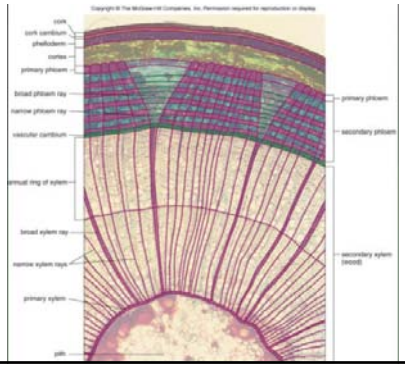
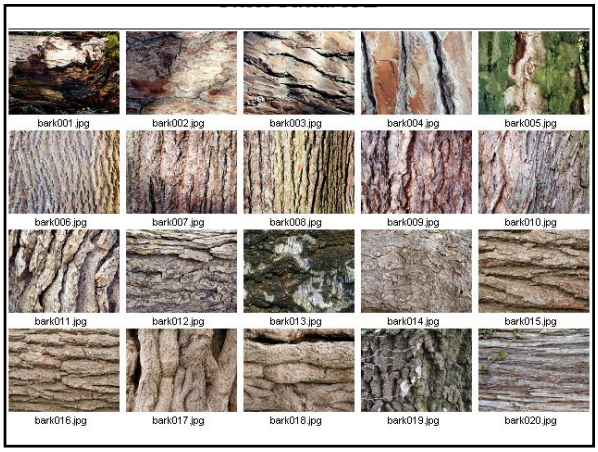
Lecture 20 Periderm and Bark



Periderm

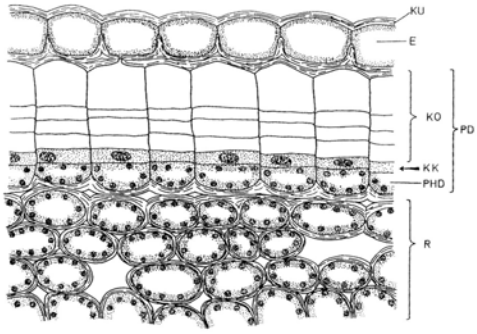
(Peri = about; derma = skin)

- Periderm = the technical term for bark;
- = contains the cork (phellem) that is produced by the cork cambium (phellogen) and any epidermis, cortex, and primary or secondary phloem that might be exterior to the cork cambium
- Effectively replaces the protective function of epidermis when this tissue is destroyed via expansion in girth
  1. Cork cells heavily suberized, lignified, some with layers of wax -> effective barrier for gaseous diffusion
  2. Cork of some species contains resins and tannins -> repel invasive organisms
  3. Many long lived species develop extremely thick periderms that protect stems against heat death in cases where fire burns rapidly through understory and accumulated litter.
- Develops in the following situations:
  - in association with leaf and branch abscission
  - around areas of diseased or dead tissues with plant
  - beneath surface of surface wounds



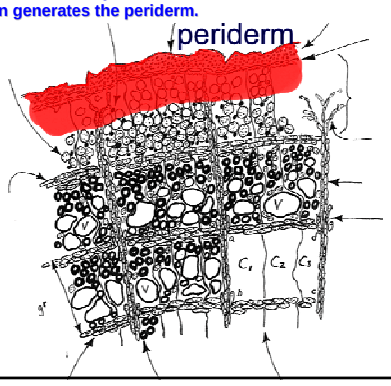
Terminology

Bark = everything outside vascular cambium	Rhytidome = Outer Bark = everything outside innermost Phellogen	Periderm
Secondary Phloem	Periderm	Phelloderm
Primary Phloem	May include Cortex	Phellogen
Cortex	May include Primary Phloem	Phellem
Periderm	May include Secondary Phloem	

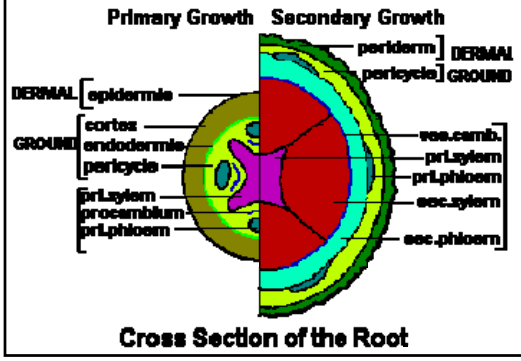


Periderm, das als sekundäres Abschlußgewebe das primäre Abschluß-gewebe der Epidermis ersetzt.
E: Epidermis der Kutikula (KU); PD: Periderm; KK: Korkkambium;
KO: Kork, Phellem; PHD: Phelloderm; R. Rinde.

