SECRETORY TISSUES IN PLANTS

Sujamol Abraham
PG Department of Botany
Deva matha College, Kuravilangad

- Plants release many substances from their cell cytoplasm to the exterior and they are called as Plant-secretions.
- Among these secretions, some are beneficial to the plant and some are not. The beneficial substances secreted from the plant parts are called as secretions.
- The secretions may be water, nectar, salt, tannins, resins, latex, gums, digestive enzymes, hormones etc.

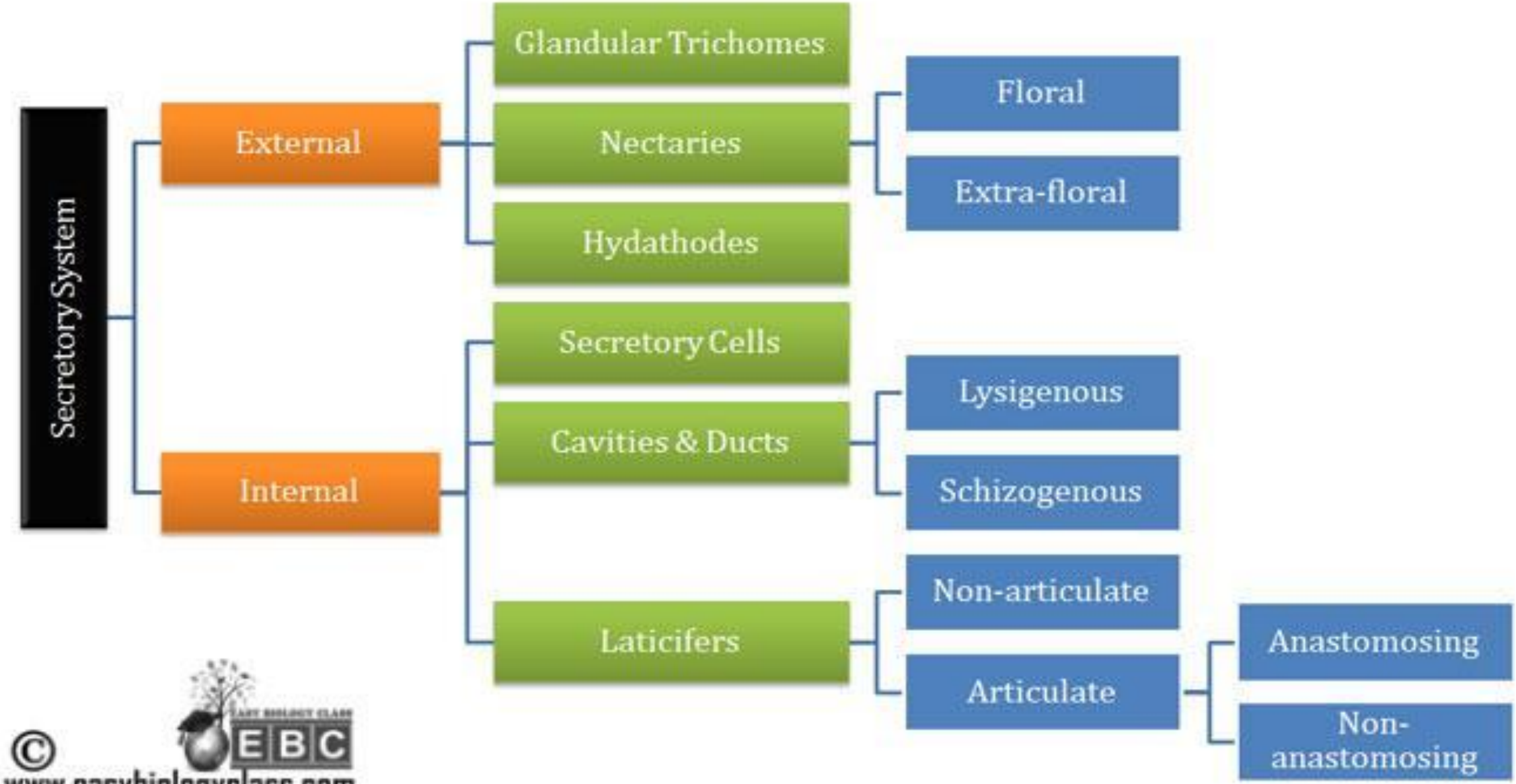
Secretory cell/tissue:

- Cells or tissue facilitate that secretion is termed as the secretory cell or secretory tissue.

