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Tissues are like the fabric of our body. The term means woven. When two or more tissues combine, they form our organs. Our kidneys, lungs, liver, and other organs are all made of different types of tissues. But what function a certain part of our organ performs, depends on what kind of tissue its made of. This is the tissue that lines, covers, and generally organizes our body, creating order during the disturbance in the body.Definition of TissueTissues are the groups of similar cells that work together to perform their defined function and in doing so they form tissues which essentially are the fabric of our body which holds us together and gives shape to our organs.What are Tissues?Tissues are clusters of cells that perform the same purpose as cells. The study of human and animal tissues is known as Histology. Xavier Bichat coined the term "tissue" in 1801. They can also be considered the building blocks of an organ. Tissue contributes to the formation of organs in a body. Each tissue carries out a specific function, such organisms with many tissues are called multicellular organisms. Multicellular organisms have tissues in their bodies which are placed at specific places to carry out specific functions, this is called division of labor in the organism's body. Each tissue has two components- cells and matrix. A cluster of cells make tissue and a matrix is a substance found between the cell. It is also called an extracellular substance. Tissues are regarded as the most important component of human anatomy. Tissues in multicellular organisms are loosely classified into four basic types epithelial, connective, muscle and nervous tissue.Types of Animal TissuesAnimals require tissues for more than just physical reasons since they travel from place to place. Almost all tissues in animals are living tissues. These tissues require nutrition, which they obtain from the organism's body. Because animals have homogeneous growth throughout their bodies, tissues split and disseminate throughout their body parts. Blood is a connective tissue in the human body that helps carry nutrients, hormones, and waste products.Four primary types of animal tissue are:Epithelial TissueConnective TissueMuscular TissueNervous Tissue1. Epithelial TissuesThese tissue cells produce a sheet-like structure that either covers the exterior surface or lines the internal processes. These tissues are classified as:Simple: One layer, thick, like the epidermis of skinStratified: Two or more layers, like the lining of the oesophagusCiliated: Like lung alveoliPseudostratified: Only a single layer of cells, but it appears to have multiple layers because the cell nuclei lie at different levels and not all cells reach the apical surface.Simple and stratified epithelial tissues are also categorised into the following kinds based on shape:Squamous: These are thin plate-like cells arrayed like tiles on the floor, such as the lining of the mouth, nose, blood vessels, and so on. Cuboidal: These cells have a cube shape, such as kidney tubules or thyroid vesicles.Columnar: These are cylindrical in shape, such as the lining of the intestine.Transitional: These cells alter shape as organs, such as the urinary bladder, stretch and relax.2. Connective TissuesConnective tissues unite and connect parts of the body and organs. It is made up of three components: CellsFibresMatrix (ground substance) The following are the numerous forms of connective tissue:Areolar Connective Tissue: These are composed of yellow and white fibres and cells. They serve as supporting and packing material, a passage for blood vessels, and a means of attaching the skin to the muscles.Adipose Connective Tissue: It is made up of fat cells. It offers insulation, stores body reserves, and acts as a shock absorber.Reticular Connective Tissue: Made up of branched fibres. Forms the foundation for a variety of vital organs such as the liver, spleen, tonsils. Bone and cartilage are supportive connective tissues, whereas blood is a fluid connective tissue.Bone (Osseous Tissue)It is a type of connective tissue that is both strong and flexible. It is composed of three primary connective tissue components. Solid Matrix: A protein matrix coated with calcium and magnesium salts such as phosphates and carbonates. Cells: Bone cells are known as oesteoblasts and osteocytes. These cells are found in fluid-filled areas known as lacunae. Fibres: These are collagen fibres.CartilageIt is a flexible but less vascularised connective tissue than bone. Its structure is similar to bone, with a protein matrix and cells suspended in the matrix known as chondrocytes. Cartilage cells are found in groups of two or three in lacunae. It is found in flexible regions such as the ear pinna, epiglottis, trachea rings.Also Read: Difference between Bone and Cartlage3. Muscular TissueThese are of 3 types:Skeletal or Striated Muscle Fibres: Alternate light and dark bands aer present in these fibres. The fibres are cylindrical, multinucleate with peripheral nuclei. They are voluntary and attached to the skeleton.Smooth Muscle Fibres: There fibres have no stripes. These are spindle-shaped, pointed at both the ends, bear a single nucleus which is central. They are involuntary and present in internal organs.Cardiac Muscle Fibres: These are striped muscular fibres as well. There form branch like structure. The existence of "tight junctions" suggests that these are multinucleate with central nuclei. They are found in the heart and are involuntary. Their primary purpose is to contract the heart.4. Nervous Tissues (Neuron)Nervous tissue is made up of three main components:Cell body: With a nucleus as well as strongly pigmented particles known as Nissl granules (ribosomes) and other cellular organelles.Dendrite: Many short processes known as dendrites accept information or impulses.An Axon: A single, long process with fine branching at the ends. Axons of myelinated nerve fibres are lined by a lipid layer called the myelein sheath, which is interrupted at certain sites called Nodes of Ranvier.Functions of Animal TissuesThe following are the functions of animal tissues:Animal tissues functions include protection, transport secretion, sensory reception.Provide the Maintenance of posture, Generation of heat (thermogenesis) etc.Provide movement of the internal organs.Types of Plant TissuesPlants do not have the same tissues as humans, and their movement is limited. Plants require dead tissues for mechanical support, hence they do not require living tissues. Plants have two types of tissues: those that divide and those that do not divide. Plants do not grow uniformly throughout their bodies; instead, growth is restricted to some areas, which contain tissues that can divide. Plant tissues can be divided into plant tissue systems, each of which performs a specific purpose. A plant tissue system is a functional unit that connects all of a plant's organs. The plant tissue system is also divided into different tissues based on their functions. Plant tissues are divided into Meristematic tissue and Permanent tissues based on their ability to divide.Meristematic TissueMade up of a group of cells with the ability to divide. They are small, cuboidal, densely packed cells that divide to generate new ones. These tissues can stretch, enlarge, and differentiate into other types of tissues. Meristematic tissues are classified into three groups based on their location: Apical meristemsLateral meristemsIntercalary meristemsPermanent TissueThese tissues have lost their ability to divide and are produced from meristematic tissues. They have reached their mature state. They are further classified into two types:Simple Permanent TissueThese are made from Parenchyma, Collenchyma and Sclerechyma.ParenchymaFound in the soft sections of plants such as roots, stems, leaves, and flowers. Tissue cells are loosely packed and have wide intercellular spaces between them. A vacuole is located in the centre of each cell. Storage, photosynthesis, and helping the plant float on water are all activities of parenchyma tissues. CollenchymaCells have stronger cell walls than parenchyma cells. They are intended to offer mechanical support to the plant structure in areas such as the leaf's petiole.SclerechymaThis tissue's cells are dead. They are stiff and have thick, lignified secondary walls. Their primary role is to offer strength and support to plant sections.Complex Permanent TissueMade up of several types of cells, as opposed to simple permanent cells. Plant vascular bundles contain complicated permanent tissues called xylem and phloem. Xylem was created by tracheids, vessels, xylem parenchyma, and xylem fibres. Tracheids and vessels are hollow tube-like structures that let water and minerals move.Functions of Plant TissuesThe following are the functions of plant tissues:Provide photosynthesis, storage and secretion. Provide mechanical support to the growing parts of the plant.Help in the mechanical strength of organs, flexibility of the organs.The xylem and phloem tissues help in material transfer throughout the plant. They divide to make new cells and aid in plant growth.They aid in cellular metabolisms such as photosynthesis, regeneration, and respiration.Also Read: Identify the main tissue types and discuss their roles in the human body.By the end of this section, you will be able to:Identify the four primary tissue types and discuss the structure and function of eachDescribe the embryonic origin of tissueIdentify the various types of tissue membranes and the unique qualities of eachThe term tissue is used to describe a group of cells that are similar in structure and perform a specific function. Histology is the the field of study that involves the microscopic examination of tissue appearance, organization, and function.Tissues are organized into four broad categories based on structural and functional similarities. These categories are epithelial, connective, muscle, and nervous. The primary tissue types work together to contribute to the overall health and maintenance of the human body. Thus, any disruption in the structure of a tissue can lead to injury or disease.The Four Primary Tissue TypesEpithelial tissue refers to groups of cells that cover the exterior surfaces of the body, line internal cavities and passageways, and form certain glands. Connective tissue, as its name implies, binds the cells and organs of the body together. Muscle tissue contracts forcefully when excited, providing movement. Nervous tissue is also excitable, allowing for the generation and propagation of electrochemical signals in the form of nerve impulses that communicate between different regions of the body (Figure 4.1.1).An understanding of the various primary tissue types present in the human body is essential for understanding the structure and function of organs which are composed of two or more primary tissue types. This chapter will focus on examining epithelial and connective tissues. Muscle and nervous tissue will be discussed in detail in future chapters.Figure 4.1.1 The Four Primary Tissue Types: Examples of nervous tissue, epithelial tissue, muscle tissue, and connective tissue found throughout the human body. Clockwise from nervous tissue, LM 872, LM 282, LM 460, LM 800. (Micrographs provided by the Regents of University of Michigan Medical School 2012)Embryonic Origin of TissuesThe cells composing a tissue share a common embryonic origin. The zygote, or fertilized egg, is a single cell formed by the fusion of an egg and sperm cell. After fertilization, the zygote gives rise many cells to form the embryo. The first embryonic cells generated have the ability to differentiate into any type of cell in the body and, as such, are called omnipotent, meaning each has the capacity to divide, differentiate, and develop into a new organism. As cell proliferation progresses, three major cell lines are established within the embryo. Each of these lines of embryonic cells forms the distinct germ layers from which all the tissues and organs of the human body eventually form. Each germ layer is identified by its relative position: ectoderm (ecto- = outer), mesoderm (meso- = middle), and endoderm (endo- = inner). Figure 4.1.2 shows the types of tissues and organs associated with each of the three germ layers. Note that epithelial tissue originates in all three layers, whereas nervous tissue derives primarily from the ectoderm and muscle tissue derives from the mesoderm.Figure 4.1.2 Embryonic Origin of Tissues and Major Organs: Embryonic germ layers and the resulting primary tissue types formed by each.View this slideshow to learn more about stem cells. How do somatic stem cells differ from embryonic stem cells?Tissue MembranesA tissue membrane is a thin layer or sheet of cells that either covers the outside of the body (e.g., skin), lines an internal body cavity (e.g., peritoneal cavity), lines a vessel (e.g., blood vessel), or lines a movable joint cavity (e.g., synovial joint). Two basic types of tissue membranes are recognized based on the primary tissue type composing each: connective tissue membranes and epithelial membranes (Figure 4.1.3).Figure 4.1.3 Tissue Membranes: The two broad categories of tissue membranes in the body are (1) connective tissue membranes, which include synovial membranes, and (2) epithelial membranes, which include mucous membranes, serous membranes, and the cutaneous membrane, in other words, the skin.Connective Tissue MembranesA connective tissue membrane is built entirely of connective tissue. This type of membrane may be found encapsulating an organ, such as the kidney, or lining the cavity of a freely movable joint (e.g., shoulder). When lining a joint, this membrane is referred to as a synovial membrane. Cells in the inner layer of the synovial membrane release synovial fluid, a natural lubricant that enables the bones of a joint to move freely against one another with reduced friction.Epithelial MembranesAn epithelial membrane is composed of an epithelial layer attached to a layer of connective tissue. A mucous membrane, sometimes called a