Periderm is a term used to describe the phellem, phellogen and phelloderm collectively. It is the outer bark of the tree. The phellogen generates the periderm.



Tissue systems of the root

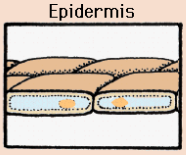
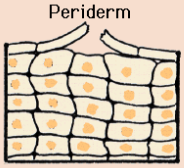


Periderm

- *In woody plants when the tree increases in diameter, the epidermis cracks and is replaced by periderm*
- *The periderm consists:*
  - *Cork cells*
  - *Cork cambium*

Periderm also occurs in thickened stems of some monocots, e.g. *Cordyline australis*

PERMANENT SURFACE TISSUE: Mature differentiated cells protecting outer surfaces of young plant body

	Characteristics:	Function:
Epidermis 	Flat cells, often with thick outer walls Aerial parts often covered with waxy cuticle	Protection in young plants
Periderm 	Waterproof cells with thick cell walls Dead at maturity	Forms outer bark in trees

Eucalyptus Bark

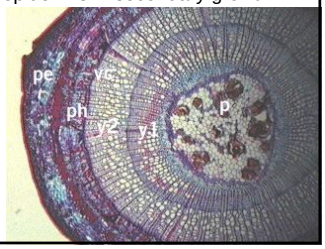
- **Note the colors of the shedding bark and its underlying cells.**
- **The green color indicates the presence of living chlorenchyma.**
- **The red/brown cells of the bark are dead.**

Periderm

- **Periderm is a secondary tissue produced by the Cork Cambium or Phellogen.**
- **Periderm is a protective tissue. Its cells are called Cork or Phellem. They are dead at maturity but their walls are impregnated with Suberin.**
- **Suberin is a waxy material like Cutin. Suberin is waterproof and resists microbial degradation.**
  - **cork cells protect the stem or root from excess water loss and the entrance of pathogens.**
  - **It also acts as an insulator against extreme temperatures.**
- **Periderm is commonly called Bark. We will say more about this term later.**

Tilia stem - 2 years

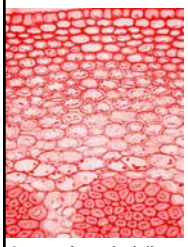
- p - pith
  y1 - first year xylem
  y2 - second year xylem
  ph - second year phloem
  vc - vascular cambium
  pe - periderm - replaces epidermis in secondary growth



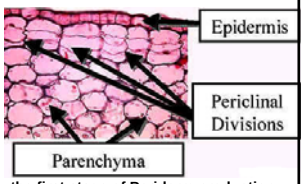
Formation of the phellogen

- Arises as living parenchyma cells resume mitotic activity and become meristematic.
- The conversion can happen in almost any parenchyma cell: epidermis, hypodermis, cortex, secondary phloem, and secondary xylem.
- Phellogen can form in all organs of the plant: shoot axis, roots, leaves, fruits, and flower parts.
- The majority of bark occurs on the shoots and roots of woody plants.

Periderm development in the stem often starts in subepidermal Parenchyma cells.

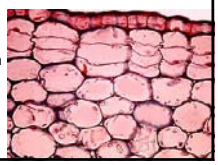


Cortex of a typical dicot stem would look like prior to the initiation of Periderm

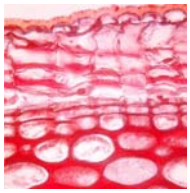


the first stage of Periderm production

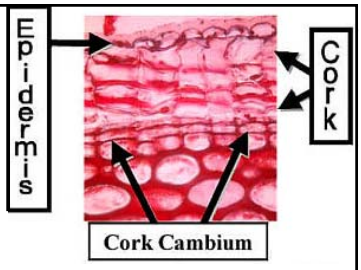
Periclinal divisions in Parenchyma cells of the outer Cortex are the first indication of Periderm formation.



