Plant structure anatomy worksheet answers

While individual plants are unique, they all share the same structure: the stem consists of stems, roots and leaves. They all transport water, minerals and sugar produced through photothesy through the plant body in a similar way. All plants also respond to environmental factors, such as light, gravity, competition, temperature, and pre-feeding. Learning Objectives Discussing the features of plant cells Identify different types of tissues and system of bodies in plants Describing the primary function and basic structure of the trunk Determining the structure and function of a typical leaf Defining two types of Root System Figure 1. Part of the workpiece. Why do plant cells look like small rectangular? Look at Figure 1 and notice how all the cells seem to stack, with no space in between. Could this allow cells to form structures that can grow vertically? Internal organs in plants? Your body consists of system of bodies, such as the digestive system, made of individual bodies, such as the stomach, liver, and pancreas, which work together to perform a certain function (in this case, breaking down and absorbing food). These bodies, in turn, are made of different types of tissue, which are cell groups that work together to perform a specific job. For example, your stomach is made of muscle tissue to facilitate movement and glandular tissue to secrete enzymes for the chemical decomposition of food molecules. These tissues, in turn, are made of cells that specialize in shape, size, and cellular composition, such as mitochond bodies for energy and microtubules for movement. Plants are also made of bodies, which are therefore made of tissues. Plant tissues, like ours, are built with specialized cells, which therefore contain specific macrosing cells. It is these cells, tissues and bodies that carry out impressive life of plants. Plant cells Plant cells Plant cells are like other standard cells in many ways. For example, they are enveloped by a plasma membrane and have a nucleus and related cells associated with another membrane. A typical plant cell is represented by the diagram in Figure 2. Chart 2. Plant cells have all the same structures as animal cells, plus some additional structures. Can you identify unique plant structures in the diagram? Structural plant cell structures are found in plant cells but not animal cells consisting of a large central vacuole, cellular formations, and plastids such as ousos. The large central vacuole is surrounded by its own membrane and contains water and soluble substances. Its main role is to maintain pressure against the inside of the cellular body, create cellular shapes and help support the plant. The cellular body is located outside the cell membrane. It consists mainly of cellulose and may contain lignin, making it more rigid. The cellular formation shapes, supports, and protects the cells. It prevents cells from absorbing too much and boom. It also keeps large molecules, damaging out of the cell. Plastids are related cells that connect cell membranes to their own DNA. Examples are utoplasts and chromoplasts. Chlorochlorochlorochlorochlorochlorography green pigment and performs photothesy. Chromoplasts make and store other pigments. They give petals their bright colors. Plant cell types There are three basic types of cells in most plants. These cells make up ground tissue, which will be discussed in a different concept. The three types of cells described in the table below. Different types of plant cells have different structures and functions. Type of cell structure function For example loose parenchymal blocks packed thin walls relatively non-dedicated containing cell photosynthetic chloroplasts store food storage tissues of Collenchymal potatoes stretching walls thickening unevenly supporting wind-resistant wires running through a celery trunk Very thick Sclerenchymal cell walls containing lignin support tough fiber strength in Hem (used to make ropes) Plant tissue plants are multi-celled standard organisms with tissue systems made of different types of cells that perform specific functions. The plant tissue system falls into one of two common types: meristematic tissue and permanent (or non-meristematic) tissue. Cells of meristematic tissue are found in meristems, which are plant areas of continuous cell division and growth. The meristematic tissue cells are either indomatic or incompletely distinguished, and they continue to divide and contribute to the growth of the plant. In contrast, permanent tissue consisting of plant cells is no longer actively divided. Meristematic tissues consist of