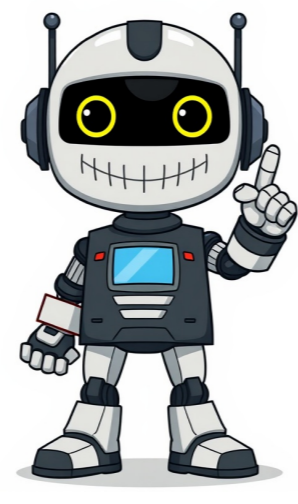


I'm not a bot

























Stelar System of Plants - A Comprehensive Overview ===== The stelar system of plants is a complex vascular structure that plays a crucial role in the transport of water, nutrients, and sugars throughout the plant. The concept of stele was first introduced by Van Tieghem and Douliot in 1886, who defined it as a central vascular cylinder with or without pith, delimited by an endodermis. The term "stele" comes from the Greek word for pillar, which aptly describes its function as a structural support for the plant's vascular system. Van Tieghem and Douliot recognized three main types of steles: protostele, siphonostele, and solenostele. Protostele is considered the most primitive type of stele, characterized by a solid mass of vascular tissue with the central core of xylem completely surrounded by phloem. This type is found in ancient plants such as *Selaginella* spp. and has several subtypes, including haplostele, actinostele, plectostele, and mixed-pith stele. Siphonostele is a modification of protostele, characterized by the presence of a medullated vascular region with a parenchymatous central region. This type of stele contains a tubular vascular region and a gap above the branch traces or leaf gaps, which are divided into two subtypes: cladophonic siphonosteles and phyllosiphonic siphonosteles. Solenostele is the simplest form of essential resources throughout the plant. Understanding the different types of steles provides valuable insights into the phylogeny and evolution of vascular plants. Solenostelic Steles Found in *Selaginella* Species, But Not Among Simple Siphonosteles ===== Some species of *Selaginella* display solenostelic steles, according to some researchers. However, among the simplest siphonosteles and lycopsids, successive leaf gaps in the central vascular core do not overlap each other and are considerably apart from each other. According to Brebner (1902), Gwynne-Vaughan (1901) solenosteles which lack overlapping of gaps are known as solenosteles. They may be ectophloic or amphiphloic. Some authors however, interpret the solenostele as an amphiphloic siphonostele. A more advanced type of stele is the dictyostele. In this case, successive leaf gaps may overlap each other, resulting in a vascular core with many intervening portions of tissue known as meristeles. Each meristele is composed of protostelic tissue. The dictyostele appears like a cylindrical meshwork when there are many meristeles. The most complex type of stele is the polycyclic stele. This stelar organization features an inner vascular system connected to the outer siphonostele, with connections at each node. A typical polycyclic stele has two or more concentric rings of vascular tissue. These may be solenosteles or dictyosteles. The plant *Pteridium aquilinum* has two concentric rings, while *Matonia peclinata* has three. There is also a modification called the eustele, described by Brebner (1902). In this case, the vascular system consists of a ring of collateral or bicollateral vascular bundles on the periphery of the pith. The distinction between inter-fascicular areas and leaf gaps is not clear in these steles. An example of this type is *Equisetum*. The stele is composed of the primary vascular system of the plant axis, along with its associated ground tissues such as the pith. This consists solely of primary tissues differentiated from apical meristem. Secondary vascular tissue, including wood, comes from a vascular cambium. Figure 1.7 shows a diagram of a plant shoot, highlighting the center of primary growth, leaves, and branch buds. The structure of xylem is particularly interesting in paleobotany due to its preservation potential. Understanding stele types is essential for studying vascular system evolution and identifying plant axes. Descriptive stele types include the protostele, siphonostele, eustele, and others like actinosteles. A useful character of stelar development is the maturation of primary xylem cells, such as protoxylem and metaxylem. Combining patterns of xylem maturation with phloem and xylem position helps to precisely describe stele types in a few words. The term "stem" refers to a specific arrangement of vascular tissues in plants, known as an endarch ectophloic (phloem on the outside) eustele. ===== the vascular bundles supplying leaves depart from the stele. If you were to examine serial sections up through the plant axis, leaf gaps would originate and close all along the stele as leaf traces arose at each node. Leaf gaps occur only in siphonosteles and related types. In protosteles, leaf traces simply diverge from the solid vascular cylinder. The areas between the vascular bundles in a eustele are not leaf gaps. In eusteles, leaf traces arise from individual vascular bundles as if they were tiny protosteles. ===== growth rings in the secondary xylem . In seasonal climates, growth varies throughout the year producing annual rings (VG 2:9)(VG 2:10). The diameter of the ring and the size of the cells can tell much about conditions within and between growing seasons. Distinguish primary and secondary tissues in these stems, and note the position of the vascular cambium, although you won't be able to actually see it. Note