

# Vascular Bundles

**CC-4**  
**UNIT-4**

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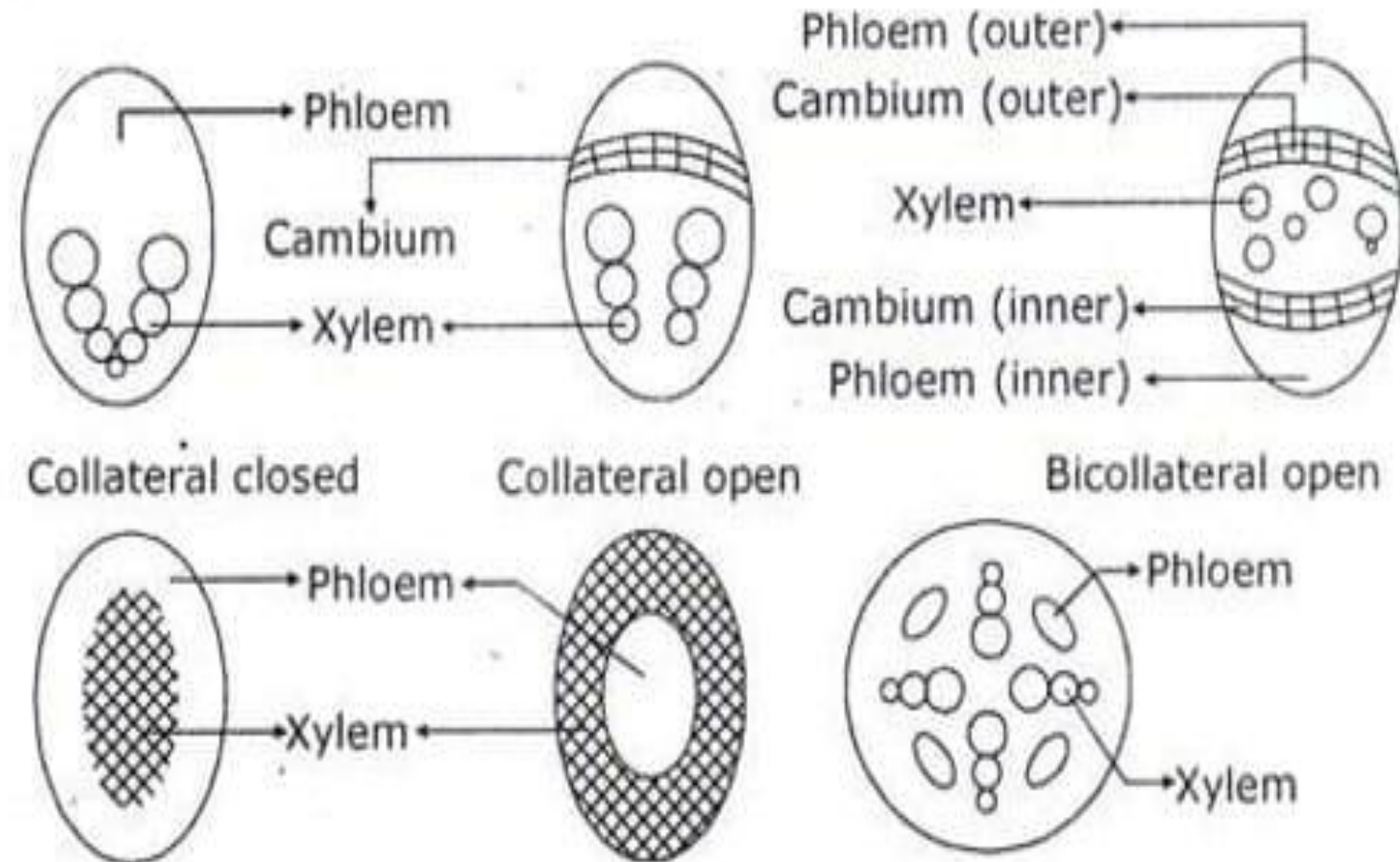
# Vascular Bundles-Introduction

- **The vascular tissue system consists of the complex tissues, xylem and phloem, which constitute discrete conducting strands called vascular bundles.**
- **These are usually primary in nature.**
- **In spite of the occurrence of supporting and other cells the function of the vascular bundles is primarily conduction- xylem for the conduction of water with dissolved mineral matters, and phloem for the conduction of elaborated food matters in solution.**
- **The vascular bundles originate from the procambium of the apical meristem.**

# Types of Vascular Bundles

According to the arrangement of xylem and phloem in the vascular bundles, they are being arranged in the following main types:

- (1) Radial,
- (2) Conjoint and
- (3) Concentric.



# Conjoint Vascular Bundles

Those in which the two types of tissues are separated from one another. Here, xylem and phloem together form a bundle.

The two subtypes are:  
(a) Collateral and  
(b) Bicollateral.