three types, based on their location in the plant. Apical meristems contain meristematic tissue located at the top of the trunk and roots, allowing a plant to extend in length. Lateral meristems facilitate growth in thickness or circafeerencies in an adult plant. Intercalary meristems occur only in monocots, at the base of the leaf blade and at the nodes (areas where the leaves are attached to a stem). This tissue allows the monocot leaf blade to increase in length from the base of the leaf; for example, it allows the leaves of grass to last even after repeated cutting. Meristems produce cells that quickly differentiate, or specialize, and become permanent tissue. Such cells take on specific roles and lose the ability to divide further. They distinguish into three main types: skin tissue, blood vessels and ground tissue. Skin tissue covers and protects the plant, and vascular tissue transports water, minerals and sugar to different parts of the plant. Ground tissue serves as a site for photothesy, provides a support matrix for vascular tissues, and helps store water and sugar. Chart 3. This light micrograph shows a cross-section of a squash (Curcurbita Each bundle of tear-shaped blood vessels consists of large xylem vessels on the inner side and smaller phloem cells on the outer side. Xylem cells, which transport water and nutrients from the roots to the rest of the plant, died as functional adults. Phloem cells, transporting sugar and other organic compounds from multi-synthetic tissue to the rest of the plant, are living. The vascular bundles are wrapped in ground tissue and surrounded by skin tissue. (credit: job modifications (biophotos)/Flickr; scale-bar data from Matt Russell) Simple or acute tissues (including similar cell types) or complex (including different cell types). Skin tissue, for example, is a simple tissue that covers the outer surface of the plant and controls gas exchange. Vascular tissue is an example of a complex tissue, and is made of two specialized electrically led tissues: xylem and phloem. Xylem tissue transports water and nutrients from the roots to different parts of the plant, and consists of three different cell types: vascular and airtillary elements (both lead water) and xylem striate. Phloem tissue, transporting organic compounds from the place of photothesy to other parts of the plant, consists of four different types of cells: sieve cells (conducting photothesy), companion cells, phloem mesothem and phloem fibers. Unlike cells that conduct xylem, cells conduct phloem alive as adults. Xylem and phloem are always next to each other (Figure 3). In the trunk, xylem and phloem form a structure called a bundle of blood vessels; in the roots, this is called a vascular or vascular cylindrical ststone. All animals are made of four types of tissue: epidermis, muscles, nerves, and connective tissues. Plants, too, are built of tissues, but not surprisingly, their very different lifestyles come from different types of tissues. All three types of plant cells are found in most plant tissues. The three main types of plant tissue are skin, ground and vascular tissues. Skin tissue Skin tissue of the trunk consists mainly of the epidermis, a single cell layer that covers and protects the tissues below. Trees have a tough, waterproof outer layer of cork cells commonly known as bark, which further protects the tree from damage. The epidermal cells are the most and least distinguished of the cells in the epidermis. The epidermis of the leaf also contains holes called stomata, through which gas exchange takes place (Figure 4). Two cells, called protective cells, surround each leaf stoma, controlling its opening and closing and thus regulating the absorption of carbon dioxide and the release of oxygen and steam. Trichomes are hair-like structures on the epidermal surface. They help reduce transpiration(dehydration by plant parts on the ground), increase solar energy and store leaf protection compounds against herbivores. Chart 4. Holes called stomata (singly: stoma) allow a plant to lose carbon dioxide and release oxygen and steam. The (a) color scan-electron micrograph shows a closed stoma of a dicot. Each stoma is side by two protective cells that regulate (b) its opening and closing. Protective cells (c) located in the epidermal cell layer (credit a: work modification by Louisa Howard, Rippel Electron Microscope Facility, Dartmouth College; credit b: revision of the work of June Kwak, University of Maryland; weight bar data from Matt Russell) Xylem and phloem vascular tissue that make up the vascular tissue of the trunk are arranged into separate strands called