mucosa, lines a body cavity or hollow passageway that is open to the external environment. This type of membrane can be found lining portions of the digestive, respiratory, excretory, and reproductive tracts. Mucus, produced by uniglandular cells and glandular tissue, coats the epithelial layer. The underlying connective tissue, called the lamina propria (literally own layer), helps support the epithelial layer.A serous membrane lines the cavities of the body that do not open to the external environment. Serous fluid secreted by the cells of the epithelium lubricates the membrane and reduces abrasion and friction between organs. Serous membranes are identified according to location. Three serous membranes are found lining the thoracic cavity; two membranes that cover the lungs (pleura) and one membrane that covers the heart (pericardium). A fourth serous membrane, the peritoneum, lines the peritoneal cavity, covering the abdominal organs and forming double sheets of mesenteries that suspend many of the digestive organs.A cutaneous membrane is a multi-layered membrane composed of epithelial and connective tissues. The apical surface of this membrane exposed to the external environment and is covered with dead, keratinized cells that help protect the body from desiccation and pathogens. The skin is an example of a cutaneous membrane. Aggregations of cells in the human body be classified into four types of tissues: epithelial, connective, muscle, and nervous. Epithelial tissues act as coverings, controlling the movement of materials across their surface. Connective tissue binds the various parts of the body together, providing support and protection. Muscle tissue allows the body to move and nervous tissues functions in communication.All cells and tissues in the body derive from three germ layers: the ectoderm, mesoderm, and endoderm.Membranes are layers of connective and epithelial tissues that line the external environment and internal body cavities of the body. Synovial membranes are connective tissue membranes that protect and line the freely-movable joints. Epithelial membranes are composed of both epithelial tissue and connective tissue. These membranes are found lining the external body surface (cutaneous membranes and mucous membranes) or lining the internal body cavities (serous membranes). Identify the four types of tissue in the body, and describe the major functions of each tissue.The four types of tissues in the body are epithelial, connective, muscle, and nervous. Epithelial tissue is made of layers of cells that cover the surfaces of the body that come into contact with the exterior world, line internal cavities, and form glands. Connective tissue binds the cells and organs of the body together and performs many functions, especially in the protection, support, and integration of the body. Muscle tissue, which responds to stimulation and contracts to provide movement, is divided into three major types: skeletal (voluntary) muscles, smooth muscles, and the cardiac muscle in the heart. Nervous tissue allows the body to receive signals and transmit information as electric impulses from one region of the body to another. The zygote is described as omnipotent because it ultimately gives rise to all the cells in your body including the highly specialized cells of your nervous system. Describe this transition, discussing the steps and processes that lead to these specialized cells.The zygote divides into many cells. As these cells become specialized, they lose their ability to differentiate into all tissues. At first they form the three primary germ layers. Following the cells of the ectodermal germ layer, they too become more restricted in what they can form. Ultimately, some of these ectodermal cells become further restricted and differentiate in to nerve cells. What happens when a terminally differentiated cell reverts to a less differentiated state? What is the function of synovial membranes?Synovial membranes are a type of connective tissue membrane that supports mobility in joints. The membrane lines the joint cavity and contains fibroblasts that produce hyaluronan, which leads to the production of synovial fluid, a natural lubricant that enables the bones of a joint to move freely against one another. This work, Anatomy & Physiology, is adapted from Anatomy & Physiology by OpenStax, licensed under CC BY. This edition, with revised content and artwork, is licensed under CC BY-SA except where otherwise noted.Images, from Anatomy & Physiology by OpenStax, are licensed under CC BY except where otherwise noted.Access the original for free at Botany Notes Angiosperms Tissues are groups of cells that share a common structure and function. They represent a level of organization in biological systems that lies between individual cells and organ systems. Tissues play a crucial role in the formation of organs, which are composed of functional groups of tissues working collaboratively to perform specific tasks.The study of tissues is referred to as histology, which involves examining the structure and function of tissues at both the microscopic and macroscopic levels. Histologists utilize various techniques to prepare tissue samples for examination, including the embedding of tissues in paraffin and sectioning them into thin slices for observation under a microscope. This method allows for the detailed analysis of cellular architecture and the identification of specific tissue types.Furthermore, the examination of tissues in relation to disease is called histopathology. This field focuses on understanding the alterations in tissue structure and function caused by various pathological conditions. Through histopathological analysis, medical professionals can diagnose diseases, assess the severity of conditions, and guide treatment options.Tissues are categorized into four primary types: epithelial, connective, muscle, and nervous tissues. Each tissue type serves distinct functions within the body. Epithelial tissue, for example, covers body surfaces and lines cavities, providing protection and facilitating absorption and secretion. Connective tissue provides structural support and connects different tissues and organs. Muscle tissue is responsible for movement, while nervous tissue is integral to the transmission of signals throughout the body.Tissues are groups of similar cells that work together to perform specific functions in an organism. They serve as the structural and functional units that form organs, playing critical roles in various biological processes.Characteristics of TissuesSupported by an extracellular matrix that gives structural integrity and promotes cell communication, tissues are collections of similar cells arranged to serve particular purposes.The cells within a tissue exhibit specialized shapes, sizes, and biochemical properties that reflect their functional roles, ensuring uniformity and efficiency in tissue performanceTissues show a clear structural arrangement, with cells stacked in layers or patterns allowing coordinated activities including protection, absorption, and secretion.In connective tissues, the extracellular matrixmade of proteins like collagen and elastinis essential for mechanical strength, elasticity, and signaling cues that control cell behavior.Clear differences between meristematic tissueswhich are actively dividing and in charge of growthand permanent tissues with specialized purposes including support, photosynthesis, and nutrient movement define plant tissues.Tissues have different regenerative capacity; for example, epithelial tissues often have high turnover rates while nerve tissues show limited regenerative potential, reflecting variations in underlying cellular mechanisms.Histologically, tissues are defined by their staining properties and microscopic architecture, which are used to identify normal versus pathological states in clinical diagnosticsThe integration of cells with their extracellular matrix in tissues is fundamental for organ formation, ensuring that each tissue type contributes effectively to the overall function and homeostasis of an organismLocation of TissuesThe structural and functional units of organs and organ systems are found in the tissues scattered across the bodies of multicellular life.Whereas connective tissue supports organs like bones, tendons, and blood vessels, epithelium tissue lines surfaces and cavities including the skin, the digestive tract, and the respiratory system in animals.Muscle tissues found in areas needing movementthe heart, limbs, the digestive tractallow contraction and coordinated motion.Found mostly in the brain, spinal cord, and peripheral nerves, nervous tissue forms the communication system guiding bodily activities.In plants, meristematic tissues at the growth pointssuch as the terminals of roots and shootsas well as permanent tissues (dermal, vascular, and ground tissues) found in structures like leaves, stems, and roots.The general arrangement of an organism depends on the placement of tissues as every kind of tissue is positioned deliberately to support certain purposes and preserve homeostasis.Formation of TissuesThe formation of tissues, known as histogenesis, involves the differentiation of cells into specialized types that collaborate to perform specific functions. In animals, this process originates from the three primary germ layers established during embryonic development:Ectoderm: Gives rise to tissues such as the epidermis and nervous system.Mesoderm: Forms connective tissues, muscles, and the circulatory system.Endoderm: Develops into the lining of the digestive and respiratory tracts.These germ layers differentiate into the four fundamental tissue types in animals:Epithelial Tissue: Covers body surfaces and lines cavities.Connective Tissue: Provides support and structure.Muscle Tissue: Facilitates movement.Nervous Tissue: Conducts nerve impulses.In plants, tissue formation begins with meristematic tissues, which are regions of actively dividing cells located at growth points like root and shoot tips. These meristematic cells differentiate into various permanent tissues:Dermal Tissue: Forms the outer protective covering.Vascular Tissue: Comprises xylem and phloem for water and nutrient transport.Ground Tissue: Performs functions such as photosynthesis, storage, and support.Types of TissuesTissues are classified into two main categories: plant tissues and animal tissues. Each category is characterized by distinct structures and functions that are vital to the overall functioning of the respective organisms.Plant TissuePlant tissues can be divided into two main types: meristematic and permanent tissues.Meristematic TissueThis tissue consists of actively dividing cells, which are undifferentiated and capable of continuous growth.Located at the tips of roots and shoots, meristematic tissue contributes to the elongation and development of the plant.Cells in this tissue are small, have thin cell walls, and contain large nuclei.Permanent TissuePermanent tissues arise from meristematic tissues after they differentiate.They are classified into two subcategories: simple and complex tissues.Simple TissuesComposed of one type of cell.Examples include parenchyma (storage and photosynthesis), collenchyma (flexible support), and sclerenchyma (rigid support).Complex TissuesMade up of more than one type of cell that work together.Examples include xylem (water transport) and phloem (nutrient transport).Animal TissueAnimal tissues are categorized into four primary types: epithelial, connective, muscle, and nervous tissues.Epithelial TissueThis tissue covers body surfaces, lines cavities, and forms glands.Epithelial cells are tightly packed, providing protection and facilitating absorption and secretion.They can be classified based on the number of layers (simple or stratified) and the shape of the cells (squamous, cuboidal, or columnar).Connective TissueConnective tissue provides structural support and binds other tissues together.It consists of cells dispersed within an extracellular matrix, which can be liquid, gel-like, or solid.Types of connective tissue include loose connective tissue (provides flexibility), dense connective tissue (provides strength), adipose tissue (stores fat), blood (transports nutrients and waste), and bone (provides structure).Muscle TissueMuscle tissue is responsible for movement and is classified into three types: skeletal, cardiac, and smooth muscle.Skeletal muscle is voluntary and striated, enabling body movements.Cardiac muscle, found only in the heart, is involuntary and striated, facilitating heartbeat.Smooth muscle is involuntary and non-striated, controlling movements in hollow organs like the intestines and blood vessels.Nervous TissueNervous tissue is specialized for communication and control within the body.It consists of neurons, which transmit signals, and glial cells, which support and protect neurons.This tissue is essential for processing information and coordinating responses to stimuli.Types of Animal TissuesAnimal tissues are classified into four primary types: connective, muscle, nervous, and epithelial tissues. Each type has distinct characteristics and functions that contribute to the overall physiology of the organism. Understanding these tissues is crucial for comprehending how organs are structured and how they perform their designated functions.Connective TissueConnective tissues consist of cells that are separated by non-living material known as the extracellular matrix. This matrix plays a vital role in providing shape and maintaining the position of various organs. Connective tissue types include:Fluid Connective Tissue: Includes blood, which transports nutrients and wastes throughout the body.Fibrous Connective Tissue: Comprises tendons and ligaments, providing support and stability.Skeletal Connective Tissue: Includes bone and cartilage, offering structural integrity and support.The functions of connective tissue are diverse and include:Providing shape and maintaining the position of organs.Acting as the primary supporting tissue in the body.Insulating the body and conserving heat.Binding