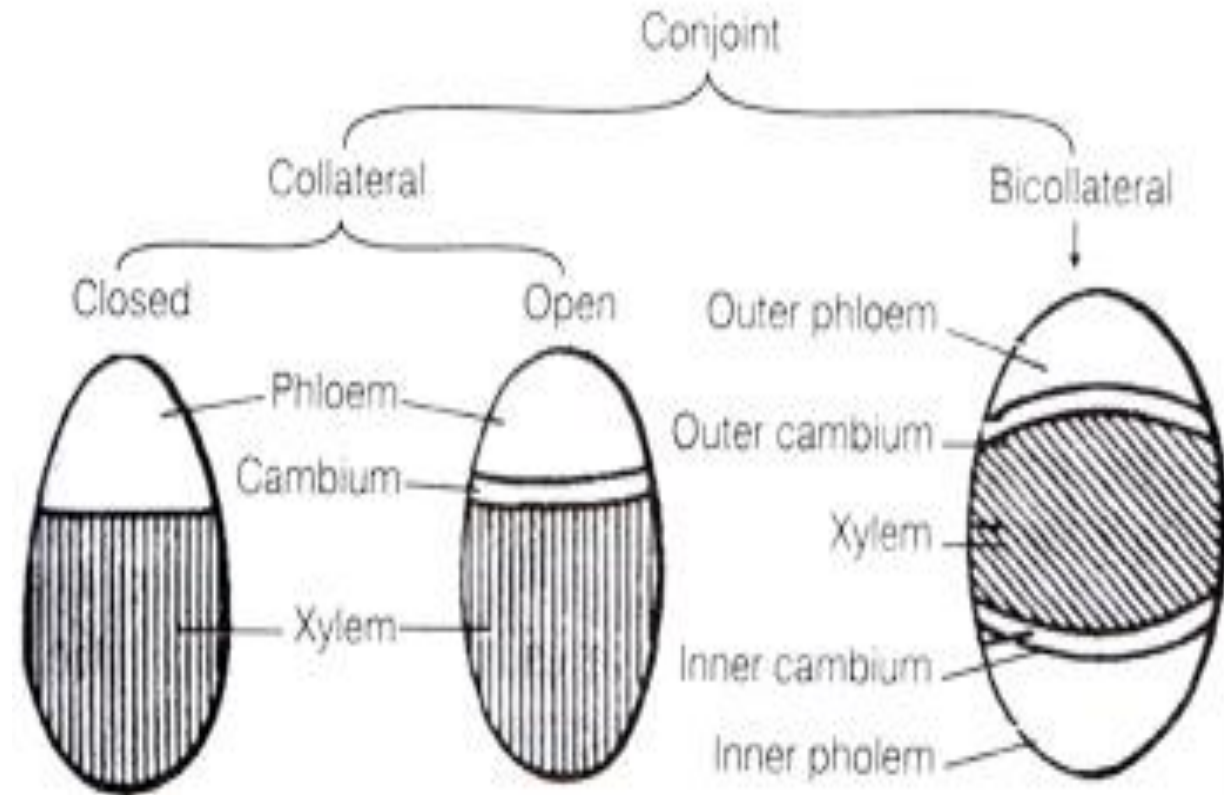
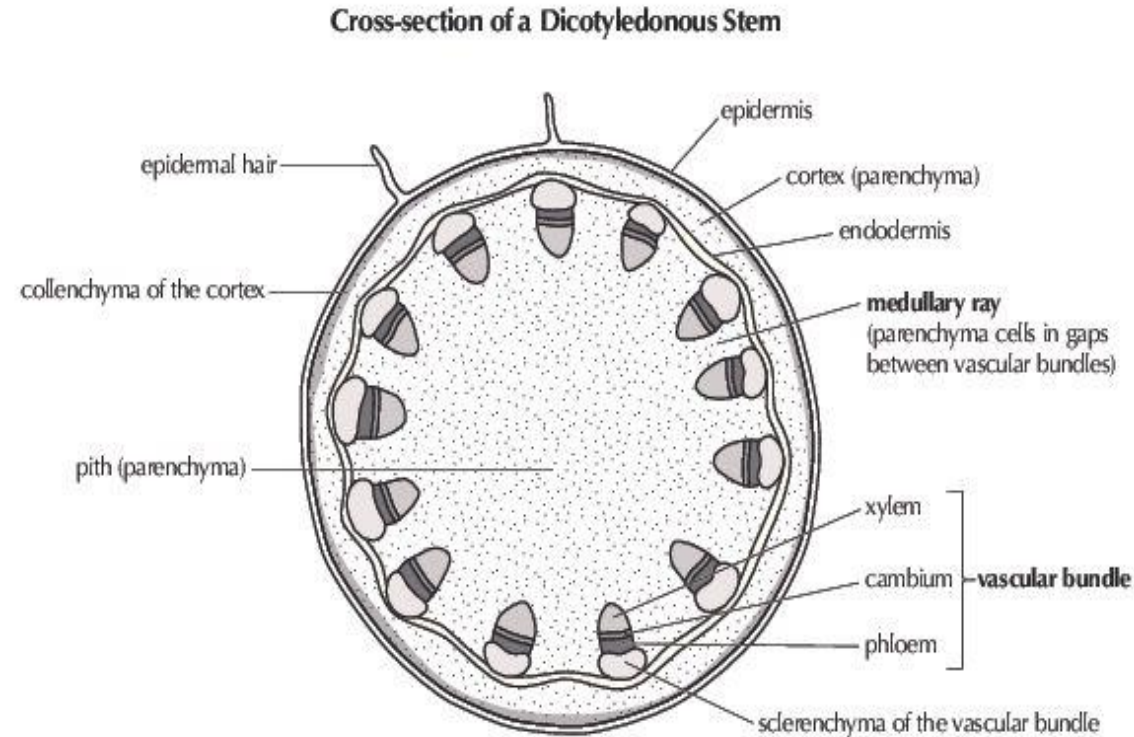