vascular bundles , running up and down the length of the trunk. When the trunk is seen in the cross section, the vascular bundles of the dicot trunk are arranged in one ring. In plants where the stems live for more than a year, individual bundles grow together and produce characteristic growth rings. In the monocot body, bundles of blood vessels are randomly scattered throughout the ground tissues (Figure 5). Chart 5. In (a) dicot trunks, bundles of blood vessels are arranged around the peripherals of ground tissue. The xylem tissue is located on the inner side of the vascular bundle, and the phloem is located on the outer side. Sclerenchyma fibers cap the vascular bundles. In (b) the monocot body, vascular bundles consisting of xylem and phloem tissues are scattered throughout the ground tissues. Xylem tissue has three types of cells: xylem mesocosis, stular and vascular elements. The second two were watery and died in adulthood. Tracheids are xylem cells with thick acute cellular formations that are lignified. Water moves from one quadwater to another through the area on the side walls known as pits, where the second walls are absent. Vascular elements are xylem cells with thinner walls; they are shorter than the air conditioning. Each ship element is connected to the next element by a puncture plate at the end walls of the element. Water moves through the puncture plates to go up the tree. Phloem tissue consists of sieve tube cells, companion cells, phloem syringes, and phloem fibers. A variety of sieve tube cells (also known as sieve tube elements) are arranged from start to finish to form a long sieve tube, transporting organic substances such as sugars and amino acids. The type of sugar that flows from one sieve tube cell to the next through the perforated sieve plate, is found at the end junction between the two cells. Although still alive as adults, the nucleus and other cellular components of the sieve tube cells have disintegrated. Companion cells are found together with sieve tube cells, which give them metabolic support. Companion cells contain more ribosomes and mitochond bodies than sieve tube cells, lack of some cellular cells. Ground tissue Ground tissue is mainly made up of cells of the mesenchyma, but may also contain collenchyma and sclerenchyma cells that help support the trunk. The ground tissues for the interior of vascular tissue in the trunk or roots are called piths, while the tissue layer between the vascular tissue and the epidermis is called the cortex. Plant organs Like animals, plants contain cells with organ cells in which specific metabolic activities take place. However, unlike animals, plants use energy from sunlight to form sugars during photothesy. In addition, plant cells have cellular formations, plastids, and a large central vacuole: structures not found in animal cells. Each cellular structure plays a specific role in plant structure and function. See Botany Without Borders, a video produced by the American Botany Society about the importance of plants. In plants, just like in animals, similar cells work together to form a tissue. When different types of tissues work together to perform a unique function, they form an agency; agencies work together to form agency systems. Vascular plants have two separate agency systems: a firing system, and a root system. The shooting system consists of two parts: plant parts (non- reproduction) of plants, such as leaves and stems, and relatives of plants, including flowers and fruits. The shooting system usually grows on the ground, where it absorbs the light needed for photosyntheses. The root system, which supports plants and absorbs water and minerals, is usually underground. Figure 6 shows the agency systems of a typical plant. Chart 6. The plant's firing system includes leaves, stems, flowers and fruits. The root system anchors the plant while absorbing water and minerals from the soil. Trunk Figure 7. The leaves are attached to the trunk at areas known as nodes. Internode is the body area between two nodes. The stem is the stalk that connects the leaves to the stems. The leaves just above the nodes arise from axillary buds. The trunk is part of the firing system of a plant. They can be from several millimeters in length to hundreds of meters, and also vary in diameter, depending on the type of plant. Stems are usually above ground, although the stems of some plants, such as potatoes, also grow underground. The stems can be herb (soft) or woody in nature. Their main function is to provide support to plants, keep leaves, flowers and buds; in some cases, the trunk also stores food for the plant. A