Classification of secretory Tissues:

- The secretory tissue is broadly classified into two categories based on their position in the plant body. They are
- (I). External secretory tissue
- (II). Internal secretory tissue

Secretory System in Plants: Classification

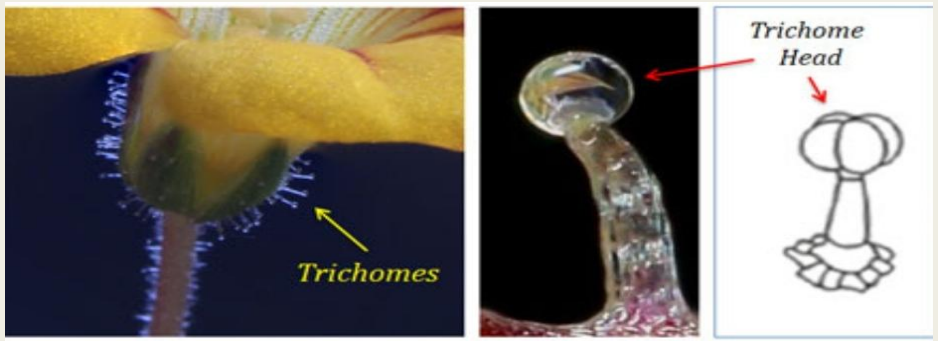


External secretory tissue

- External secretory tissues occur in the external surface of the plants.
- They may be unicellular or multicellular and with our without the vascular elements.
- They usually develop from the epidermis or sub-epidermal layers of the plant organs.
- Three main types of External Secretory Tissues.
- (1). Glandular trichomes
- (2). Nectaries
- (3). Hydathodes

Glandular trichomes:

- Glandular trichomes are unicellular or multicellular epidermal hairs with secretory function.
- Usually they have a stack and a head.
- The head portion will be secretory in nature.
- The heads of glandular trichomes are covered with cuticle.
- The secretion accumulates in the space between the cell wall and the cuticle.
- The cuticle burst to release the secretion.
- Glandular Trichomes Examples:



Glandular Trichome

(a).Digestive glands of drosera:

- *Drosera* lure, capture, and digest small insects using stalked mucilaginous glands (tentacles) present on their leaf surfaces.
- These glands are glandular trichomes.
- The glandular trichomes of *Drosera* possess vascular elements.a

Glandular Trichome: Digestive Glands of *Drosera*

(b). Salt Glands of Mangrove Plants

- Salt glands are external glandular structures present on the epidermis of mangrove plants.
- They are abundantly present on the leaves of halophytic plants.
- They help to remove excess salts from organs.

Salt crystals on the leaf surface of the Black Mangrove

http://commons.wikimedia.org/wiki/File:Avicennia_germinans-salt_excretion.jpg

(c). Colletors

- Colletors are specialized and more complex external secretory structure found in some plants such as *Malus*, Rosa and *Pyrus*.
- They are found on the young leaf primordia.
- Colletors produce a sticky fluid which covers the leaf primordia.
- Collectors drop off as the leaf primordia matures.
- Thus they provide protection to dormant bud and young leaves.