Fig. 23.10 Types of conjoint vascular bundles

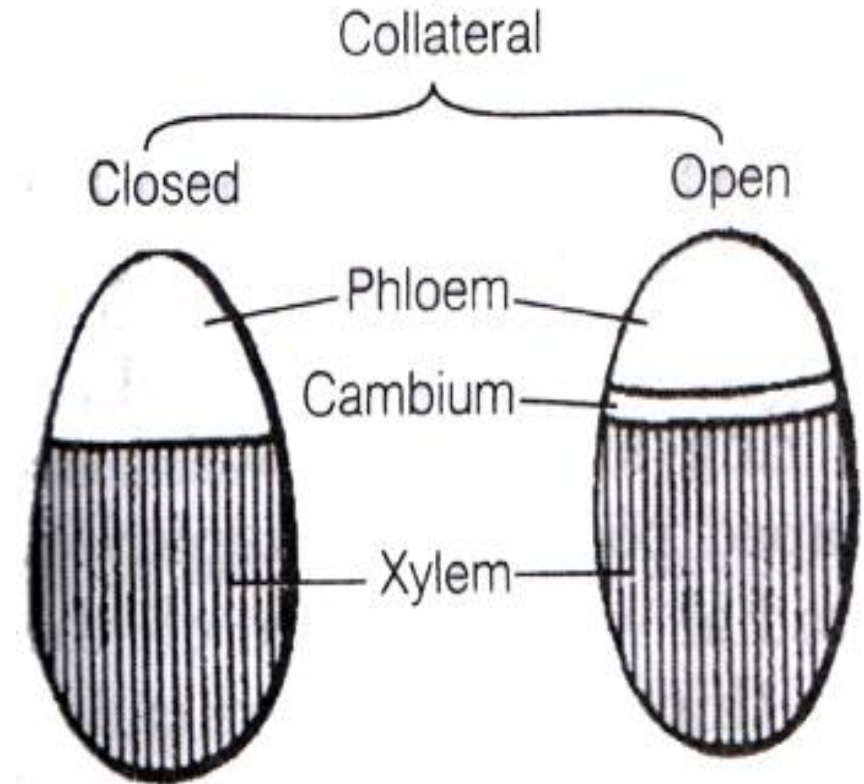
# Collateral Vascular Bundles

- The xylem and phloem lie together on the same radius in the position that xylem lies inwards and the phloem outwards.
- Here the phloem occurs on one side of the xylem strand.
- In dicotyledonous stem, the cambium is found to be present in between xylem and phloem, such bundles are called open (e.g., in *Helianthus*), and when the cambium is absent it is called closed (e.g., in monocotyledonous stems).