trunk may not suffer from branches, like that of a palm tree, or it can be branched high, like that of an magnolia tree. The stem connects the roots to the leaves, helping to transport absorbed water and minerals to different parts of the plant. It also helps transport photothesy products, namely sugars, leaves for the rest of the plant. Trunks, whether above or below ground, are characterized by the presence of nodes and internodes (Figure 7). The nodes are attachment points for leaves, air roots and flowers. The body area between the two nodes is called internode. The stalk extends from the stem to the base of the leaf stalk. An axillary bud is usually found in the armpit- the area between the base of the leaf and the stem - where it can produce a branch or a flower. The top (head) of the photo contains the vertex meristem in the vertex bud. Stem Anatomy Figure 8. The common trunk st. John's Wort (Hypericum perforatum) is shown in cross-section in this light micrograph. (credit: Rolf-Dieter Mueller) Stems and other plant bodies arise from ground tissue, and are mainly made up of simple tissues formed from three types of cells: asymenchyma, collenchyma and sclerenchyma cells. Asymo connective cells are the most common plant cells (Figure 8). They are found in the stems, roots, inside leaves, and pulp of fruits. Cellular tissue is responsible for metabolic functions, such as photosynthesestheses, and they help repair and heal wounds. Some cells also store starch. In Figure 8, we see the central pith (green, in the middle) and the peripheral cortex (narrow area of 3-5 thick cells just inside the epidermis); both include meninger cells. Vascular tissue consists of xylem (red) and phloem tissue (green, between xylem and cortex) that surrounds the pith. Collenchyma cells are stretched cells with uneven thick walls (Figure 9). They provide structural support, mainly stems and leaves. These cells are alive as adults and are often found beneath the epidermis. The wires of the celery stalk are an example of collenchyma cells. Chart 9. Collenchyma cell formations have an uneven thickness, as seen in this light micro machine. They provide support for plant structures. (credit: revised work by Carl Szczerski; scale-bar data from Matt Russell) Sclerenchyma cells also provide support for the plant, but unlike collenchyma cells, many of them died as adults. There are two types of sclerenchyma cells: fibers and sclereids. Both types have layered cells that are thickened with deposits of lignin, an organic compound that is an important component of wood. Fibers are long, slender cells; sclereids are smaller in size. Sclereids give pears their gritty texture. People use sclerenchyma fibers to make linen and rope (Figure 10). Chart 10. The central pith and the outer cortex of the linen body (a) are made up of cells of the mesothem. Inside the cortex is a layer of sclerenchyma cells, which make up the fibers in linen and clothing. Humans have been planting and harvesting flax for thousands of years. In (b) this drawing, 14th century women prepare linen. Linen (c) is grown and harvested for its fibers, used for weaving linen, and for its seeds, which are the source of flaxseed oil. (credit a: revised work by Emmanuel Boutet based on original work by Ryan R. MacKenzie; credit c: revised work by Brian Dearth; scale-bar data from Matt Russell) What layers of stems are made of systular cells? cortex and pith phloem sclerenchyma xylem Stem Modifications Some plant species have modified stems specifically in accordance with a specific habitat and environment (Figure 11). The rhizome is a modified trunk that grows horizontally underground and has nodes and internodes. Vertical shoots can arise from buds on the rhizomes of some plants, such as ginger and ferns. Corms are similar to rhizomes, except that they are more rounded and more fleshy (such as in gladiolus). Corms contain stored food that allows some plants to survive in winter. Stolons are trunks that run almost parallel to the ground, or just below the surface, and can give birth to new plants at the nodes. Runners are a kind of stolon that runs on the ground and creates new man-made plants at nodes at different intervals: strawberries are an example. Tubers are modified stems that can store starch, as seen in potatoes (Solanum sp.). Tubers arise as the swollen end of stolons, and contain many adventurous or unusual buds (familiar to us as eyes on potatoes). A bulb, which functions as an underground storage unit, is a modification of a trunk with the appearance of enlarged meat leaves emerging from the trunk or around the base of the trunk, as