(2) Nectaries

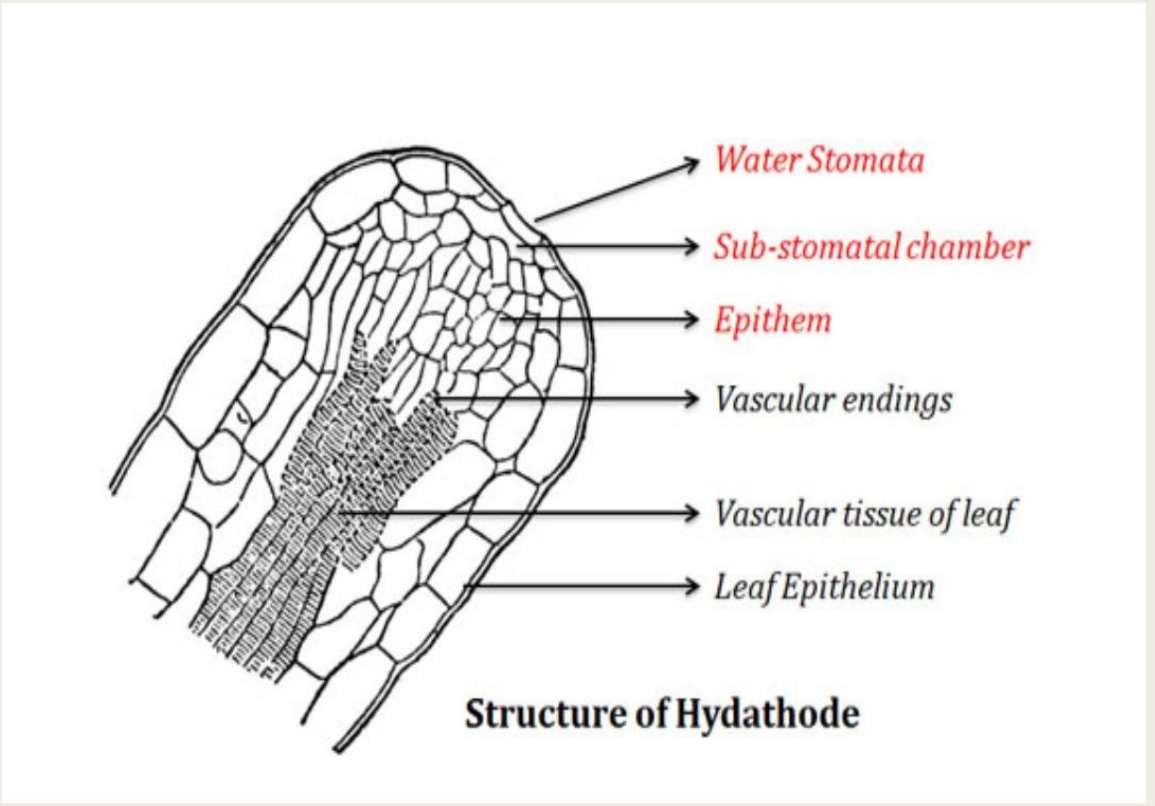
- Nectaries are external secretory structures.
- They secrete a sugary fluid called nectar.
- The nectar attracts insects and thus helps in pollination.
- The nectaries are usually multicellular and can occur in the epidermis, hypodermis or on trichomes.
- Nectaries are associated with vascular structures particularly the phloem .
- Nectaries have thick cuticle. The nectar accumulates between cuticle and the cell wall.
- During the release of nectar, the cuticle ruptures.
- The secretion of nectar lasts only for a short time.
- Two types of nectaries are present in plants: (a) Floral and (b) Extra-floral.

