

## Quadrant II – Transcript and Related Materials

**Programme:** Bachelor of Science (First Year)

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**Unit:** 1- Pteridophytes

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### Notes

Stele is the central cylinder or core of vascular tissue in higher plants. Stele consists of xylem, phloem, pericycle, medullary rays (if present) and pith. Van Tieghem and Douliot (1886) developed “Stellar Theory”. The cortex and the stele are the fundamental parts of a shoot and both these parts are separated from each other by the endodermis.

According to stellar theory, primarily there is no fundamental difference in the anatomy of stem and roots, because in both of them a stele surrounded by the cortex. According to Van Tieghem and Douliot (1886) endodermis represents the inner boundary of cortex. The cells of endodermal layer shows the presence of casparian strip.

### Types of Stele

#### 1. Protostele

Stele in which the vascular cylinder consists of a solid core of xylem surrounded by phloem, pericycle and endodermis is called **protostele**. The protostele is primitive type of stele in vascular plants. There is no pith in protostele.

**a. Haplostele-** The protostele with a smooth core of xylem surrounded by a uniform layer of phloem. Examples: fossil genera like *Rhynia*, *Horneophyton* and living genera like *Selaginella chrysocaulos*, *S. kraussiana*.

**b. Actinostele-** It is a protostele having a xylem core with radiating stellate ribs. In actinostele the phloem is not present in a continuous manner, Examples: *Psilotum*, *Lycopodium serratum* and *Sphenophyllum*.

**c. Plectostele-** The xylem gets broken into a number of parallel plates. Such xylem plates alternate with the phloem plates. Example: *Lycopodium clavatum*.

**d. Mixed protostele-** The xylem groups are uniformly scattered in the ground mass of the phloem, such stele is called mixed protostele. Example: *Lycopodium cernuum*.

## 2. Siphonostele

In a siphonostele the centrally placed xylem core is replaced by parenchymatous cells called **pith**. Examples: *Anemia phyllitidis*, *Botrydium*, *Osmunda*.

Jeffrey (1898) classified siphonostele into the following two types on the basis of the position of phloem.

**a. Ectophloic siphonostele:** The phloem is restricted only to the external side of the xylem. The pith is central in position. Example: *Osmunda*, etc.

**b. Amphiphloic siphonostele:** The phloem is present on both the external and internal side of the xylem. The pith is present in the centre. Eg. Rhizome of *Marsilea*.

## 3. Solenostele

When the siphonostele is perforated at a places corresponding to the origin of the leaf trace, such a condition is known as solenostele. It may be of following types:

**a. Ectophloic solenostele:** It is derived from ectophloic siphonostele, in this case the phloem is present only on the outer side.

**b. Amphiphloic solenostele:** It is derived from amphiphloic siphonostele, i.e, phloem is present on both the sides of xylem, e.g. *Adiantum pedatum*.

#### **4. Dictyostele**

Solenostele which is broken into a network of separate vascular strands, mainly because of the crowded leaf gaps, each separate vascular strand is known as meristele. Examples: *Ophioglossum lusitanicum*, *Pteris*, *Adiantum capillaris-veneris*, *Dryopteris chrysocoma*, *D. rigidia* and *D. filix-max*.

#### **5. POLYCYCLIC**

This type of stelar organization is the most complex one amongst all vascular cryptogams (pteridophytes). A typical polycyclic stele possesses two or more concentric rings of vascular tissue. This may be a solenostele or a dictyostele.

(a) Polycyclic solenostele and (b) Polycyclic dictyostele

#### **7. Eustele**

The vascular system consists of a ring of collateral or bicollateral vascular bundles situated on the periphery of the pith. It is the modification of ectophloic siphonostele. Splitting takes place because of the overlapping leaf gaps. The example of this type is internode of *Equisetum*.