seen in the i i.e. Chart 11. Trunk modification allows plants to thrive in a variety of environments. Shown are (a) ginger (Zingiber officinale) rhizomes, (b) a carrion flower (Amorphophallus titanum) cormium (c) Rhodes grass (Chloris gayana) stolons, (d) strawberries (Fragaria ananassa) runners, (e) potatoes (Solanum tuberosum) tubers, and (f) red onion (Allium) bulbs. (credit a: revised work by Maja Dumat; credit c: harry rose's work amendment; credit d: rebecca Siegel's work amendment; credit e: scott bauer's work amendment, USDA ARS; credit f: stephen Ausmus's work amendment, USDA ARS) Watch botanical house Wendy Hodgson, of the Desert Botanical Garden in Phoenix, Arizona, explain how agave crops were grown for food hundreds of years ago in the Arizona desert in this video: Finding the Roots of an Ancient Crop. Some of the above modifications of the trunk are tendrils and spines (Figure 12). Tendrils are slender, twining fibers that allow a plant (like a vine or pumpkin) to seek support by climbing on other surfaces. Thorns are modified branches that appear as sharp growths that protect the plant; Common examples include roses, orange osage and walking sticks of the devil. Charts Found in the southeastern United States, (a) the cane (Brunnichia ovata) is a the tree climbs with the help of tendrils. This is shown climbing a wooden pile. (b) Spikes are modified branches. (credit a: revised work by Christopher Meloche, USDA ARS; credit b: macrophile/Flickr work modification) Leaf leaves are the main sites for photothesy: the process by which plants synthesize food. Most leaves are usually green, due to the presence of chlorolyx in leaf cells. However, some leaves may have different colors, caused by other plant pigments that conceal green chlorolyx. The thickness, shape and size of the leaves are adjusted to suit the environment. Each variant helps a plant maximize its chances of survival in a specific habitat. Most often, the leaves of plants growing in tropical rainforests have a larger surface area than plants that grow in deserts or very cold conditions, potentially having a smaller surface area to minimize dehydration. The structure of a typical leaf 13. Deceptively simple in appearance, a leaf is a highly effective structure. Each leaf usually has a leaf blade called lamina, which is also the widest part of the leaf. Some leaves are attached to the stems with a leaf stalk. The leaves have no leaf stalks and are attached directly to the stems called sessile leaves. Small green subsys are often found at the base of the stalk called the spletil. Most leaves have a midrib, which goes the length of the leaves and branches to each side to produce veins of vascular tissue. The edges of the leaves are called margins. Figure 13 shows the structure of a typical eudicot leaf. In each leaf, vascular tissue form veins. The arrangement of veins in the leaves is called the venation pattern. Monocots and dicots differ in their venation patterns (Figure 14). Monocots have parallel venation; The veins run in straight lines over the length of the leaves without converging at one point. However, in dicots, the veins of the leaves are shaped like meshes, form a pattern called mesh venation. An existing plant, Ginkgo biloba, has dichotomous venation where the fork is vein. Chart 14. (a) Tulip (Tulipa), a one-leafed, leafy plant with parallel venation. Venation netlike in this (b) linden (Tilia cordata) leaves distinguish it as a dicot. The (c) Ginkgo biloba tree has dichotomous venation. (credit one image: revised work by Drewboy64/Wikimedia Commons; credit b photo: edit work by Roger Griffith; credit c photo: job modification of geishaboy500/Flickr; credit abc illustration: work modification by Agnieszka Kwiecień) Leaf arrangement The arrangement of leaves on the stems is called phyllotaxy. The number and location of the leaves of the plant will vary depending on the species, with each species exhibiting a characteristic leaf arrangement. Leaves are classified as either spiral, or vice versa. Plants with only one leaf on each node have leaves that are supposed to alternate - meaning that the leaves alternate on each side of the trunk in a plane or spiral, meaning that the leaves are patched in a spiral along the trunk. In an opposite leaf arrangement, two leaves arise at the same point, with the leaves connecting together along the branches. If there are three or more connecting leaves at a node, the leaf arrangement is classified as twisted. Leaf patterns can be simple or compound (Figure 15). In a simple leaf, the blade is either completely unseeded as in banana leaves or it has