organs together and offering support.Protecting against pathogens through phagocytic activity.Transporting water, nutrients, minerals, hormones, gases, and waste products within the body.Muscle TissueMuscle tissues are responsible for producing force and generating motion, facilitating both locomotion and movements within internal organs. The three types of muscle tissue include:Skeletal Muscle: Typically attached to bones, allowing voluntary movement.Cardiac Muscle: Found exclusively in the heart, responsible for involuntary contractions that pump blood.Visceral or Smooth Muscle: Located in the inner walls of organs, aiding in involuntary movements.The functions of muscle tissue encompass:Facilitating movements such as walking, running, lifting, and chewing.Maintaining posture and an erect position.Constricting organs and blood vessels to regulate flow.Pumping blood and controlling blood flow in arteries.Regulating respiration through involuntary movements that drive air in and out of the body.Nervous TissueNervous tissue is a critical component of the central nervous system, which includes the brain and spinal cord, as well as the peripheral nervous system, which forms cranial and spinal nerves.The primary functions of nervous tissue include:Serving as a communication network for the nervous system, crucial for information processing.Responding to stimuli and transmitting information within the body.Playing a significant role in emotions, memory, and reasoning.Maintaining homeostasis and creating awareness of the surrounding environment.Coordinating various metabolic activities throughout the body.Epithelial TissueEpithelial tissues are formed by cells that cover the external surfaces of body organs and line the surfaces of internal cavities. They are found in areas such as the skin, reproductive tract, airways, and the inner lining of the digestive tract.The functions of epithelial tissue are varied and include:Participating in sensory reception, excretion, filtration, and metabolic activities.Providing mechanical strength and resistance to underlying cells and tissues.Facilitating the movement of materials through filtration, diffusion, and secretion.Protecting internal organs against pathogens, toxins, physical trauma, and radiation.Secreting hormones, enzymes, mucus, and other products, transporting them to the circulatory system.Types of Plant TissuesPlant tissues can be classified based on two key criteria: the different parts of the plants they are associated with and the various types of cells they contain. This classification leads to a deeper understanding of how plant tissues function and contribute to the overall growth and health of the plant.Classification Based on Plant PartsPlant tissues are broadly categorized into three tissue systems based on their location and function:Epidermal Tissue:Comprises cells that form the outermost surface of leaves and stems.Functions primarily in protection against mechanical injury, water loss, and pathogen invasion.Vascular Tissue:Responsible for the internal transport of fluids and nutrients.Consists of xylem, which transports water and minerals from roots to other parts of the plant, and phloem, which distributes sugars and nutrients produced during photosynthesis.Ground Tissue:Involved in the production and storage of nutrients through photosynthesis.Serves as a site for metabolic processes and provides structural support to the plant.Classification Based on Cell TypesPlant tissues can also be divided into two types based on the kinds of cells they contain:Meristematic Tissue:Comprises young cells that are continuously dividing, facilitating the increase in both length and width of the plant.Different types of meristematic tissues can be classified according to their position, function, plane of division, origin, and development. The three main types are:Apical Meristem: Located at the tips of roots and shoots, promoting primary growth.Lateral Meristem: Responsible for secondary growth, increasing the girth of the plant.Intercalary Meristem: Found at the base of leaves or internodes, contributing to the growth of new leaves or stems.The functions of meristematic tissue include:Responsible for the growth of new organs.Involved in the movement of water and nutrients within the plant.Facilitates both primary and secondary growth.Provides protection from mechanical injury as the outermost tissue.Gives rise to other tissues, including the epidermis, cortex, endodermis, ground tissue, and vascular tissue.Permanent Tissue:Composed of a group of cells that are similar in origin, structure, and function, which have undergone complete growth and differentiation after the cessation of meristematic activity.Permanent tissues can be classified into three types:Simple Permanent Tissues: Consist of one type of cell and include parenchyma, collenchyma, and sclerenchyma.Complex Permanent Tissues: Composed of more than one type of cell, such as xylem and phloem.Special or Secretory Tissues: Involved in producing specific substances like resins or essential oils.The functions of permanent tissues encompass:Assisting in flotation in aquatic plants.Storing food in the form of starch, proteins, oils, and fats.Providing hardness and protection to fruits such as nuts and coconuts.Containing chloroplasts for conducting photosynthesis.Involvement in secretion, transportation, and providing mechanical support to the plant.The Plant TissuesThe plant tissues are mainly of two catagories:Meristematic (Gk. meristos : dividing)Permanent (non-dividing)Classification of plant tissuesA. Meristematic tissuesMeristematic tissues are essential components of plant growth, consisting of undifferentiated cells that are actively dividing. These tissues are primarily located in regions of the plant where growth occurs, such as at the tips of roots and shoots, as well as in the cambium layer. The presence of meristematic tissues enables plants to increase in both length and girth, which is crucial for their development and overall health. Location of the meristematic tissues in an angiospermous plantCharacteristics of Meristematic Tissue:Active Cell Division: Cells in meristematic tissue are continuously dividing, which is vital for plant growth.Dense Cytoplasm and Large Nucleus: Each meristematic cell contains a significant amount of cytoplasm and typically features a single, prominent nucleus.Compact Arrangement: The cells are closely packed together, exhibiting little to no intercellular space.Thin Cell Walls: The cell walls of meristematic cells are made of a thin layer of cellular material, allowing for flexibility and growth.Varied Cell Shapes: These cells may be spherical, oval, polygonal, or rectangular in shape, adapting to their functional requirements.Vacuole Presence: Depending on the specific type of meristematic tissue, the cells may or may not contain vacuoles.Functions of Meristematic Tissue:Continuous Cell Division: Meristematic tissues possess the ability to divide, which results in the continuous production of new cells. These new cells subsequently differentiate into specialized cell types that perform various functions within the plant.Increase in Length: The cells located at the root tip and shoot tip contribute to the elongation of the plant, enabling it to grow taller and deeper into the soil.Increase in Girth: The cambium, found in the lateral regions of the plant, is responsible for increasing the thickness or girth of the plant, allowing it to support additional weight and resist external pressures.Meristematic tissues are classified based on their location and functional roles within the plant. Each type serves distinct purposes in facilitating growth and development. The three primary types of meristematic tissue include apical meristem, lateral meristem, and intercalary meristem. Understanding these types is crucial for comprehending how plants grow in length and girth.Apical Meristem:Location: Apical meristems are situated at the tips of roots and stems.Function: This type of meristem is primarily responsible for the increase in length of the plant axis. By contributing to the elongation of roots and shoots, apical meristems enable plants to explore new areas for water and nutrients, enhancing their overall growth potential.Lateral Meristem (Cambium):Location: Lateral meristems are found on the lateral sides of stems and roots.Function: These tissues play a critical role in increasing the thickness or girth of the stem and root. This thickening process, known as secondary growth, is essential for providing structural support to mature plants, allowing them to withstand external pressures and maintain stability.Intercalary Meristem:Location: Intercalary meristems are located at the bases of leaves or internodes in twigs.Function: This type of meristem is responsible for the longitudinal growth of plants, particularly contributing to the increase in length of the internodal regions. Intercalary meristems enable quick growth responses, particularly in monocots like grasses, allowing them to recover rapidly from damage or herbivory.B. Permanent tissuesPermanent tissues are specialized structures that arise from meristematic tissues as a result of cell differentiation. This process involves cells taking on a permanent shape, size, and function, marking a transition from the undifferentiated state of meristematic tissues. Understanding permanent tissues is crucial for comprehending how plants maintain their structure and perform various functions.Origin: Permanent tissues originate from meristematic tissues, which are characterized by actively dividing cells. As these cells differentiate, they develop into permanent tissues, taking on specific roles in the plant.Characteristics:Loss of Division: Cells in permanent tissues have lost their ability to divide, marking a significant transition from the meristematic phase.Definite Form and Size: The cells exhibit a definite shape and size, which allows them to perform specialized functions effectively.Specific Functions: Each cell within permanent tissues is differentiated, meaning it carries out specific functions essential for the plants growth and survival.Cell Composition: The cells can be either living or dead, contributing to various functions in the plant. For instance, thin-walled permanent tissues are typically living, while thick-walled tissues can be either living or dead.Cell Wall Structure: The cell walls of permanent tissues can be thin or thick, depending on the tissue type. This variation in wall thickness affects the tissues overall function and durability.Cytoplasm: Permanent tissue cells are generally large and often contain vacuolated cytoplasm, which aids in storage and other cellular processes.Functionality:Permanent tissues serve various functions within the plant, reflecting their specific adaptations. For example, living permanent tissues contribute to metabolic processes, while dead permanent tissues may provide structural support or aid in water retention.The functionality of permanent tissues can be seen in their role in storage, support, and transport within the plant.Permanent tissues in plants are crucial components that have undergone differentiation from meristematic tissues, taking on specific structures and functions to support various plant activities. They are categorized into two main types: simple permanent tissues and complex permanent tissues, each serving distinct roles within the plant.Various types of simple tissuesSimple Permanent Tissues: These tissues are composed of structurally similar cells, meaning they consist of only one type of cell. Simple permanent tissues are further divided into three categories based on the nature of their cells:Parenchyma:This tissue is regarded as the most primitive and fundamental among plant tissues, being the most common type found in plants.Parenchyma cells are living and can take on various shapes, including spherical, oval, or polygonal.The cell walls are thin, primarily composed of cellulose, which contributes to their flexibility.These cells are loosely packed with substantial intercellular spaces, allowing for efficient gas exchange and storage.A large central vacuole typically occupies much of the cells interior, surrounded by dense peripheral cytoplasm containing a distinct nucleus.Parenchyma is commonly found in soft parts of the plant, such as the cortex of roots, ground tissues in stems, and the mesophyll of leaves.Function: The primary role of parenchyma is the storage of food and other substances.Specialized Parenchyma:Chlorenchyma: Parenchyma containing chloroplasts, involved in photosynthesis.Aerenchyma: Parenchyma with air cavities, facilitating buoyancy in aquatic plants.Stellate/Steel Parenchyma: Star-shaped parenchyma, contributing to structural integrity.Idioblast: Parenchyma that contains ergastic substances, which are metabolic waste products.Collenchyma:Cells of collenchyma are living and characterized by their elongated shapes.The cell walls are irregularly thickened at the corners, providing support and flexibility.Intercellular spaces are minimal, enhancing structural integrity.Function: Collenchyma provides mechanical strength and flexibility to the plant, allowing for easy bending without breaking, particularly in leaves and stems.Sclerenchyma:Unlike the previous types, the cells of sclerenchyma are dead at maturity.The cell walls are long, narrow, and significantly thickened due to lignin deposition, which acts as a cementing agent that hardens the cell walls.These cells lack intercellular spaces, providing robust structural support.Sclerenchyma is typically found in stems, around vascular bundles, within leaf veins, and in the hard coverings of seeds and nuts.In older plants, the epidermis undergoes changes, forming several layers of thick cork or bark, composed of dead and compactly arranged cells.Cork cells contain suberin, a substance that renders them impervious to gases and water.Complex Permanent Tissues: In contrast to simple permanent tissues, complex permanent tissues consist of structurally different cells that coordinate to perform a common function. The primary examples of complex permanent tissues are xylem and phloem, both of which are conducting tissues forming vascular bundles.Xylem:Xylem is composed of four types of cells:Tracheids: Dead, thick-walled, lignified tubular cells that conduct water.Vessels/Tracheae: Also dead and thick-walled, vessels are found exclusively in the xylem of angiosperms and are absent in gymnosperms and pteridophytes.Xylem Parenchyma: Living cells with thin cell walls, involved in storage and transport.Xylem Fibers: Dead cells with thick walls that provide support to the xylem tissue.Phloem:Phloem, also known as bast, consists of four types of cells:Sieve Tubes: Tubular cells with perforated end walls, allowing for the flow of nutrients; these cells lack a nucleus but contain a thin layer of cytoplasm.Companion Cells: Small, elongated cells with dense cytoplasm and a prominent nucleus, supporting sieve tube function.Phloem Parenchyma: Thin-walled cells that play a significant role in the storage and transportation of food.Phloem Fibers: Thick-walled, elongated dead sclerenchymatous cells that provide mechanical strength to the phloem tissue.Functionality of Complex Tissues: The primary function of both xylem and phloem is to facilitate the transport of water, minerals, salts, and food materials throughout the plant. Xylem transports water and nutrients from the roots to the rest of the plant, while phloem is responsible for moving food from the leaves to storage organs and growing regions.Various types of complex tissuesStructure, Function and Distribution of simple tissuesTissueLiving or DeadStructureFunctionDistribution1. ParenchymaLiving(i) Oval or round, thin-walled with sufficient cytoplasm.