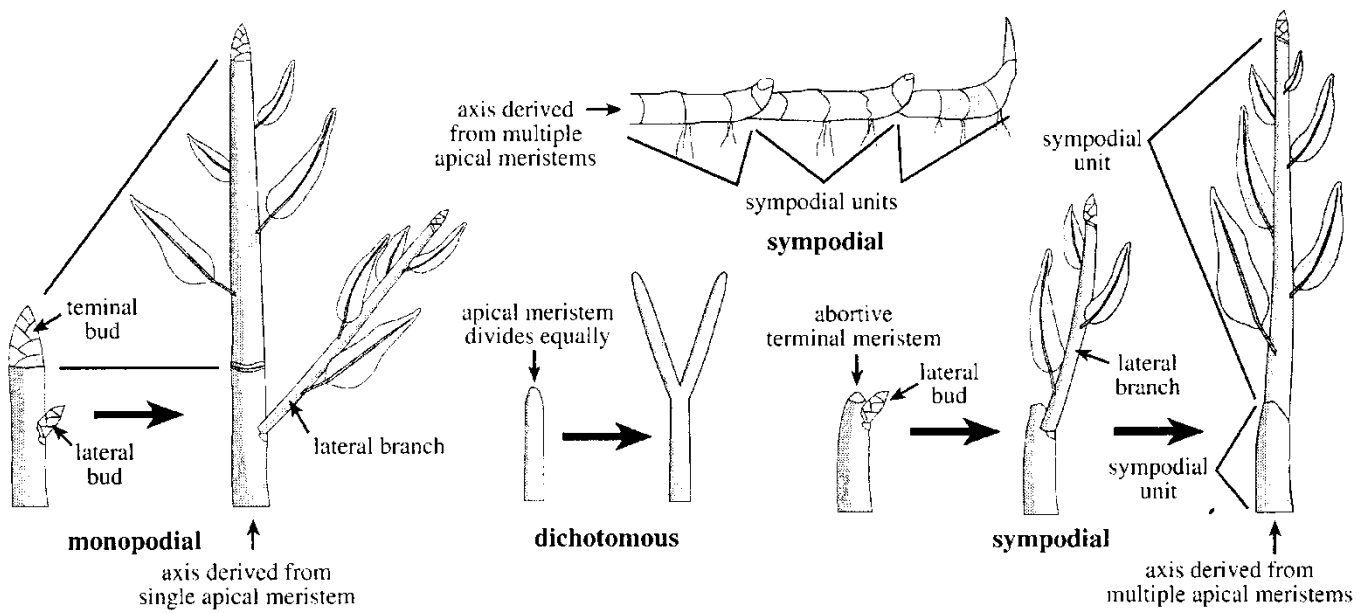


STEM BRANCHING PATTERN

The below- or above-ground stems or shoots of a plant often exhibit characteristic branching patterns. Branching pattern is determined by the relative activity of apical meristems, both the original shoot apical meristem derived from the seedling epicotyl and apical meristems subsequently derived from lateral buds. One major feature of branching pattern has to do with the duration of apical meristematic growth of a shoot. If a given shoot has the potential for unlimited growth, such that the apical meristem is continuously active, the growth is termed **indeterminate**. If instead a shoot terminates growth after a period of time, with either the abortion of the apical meristem or its conversion into a flower, inflorescence or specialized structure (such as a thorn or tendril), the growth is termed **determinate**. (Note that these same terms are used for inflorescence development. Two other, related terms have to do with flowering). A determinate shoot that completely transforms into a flower or inflorescence is called **hapaxanthic**. An indeterminate shoot that bears lateral flowers but that continues vegetative growth is termed **pleoanthic**.

Many different models of stem branching pattern have been described. These models may be of taxonomic value, they may represent evolutionary adaptations to a given environment or life strategy. Three general terms focus on the developmental origin of a given branch or axis. If a given stem axis is derived from growth of a single apical meristem, the pattern is termed **monopodial**. The monopodial axis may grow indefinitely and thus be indeterminate.

In contrast, if a given axis (which may appear to be a single, continuous structure) is made up of numerous units that are derived from separate apical meristems, the branching pattern is **sympodial**. These sympodial units arise from lateral buds that are proximal to the apical meristem of the original shoot. Many rhizomes have sympodial growth. Finally, a rare type of branching is **dichotomous**, in which a single apical meristem divides equally into branches, e.g., *Psilotum*



TWIGS AND BUDS

Twigs are the woody, recent-growth branches of trees or shrubs. **Buds** are immature shoot systems that develop from meristematic regions. In deciduous woody plants the leaves fall off at the end of the growing season and the outermost leaves of the buds may develop into protective **bracts** (modified leaves) known as **bud scales**. The bud of a twig that contains the original apical meristem of the shoot (which by later growth may result in further extension of the shoot) is called the **terminal** or **apical** bud. Buds formed in the axils of leaves are called **axillary** or **lateral** buds.

A given bud may be **vegetative**, if it develops into a vegetative shoot bearing leaves; **floral** or **inflorescence**, if it develops into a flower or inflorescence; or **mixed**, if it develops into both flower(s) and leaves. In some species more than one axillary bud forms per node. Two or more axillary buds that are oriented sideways are called **collateral buds**; two or more axillary buds

oriented vertically are called **superposed buds**. If the original terminal apical meristem of a shoot aborts (e.g., by ceasing growth or maturing into a flower), then an axillary bud near the shoot apex may continue extension growth; because this axillary bud assumes the function of a terminal bud, it is called a **pseudoterminal bud**.

Several scars may be identified on a woody, deciduous twig. These include the **leaf scar**, **leaf vascular bundle scars**, **stipule scars** (if present), and **bud scale scars**. Bud scale scars represent the point of attachment of the bud scales of the original terminal bud after resumption of growth during the new season. Thus, bud scale scars represent the point where the branch ceased elongation the previous growing season; the region between adjacent bud scale scars represents a single year's growth.