lobes, but the separation does not reach the midrib, as in maple leaves. In a compound leaf, the leaf blade is completely divided, formed into leaflets, as in locust plants. Each leaflet may have its own stalk, but is attached to rachis. A palmately palmately palmately palmately palmate-like compound leaf, with leaflets radiating out from a point for example includes leaves of poisonous spring trees, buckeye trees, or familiar indoor plants Schefflera sp. (common name umbrella trees). Feather compound leaves take their name from their feather-like appearance; the leaflets are arranged along the midrib, as in pink leaves (Rosa sp.), or leaves of hickory, p lake, ash, or tree. Chart 15. Leaves can be simple or compound. In simple leaves, lamina is constant. (a) banana trees (Musa sp.) have simple leaves. In the compound leaves, lamina is separated into leaflets. Leaf compounds can be palmate or feathers. In (b) palmately leaf compounds, such as those of horse chestnuts (Aesculus hippocastanum), the leaflet branches from the leaf stalk. In (c) feather compound leaves, the leaflet branches from midrib, as on a hickory rub (Carya floridana). Honey choppers (d) have compound double leaves, in which branch leaflets from veins. (credit a: bazzaDaRambler/Flickr job modification; credit b: Roberto Verzo's work amendment; credit c: amending Eric Dion's work; credit d: valerie Lykes's work amendment) Leaf structure and function The outer outer layer of the leaf is the epidermis; it is present on both sides of the leaf and is called the upper and lower epidermis, respectively. Plant scientists call the upper axial surface (or adaxis) and below the axial surface (or abaxis). The epidermis helps in regulating gas exchange. It contains stomata (Figure 16): holes through which the gas exchange takes place. Two protective cells surround each stoma, adjusting its opening and closing. Chart 16. Visualized at 500x with a scanning electronic microscope, some stomata are clearly visible on (a) the surface of this sumac leaf (Rhus glabra). At a magnification of 5,000x, the cells protect (b) a single stoma from lyre-leaved sandcress (Arabidopsis lyrata) the appearance of the lips surrounds the opening. In this light microscope cross section (c) of the A. lyrata leaf, pairs of protective cells are visible along with large air space, under the mouth in the leaves. (credit: revised work by Robert R. Wise; part c-scale-bar data from Matt Russell) The epidermis is usually thick with a layer of cells; however, in plants that develop in very hot or very cold conditions, the epidermis can be several layers thick to protect against excessive dehydration from transpiration. A waxy layer called the epidermis covers the leaves of all plants. The epidermis reduces the rate of dehydration from the surface of the leaves. Other leaves may have small hairs (trichomes) on the surface of the leaves. Trichomes help prevent herbivory by limiting insect movements, either by storing toxic or tasting compounds; they can also reduce the rate of absorption by blocking the flow of air on the leaf surface (Figure 17). Chart 17. Trichomes give the leaves a translucent appearance as in this (a) sundew (Drosera sp.). Leaf trichomes consist of (b) trichomes branched on the leaves of Arabidopsis lyrata and (c) multibranched trichomes on an adult marilandica leaf quercus. (credit a: John Freeland; credit b, c: revised work by Robert R. Wise; scale-bar data from Matt Russell) Beneath the epidermis of dicot leaves are layers of cells called mesophyll, or middle leaves. Mesophyll of most leaves usually contains two arrangements of cells of syeling: palisade and spongy mesothic (Figure 18). Palisade(also known as palisade mesophyll) is column-shaped, tightly packed cells, and can be present in one, two or three layers. Beneath the palisade are loosely arranged cells with an uneven shape. These are cells of porous (or porous mesophyll) spongy mesophyll. The air space found between porous systular cells allows gas exchange between the leaves and the outer atmosphere through stomata. In aquatic plants, intocyte spaces in the spongy need help leaves float. Both layers of mesophyll contain many estes. Protective cells are the only epidermal cells that contain estors. In the leaf drawing (Figure 18a), the central mesophyll is sandwiched between the upper and lower epidermis. Mesophyll has two layers: an upper layer of palisade consisting of tightly packed column cells, and a lower porous layer, consisting of loose, unevenly shaped cells. Stomata on the under the leaf allows gas exchange. A waxy epidermis covers all the over-air surfaces of soil