(ii) Has a prominent nucleus and intercellular spaces.(iii) Wall made up of cellulose.(a) Forms large parts of various organs in most plants.(b) Acts as storage cells.(c) Chlorenchyma carries out photosynthesis.(d) Turgid parenchyma gives rigidity to the plant body.(1) Pith and cortex of stem and root.(2) Mesophyll of leaves.(3) Endosperm of seed.(4) Xylem and phloem parenchyma in vascular tissue.(5) Occur in leaves and stems of aquatic plants.(a) ChlorenchymaLivingParenchyma containing chloroplasts.Carries out photosynthesis.Present in the mesophyll of leaves.(b) AerenchymaLivingParenchyma with large air spaces or intercellular spaces.Facilitates buoyancy in aquatic plants.Found in aquatic plants.2. CollenchymaLiving(i) Elongated cells with thick primary walls, thickenings more in the corners of the cells.(ii) Wall material is cellulose and pectin.(iii) Intercellular spaces present.Provides mechanical support and flexibility to the plant body.Occurs in the peripheral regions of stems and leaves.3. SclerenchymaDead(i) Consists of thick-walled cells, walls uniformly thick with lignin.(ii) Elongated cells with pointed ends.(iii) Walls are thick with lignin and irregular in shape.(a) Provides mechanical support to the plant body.(b) Protects inner thin-walled cells from damage.(1) Found in the stems, around vascular bundles, in leaves, fruits, and seeds.(2) Fibers occur in patches or continuous bands in various parts of stems in many plants.(3) Sclereids occur commonly in fruits and seeds.Structure and function of the components of xylem and phloemTissuesLiving or DeadStructureFunctionXylemDead1. Tracheids(i) Long cells with pointed ends.(ii) Walls thick with lignin.(iii) Have pores on the walls.Conducts water and minerals upward from roots to leaves.2. Vessels(i) Shorter and broader than tracheids.(ii) Walls thick with lignin and have pores.(iii) End walls open, forming long tubes.Conducts water and minerals upward from roots to leaves.3. Xylem Fibers(i) Long cells with very thick lignin deposition on the walls.(ii) No pores on the walls.Provides mechanical support to the plant.Living4. Xylem Parenchyma(i) Small thin-walled cells with cellulose walls.Storage and transport of nutrients.PhloemLiving1. Sieve Tube(i) Elongated sieve elements join to form sieve tubes.(ii) Cell wall made of cellulose.(iii) End walls have perforations.Translocates food assimilated in the leaves by photosynthesis to different parts of the plant.Living2. Companion Cell(i) Long, rectangular cells associated with sieve cells.(ii) Cell wall made of cellulose.Assists in the transport of nutrients through the sieve tubes.Dead3. Phloem Fiber(i) Very long cells with thick lignified walls.Provides mechanical support to the phloem tissue.Living4. Phloem Parenchyma(i) Elongated cells.(ii) Cell walls thin and made of cellulose.Storage and transportation of nutrients.Theories explaining growth of the plant at its shoot apex and root tipThe growth of plants at their shoot apex and root tip is a fundamental aspect of their development and is explained through two primary theories: the Tunica Corpus Theory and the Histogen Theory. Both theories elucidate the processes and mechanisms governing the division and differentiation of cells in these crucial growth regions.Tunica Corpus Theory:Developed specifically for the vegetative shoot apex, this theory posits that the apical meristem is organized into two distinct zones of tissue: the tunica and the corpus.The tunica (derived from the Latin word for cover) consists of one or more layers of peripheral cells that primarily undergo anticlinal divisions. This means that the cells divide perpendicularly to the surface, contributing to surface growth.The corpus (from the Latin word for body) is a mass of cells enclosed by the tunica, where cell division occurs irregularly and in various planes. This results in an increase in the volume of the mass.The tunica ultimately gives rise to the epidermis and cortex, while the corpus develops into the endodermis, pericycle, pith, and vascular tissue.Histogen Theory:This theory describes the apical meristem of both stems and roots as a compact mass of meristematic cells, which are similar and exhibit rapid division. This collective of cells is referred to as the promeristem.The promeristem differentiates into three specific zones, known as dermatogen, periblem, and plerome. Each zone consists of a group of initials termed a histogen (tissue builder), which plays a critical role in tissue formation.The dermatogen is responsible for forming the epidermis of stems and the epiblema of roots, serving as the protective outer layer.The periblem, located in the middle layer, develops into the cortex of both stems and roots, playing a vital role in storage and transport.The plerome forms the central meristematic region, which contributes to the development of the pericycle, pith, and vascular tissues, essential for the plants structural integrity and nutrient transport.Both theories provide a comprehensive understanding of how plants grow at their shoot and root tips, highlighting the intricacies of cellular division and differentiation in apical meristems.Animal tissuesClassifications of Animal tissuesA. Epithelial TissueEpithelial tissue plays a crucial role in the structure and function of animal bodies, serving as a protective barrier that covers surfaces and lines tubes and cavities. This type of tissue, often referred to as covering and lining tissue, is integral to maintaining the integrity of organs and facilitating various physiological processes.The structure of different kinds of epithelial tissuesCharacteristics of Epithelial Tissue:Cells within epithelial tissue are tightly packed together, forming continuous sheets that provide a cohesive layer.There is minimal intercellular space, with only a small amount of connecting material between the cells.Epithelial tissue is typically separated from underlying connective tissues by an extracellular fibrous basement membrane, which provides support and anchorage.This tissue is avascular, meaning it does not contain blood vessels, relying instead on diffusion from adjacent tissues for nutrient and waste exchange.Classification of Epithelial Tissue: Depending on the cell shape and function, epithelial tissue can be classified into two main categories: simple epithelial tissue and complex epithelial tissue.Simple Epithelial Tissue:Squamous Epithelium (Pavement Epithelium):Composed of extremely thin and flat cells, this tissue forms delicate linings.Locations include the lining of the esophagus, mouth, blood vessels, alveoli of lungs, and Bowmans capsule of the nephron.Cuboidal Epithelium:Cells are cube-shaped and provide a more robust lining.Found in the lining of kidney tubules and the ducts of salivary glands, this type plays a role in secretion and absorption.Columnar Epithelium:Characterized by tall, pillar-like cells, this tissue is essential for absorption and secretion, especially in the inner lining of the intestines.The cells can be modified into three specialized types:Ciliated Epithelium: Features cilia on their free ends, facilitating the movement of small particles. This type lines the fallopian tubes and respiratory tract.Glandular Epithelium: Cells that have adapted to form glands, responsible for the secretion of various substances.Sensory Epithelium: Modified to form sensory cells, which receive stimuli; examples include rod and cone cells in the eyes and taste buds in the tongue.Complex Epithelial Tissue:Stratified Squamous Epithelium:Composed of multiple layers of epithelial cells, this tissue is designed to withstand wear and tear.Commonly found in the skin, it provides a protective barrier against mechanical injury, pathogens, and water loss.B. Connecitve tissueConnective tissue plays a vital role in the animal body, serving to connect, support, and bind various organs and tissues together. This diverse category of tissue is essential for maintaining the structural integrity of the body and facilitating numerous physiological processes.8 Some representative types of connective tissues.Characteristics of Connective Tissue:The cells of connective tissue are living and loosely spaced, allowing for flexibility and adaptability within the tissue structure.These cells are embedded in an intercellular matrix, which can vary in consistency. The matrix may be jelly-like, fluid, dense, or rigid, depending on the specific type and function of the connective tissue. This matrix is a secretion from the cells of the tissue and serves to support and bind cells together.Types of Connective Tissue: Connective tissue can be classified into three main categories: connective tissue proper, skeletal tissue, and fluid connective tissue.Connective Tissue Proper (Packing Tissue):Areolar Tissue (Loose Connective Tissue):This type of tissue provides support and elasticity to various organs and is involved in the cushioning of structures.Fibrous Tissue:Fibrous connective tissue is further categorized into two structures:Tendons: These connect muscles to skeletal tissue, such as cartilage and bone. Tendons are strong and non-flexible, allowing for the efficient transfer of force from muscle to bone.Ligaments: Ligaments connect skeletal tissues to each other, providing stability to joints. They are elastic and flexible, allowing for movement while maintaining structural integrity.Adipose Tissue:This tissue is distributed abundantly beneath the skin and is primarily responsible for the storage of fat. Adipose tissue also plays a role in insulation and energy storage.Skeletal Tissue:Skeletal tissue comprises both cartilage and bone, contributing to the framework of the body.Cartilage: This connective tissue provides support and flexibility to various body parts and smoothens bone surfaces at joints. It is found in locations such as the nose, ears, trachea, and larynx, serving critical functions in cushioning and facilitating movement.Bone: Bone is a strong and non-flexible connective tissue due to the presence of calcium and phosphorus, which provide hardness. Bone serves as the primary structural component of the skeleton, supporting the body and protecting vital organs.Fluid Connective Tissue:This category includes blood and lymph, which are essential for transportation and immune responses.Blood:Blood consists of a liquid matrix called plasma, which accounts for approximately 55% of its volume. Plasma contains water, proteins, nutrients, electrolytes, metabolic wastes, dissolved gases, hormones, and anticoagulants such as heparin.Blood corpuscles include three main types:Red Blood Cells (RBCs or Erythrocytes): Responsible for transporting respiratory gases, primarily oxygen and carbon dioxide.White Blood Cells (WBCs or Leukocytes): These cells play a crucial role in the immune response, helping to fight infections by producing antibodies.Blood Platelets: These components are essential for blood clotting, preventing excessive bleeding after injury.Lymph:Lymph is a colorless fluid that contains plasma and white blood cells. It escapes from blood capillaries into body tissues and flows through lymph vessels.The primary functions of lymph include aiding in the exchange of materials between tissues and blood, as well as protecting the body against infections through the immune response.C. Muscular tissueMuscular tissue is essential for movement within the animal body, consisting primarily of elongated cells known as muscle fibers. This specialized tissue facilitates various types of movement in body parts and plays a crucial role in locomotion. Muscular tissue contains specific proteins, referred to as contractile proteins (including myosin, actin, troponin, and tropomyosin), which enable the contraction and relaxation of muscle fibers, thus facilitating movement. Types of Vertebrate Muscle TissueTypes of Muscular Tissue: Muscular tissue is categorized into three distinct types based on the structure of muscle fibers:Striated / Stripe / Voluntary / Skeletal Muscular Tissue:This type is predominantly associated with the skeletal system, as these muscles are primarily attached to bones.The term striated refers to the presence of alternating light and dark bands or striations, which are visible under a microscope. This striation pattern results from the organized arrangement of contractile proteins.The cells within skeletal muscular tissue are characterized as long, cylindrical, unbranched, and