

11.APPENDIX i GLOSSARY

Comparative Anatomy of Branches, Roots and Wood of Some North American Dicotyledonous and Coniferous Trees and Woody Shrubs Used in Ethnographic Artifacts: Identification and Conservation Concerns

Angiosperm, class (Angiospermae): of plants in which the seed is formed inside an enclosed ovary as opposed to gymnosperms that produce a naked seed. The class includes the dicotyledonous trees, shrubs and herbaceous plants and the monocotyledonous grasses.

Bark: a generic term for the tissues that cover the outside of a tree trunk. In early growth of a tree trunk, young branch or sapling, they will have an outer epidermis. The epidermal cells produce a waterproof membrane composed of lipids and hydrocarbons mixed with waxes. As the trunk grows the epidermis is replaced by a periderm. The periderm is a complex of the three layers of tissues. The central meristematic tissue of the phellogen (cork cambium) produces towards the outside, the phellem- such as cork, white birch bark cells or red maple cell. The phellem cells are thick walled that contain suberin a waxy material that seals the cells making them air and water tight. The phellogen produces towards the center of the stem, etc. the phellogen or secondary cortex. In a few trees and shrubs such as in Western Red Cedar and Yellow Cedar, as the tree ages the periderm is sloughed off and the secondary phloem tissue becomes the outer bark. 2nd phloem is made up of many fibers and as it dies the dead cells are easily fragmented. These have been used in making garments, ropes and baskets, etc., by first Nations People.

Bast Fibers see sclerenchyma fibers.

Birefringence—is a characteristic of crystalline material such as cellulose in cell walls. When viewed under polarizing light the light is refracted –bent in two different angles and the crystals shine. This is used to view cellulosic material under the microscope.

Cambium: a lateral meristem that produces secondary growth present in the two lateral meristems, the **vascular cambium** and the **cork cambium**. It consists of one layer of embryonic cells between the 2nd xylem and 2nd phloem that produce orderly radial parallel rows of cells.

Cellulose: is the main structural chemical of the cell walls of most terrestrial plants. It is a polysaccharide polymer -a long unbranched chain of glucose units.

Collenchyma cells: Are thick walled living cells, in the cortex of plant stems that give structural support. The cell protoplast is circular but its cell walls along their sides are variable in thickness. The thick walls fill the gaps between the cells between adjacent cells. This is an identifying characteristic of collenchyma. The cell wall is pectin covered cellulose and xyloglucans fibrils that are oriented in layers of opposite directions. On hydration the

pectin swells increasing rigidity. The fibers in celery are collenchyma and when limp and placed in water the pectin swell to bring back its crispness.

Companion cells: are small cells attached to the sieve cells in phloem tissue in angiosperms. They are not present in gymnosperms. Angiosperm sieve cells do not have a nucleus but the companion cell controls its functioning. The complex is called the companion cell sieve cell complex.

Cork cells: bark cells (phellem) that have replaced the epidermis in some tree trunk or branches. The cells contain 30% suberin, 20% lignin and 10% extractives. Suberin is composed of fatty acids and other chemicals that make the cells water proof. The cells are polyhedral in shape and attached on all sides to adjacent cells for compactness. The cell shape gives them resilience in bending and crushing.

Cork periderm: a complex of cells, the result of growth of a lateral cork cambium meristem that grow to replace the surface epidermis in some trees. It is made up of the outer dead cork cells- the phellem, the central meristem- the phellogen, and inner phelloderm a type of cortex that may store starch or has chlorophyll for photosynthesis.

Cambium: the meristem of secondary growth commonly called vascular cambium.

Cortex: a group of thin walled parenchyma cells that fill the area from the stem periderm surface to the vascular tissue. The cells function as filler cells and may contain materials for storage i.e. starch, oils, latex, resins, tannins or chlorophyll.

Cuticle: the water proof waxy surface on the epidermal cells of leaves and branch surfaces, composed of waxes and polyester cutin.

Cutin: is a component of the cuticular membrane of the epidermis; a polyester polymer.

Dicotyledon, dicotyledonous; dicot: The terms are used for taxonomic purposes. It is used to separate the two groups of angiosperm plants that have a seed embryo with two leaves (cotyledons)- dicotyledons; as opposed to those with one seed leaf, called monocotyledon

Endarch: a term used in describing the type of xylem development within the pith of the stem of flowering plants and trees. It describes a type in which protoxylem faces towards the pith and the metaxylem towards the outside of the stem. Outward growth develops 2nd xylem.