plants to minimize dehydration. These layers of leaves are clearly visible in the scanning electronic microscope (Figure 18b). Many small bumps in palisade cells are esto ester. Estes are also present in porous, but unclear. Bumps protruding from the bottom of the rest are glandary trichomes, which differ in structure from the stalk trichomes in Figure 17. Chart 18. (a) Draw leaves (b) Scan the micrograph electronically of a leaf. (credit b: editing the work of Robert R. Wise) Chart 19. This micro-electronic scan shows xylem and phloem in the leaf vascular bundle from the lyre-leaf sand watercress (Arabidopsis lyrata). (credit: editing the work of Robert R. Wise; scale-bar data from Matt Russell) Like stems, the leaves contain bundles of blood vessels including xylem and phloem (Figure 19). Xylem consists of the air conditioning and vessels, transporting water and minerals to the leaves. Phloem transports the due diligence products from the leaves to other parts of the plant. A single vascular bundle, no matter how large or small, always contains both xylem and phloem tissue. The leaves are adapted to needle plants that thrive in cold environments, such as spruce, fir, and pine, with leaves reduced in size and needle-like appearance. Needle-like leaves have sunken stomata and a smaller surface area: two properties that aid in reducing dehydration. In hot climates, plants such as cacti with leaves are reduced to thorns, combined with their succulent stems, which help to conserve water. Many species of aquatic plants have leaves with broad lamina that can float on the surface of water, and a thick waxy epidermis on the surface of the leaves repels water. Watch The Pale Pitcher Plant episode of the Plants Are Cool video series, Too, an American Plant Association video of a carnivorous plant found in Louisiana. The leaf is the main location of photothesy. A typical leaf consists of a lamina (the wide part of the leaf, also known as a blade) and a leaf stalk (the stalk attaches the leaf to the stem). The arrangement of leaves on the stems, called phyllotaxy, allows maximum exposure to sunlight. Each plant has a characteristic leaf arrangement and formation. The leaf arrangement pattern can replace, opposite, or spiral, while leaf form can be simple or compound. Leaf tissue consists of the epidermis, which forms the outer layer of cells, and chlorolytic and vascular tissue, which forms the inner part of the leaf. In some plants, the leaf form is modified to form structures such as tendrils, spines, bud scales and needles. The roots of seedlings have three main functions: anchoring plants to the soil, absorbing water and minerals and transporting them to the top, and storing photoc ray products. Some roots are modified to absorb moisture and exchange gases. Most of the roots are underground. However, some trees also have adventurous roots, appearing on the ground from the ng. The original system types are mostly two types (Figure 20). Dicots have a faucet root system, while monocots have a fibrous root A faucet root system has a longitudinal root, and from there many smaller lateral roots arise. Dandelion is a good example; their proboscis roots are often broken when trying to pull these weeds, and they can regrow another shot from the other root). A proboscis root system penetrates deep into the soil. Conversely, a fibrous root system is located closer to the surface of the soil, and forms a dense root network that also helps prevent soil erosion (grass grass is a good example, as well as wheat, rice and corn). Some plants have a combination of proboscis roots and fibrous roots. Plants that grow in dry areas often have deep root systems, while plants that grow in areas with abundant water are likely to have shallower root systems. Chart 20. (a) Tap root system has a primary root growing down, while (b) the fibrous root system consists of many small roots. (credit b: austen Squarepants/Flickr's work modification) Root growth and anatomy figure 21. A longitudinal view of the root shows areas of cell division, stretching, and maturity. Cell division occurs in apical meristem. Root growth begins with seed germination. When plant embryos appear from the seed, the radicle of the embryo form the root system. The root head is protected by the root cap, a proprietary structure for the roots and unlike any other plant structure. The root cap is constantly replaced because it is easily damaged when the roots push through the soil. The root head can be divided into three regions: a cell division, a prolonged region and an adult and distinct region (Figure 21). The closest cell division to the