multinucleated, meaning they contain multiple nuclei. This structure is adapted for the rapid and forceful contractions required for voluntary movements.Involuntary Muscular Tissue / Smooth Muscular Tissue / Unstriated Muscular Tissue:In contrast to striated muscles, involuntary muscular tissue operates without conscious control, meaning movements are not under voluntary control.It is referred to as smooth muscular tissue because it is primarily found in the walls of smooth, visceral organs.The absence of striations distinguishes this tissue, which leads to the term unstriated.The cells in smooth muscular tissue are typically long with pointed ends, giving them a spindle shape, and are uninucleated, possessing a single nucleus. This tissue type is located in various structures, including the alimentary canal, blood vessels, the iris of the eye, ureters, and bronchi of the lungs.Cardiac Muscular Tissue / Striated Involuntary Muscular Tissue:Cardiac muscular tissue is specific to the heart, forming the heart wall, which is crucial for its pumping action.This type of muscle is both striated and involuntary, as it features striations similar to skeletal muscle while operating independently of conscious control.The cells of cardiac muscular tissue are cylindrical, branched, and uninucleated, reflecting a unique structure that allows for coordinated contractions necessary for effective heart function.D. Nervous TissueNervous tissue is a specialized type of tissue integral to the functioning of the nervous system, which governs all body activities. This tissue is primarily composed of nerve cells, or neurons, which are uniquely adapted to receive stimuli and transmit signals rapidly throughout the body. The brain and spinal cord are the central components of this tissue, playing pivotal roles in processing and coordinating information.Nerve cell and nerve fibre.Components of Neurons: Each neuron consists of three main parts:Cyton (Cell Body): The cyton houses the large central nucleus and cytoplasm, from which long, thin, hair-like extensions emerge. This structure supports the overall function of the neuron by providing metabolic support and housing the nucleus, which contains genetic material.Dendrites: These are short, branched fibers that receive nerve impulses. Dendrites play a critical role in collecting signals from other neurons or sensory receptors, thereby facilitating communication within the nervous system.Axon: In contrast to dendrites, the axon is a single, long conducting fiber that transmits impulses away from the cell body. The axon may be myelinated, which enhances the speed of impulse conduction.Functions of Nerve Cells: Neurons serve several essential functions within the body:Control of Body Activities: Nerve cells are responsible for regulating and controlling all bodily functions, from voluntary movements to involuntary processes.Coordination Among Body Parts: They facilitate communication and coordination between different body systems, ensuring that responses to stimuli are timely and appropriate.Transmission of Nerve Impulses: Dendrites carry nerve impulses towards the cyton, whereas the axon conducts these impulses away from the cyton, thereby maintaining the flow of information throughout the nervous system.Synapse: The synapse is the junction or region where the axon of one neuron connects with the dendrite of another neuron. This specialized area is crucial for the transfer of nerve impulses, as it allows chemical and electrical signals to pass between neurons, enabling communication within the nervous system.Characteristics of Axon and Dendrite:The axon is typically single in number and can be long, with possible branching, facilitating long-distance signal transmission.In contrast, dendrites may be one or more in number and are always branched, allowing for the reception of multiple incoming signals.Nerve Impulse: A nerve impulse is the information transmitted through neurons in the form of chemical and electrical signals. This transmission is vital for the functioning of the nervous system, allowing for rapid communication between various body parts.Functions of TissuesGroups of like cells and extracellular materials work together in tissues to carry out particular physiological activities.On internal cavities and body surfaces, epithelial tissues serve as protective barriers mediating activities like absorption, secretion, and sensory perception.Connective tissues support organs structurally, bond, and cushion; they also help in nutrition movement, immunological reactions, and energy storage.Through contraction of specialized cells, muscle tissues generate force and movement, therefore supporting both intentional and involuntary motions.By sending electrical and chemical impulses between several areas, nervous tissues enable quick coordination and communication inside the body.Meristematic tissueswhich drive developmentas well as permanent tissues including vascular tissues for water and nutrient transport, cutaneous tissues for protection, and root tissues for photosynthesis and storage split tissue activities in plants.Maintaining homeostasis and general organismal health depends on the coordinated activities of these many tissue types; their organization and performance are therefore crucial indicators in both normal physiology and disease diagnosis.Chen, Ting-Hsuan. (2014). Tissue Regeneration: From Synthetic Scaffolds to Self-Organizing Morphogenesis. Current stem cell research & therapy. 9. 10.2174/1574888X09666140507123401. //ilovepathology.com/tissue-repair-by-connective-tissue-deposition-angiogenesis-tissue-remodeling/ //organismalbio.biosci.gatech.edu/growth-and-reproduction/plant-development-i-tissue-differentiation-and-function/ 28biology%29 //organismalbio.biosci.gatech.edu/growth-and-reproduction/plant-development-i-tissue-differentiation-and-function/Generate flashcards, quizzes, and ask questions to deepen your understandingPlease login to use this AI.Login here views updated Jun 08 2018Tissue is the name for a group of similar cells that have a common structure and function and which work together. Tissues fit together to form organs in higher animals These animals have four basic types of tissue.The animal body is made up of many different kinds of cells. These specialize to perform certain functions, or specific tasks. A group of closely associated or similar cells that work together to do one thing is called a tissue. All the cells in a tissue look very similar and all do the same work.TYPES OF TISSUEThere are four types of animal tissue: epithelial, connective, muscle, and nervous tissue. Every cell in each of these tissues is an independent unit, yet all of the cells in a given tissue interact with one another. They must do this in order to perform a certain necessary function for the animal's body. For example, an animal's brain is made of nerve tissue that is composed of millions of connected nerve cells. In animals, when two or more tissues are associated and work together, they form an organ such as the stomach or the heart.The same is true for plants, except they have only three types of tissue. Plant tissue, like animal tissue, is also organized into organs, so that epidermal plant tissue makes up the organ known as a leaf. For both plants and animals, a tissue is the "stuff," or specific type of cellular material, out of which specialized organs are made.HUMAN TISSUEAs animals, humans have four different types of tissues: epithelial, connective, muscle, and nervous tissue.Epithelial Tissue. The epithelial tissue, whose closely packed cells make it ideal for forming a lining or a covering, is what makes up the skin. This tissue also makes up the lining for the organs and the many passageways. Because its cells are so tightly packed together, it allows the skin to be an excellent barrier and protects the body against injury and invading microorganisms (any form of life that is too small to be seen without a microscope). It also regulates fluid loss.Nervous Tissue. The nervous tissue is made up of cells called neurons. These are designed to carry impulses. This highly specialized tissue carries electrical signals from one part of the body to another and allows it to function as an organized unit.Muscle Tissue. Muscle tissue is responsible for producing movement. Its cells are designed to work by contracting and relaxing. They also are built to respond to stimuli transmitted by neurons. There are three types of muscle tissue. Smooth muscle makes up organs that people do not control, such as the intestines. Striated, or skeletal muscle, is under people's control and makes up the muscles that allow people to move. Cardiac muscle is also called heart muscle and is responsible for the regular and powerful contraction of the heart. Unlike skeletal muscle, it never needs to rest.Connective Tissue. Finally, connective tissue is the most common tissue in the body, and it is what holds the entire body together. Bone, cartilage, and blood are made of connective tissue. Bone is a type of mineralized connective tissue, cartilage is found between joints, and blood is considered to be a connective tissue in liquid form since it circulates throughout the body.PLANT TISSUEPlants have three types of tissue. Their epidermal tissue serves a purpose similar to humans, in that it covers the surfaces of leaves, stems, and roots and protects its inner parts. The tissue through which a plant transports materials is called its vascular tissue. Its cells are elongated and form tubelike organs. The rest of a plant is made up of what is called fundamental plant tissue. In plants and animals then, tissues are the intermediary stage between an organism's individual cells and its specialized organs. Therefore, cells are arranged into groups, called tissues, and tissues are eventually grouped into organs.[See alsoCell; Organ] views updated Jun 11 2018A tissue is a collection of similar cells grouped to perform a common function. Different tissues are made of their own specialized cells that are adapted for a given function.All animal cells are basically similar. Each cell has a cell wall or plasma membrane that surrounds the cell and contains various receptors that interact with the outside area. A nucleus, Golgi apparatus, mitochondria, and other structures are contained in each cell. Beyond that, cells are specialized in structure for a given function.The study of tissues is called histology. Studying the structure of tissue is done by staining a thin specimen of the tissue and placing it under a microscope . An experienced histologist can look at a specimen and immediately determine from which organ it was taken. A histologist can also see and diagnose a disease if it is present in the tissue. The study of disease processes is called pathology .Tissues are divided by function into a number of categories. Muscle tissue, for example, makes up the muscles of the body. A muscle belongs to one of three categories-voluntary muscle which can be controlled for movement or lifting, involuntary muscle which is not under conscious control (such as the muscle tissue in the digestive organs), and cardiac muscle which forms the heart .Connective tissues compose the bones, tendons, and ligaments that make up the support of the body. The body also consists of adipose tissue or fat .Nervous tissue forms the brain , spinal cord, and the nerves that extend through the body. Digestive tissue is found in the digestive system including the stomach, intestines, liver, pancreas, and other organs involved in digestion. Vascular tissue comprises the blood-forming portion of the bone marrow and the blood cells themselves. Epithelial tissue forms sheets that cover or line other tissues. The skin and the lining of the stomach are both examples of epithelial tissue. Various reproductive tissues form the ovaries, testes and the resulting gametes (ova and sperm).Combined, these tissues form the human body and carry out its functions. views updated May 29 2018A tissue is a collection of similar cells grouped to perform a common function. Different tissues are made of their own specialized cells that are adapted for a given function.All animal cells are basically similar. Each cell has a cell wall or plasmamembrane that surrounds the cell and contains various receptors that interact with the outside area. A nucleus, Golgi apparatus, mitochondria, and other structures are contained in each cell. Beyond that, cells are specialized in structure for a given function.The study of tissues is called histology. Studying the structure of tissue is done by staining a thin specimen of the tissue and placing it under a microscope. An experienced histologist can look at a specimen and immediately determine from which organ it was taken. A histologist can also see and diagnose a disease if it is present in the tissue. The study of disease processes is called pathology.Tissues are divided by function into a number of categories. Muscle tissue, for example, makes up the muscles of the body. A muscle belongs to one of three categories-voluntary muscle which can be controlled for movement or lifting, involuntary muscle which is not under conscious control (such as the muscle tissue in the digestive organs), and cardiac muscle which forms the heart.Connective tissues compose the bones, tendons, and ligaments that make up the support of the body. The body also consists of adipose tissue or fat.Nervous tissue forms the brain, spinal cord, and the nerves that extend through the body. Digestive tissue is found in the digestive system including the stomach, intestines, liver, pancreas, and other organs involved in digestion. Vascular tissue comprises the blood-forming portion of the bone marrow and the blood cells themselves. Epithelial tissue forms sheets that cover or line other tissues. The skin and the lining of the stomach are both examples of epithelial tissue. Various reproductive tissues form the ovaries, testes and the resulting gametes (ova and sperm).Combined, these tissues form the human body and carry out its functions. views updated May 14 2018A tissue is made up of a group of cells that usually look similar to one another and come from the same region in a developing embryo. The group of cells that make up a tissue have physiological functions that work together in a coordinated way to support special functions. The special function ofa tissue is also influenced by the kind of material that surrounds the tissue and by communication among the cells of the tissue. Different kinds of tissue have different physical properties. Tissues may be hard (bone), soft (muscle), or even liquid (blood).In the structural organization of the body, tissues are located between the cell and organ levels of organization. Individual cells are a lower level of organization. Tissues are made up of many individual cells.