Periderm



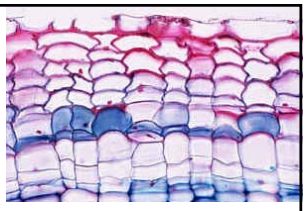
Periclinal Divisions in the Periderm produce cells predominately towards the Outside in radial files. If you trace a cell file backwards you will arrive at the Cork Cambium or Phellogen

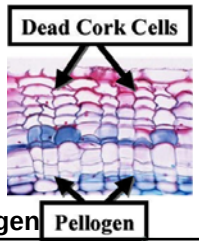


Cork cells are dead at maturity!
Consequently, all cells and tissues outside of the cork die. The Epidermis is dead. Locate the Epidermis and note the presence of a Cuticle

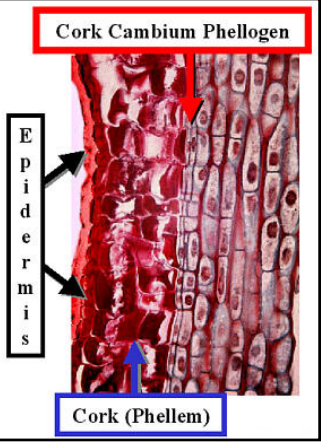
Periderm

- The Epidermis has fallen away from this stem. As the diameter of the stem increases, the Epidermis cracks and eventually falls off.



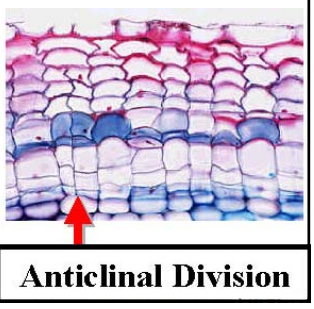


Periderm



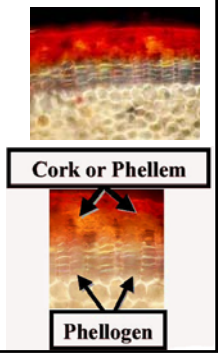
Periderm - The Phellogen cells are usually the smallest ones in a file. Why is this so???

- **As the Diameter of the stem increases due to the activity of the Vascular Cambium, cracks would develop in the Periderm if only Periclinal Divisions occurred, as these produce radial files of cells without producing cells laterally. Consequently, Anticlinal divisions occur. These increase the number of cell files laterally and thus increase the circumference of the Phellogen & Phellem.**



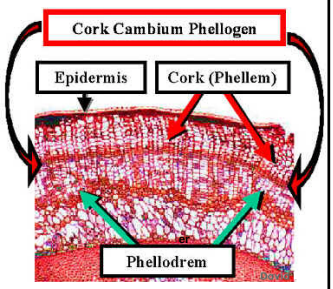
Hand section of coffee young stem stained with Sudan

- **The red color is due to the presence of Suberin.**
- **Note the radial files of cells emanating from the Phellogen & the intense staining in the outer Phellem (Cork).**



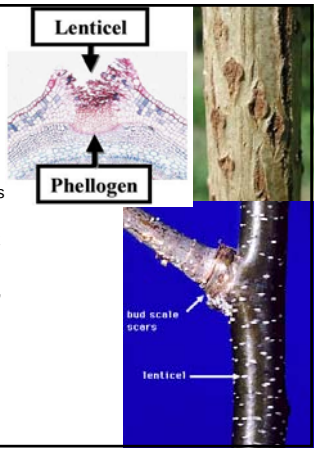
Young *Aristolochia* Stem

- **The Cork Cambium in *Aristolochia* also produces cells towards the inside of the stem. These are called Phelloderm & they resemble typical Parenchyma. They do not produce Suberin and they remain alive at maturity**



Lenticels

- The cork is impermeable to gaseous diffusion but the numerous lenticles facilitate the movement of O2 into the living tissues within this barrier and also allow the exit of CO2.
- A region in the bark that contains loose, rounded complementary cells, and that permits the diffusion of oxygen into the plant through the bark.
- Lenticels arise from less tightly-packed regions of the phellogen, and the cork produced consists of rounded cells with large intracellular spaces between them.



Older *Aristolochia* Stem

- The Cork Cambium becomes hyperactive in certain locations. This disrupts the surface and can produce cells which are loosely interconnected and contain less suberin that typical cork cells. These areas are called Lenticels.
- It is thought that these provide a path for gas exchange across the otherwise impermeable Periderm.