- **(a). Floral nectaries:**
- They are the common type of nectaries.
- They are associated with flowers.
- Usually found on the floral thalamus, base of gynoecium or androecium.
- **(b). Extra-floral nectaries:**
- Extra-floral nectaries are present on the vegetative parts such as petiole, pedicel or stem.
- Extra-floral nectaries are common in families such as Euphorbiaceae, Verbenaceae and Bignoniaceae

(3). Hydathodes

- Hydathodes are a type of secretory tissue in leaves.
- They are modified pores, especially on a leaf, which exudes water as drops.
- The pores of the hydathodes are also called as water stomata.
- They facilitate guttation(secretion of water as droplet .
- Hydathode is made of a group of living cells called epithem with numerous intercellular spaces.
- The cells of the epithem lack chloroplasts.
- Vascular bundles of leaves end in the epithem.
- Epithem cells open out into one or more sub-epidermal chambers.
- Sub-stomatal chamber communicate with exterior through the pore (water stoma).
- Water stomata resemble an ordinary stoma in shape and structure.
- However, they are larger than the ordinary stomata.
- Hydathodes always stay opened, since they do not have the opening and closing mechanism.


Guttation in Some Leaves


Water Stomata
Sub-stomatal chamber
Epithem
Vascular endings
Vascular tissue of leaf
Leaf Epithelium
Structure of Hydathode

(II). Internal Secretory Tissues

- Internal secretary tissue is embedded inside the plants and they cannot be visualized externally.
- They store secretory products.
- Internal secretory system of plants may be single-celled or multicellular.
- In some plants, it is highly specialized and complex.
- THREE types of internal secretory systems present in plants:
- (1). Internal secretory cells
- (2). Secretory cavities and ducts
- (3). Laticifers

(1). Secretory cells (Idioblasts)

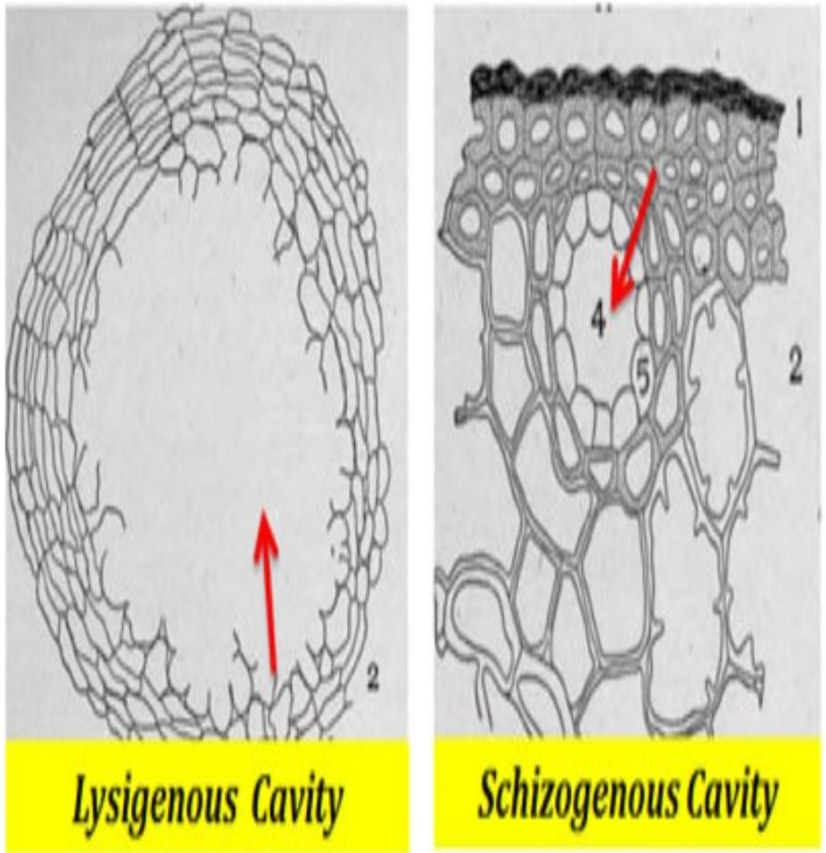
- They are specialized secretory cells with secretion. Also called as **idioblasts**.
- Secretory cells are found dispensed in the normal cells.
- Idioblasts may be isodiametric or elongated and tube-like.
- Most of the idioblasts contain secretory contents.
- They can store tannin, mucilage, oils, crystals such as raphides and cystoliths.