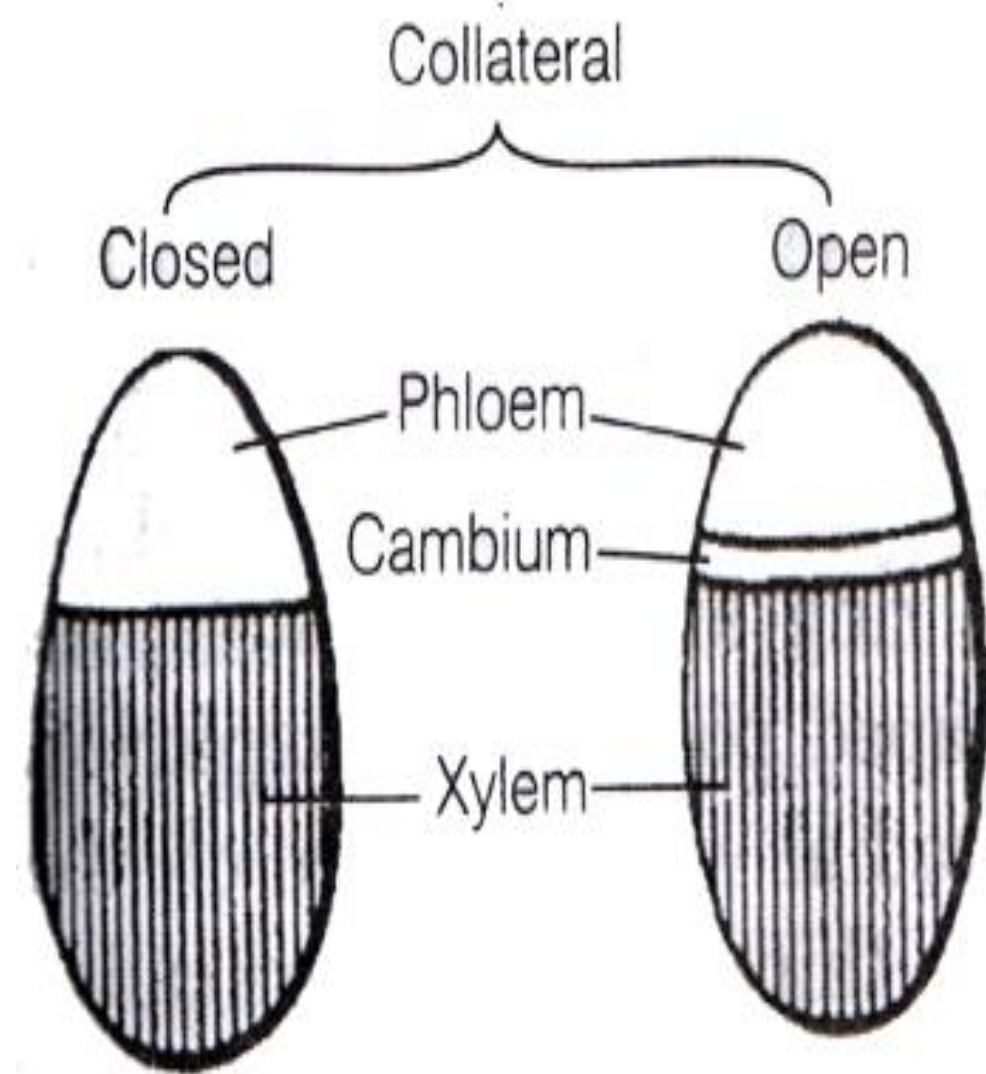
# Open Vascular Bundles

1. Vascular bundle contains a strip of cambium in between phloem and xylem.
2. Phloem and xylem do not lie in direct contact with each other.
3. Due to activity of cambium, original or primary phloem and xylem move away from each other. Secondary phloem and secondary xylem are formed in between.
4. Open vascular bundles occur in dicot and gymnosperm stems.
5. Open vascular bundles can be collateral and bi-collateral.



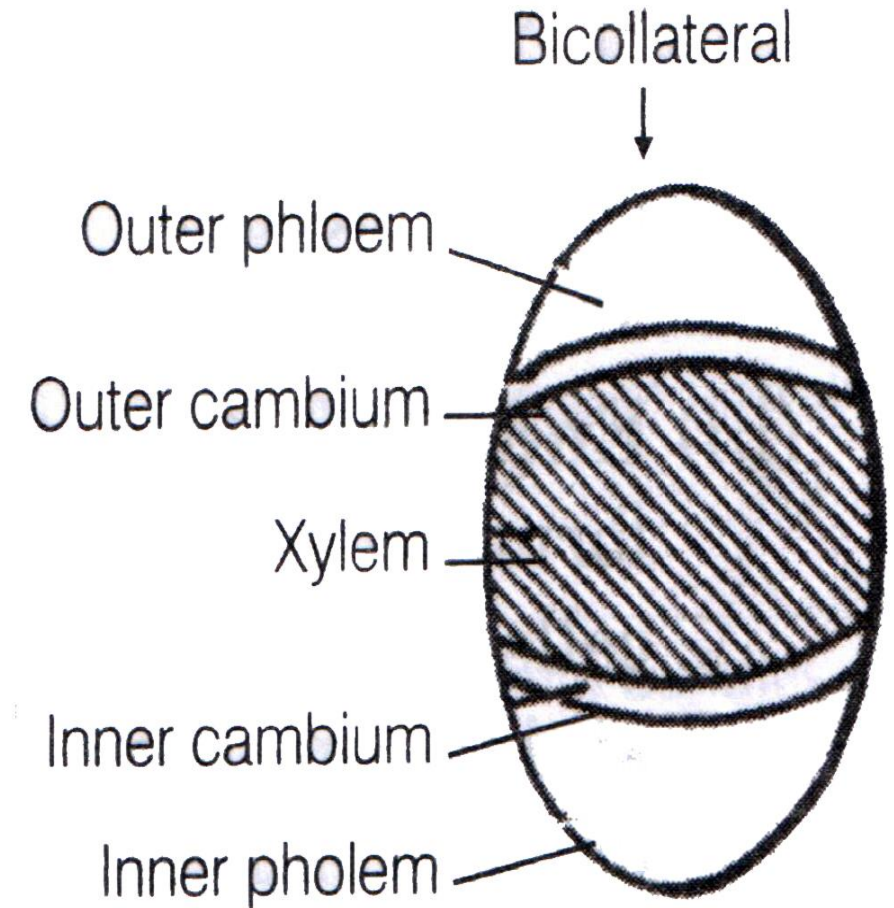
# Closed Vascular Bundles

1. Intra-fascicular cambium is absent
2. Phloem and xylem occur in direct contact with each other.
3. There is no such activity.
4. Closed vascular bundles are found in leaves and monocot stems.
5. Closed vascular bundles can be collateral or concentric.



