Outline – Vascular Tissue System

1. Overview of vascular tissue & plant diversity
2. Types of vascular tissue
   - xylem
   - phloem
3. Xylem: types - Tracheids & vessel members
   - Tracheary cell characteristics
   - Secondary cell wall architecture in xylem cells
   - Development of primary xylem
4. Phloem: Types and cell characteristics
5. Vascular Tissue Development
   - Primary vascular tissue
   - Secondary growth

Vascular Tissue & Plant Diversity

Plants

Vascular Plants

300,000 + species

Nonvascular plants

~25,000 species

Bryophyta...mosses
Hepaticophyta...liverworts
Anthocerotophyta...hornworts

No Seeds
Lycophyta...ground pines & club mosses
Pterophyta...horsetails

With Seeds
Naked Seeds – No Ovary...Gymnosperms
Seeds enclosed in an ovary...Angiosperms

Types of Vascular Tissue - Xylem

1. Xylem
   - Tracheids
   - Vessel members
   - Parenchyma
2. Primary Xylem
   - Protoxylem
   - Metaxytem
3. Secondary Xylem
Xylem: Tracheids and Vessel Members

- Tracheid – Imperforate cell = No perforation plate

Xylem: Vessel Members & Perforation Plates

- Vessel - Perforation plates

Xylem Secondary Wall Architecture

Types of Secondary Wall Thickenings in Xylem
1. Annular
2. Helical
3. Scalariform
4. Reticulate
5. Pitted

Xylem: Circular Bordered Pits

- Bordered Pit
Primary Xylem Development
1. Protoxylem forms first
2. Metaxylem forms next
3. Xylem development
   A. centrifugal (outward) in stems
   B. centripetal (inward) in roots

Types of Vascular Tissue - Phloem
1. Phloem
   - Sieve Cells
   - Sieve tube members
   - Companion cells
   - Phloem parenchyma
2. Primary Phloem
   - Protophloem
   - Metaphloem
3. Secondary Phloem

Phloem Cell Characteristics
- Sieve elements
  - Sieve cells
  - Sieve tube members
  - form sieve tubes
- Companion cells
- Phloem parenchyma

Phloem Anatomy
- Sieve plate
- Pores
- Lateral sieve area
- Phloem Parenchyma
- Start wed 1/30

**Stem With Primary Growth**

**Development of Secondary Vascular Tissue in Stems**

**Initiation of Early Secondary Growth**
Development of Secondary Vascular Tissue in Stems

Increase in stem diameter and circumference

Additive (periclinal) cell divisions → increase stem diameter

Multiplicative (anticlinal) cell divisions → increase stem circumference

Vascular Cambium

Secondary Xylem and Phloem Development from Vascular Cambium

Direction of Xylem Development

Direction of Phloem Development

Secondary Growth

Secondary xylem

Vascular cambium

Phloem

Pith

Cortex

Tomato Stem longitudinal section

Tomato Stem transverse section
Outer Bark Development - Lenticels

1 = Lenticle
2 = epidermis
3 = cork
4 = cork cambium
5 = collenchyma
6 = 2ª phloem
7 = vascular cambium
8 = 2ª xylem

Rhytidome – Sequent Periderm Formation

Outer Bark Development

endo phloem (cork)
phellogen (cork cambium)
pheloderm
phloem fibers (sclerenchyma)
phloem parenchyma
sieve tube
ray
vascular cambium
xylem fibers (wood)
vessel

END

Vascular Tissue