Exarch: as compare with endarch- it is common in roots and the protoxylem is external to metaxylem and faces outwards and the xylem inward towards the center of the roots. The pith region is now 2nd xylem.

Fusiform shaped cell: a shape in which both ends are tapered so as to slide tightly into each other.

Herbaceous: non-woody annual plant having little or no secondary development.

Interfascicular cambium: Vascular cambium, placed between primary vascular bundles, giving rise to a ring of secondary xylem in a stem.

Lacunae - in plant stems or leaves: empty spaces, commonly in pith of a stem. A result of autolysis (self hydrolysis) leaving an empty space in center of a pith or amongst the pith cells.

Leaf trace: An extension of the primary xylem in the stem from the central pith region to the surface of the stem node or branch to develop a leaf, branch or bud. In cross section it is shown that the leaf trace develops from the primary vascular bundle's procambium at the margin of the pith and extends through the established 2nd xylem of the stem to reach its surface and develops to form a leaf, branch, or bud.

Lumen : an intracellular space.

Meristem: Generic term for all embryonic tissues that is responsible for formation of new cells by division in stem, root, and leaf growth. The meristems are procambium, apical meristem, phellogen (cork cambium), and vascular cambium.

Metaxylem: Is a type of primary xylem that differentiates and matures later than the protoxylem; generally metaxylem tracheids are larger in cross section than protoxylem. It is commonly seen adjacent to branch pith.

Monocotyledon (monocot): An angiosperm embryo having only one cotyledon (first leaf); commonly grasses. See dicotyledon

Node (nodal): an external region of a stem where one or more leaves, branches or buds are attached to the stem..

Parenchyma: Is the commonest cell type in plants. They are filler cortex; pith cells, and have a great variation in function depending on its location and the plant species. The cells may collect water to maintain turgidity and plant part shape. They may store starch, fat, crystals etc. It may contain chlorophyll and maintain photosynthesis; such cells are called chlorenchyma cells. The cells may be sealed and filled with air to give buoyancy to the plant- these are aerencyhma cells. Its shape may allow intercellular spaces for gaseous exchange. Most cell types are living but some may be dead and give structural support. The cell walls are mainly cellulose.

Phellem (cork): Protective tissue composed of nonliving cells with suberized (cork) walls. It replaces the epidermis in one-year and on older stems and roots of many plants. It is formed by the phellogen (cork cambium), part of the periderm.

Phelloderm: A tissue formed by the phellogen-cork cambium- in the opposite direction of the phellem cork; resembles cortex; function in storage, photosynthesis, filler cells, etc.; part of the periderm.

Phellogen: (cork cambium): The phellogen is between the phelloderm and phellem. A lateral meristem forming the periderm, a protective tissue common in stems and roots of dicotyledons and gymnosperms; produces phellem (cork) toward the surface of the plant, phelloderm toward the inside.

Phloem: The anatomy of phloem includes parenchyma, sieve cells and companion cells and depending on species, secondary phloem fibers. The parenchyma cell stores, converts and transports by protoplasmic streaming nutrients and water to other cell - where ever needed. In some trees the secondary phloem fibers acts as a bark replacing the periderm (see bark). The inner secondary phloem has been used as a source of nutrition and the outer dead fibrous material of western red cedar and yellow cedar for bedding, weaving, garment, rope, and basket making by first Nations People.

Primary Phloem Fibers: – see sclerenchyma fibers

Pith: is the central parenchyma tissue in stems of vascular plants. It is composed of parenchyma cells. In some stems they are packed and air tight and give strength to narrow herbaceous stems. It has many other functions- see parenchyma. It is developed form the apical meristem.

Protoxylem: first formed xylem tissue developed from procambium during primary growth and differentiation of a vascular plant; commonly divided into the first formed small protoxylem and then larger metaxylem cells. Commonly observed in central region of branches and stems

Resin canals (ducts): ducts in a few angiosperm and some gymnosperm species' needles, heartwood, sapwood and root. Their presences in any one or any number of these parts, is species specific and assist in species identification. The ducts are lined internally with epidermal cells that secrete resin. The number of secreting epidermal cells is used for identification. There are two types of resin canals, the traumatic resin canals and radial resin canals. The traumatic resin canals, run vertically in the tree and their resin is used to repair wounds and for protection from insects and fungi. The radial resin canals run horizontally in the 2nd xylem radial rays and the resin is mainly for waterproofing heartwood cells and it may act as a biocide.