# Bicollateral Vascular Bundles

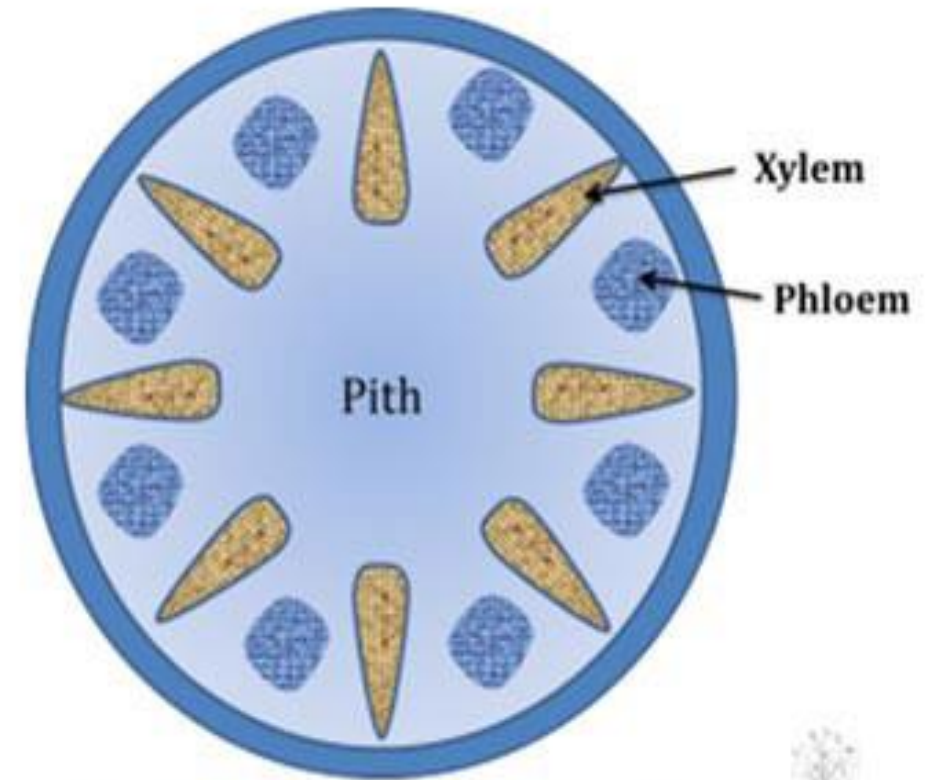
- In such bundles the phloem is found to be present on both sides of xylem. Simultaneously two cambium strips also occur.
- Various elements are arranged in the following sequence—outer phloem, outer cambium, xylem, inner cambium and inner phloem.
- Such bundles are always open.
- Such bundles are commonly found in the members of Cucurbitaceae.





# Radial Vascular Bundles

- A vascular bundle, in which the primary xylem and primary phloem strands are separated from each other by nonvascular tissues and they are situated on alternate radii of an axis, is known as radial vascular bundle or radial bundle.
- These bundles are the characteristic of roots. There is no primary cambium in this bundle



*Radial Vascular Bundles*

# Radial Vascular Bundles

The dicot roots usually have four to six number of protoxylem poles in contrast to monocot root where many poles of xylem (more than six) are present.

The number of protoxylem poles in a root may be 1, 2, 3, 4, 5, 6 or more. Accordingly they are called monarch, diarch, triarch, tetrarch and so on. The term polyarch is used when the number of protoxylem poles are more than six.

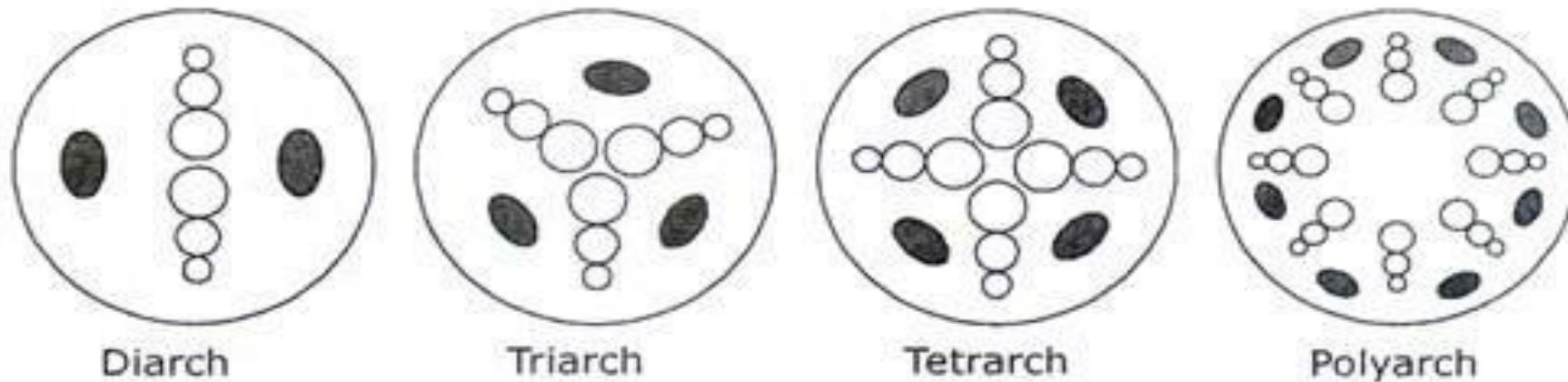


Figure 14.4

Diagram illustrating the different arrangements of the number of protoxylem groups in roots in cross-sectional view.

