**DICHOTOMOUS KEY TO WOOD ANATOMY (by genus)**

I. **WOOD NONPOROUS (Vessels absent) -- Mostly gymnosperms**

A1. Rays mostly uniseriate, occasionally biserate; wider when resin ducts are present in them. ................................................................. Conifers

   B1. Axial resin ducts normally present

      C1. Epithelial cells of resin ducts mostly with thin walls. Ray tracheids present ................................................................. Pinus

      C2. Epithelial cells of resin ducts mostly with thick walls.

         D1. Tracheids with helical thickenings, at least in early wood. No ray tracheids present. .......................................................... Pseudotsuga

         D2. Tracheids rarely with helical thickenings. Ray tracheids present........ Larix

   B2. Axial resin ducts normally absent; may be traumatic, then in tangential rows or groups.

      C1. Axial wood parenchyma present and conspicuous. End walls of ray cells not conspicuously pitted. (Wood without aromatic scent.).................. Sequoia

      C2. Axial wood parenchyma absent or sparse.

         D1. End walls of ray cells conspicuously pitted (nodular). (Wood with aromatic scent.)....................................................... Thuja

         D2. End walls of ray cells not conspicuously pitted. (Wood without aromatic scent.).............................................................. Abies

   A2. Rays multiserate and uniseriate, composed of upright cells ................................. Drimys

II. **WOOD POROUS (Vessels present) -- Dicotyledons**

A1. WOOD RING-POROUS. Vessels in spring wood clearly larger that the late wood, with an abrupt transition between the two.

   B1. Late wood without pores organized in bands or patches of small pores; tracheids, and parenchyma cells. Apotracheal parenchyma distributed as isolated cells, scattered patches, or non-continuous bands.
C1. Rays all uniseriate. ................................................................. *Castanea*

C2. Rays of two distinct sizes, the large ones multiseriate and very high, the small ones uniseriate and low.

D1. Pores individually distinct in late wood, usually crowded in early wood. Transition between early and late wood relatively gradual. Vessels usually without tyloses. ................................................................. *Quercus* - Red oak series

D2. Pores rarely individually distinct in late wood, usually not crowded in early wood. Transition between early and late wood abrupt. Vessels usually with tyloses in heartwood.............................................................*Quercus* - White oak series

B2. Late wood organized with pores in distinct radial lines or with patches of pores arranged near other cells. Fine contiguous bands of apotracheal parenchyma.


D1. Pores in late wood small and numerous, in tangential, more or less curved bands. Paratracheal and boundary axial parenchyma.

E1. Rays 1-6 Seriate. ................................................................. *Ulmus*

E2. Rays 1-13 seriate................................................................. *Celtis*

D2. Pores in late wood variable in size and occur in clusters. Paratracheal, often confluent, axial parenchyma. .............................................................*Robinia*

C2. Pores in late wood few, solitary or in small multiples. Small pores with thick walls. Ground mass usually fiber-tracheids, but libriform fibers may be present.

D1. Wood parenchyma in late wood paratracheal, often aliform and confluent. Pores in late wood all smaller than those in early wood.................................*Fraxinus*

D2. Wood parenchyma in late wood in numerous fine apotracheal bands; also boundary parenchyma. Pores in late wood sometimes as wide as those in early wood. Comparatively few, irregularly arranged pores in early wood.

E1. Storied wood. Bands of axial parenchyma much or somewhat finer than the rays. Tyloses absent ................................................................. *Diospyros*

E2. Nonstoried wood. Bands of axial parenchyma as distinct as the rays. Tyloses often present. *Hicoria*
A2. WOOD DIFFUSE POROUS. Pores throughout growth ring fairly uniform in size or only gradually changing in size and distribution from early to late wood.

B1. Pores variable in size, the large ones readily visible without magnification, not crowded.

............................................................................................................................. Juglans

B2. Pores small to minute, often not distinct without lens; sometimes few and scattered but mostly crowded, although well distributed throughout growth ring.

C1. Wide aggregate rays present. (Wide aggregate rays are tight groupings of usually multiseriate rays.)

D1. Perforation plates in vessels mostly simple. .................. Carpinus

D2. Perforation plates exclusively scalariform. .................. Alnus

C2. No wide aggregate rays.

D1. Pores solitary or in small multiples, not crowded.

E1. Rays narrower than the pores, inconspicuous. Scalariform perforations in vessels. .................. Betula

E2. Large rays as wide or wider than the pores, conspicuous. Simple perforations in vessels. .................. Acer

D2. Pores very numerous, usually crowded.

E1. Largest rays nearly as wide as (or wider than) pores (ref. tangential section).

F1. Largest pores and rays differ little in width. Vessels with gum plugs but without tyloses. Gum ducts (Gummosis type) frequently present. Prunus

F2. Largest rays much wider than the pores. Vessels with tyloses but without gum plugs. Gum ducts absent.

G1. Rays nearly all wide, numerous, uniformly spaced. ....... Platanus

G2. Rays of several widths, the wider not numerous and irregularly spaced. ................................. Fagus

E2. Rays narrower than the pores.

F1. Scalariform perforations in vessels.

G1. Axial parenchyma at boundary. .................. Liriodendron
G2. Axial parenchyma paratracheal or apotracheal diffuse or both, the cells scattered. Frequently very scanty..................Liquidambar

F2. Simple perforations in vessels.

G1. Rays of two sizes, uniseriate and conspicuous multiseriate....Tilia

G2. Rays all uniseriate.

H1. Rays homocellular.................................................... Populus

H2. Rays heterocellular.................................................... Salix

Modified from Esau's Anatomy of Seed Plants. 1960.
Additional modifications from Dr. Russell’s Class of 2009.