Groups of different kinds of tissues are organized together to form organs, which have special functions with characteristic shapes and functional properties.There are four kinds of tissues based on differences in their anatomy and function: epithelial tissue, connective tissue, muscle tissue, and nervous tissue. Epithelial tissue is made of layers of cells that are joined together and may cover the surface of the body (epidermis of the skin), line spaces in the body (lining of the abdominal cavity) and hollow structures (lining of blood vessels), or form glands (sweat glands). Connective tissue is usually made of cells and extracellular fibers that hold structures together (tendons), protect them (cartilage), store energy (fat), or produce blood.Muscular tissue is made of cells that are organized to shorten and produce force when they contract (smooth skeletal and cordine muscle). Nervous tissue is made of neurons and accessory cells. Neurons are the cells that carry information in the form of electric action potentials . Accessory cells protect and support the function of neurons.see also Blood; Connective Tissue; Epithelium; Muscle; Nervous Systems; Neuron; Organ; SkinMichael G. ScottBibliographyTortora, Gerard J., and Sandra R. Grabowski. Principles of Anatomy and Physiology. New York: John Wiley & Sons, Inc., 2000. views updated Jun 27 2018tissue / tisho/ n. 1. any of the distinct types of material of which animals or plants are made, consisting of specialized cells and their products: inflammation is a reaction of living tissue to infection or injury| (tissues) the organs and tissues of the body.2. tissue paper. a disposable piece of absorbent paper, used esp. as a handkerchief or for cleaning the skin. rich or fine material of a delicate or gauzy texture: [as adj.] the blue and silver tissue sari. 3. [in sing.] an intricate structure or network made from a number of connected items: such scandalous stories are a tissue of lies.DERIVATIVES: tissuey adj. (in sense 2). views updated May 17 2018tissue (singular): the term used to describe an aggregation of body cells with specialized structure and function (muscle, nerve, glandular, adipose, connective tissue and so on). Within each category there is usually more than one cell type usually the main cells with a special function, plus connective tissue cells. Tissues (plural) refers in general to the whole fabric of the body as in the statement the blood transports oxygen and nutrients to all body tissues, or sometimes to all organs and tissues, using the word to cover everything which is not a discrete organ. Stuart Judge views updated May 29 2018tissue (tis-yoo) n. a collection of cells specialized to perform a particular function. Aggregations of tissues constitute organs. t. culture the culture of living tissues, removed from the body, in a suitable medium supplied with nutrients and oxygen. t. typing determination of the HLA profiles of tissues (see HLA system) to assess their compatibility. It is the most important predictor of success or failure of a transplant operation. views updated May 29 2018tissue Material of a living body consisting of a group of similar and often interconnected cells, usually supporting a similar function. Tissues vary greatly in structure and complexity. In animals, they may be loosely classified according to function into epithelial, connective, skeletal, muscular, nervous, and glandular tissues. views updated May 29 2018tissue A group of cells of similar type working in a co-ordinated manner towards a common function. In plants, they are normally bound together by their cell walls. Some fluids are also considered to be tissues. views updated Jun 08 2018tissue A collection of cells of similar structure organized to carry out one or more particular functions. For example, in animals nervous tissue is specialized to perceive and transmit stimuli. An organ, such as a lung or kidney, contains many different types of tissues. Tissot, Alice (18951971) Tisserand, Franois Flix Tisma, Aleksandar 1924-2003 Tishman Speyer Properties, L.P. Tishchenko, Boris (Ivanovich) Tissue Banking and Transplantation, Ethical Issues in tissue-type plasminogen activator Titan Cement Company S.A. Titan International, Inc. Titanic Survivors Found in Bermuda Triangle Tissue n., plural: tissues [tu] Definition: aggregate of cells having the same structure and function What is tissue in the body? The body tissue is an aggregation of cells that function together and have a similar function. The cells of a multicellular organism do not usually function independently instead they are usually associated with other cells forming a tissue. Mostly, tissues are made up of several types of cells that cover different requirements of tissue function. The study of tissues is called histology. This science studies the anatomy of different tissues using microscopes. The microscopic biological science histology helped in the classification of tissues of both plant and animal tissue as well as identifying their detailed structure. When cells of an organism with similar functions and structures come together to form a group, this unit is called tissue. Get info straight from an Expert: Smooth muscle vs dense regular connective tissue. Join us now! Biology definition: A tissue is an aggregate of cells in an organism that have similar structure and function. Tissues that work in unison to carry out a specific set of functions form an organ. Examples of plant tissues are meristematic tissues and vascular tissues. Examples of animal tissues are epithelial tissues, connective tissues, muscular tissues, and nervous tissues. Etymology: Middle English tissu, a rich kind of cloth, from Old French, from past participle of tistre, to weave, from Latin texere. What are tissues? The definition of tissue in animals is a group of cells combined together to perform a certain function. There are four tissue types in animals, each type of tissue has its distinct structure and function.They are (1)epithelial tissues, (2) connective tissues, (3) muscular tissues, and (4) nervous tissues. Each of these tissues has its own unique structure and biological function. These different types of tissues are discussed below: Epithelial tissue Epithelial tissues (or epithelium) are the most abundant human tissues. They cover the whole surface of the body forming the epidermis layer of the skin. Moreover, it covers the lining of body organs forming mucus lining, such as the digestive system lining. Thus, they protect the organ from external factors, such as injury, pathogenic microorganisms, and loss of fluids. Epithelium contributes to the excretory process where glandular epithelial cells are incorporated in the synthesis and excretion of wastes. Epithelial tissues are also responsible for body secretions and absorption. They are responsible for the secretion of saliva, mucus, sweat, etc. so they form a considerable part of multicellular glands, such as the liver and pancreas. Other epithelial tissue covers the different body cavities to produce secretory lubricants. Epithelial tissue is either formed of a single layer of epithelial cells (called the simple epithelium) or formed of multiple layers of cells (called the stratified epithelium). Epithelial cells forming a single layer of epithelial tissue have three surfaces: (1) an apical surface, (2) a basal surface, and (3) a lateral surface. Each of these surfaces has a distinct function. The apical surface of epithelial cells is responsible for exchanging material passing in and out of the cell. The apical surface of epithelial cells of the inner lining of the small intestine contains microvilli that project into the small intestine whereas mucus-moving epithelial cells possess cilia projecting from the apical surface. On the contrary, the surface of the epidermis has no or minimal specialization at the apical surface since these cells are subjected to shedding and abrasion. The basal surfaceserves to connect the bottom layer of epithelial tissue to a basement membrane. Thebasement membraneis a thin non-cellular layer like a sheath. It covers theperipheral nervesandmusclesas well as underlying the epithelial tissue. The basement membrane is secreted by different cells. It consists of proteins, such aslamininandcollagen.Integrinsare proteins in theplasma membranesof epithelial cells that connect them to the basement membranes.In secreting and absorbing cells, the apical surface functions to increase the surface area. The lateral surface mediates the intracellular connections among epithelial cells. Epithelial cells are connected together forming the epithelial tissues through tight junctions near their apical ends; these junctions do not permit the passage of ions, water, and solutes in the intercellular spaces. Figure 1: The different types of epithelium Connective tissue How does connective tissue differ from the other three major tissue types? Connective tissues contain nonliving extracellular material more than living cells. Relatively few cells are found among connective tissues. They are embedded in the extracellular matrix. The cells are often far from each other except fat tissue cells where adipocytes are packed close to each other. The main function of connective tissue is to connect different cells and tissues with the aid of some molecules secreted from the connective tissue in the extracellular matrix forming fibrous tissues. Other functions are as follows: providing protection and support to soft tissues, transmit mechanical forces, and production of carbohydrates and proteins. Figure 2: Different connective tissues. Source: Public Domain. Classification of connective tissues In humans and other vertebrates, the connective tissues may be classified as follows: I. Connective tissue proper A. Dense connective tissue has more fibers than ground substance. Dense regular connective tissue characterized by collagen fibers that are arranged apparently in one direction, particularly, in a parallel fashion. For example, tendons and ligaments Dense irregular connective tissue characterized by collagen fibers that seem to be arranged in multiple directions. For example, connective tissues found in the lower layers of the skin (dermis) and in the protective white layer of the eyeball Join our discussion about tissues: Smooth muscle vs dense regular connective tissue. Wed be happy to hear your ideas! B. Loose connective tissue has more ground substance than fibers. II. Special connective tissue connective tissues that are not fibrous. Examples: reticular connective tissue, adipose tissue, cartilage, bone, and blood. Other references classify connective tissues differently; for instance, adipose tissue, a special connective tissue type, is classified as a loose connective tissue (under connective tissue proper). Connective tissue cells The cells of connective tissues vary depending on their structure and functions.Fibroblasts, for instance, are a type of connective tissue cells characterized by having abundantendoplasmic reticulumandGolgi apparatus. They produce and secrete fibers, such as collagen, reticular fibers, and elastic fibers. Thus, they are responsible for the maintenance of the extracellular matrix (especially during wound healing or tissue repair). They provide the structural framework for many tissues. During the embryonic stage, the mesenchymal cells differentiate into different types of connective tissues. Some differentiate into osteoblasts forming bones. Others differentiate into chondroblasts forming cartilages of the deep skull bones. What type of tissue is blood? Blood is one of the most important connective tissues in the body. It is mainly composed of blood cellsand plasma. The blood cells are white blood cells (leukocytes) and red blood cells (erythrocytes). The platelets (thrombocytes) are cellular fragments and so some references do not consider them as blood cells. All of the three types originate from the multipotent stem cells in the red bone marrow. The function of the white blood cells is for protection against infections and for removing cellular debris. The red blood cells carry oxygen throughout the body. The platelets are involved in blood clot formation. Connective tissue fibers The fibrous connective tissues are rich in non-cellular components, such as fibers. These fibers are of different types: collagen fiber, elastic fiber, and reticular fiber. The collagen fibers are made up of collagen. They are found in tendons and ligaments. They support the walls of internal organs. They also represent about one-third of the bone weight. Another type of connective tissue fiber is elastic fibers. They are made up largely of elastin. They are likened to rubber bands due to their elastic property. The elastic fibers can retain their original shape after deformation such as the dermis of the skin, large arteries, and lungs where these tissues containing elastic fibers can stretch and contract in response to different stimuli. The reticular fibers are fibers made up chiefly of type III collagen secreted by the reticular cells. These fibers are found in different parts of the body, such as the connective tissues supporting fats or lymphoid tissue. Ground substance The ground substance is made up chiefly of proteoglycans, glycosaminoglycans, glycoproteins, water, andions. They serve as space-fillers, absorb