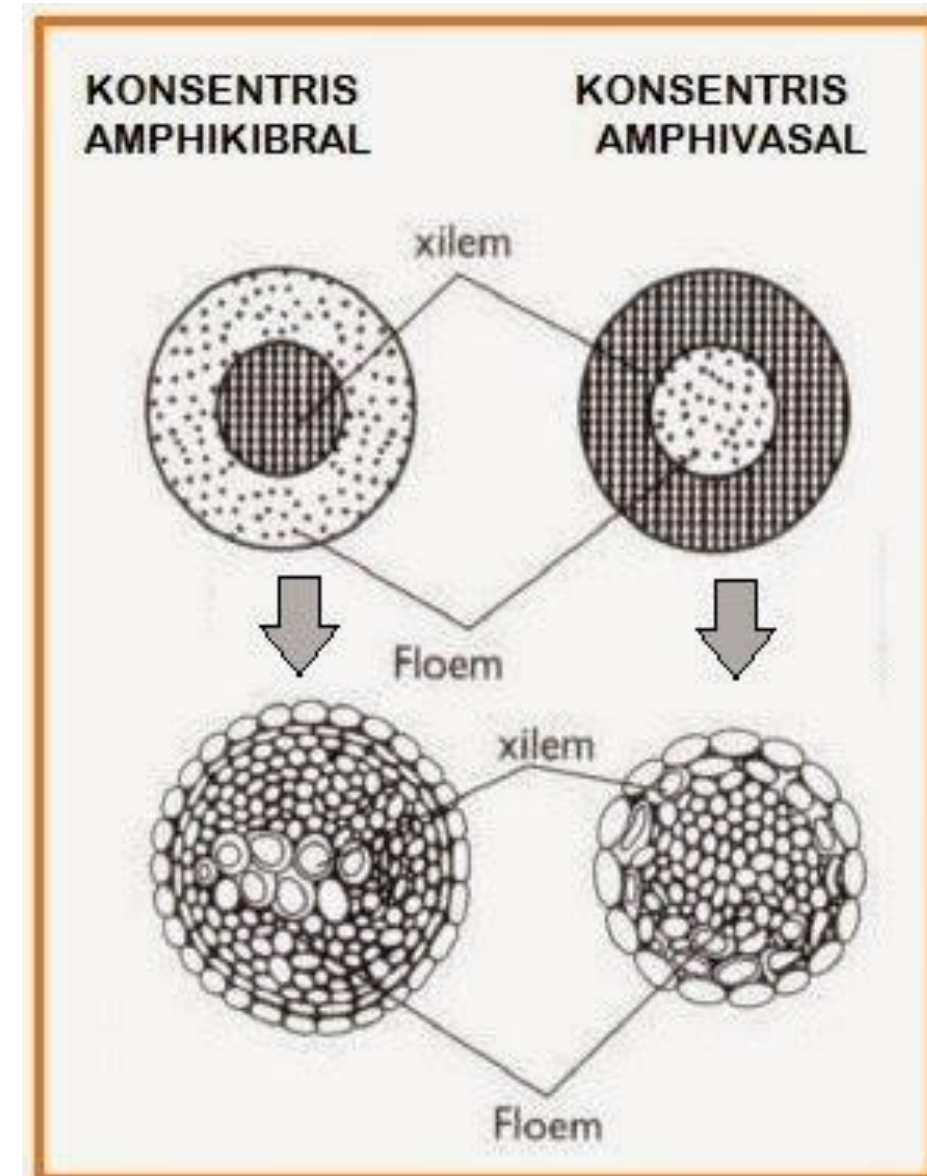
# Concentric Vascular Bundles

A vascular bundle in which one type of vascular tissue surrounds the other is known as concentric bundle.

In this bundle xylem either encircles or is encircled by phloem and accordingly the following two types are recognized:

## (a) Amphivasal bundle:

A vascular bundle in which xylem encircles the central strand of phloem is known as amphivasal bundle, also called leptocentric bundle. Ex. *Dracaena sp*, *Yucca sp*.

