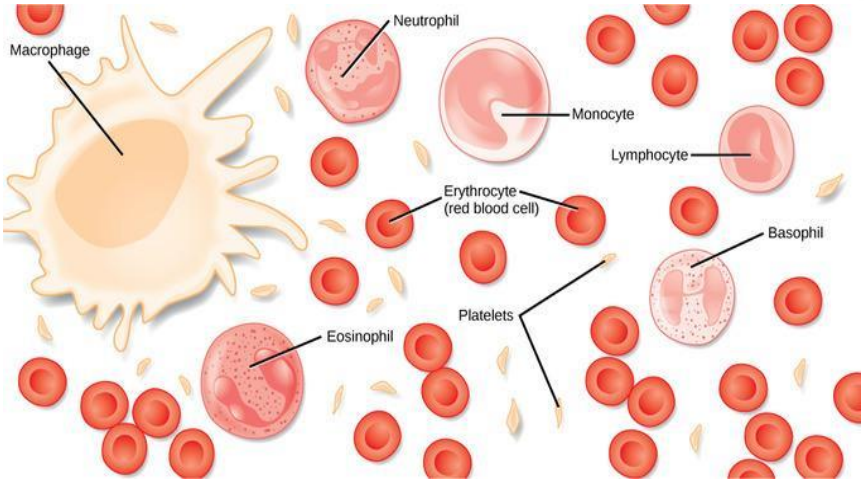
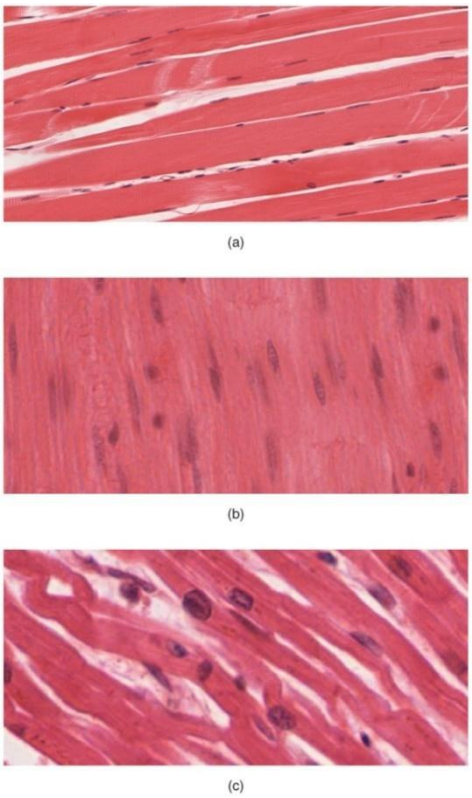


Figure 16. Blood tissue, by Boundless (2020), from https://bio.libretexts.org/Bookshelves/Introductory_and_General_Biology/Book%3A_General_Biology_(Boundless)/33%3A_The_Animal_Body%3A_Basic_Form_and_Function/33.2%3A__Animal_Primary_Tissues/33.2C%3A_Connective_Tissues%3A_Bone%2C_Adipose%2C_and_Blood#:~:text=Bone%2C%20or%20osseous%20tissue%2C%20is,of%20collagen%20and%20elastic%20fibers. License: CC BY-NC-SA

C. Muscle tissue

- composed of cells that possess contractile filaments that change the size of the cell; facilitates movement by contraction of each muscle cell

Types of muscle tissue:



1. skeletal
   - striated and attached to bones by tendons; possess cells with many nuclei; responsible for voluntary movements

2. smooth
   - lacks striations; located in walls of the internal organs; responsible for involuntary movements

3. cardiac
   - striated; cells are connected by intercalated disks; responsible for the contractions of the heart

Figure 17. Muscle tissue: (a) skeletal muscle. (b) smooth muscle. (c) cardiac muscle; from *Anatomy & Physiology* by Biga et al. (n.d.). https://open.oregonstate.education/aandp/chapter/4-4-muscle-tissue/. License: Creative Commons Attribution-ShareAlike 4.0

D. Nerve tissue

- made up of neurons and neuroglia; responsible for the transmission and receipt of signals that provide information

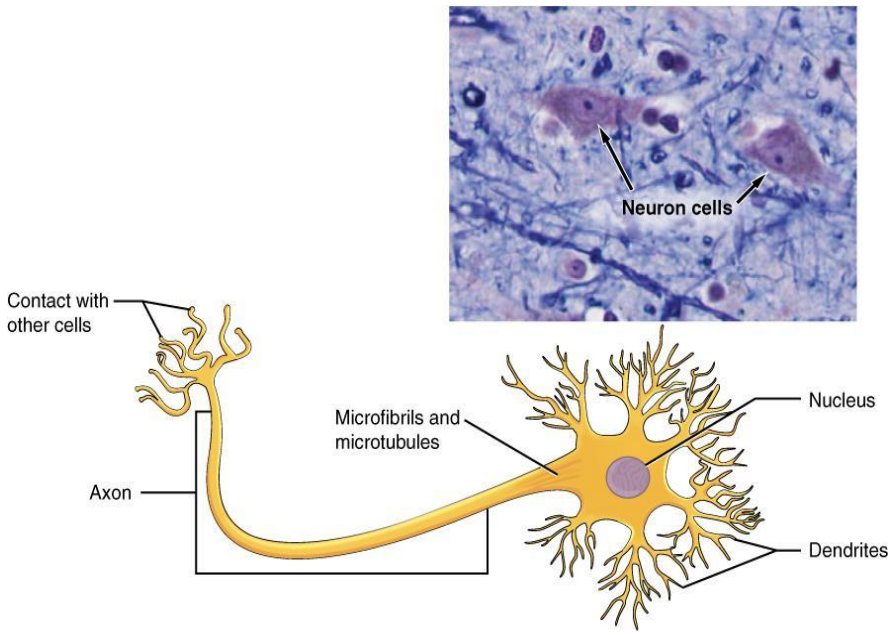


Figure 18. The neuron, from *Anatomy & Physiology* by Biga et al. (n.d.). https://open.oregonstate.education/aandp/chapter/4-4-muscle-tissue/. License: Creative Commons Attribution-ShareAlike 4.0

NAVIGATE

Concept Check. (This is a non-graded assessment.)

1. Which animal tissue has the same functions as the xylem and phloem of plants?

2. Which plant tissue would most likely be similar to the connective tissue of animals?

KNOT

You have just been given an overview of the different types of tissues that can be found in plants and animals. Cells in each tissue work together and perform similar functions. Cells in each type of tissue differ in structure from cells in other types of tissues since they perform different functions. Plants are simpler than animals in that they only have three types of tissue systems: dermal, vascular and ground, whereas animals have four types: epithelial, connective, muscle and nervous tissues.

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