Ramet: an individual stems that grow annually from roots or rhizoids; they are individuals of a clone; the roots may be adventitious arising from stem rhizoids; they are produced asexual from the rhizoid not from a seed. The group of plants is called a genet- meaning with identical genome.

Rhizome: horizontal stem, whether lying on the ground (prostrate) or growing belowground that produces adventitious (anatomy of the stem) roots; have nodes and internodes and functions in anchorage, absorption and nutrient storage.

Sclereid: is a short, irregular shaped sclerenchyma cell with pits. Sclereids function as tissue support and in some cases in bark for prevention of mammalian grazing.

Sclerenchyma fibers: these are plant cells composed of thick walled cellulose cells with some lignin; sclerenchyma, primary phloem, and bast cells are all the same type of cell, but are called those different names; they are all primary phloem cells. The fibers may be soft or hard depending on the amount of lignin present, with the hard fibers with the most lignin. The composition of sclerenchyma cells is mainly cellulose and hemicellulose with different amounts of lignin. When present they are the main structural supporting tissue in stems and leaves. Examples are primary phloem fibers- bast fibers- in flax, ramie, hemp, in maple tree branch inner bark, etc.

Secondary growth: It is initiated by the vascular cambium and cork cambium. Giving growth in circumference –width- of a tree trunk or branch stem, i.e 2nd xylem

Sieve cell: (see phloem), large phloem cells with specific shaped sieve plates that allow easily movement of protoplasmic streaming to sapwood for all cells in need. It is present in gymnosperm cells but not in angiosperms.

Sieve plate: the sieve plate anatomy is a perforated near circular plate on the walls of the sieve cells that are connected by cytoplasmic connections to other cells for liquid movement. They are many along the sieve cell surface. They are species specific in structure.

Stele: is the central vascular cylinder in stems and roots where the vascular tissue is located.

Stolon: a runner or rootstock used commonly to propagate grasses where as rhizomes (see rhizome) are commonly used for food storage in plants; both can produce adventitious roots.

Suberin: is present in bark inside phellem cork cells and endodermis of roots. It is hydrophobic, rubbery, and water resistant. It is found in the endodermis of roots and phellem cork cells. The chemistry is complex but it is considered as a glycerolipid polymer.

Tracheid: There are two types of tracheids, **axial tracheid** in 2nd xylem that are oriented longitudinally and **radial tracheids** on coniferous radial rays. In both their function is water conducting. Both have about the same amount of lignin in the 2nd cell wall. They vary considerably by anatomy. The axial tracheids are much larger and are the main component of 2nd xylem. Whereas the ray tracheid may be present on one side or both sides in one layer or two layers of the radial rays or not present at all. It is species specific thus used for identification of wood species. In embryonic sapwood they are gargoyles like depending on age and species. In archaeological material wood the ray tracheids may remain because of their lignin content.

Vascular Bundles: vascular tissue organized into discrete bundles. Each bundle is made up of primary xylem and phloem and cambium cells. In cross section they are of variable shapes circular to elliptical. They grow longitudinally and are present through the length of a stem. Vascular bundles are common in annual herbaceous plants and in primary tissue.

Wood ray: a group of radial orient parenchyma cells in wood. In tangential view they show variable shapes from circular to oval and at their tips they may show the presence of ray tracheids- species specific. They vary in height- number of cells- according to species. The function of the parenchyma cell is conduction of nutrients and water radially in stems and roots of trees. Ray tracheids associated with outer ray parenchyma cells may also be present.

Xylem: xylem may be protoxylem- **primary xylem**- first formed from the procambium and **2nd secondary xylem** produced by the vascular cambium. 2nd xylem is called **sapwood** when alive and transports water and dissolved minerals to all parts of the tree and increases the girth of a tree. **2nd xylem** when dead is called **heartwood** and makes up the main mass of the xylem and is involved in structural strength for keeping the tree upright.