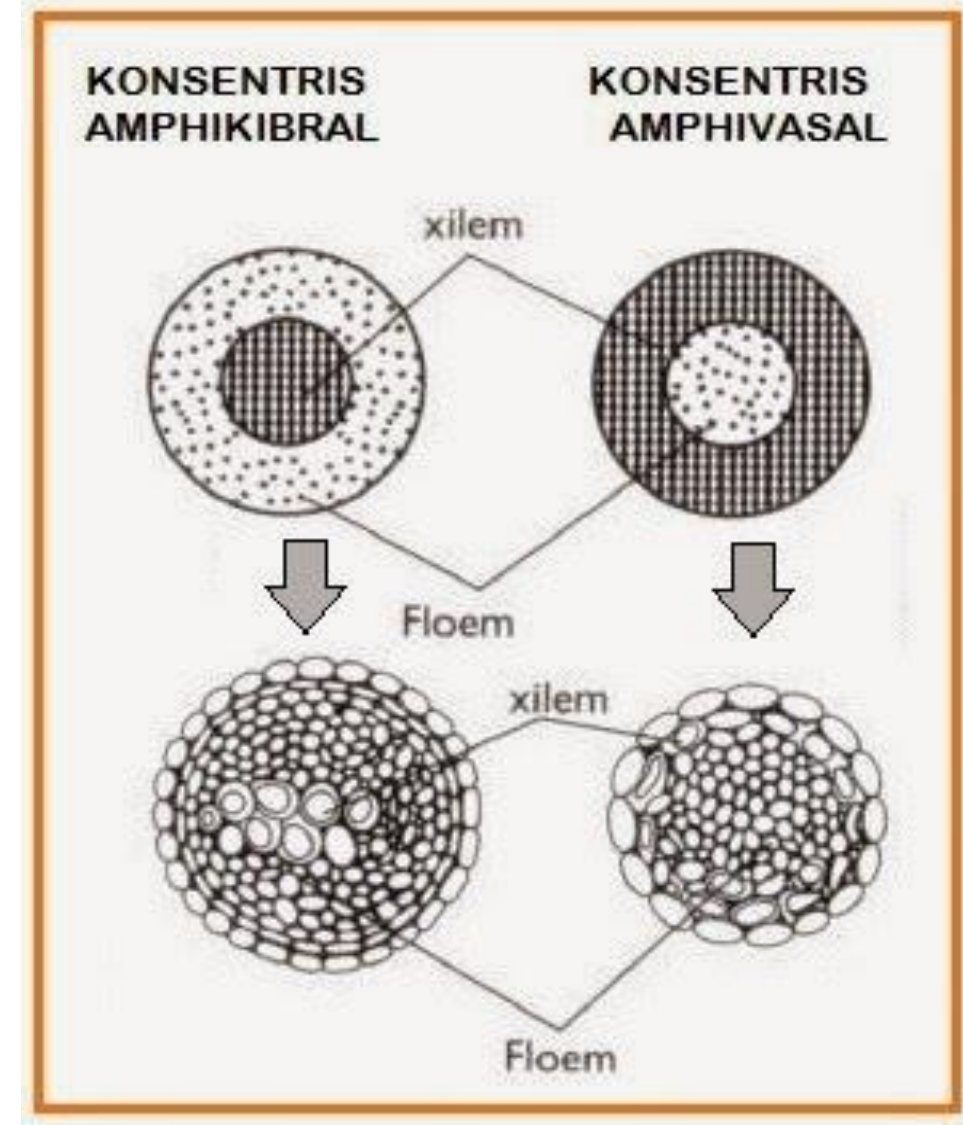


# Concentric Vascular Bundles

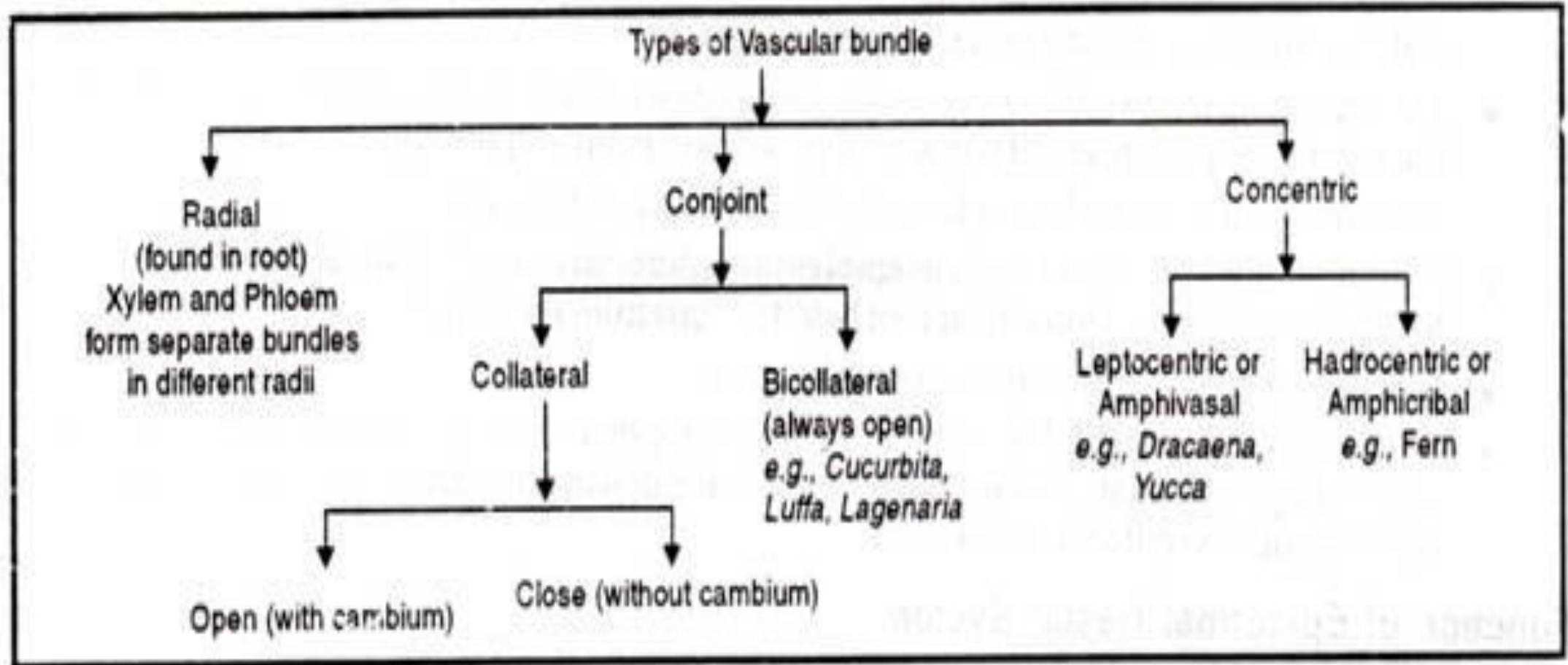
## (b) Amphicribal bundle:

A vascular bundle in which phloem encircles the central strand of xylem is called as amphicribal bundle, also known as hadrocentric bundle. Ex. *Selaginella sp.*

The concentric bundles, either amphivasal or amphicribal, are closed as there is no cambium in between xylem and phloem.



# Overview of Classification



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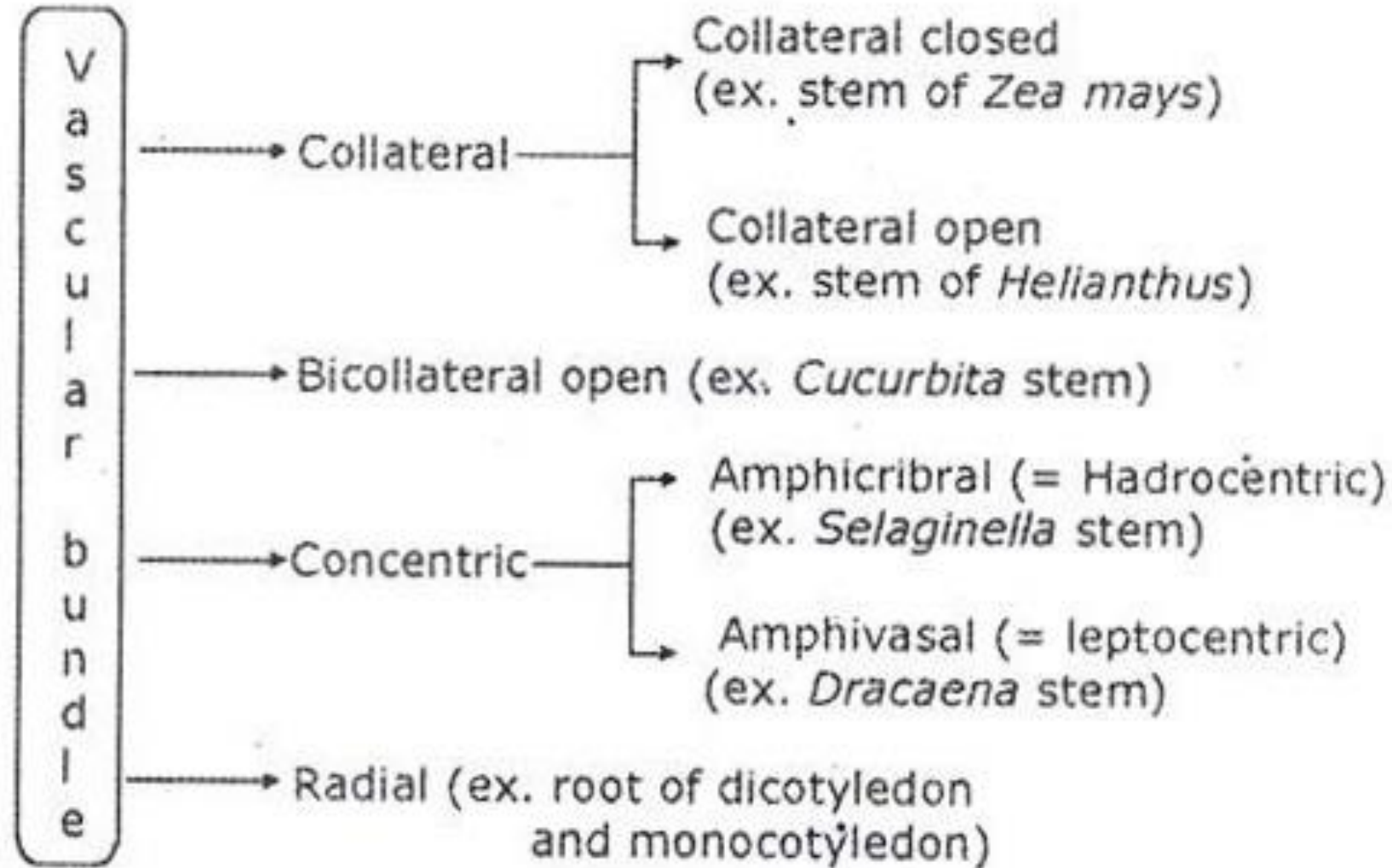


Chart summarizing the different types of vascular bundle.