shocks, lubricate, and limit the movement of bacteria in connective tissues. Muscles are contractile tissues in the body. The muscular tissue is classified into three types: (1) skeletal muscles that are attached to the bones and help in the body movement, (2) smooth muscles that form the inner lining of blood vessels, and (3) cardiac muscles that form the heart. Figure 3: The three types of muscles diagram. OpenStax Biology- 3 types of muscle tissues (diagram), CC BY-SA 4.0. The skeletal muscles are responsible for the voluntary movement of the body. The smooth muscles are for involuntary movement, similar to cardiac muscles. However, the cardiac muscles are similar to skeletal muscles in having conspicuous striations when viewed under the microscope. The cardiac muscles also differ from the other two in having intercalated discs. READ: The Human Physiology Muscle The smooth muscles lack the striations when viewed under the microscope. They are made up of spindle-shaped narrow cells with a single, centrally-located nucleus. They lack the characteristic striations because their actin and myosin filaments are not organized in a manner similar to that of skeletal and cardiac muscular tissues. The arrangement of actin and myosin in the smooth muscle cells enables the smooth muscles to contract for a longer time than skeletal muscles with less energy. Therefore, smooth muscles have the ability to maintain the tone of vessels or the uterine contraction during birth. Smooth muscles line the walls of the body tubes such as the digestive system because they are responsible for the movement of material through these tubes. Watch the smooth muscle contraction below. Smooth muscles as well as the cardiac muscles contract involuntarily, meaning they are not controlled by the conscious demand of an individual. In contrast, skeletal muscles are voluntary muscles that follow conscious control. How does connective tissue differ from muscle tissue? Get the answer here: Smooth muscle vs dense regular connective tissue. Join our Forum now! Skeletal muscle tissue Skeletal muscles are multinucleated tissues of fused cells. The muscle cells are fused together forming myotubes. The nuclei of myotubes are large and elongated with a large nucleolus. Skeletal muscle tissues produce great amounts of proteins and RNA. RNA and proteins stimulate the muscle to contract after proteins organize in arrays called sarcomeres. Watch the video below to see how the skeletal muscle contracts. Skeletal muscles secrete a basal lamina that surrounds the muscle. The basal lamina helps in the transmission of muscle contraction to the surrounding tissues. Satellite cells are located between the basal lamina and the fiber of the muscle. Satellite cells help in the development and regeneration of muscle fibers. There are two main types of skeletal muscle tissues: fast and slow muscles. They are classified according to their oxygen consumption while contracting. Fast muscles are thicker, stronger, and contract for less period than slow muscles. Cardiac muscle tissue Cardiac muscles are striated muscles. They contact like skeletal muscles; however, they are involuntary muscles. Another difference between skeletal and cardiac muscles is that cardiac muscles contain only one nucleus in contrast to multinucleated skeletal muscles. Cardiac muscles are rich in blood vessels and mitochondria since they need active metabolism to support their continuous contraction. Unlike skeletal muscles, cardiac muscles must contract at the same time to pump the blood from the heart. This effect is achieved by the presence of junctions between cardiac muscles; these junctions link each muscle to the next one so it helps in signal transmission through the entire heart. Cardiomyocytes (cardiac muscles) do not contain satellite cells as in skeletal muscles; therefore, cardiac muscles do not divide or differentiate. Instead, they grow by increasing their size only. READ: Heart Anatomy Biology Online Tutorials Nervous tissue Nervous tissues are tissues that form the central nervous system and the peripheral nervous system. Nervous cell tissue forms the brain and the spinal cord in the central nervous system whereas in the peripheral nervous system, they form sensory, motor, and autonomic nerves. Nervous tissue is formed of large cells called neurons; they have a long body that may reach up to a meter. Neurons have cell processes, dendrites or axons. These cell processes carry signals across different neurons from the cell body to the nerve terminal. In particular, the dendrites carry signals from the periphery to the cell body. The cell body contains numerous organelles that serve its function including ribosomes, cytoplasm, and Golgi apparatus. The axons, on the other hand, contain a large amount of cytoplasm in comparison to the cell body. They also contain microfilaments and microtubules that transport signals and support the cell. Figure 4: The different parts of a neuron Each axon is branched into regions known as the presynaptic terminals. At presynaptic terminals, the electrical impulse is converted into chemical neurotransmitters that send signals to the following neuron or muscle cell in the chain. Neurotransmitters are stored in pockets and released as a result of the change in the cell membrane permeability when the electrical signal reaches the synapse.Neurotransmitters are released to bind to their receptor on the next cell continuing the transmission of a nerve impulse until it reaches the target tissue. Nervous tissue function is to transmit nerve impulses across different nerve cells in order to control all voluntary and involuntary actions in the body. What is tissue in plant biology? We already know that biological tissue is made up of a number of cells performing a specific function. In plants, tissues are similarly made up of cells that perform a particular function. Below are some of the examples of plant tissues that perform a particular function. For example, the plant epidermis is the tissue that renders protection. The ground tissues are the tissues consisting of fundamental plant cells that perform a distinct function. The vascular tissues are the plant tissues involved in the transport of nutrients throughout the plant body. Lets take a closer look at them below. Plant epidermal tissue The plant epidermal tissue (epidermis) is the most outer protective tissue of the plant. It covers the surface of the plant protecting the inner layers from the outer environment. It is covered by a layer of cuticle that makes the epidermis impermeable to water and therefore helps prevent water loss. Figure 5: The upper and lower epidermis of a plant leaf. Credit: Zephyris CC BY-SA 3.0 Figure 6: The cuticle on the leaf surface makes it impermeable to water. The epidermis of the plant protects it from the ultraviolet radiation of the sun. However, it permits the exchange of gases between the outer environment and the plant via the stomata. The stomata of epidermal tissue are composed of two guard cells. Together, they form the stomatal pore. The inner walls of guard cells are thicker than their outer walls. The guard cells are kidney-shaped. They are attached to each other at their ends with microfibrils of cellulose surrounding them. Guard cells expand when they absorb water, but due to the presence of cellulose microfibrils, they expand longitudinally instead of widely to create a pore that permits the exchange of gases. Figure 7: Specialized cells, called guard cells, create an opening called a stoma (plural: stomata). The stomata are where gases, e.g. carbon dioxide and oxygen, are exchanged between the plant and its environment. Epidermal cells may have extensions called trichomes. Trichomes function to protect the plant from herbivores and insects by secreting toxins or blocking access to the surface of the plant. Unlike the shoot epidermis, the root epidermis permits the passage of water from the soil to the plant. It is covered by a thinner cuticle that contains shorter waxes. Roots outgrow forming root hairs; these hairs increase the absorbing area of the root (increased intake of water and nutrients). The root epidermis usually produces a hydrophilic carbohydrate that traps water to facilitate its absorption from the soil and to lubricate the area through which the root passes. Ground tissue Ground tissues represent all tissues that form the plant which is not epidermal or vascular tissues. Ground tissues are divided into three fundamental plant cell types: parenchyma, collenchyma, and sclerenchyma according to the structure of their cell wall. The parenchyma cells have a thin wall. They occupy most of the cortex, which is the area between other layers, epidermal, vascular, and pith. Parenchyma stores proteins, starch, and oils in the plant. They also contribute to the growth, development, and support of the plant. The collenchyma cells are similar to parenchymal cells in having a primary cell wall. The cell wall materials are deposited in the edges of the cell forming collenchyma. Collenchyma cells contribute to the elongation of plant stems. However, they only provide support when the plant is turgid because their cell walls lack hydrophilic substances. The sclerenchyma cells have thick walls containing lignin. This structure makes sclerenchyma waterproof and strong. The sclerenchyma provides support to the plant more than parenchyma and collenchyma. However, it is more difficult to make thus it is not as abundant as other types of ground tissue. Owing to their rigidity, sclerenchyma may be incorporated in the structure of vessel tissues, it forms the tracheids and vessels in the xylem. Figure 8: Different types of plant tissues. Credit: Kelvinsong diagram, CC BY 3.0. Vascular tissue The vascular tissues of the plant represent the main system responsible for transportation in the plant, it is composed of xylem and phloem. Vascular tissue is present in all parts of the plant in the form of vascular bundles, stems, leaves, and traversing roots. The xylem transports different materials such as water and ions from roots to leaves and stems of the plant. The phloem transports metabolites, such as amino acids, sugars, and ions produced by the plant from the site of production in leaves to different areas like roots, fruits, and leaves. The phloem is mainly made up of companion cells, phloem parenchyma cells, sieve tubes, and phloem fibers. Sieve plates separate sieve tubes, these tubes have pores termed as sieve pores. Even though sieve elements lack nuclei, they are living cells containing plasmalemma and proteins. Companion cells surround sieve elements. They contain large nuclei, vacuoles, and dense cytoplasm. Companion cells function to transport metabolites in and out of sieve elements. The xylem consists of xylem vessels, tracheids, xylem parenchymal cells, and xylem fibers. Large plates join vessels together leaving gaps between vessels, while the ends of tracheids overlap with the following cells with no gaps in between. Lignin is distributed in different forms in vessels such as helical, reticulate, annular, scalariform, and pitted. It can be transported either longitudinally or laterally through pores or pits of plates. In plants, the different types of tissues are: (1) Embryonic or meristematic tissues (e.g. apical meristem and cambium) (2) Permanent tissues (e.g. epidermis, cork, trichome) Fundamental (e.g. parenchyma, collenchyma, sclerenchyma) Complex (e.g. phloem and xylem tissues) (3) Reproductive tissues (i.e. sporogenous tissues). Tissue Engineering Tissue engineering is a method of producing tissues outside the body, it combines biological and engineering to repair or create new tissues. This science can affect the medical field greatly by enhancing recovery of damaged tissues due to burns, trauma, or diseases by creating an artificial graft of tissues. Even though this approach seems promising, however, it faces some difficulties such as creating artificial nutritional blood vessels and supplying tissues with circulating blood. Other challenges include manufacturing and using bioreactors to create tissues using the exact right amount of nutrients, enzymes, and cellular components. Cell differentiation in culture might not be controlled so the produced tissue will be hypertrophied and may contain more than one nucleus per cell leading to the formation of a deformed tissue. Therefore, tissue engineering is an emerging promising science that implies the importance and impact of tissue culturing in the field of medicine. Try to answer the quiz below to check what you have learned so far about tissues. Bruce M. Carlson (2019). Tissues. The Human Body (pp 27-63). Academic Press. . Enderle, J. (2012). Introduction to biomedical engineering. Academic press. Fry, S. C. (2017). Cell walls. Encyclopedia of Applied Plant Sciences,, 1, 161-173. Lopez, F. B., & Barclay, G. F. (2017). Plant anatomy and physiology. In Pharmacognosy (pp. 45-60). Academic Press. BiologyOnline.com. Content provided and moderated by Biology Online Editors. Tissues are groups of cells that have a similar structure and act together to perform a specific function. The word tissue comes from a form of an old French verb meaning to weave. There are four different types of tissues in animals: connective, muscle, nervous, and epithelial. In plants, tissues are divided into three types: vascular, ground, and epidermal. Groups of tissues make up organs in the body such as the brain and heart. Connective tissue connects or separates groups of other tissues. It is found in between all the other tissues and organs in the body. Connective tissue is made up of cells and ground substance, which is a gel that surrounds cells. Most connective tissue, except for lymph and blood, also contains fibers, which are long, narrow proteins. Fibers can be collagenous, which bind bones to tissues; elastic, which allow organs like the lungs to move; or reticular, which provide physical support to cells. Connective tissue also allows oxygen to diffuse from blood vessels into cells. About 1 in 10 people are have a disorder involving connective