root head; it is made up of cells that actively divide the root meristem. The area of stretching is where new cells are formed increasing in length, thereby stretching the root. Starting from the first root hair is the area of cell maturity, where stem cells begin to differentiate into special cell types. All three areas are in the first centimeter or so of the root head. The root has an outer layer of cells called the epidermis, which surrounds areas of ground tissue and vascular tissue. The epidermis provides protection and helps to absorb. The root hair, which is an extension of the stem epidermal cells, increases the surface area of the root, which significantly contributes to the absorption of water and minerals. Chart 22. Dyeing shows different cell types in the light micrograph of a wheat (Triticum) cross-section root. Sclerenchyma cells of exodermis and xylem cells stain red, and phloem cells stained blue. Other cell types black marks. The ststone, or vascular tissue, is the area inside the inlay (indicated by a green ring). Root hairs are visible outside the epidermis. (credit: scale-bar data from Matt Russell) Inside the root, ground tissue form two regions: the cortex and the pith Compared to stems, the roots have a lot of cortex and less pith. Both areas consist of cells that store cosmetic products. The cortex is located between the epidermis and vascular tissue, while the pith is located between the vascular tissue and the center of the root. The vascular tissue at the root is arranged in the inner part of the root, which is called the stor (Figure 23). A cell layer called the endodermis separates the stor from the ground tissue in the outer part of the root. Endodermis is exclusive to the roots, and serves as a checkpoint for materials that penetrate the vascular system of the root. A waxy substance called suberin is present on the walls of endodermal cells. This waxy region, known as the Casparian strip, forces water and sociables to cross the plasma membranes of endotder cells instead of slipping between cells. This ensures that only the required materials of the roots pass through the inlay, while toxic substances and pathogens are often excluded. The outer layer of the vascular tissue of the root is surrounded, an area that can give birth to lateral roots. In the coding roots, xylem and phloem of the stor are arranged alternately in an X shape, while in monocot roots, vascular tissue is arranged in a ring around the pith. Chart 23. In the typical (left) dicots, the vascular tissue forms an X shape in the center of the root. In the typical (right) monocots, phloem cells and larger xylem cells form a characteristic ring around the central pith. Modify original Figure 24. Many vegetables are modified roots. The root structure can be modified for specific purposes. For example, some roots are onions and starch storage. Air roots and prop roots are two forms of ground roots that provide additional support for anchoring plants. Tap roots, such as carrots, beets, and beets, are examples of roots modified for food storage (Figure 24). Epiphytic roots allow one plant to grow on another. For example, the epiphytic roots of orchids develop a porous tissue to absorb moisture. Ban bante (Ficus sp.) begins as an epiphyte, germinating in the branches of a host plant; Upper roots do not grow from branches and eventually reach the ground, providing additional support (Figure 25). In screwpine (Pandanus sp.), a palm-like plant that grows in sandy tropical soils, prop roots on the ground grow from nodes to provide additional support. Chart 25. (a) ban ban ban bana, also known as scaly strangle, begins life as an epiphyte in a host tree. The upper roots do not extend to the ground and support the growing plant, eventually strangling the host plant. The (b) screwpine growing roots on the ground help support plants in sandy soils. (credit a: psyberartist/Flickr job modification; credit b: david eikhoff's work amendment) Compare the original system tap with fibrous root system. For each type, name a plant that provides food in the human diet. What kind of root system is found in one-leaf home plants? What kind of root system is found in dicots? What can happen to a root if the pericycle disappears? Check out your understanding Answer the question(s) below to see how well you understand the topics mentioned in the previous section. This short test does not count on your grades in class, and you can do it again unlimited number of times. Use this test to test your understanding and decide whether to (1) further study the previous section or (2) move on to the next section. Part.