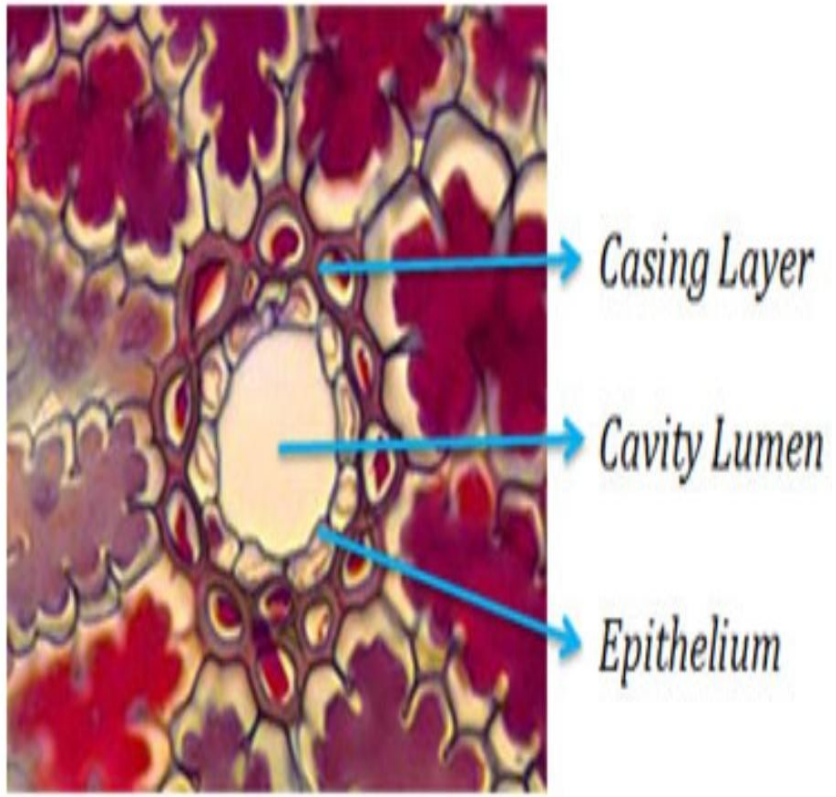
(2). Secretory cavities and ducts

- These are cavities inside the plant body with secretory contents.
- Based on their origin, TWO types of secretory cavities present in plants.
- (a). Lysigenous cavity
- (b). Schizogenous cavity

- **(a). Lysigenous cavity:**
- Lysigenous cavity is formed by the lysis of some cells filled with the secretory contents.
- They are usually irregularly sized and shaped.
- Found in the members of Rutaceae *(Citrus, Lemon* etc.).
- **(b). Schizogenous cavity:**
- Schizogenous cavities are formed by the separation of cells by the breakdown of middle lamella (no cell lysis occurs here).
- These cavities are more or less isodiametric and circular in cross-section.
- Schizogenous cavities are internally lined with interact secretory cells called epithelial cells.
- The epithelial cells secrete the contents into the cavity.
- Example: Secretory cavities found in members of Asteraceae, Coniferales and Apiaceae.

Lysigenous vs Schizogenous Cavities in Plants





Schizogenous Cavity

Resin Canal *(Pinus)*

- **(3). Laticifers (laticifer tissues)**
- Laticifers are fused tube-like cells filled with a fluid called latex.
- Laticifers are usually confined to phloem (bark) however, they can occur in any part of the body.
- TWO types of laticifers in plants.
- (a). Non-articulate laticifers
- (b). Articulate laticifers