tissue. Some connective tissue disorders include sarcomas, Marfan syndrome, lupus, and scurvy, which is a Vitamin C deficiency that leads to fragile connective tissue. Muscle tissue comprises all the muscles in the body, and the specialized nature of the tissue is what allows muscles to contract. There are three types of muscle tissue: skeletal muscle, cardiac muscle, and smooth muscle. Skeletal muscle anchors tendons to bones and allows the body to move. Cardiac muscle is found in the heart and contracts to pump blood. Smooth muscle is found in the intestines, where it helps move food through the digestive tract, and it is also found in other organs like blood vessels, the uterus, and the bladder. Skeletal and cardiac muscles are striated; this means that they contain sarcomeres (a unit of muscle tissue) that are arranged in a uniform pattern. Smooth muscle does not have sarcomeres.Duchenne muscular dystrophy is an example of a muscle tissue disorder. It is an inherited disorder that causes muscles to atrophy over time. The muscles shorten as they atrophy, which can cause scoliosis and immobile joints. Individuals with the disorder are usually male because the gene responsible for it is found on the X chromosome (of which males have only one). Nervous tissue is found in the brain, spinal cord, and peripheral nerves, which are all parts of the nervous system. It is made up of neurons, which are nerve cells, and neuroglia, which are cells that help nerve impulses travel. Nervous tissue is grouped into four types: gray matter and white matter in the brain, and nerves and ganglia in the peripheral nervous system. The main difference between gray and white matter is that axons of the neurons in gray matter are unmyelinated, while white matter is myelinated. Myelin is a white, fatty substance that insulates neurons and is crucial for nervous system functioning.The symptoms of Alzheimers disease, such as memory loss, mood swings, and confusion, are caused by the breakdown of nervous tissue. Amyotrophic Lateral Sclerosis (ALS) is another disease that causes nervous tissue to degenerate, which leads to the loss of higher brain functions over time. Other nervous tissue disorders include multiple sclerosis, where the immune system attacks and destroys nervous tissue, Huntingtons disease, where an abnormal protein causes neuron death, and Parkinsons disease, where the part of the brain that controls movement is impaired because not enough dopamine is produced.This image is a microscopic view of nervous tissue. It is a cross-section of a peripheral nerve. Epithelial tissue, or epithelium, covers the surfaces of organs including the skin, the trachea, the reproductive tract, and the digestive tracts inner lining. It creates a barrier that helps protect organs, and it also has roles in absorbing water and nutrients, getting rid of waste, and secreting enzymes or hormones. All of the bodys glands are formed from ingrowths of epithelium. Some common epithelial tissue diseases are skin diseases like eczema and psoriasis, which both cause rashes. When cancer develops from epithelial tissue, it is called a carcinoma. Epithelial cells in the airways are also responsible for asthma, which is characterized by inflammation of the airways that leads to shortness of breath. Vascular tissues in plants transport substances throughout the different parts of the plant. The two types of vascular tissue are xylem and phloem. Xylem transports water and some soluble nutrients, while phloem transports organic compounds the plant uses as food, particularly sucrose. Vascular tissues are long and thin, and form cylinders that nutrients are transported through like pipes. Vascular tissue is also involved with two types of meristems, which are tissues that contain undifferentiated cells that are used during a plants growth. The meristems accompanying vascular tissue are the cork cambium and the vascular cambium. These meristems are associated with the growth of the plants vascular tissues. Ground tissue is made up of all cells that are not vascular or dermal (having to do with the epidermis; see below). There are three types of ground tissue: parenchyma, collenchyma, and sclerenchyma. Parenchyma cells form the filler tissue in plants, and perform many functions like photosynthesis, storage of starch, fats, oils, proteins, and water, and repairing damaged tissue. Collenchyma tissue is made up of long cells with irregularly thick walls that provide structural support to the plant. Plants that grow in windy areas have thicker walls of collenchyma tissue. Sclerenchyma is also supporting tissue, but it is made of dead cells. There are two types of sclerenchyma: fibers and sclereids. Fibers are long, slender cells, while sclereids are star-shaped with thick cell walls. Sclerenchyma fibers make up fabrics such as hemp and flax. The epidermis is made up of a single layer of cells that covers a plants roots, stems, leaves, and flowers. (Epidermis is also the word for skin in human anatomy.) It guards the plant against water loss, regulates the exchange of carbon dioxide and oxygen, and in roots, it absorbs water and nutrients from the soil. The epidermis on a plants stems and leaves have pores called stomata, which carbon dioxide, water vapor, and oxygen diffuse through. Epidermal cells are themselves covered by the plant cuticle, which contains mainly cutin, a waxy substance that protects against water loss. Plants in deserts and other arid regions often have thick cuticles to help conserve water. Cell the basic biological unit of living things; groups of them form tissues.Organ a self-contained group of tissues that performs a specific function in the body.Sarcomere a unit of striated muscle tissue that contains the filaments actin and myosin.Meristem a region of undifferentiated plant tissue found at the site of new plant growth at the tips of roots and offshoots of stems. 1. Which is NOT a type of plant tissue?A. GroundB. ConnectiveC. EpidermalD. VascularB is correct. Ground tissue, epidermal tissue, and vascular tissue are the three general types of tissues found in plants. Connective tissue is a type of animal tissue that connects or separates other tissues, and it also includes lymph and blood.2. Alzheimers disease is associated with the breakdown of what type of tissue?A. ConnectiveB. MuscleC. NervousD. EpithelialC is correct. Individuals with Alzheimers disease suffer from a breakdown of nervous tissue, which is the tissue found in the brain and spinal cord. When this tissue breaks down, it causes memory lapses, mood swings, and confusion, among other symptoms.3. What is a function of epithelial tissue?A. To cover the surface of organs and protect themB. To cover the parts of a plant and guard it against water lossC. To transport nutrients throughout a plantD. To allow the body to moveA is correct. Epithelial tissue covers the surfaces of organs in animals and protects them from damage. Choices B, C, and D represent epidermal, vascular, and muscle tissues, respectively. In simple terms, tissue can be defined as a group of cells with similar shape and function are termed as tissues. They form a cellular organizational level, intermediate between the cells and organ system. Organs are then created by combining the functional groups of tissues. Let us learn in detail about thetypes of tissues in different organs.The study of tissue is known as histology and study of disease-related to tissue is known as histopathology. The standard tools for studying tissues is by embedding and sectioning using the paraffin block.Types of Animal TissuesAnimal tissues are grouped into four types:Connective TissueMuscle TissueNervous TissueEpithelial TissueThe collection of tissues are joined in structural units to serve a standard function of organs. The primary purpose of these four types of tissue differs depending on the type of organism.For example, the origin of the cells comprising a particular tissue type also differs.Connective TissuesThey are the group oftissues made up of cells separated by non-living material, called as an extracellular matrix. This tissue provides shape to the different organs and maintains their positions. For example, blood, bone, tendon, adipose, ligament and areolar tissues. There are three types of connective tissue:Fluid Connective Tissue.Fibrous Conctive Tissue.Skeletal Connective Tissue.Functions of Connective TissueThe connective tissue functions by providing shape and maintains the position of different organs in the body. It functions as the primary supporting tissue of the body. Other important and the major functions of connective tissue in the body are:Insulating.Helps in binding the organs together and provides support.It protects against the invasions of pathogens by their phagocytic activity.Provides shape to the body, conserves body heat and also stores energy.It is involved in the transportation of water, nutrients, minerals, hormones, gases, wastes, and other substances within the body.Also refer to Blood The Fluid Connective Tissue.Muscle TissueThey are involved inproducing force and generating motion, either for the locomotion or for other body movements within internal organs. There are three types of muscle tissue:Skeletal Muscle theyare typically attached to bonesCardiac Muscle found in the heart.Visceral or Smooth Muscle they are found in the inner walls of organs.Functions of Muscle TissueMuscle tissues are associated with their movements including walking, running, lifting, chewing, picking and dropping objects, etc. The other major functions of muscle tissue in the body are:Helps in maintaining an erect position, or posture.Helps in the constriction of organs and blood vessels.Involved in both voluntary and involuntary movements.Involved in pumping blood and regulating the flow of blood in arteries.Controls respiration by automatically driving the movement of air both into and out of our body.Also Read:Muscular Tissue.Nervous TissueThey are the main tissue components of the brain and spinal cord in the central nervous system. While, in the peripheral nervous system, the neural tissue forms the cranial nerves and spinal nerves.Functions of Nervous TissueThe nervous tissue forms the communication network of the nervous system and is important for information processing. The other major functions of nervous tissue in the body are:Response to stimuli.Stimulates and transmits information within the body.Plays a major role in emotions, memory, and reasoning.Maintains stability and creates an awareness of the environment.Nervous tissue is involved in controlling and coordinating many metabolic activities.Also Refer:Central nervous system. Epithelial TissueThey areformed by cells which cover the external parts of the body organs and lines the organ surfaces such as the surface of the skin, the reproductive tract, the airways, and the inner lining of the digestive tract.Functions of Epithelial TissueThis tissue performs a wide variety of functions including:Play a major role in sensory reception, excretion, filtration and other metabolic activities.Provide mechanical strength and resistance to the underlying cells and tissue.It is involved in the movement of materials through the process of filtration, diffusion and secretion.Protects the internal organs against the invasions of pathogens, toxins, physical trauma, radiation, etc.Epithelial tissues are also involved in secreting hormones, enzymes, mucus and other products from ducts and transporting it to the circulatory system.Also Refer :Epithelial Tissue & Connective Tissue.Types ofPlant TissuesThe classification of plant tissues are mainly based on the two important criteria:Based on the different part of plants.Based on the different types of cells.Plant Tissuesare broadly categorized into three tissue systems. This classification ison the basis of parts of the plants they are present.Epidermis Tissues cellsformed from the outermost surface of the leaves.Vascular Tissues involved intransporting fluid and nutrients internally.Ground Tissue involved inproducing nutrients by photosynthesis and preserve nutrients.Plant tissue is divided into two types. This classification ison the basis of the types of cells, they comprise.Meristematic tissues.Permanent tissues.Also, read Parts Of Plants.Meristematic TissueThey are the group of young cells, which consists of continually dividing cells and helps in the increase of length and width of the plant. There are different types of meristematic tissues, which are classifiedon the basis ofpositions,functions, plane of divisions,origin and development. The three main types of meristematic tissues depending on the occurrence of the meristematic tissue on the plant body are:Apical Meristem.Lateral Meristem.Intercalary Meristem.Functions of Meristematic TissueIt is responsible for the growth of the new organs.Involved in the movement of water and nutrition within the plants.These tissues are responsible for both primary and secondary growth of the plant.It is the outermost tissue, functions by providing protection from mechanical injury.It gives rise to epidermis layer, cortex, endodermis, ground tissue and vascular tissue.Explore more aboutMeristematic tissue.Permanent TissuesA group of cells which are similar in origin, structure and in function. They are involved in complete growth and differentiation during the ineffective of meristematic activity.There are three types of permanent tissues:Simple Permanent Tissues.Complex Permanent Tissues.Special or Secretory Tissues.Functions of Permanent TissuesIn aquatic plants, these tissues help in floating.Stores food in the form of starch, proteins, oils and fats.They provide hardness to fruits such as nuts, coconut, almond etc.These tissues contain chloroplast which helps in carrying out photosynthesis.Permanent Tissues are also involved in the Secretion, Transportation, and provides mechanical support to the plants.Explore more about Permanent Tissues.Stay tuned with BYJUS to learn more about the tissue, its types, functions and other related topics @ BYJUS Biology

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