rays (parenchyma cells revisited) in woody tissue. ===== In angiosperm: Roots...converge into a single central vascular cylinder in the root, forming a continuous system of vascular tissue from the root tips to the leaves. At the centre of the vascular cylinder of most roots is a solid, fluted (or ridged) core of primary xylem. The primary phloem lies ===== The simplest and apparently most primitive type of stele is the protostele, in which the xylem is in the centre of the stem, surrounded by a narrow band of phloem. It in turn is bounded by a pericycle of one or two cell layers...Read More In fern: Vascular tissuesThe steles—cylinders of vascular tissues in the centres of fern stems—exhibit somewhat diverse patterns. Most common ferns possess a "dictyostele," consisting of vascular strands interconnected in such a manner that, in any given cross section of stem, several distinct bundles can be observed. ===== The name 'stele' has been derived from a Greek word meaning 'Pillar'. It refers to the different parts of the central region of the roots and stems in the vascular plants. The stelar evolution in pteridophytes is significant as they are the first plants that have developed vascular bundles. Earlier, plant anatomists believed that the fundamental unit in the vascular system was the vascular bundle in both pteridophytes and higher plants. However, in 1886 Van Tieghem and Douliot proposed the stelar theory. According to them the primary bodies of the stem and root are alike in gross anatomy consisting of a central core- the stele- separated from the outer cortex by endodermis. ===== A protostele is the simplest type of stele which is considered to be phylogenetically primitive. It is the fundamental stelar type for the tracheophytes in general and for the pteridophytes in particular. All other types of stele have been in the evolutionary process, all pteridophytes originate from a protostelic stem. The *Rhynia* stem features a small protostele composed of few tracheids and phloem elements, classified as a primitive protostele. This structure persists in adult stems of *Selaginella*, *Lycopodium*, and *Gleichenia*. Brebner (1902) proposed two protostele types: haplostele and actinostele. Haplostele has a smooth xylem core with phloem surrounding it, as seen in *Selaginella*. Actinostele features radiating xylem ribs and solid phloem masses, exemplified by *Lycopodium serratum* and *Psilotum*. Variations exist, such as Plectosteles in *L.volubile*, where xylem and phloem form parallel lobes. Mixed protosteles, like in *L.cernum*, show uniform xylem and phloem distribution. In *Gleichenia dichotoma*, parenchyma develops within the original protostele, forming a medullated siphonostele. The origin of siphonostele remains debated, with hypotheses suggesting inner vascular tissue transforms into parenchyma. In *Anemia* and *Schizaea* stems, protostele transitions to parenchyma zones, supporting Jeffrey's theory. Cortical parenchyma invades the stele through leaf and branch gaps, linking pith to cortex. Eames (1936) notes lycosid piths originate interstalarly, while higher ferns likely have extra stelar origins. Siphonostele types include ectophloic and amphiphloic variants, with leaf and branch gaps forming axial parenchyma zones. Clado siphonic siphonostele lacks gaps, contrasting with phyllo siphonic structures in Polypodiophyta. The vascular cylinder in Polypodiophyta stems is dissected into a tubular network due to large leaf gaps overlapping along their longitudinal extent. This results in a protostelic arrangement, where the early formed portion has a stele resembling that of its early ontogeny, and a siphonostelic arrangement in the later formed portion. *Macedonia pectata* demonstrates this transition from protostele to solenostele and then polycyclic condition as development progresses. Solenosteles are characterized by scattered leaf gaps not overlapping with each other, and may be ectophloic or amphiphloic. The dictyostele is an advanced type of vascular organization seen in higher ferns, where the vascular parts between neighboring leaf gaps appear as separate strands called meristeles. These resemble protosteles in structure but are distinct from polysteles such as *Selaginella*. In addition to these types, some ferns exhibit perforated dictyostele, with gaps unrelated to leaf trace departure, while others have a polycyclic stele where the vascular system develops several separate steles. The eustele type proposed by Brebner features a ring of collateral or bicollateral strands including pericycle and medullary ground tissue without delimited intravascular areas. The atactostele is the most complex type seen in monocotyledons, with scattered vascular bundles devoid of pith. This term was coined by George Brebner in 1902 for the vein arrangement of vascular bundles. The polycyclic stele has vascular bundles in concentric rings, typically solenostelic or dictyostelic. Polysteles is a condition where some pteridophytes have more than one type of stele, and this variation can be found within families or genera. Evolutionary changes in stelar organization occur independently and may range from protostele to siphonostele, with the transformation from siphonostele leading to polycyclic steles in pteridophytes.