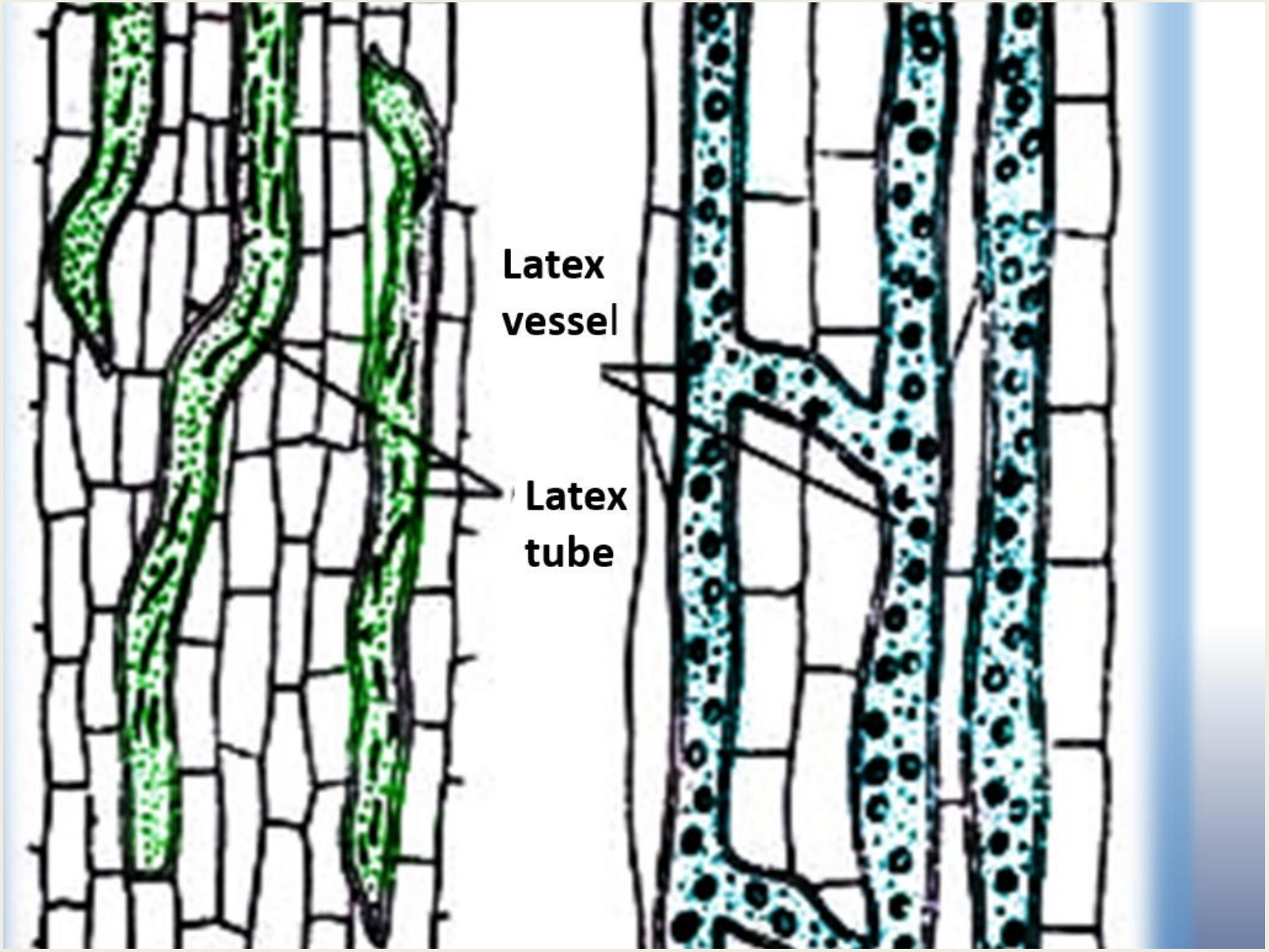
(a). Non-articulate laticifers

- Non-articulate laticifers are also called as latex cells.
- They are originated from a single cell.
- They occupy the intercellular spaces of other cells.
- Non-articulate laticifers may be branched or unbranched.
- Example: Un-branched non-articulate laticifers: *Euphorbia, Nerium*
- Branched non-articulate laticifers: *Ficus*

(b). Articulate laticifers

- They are also called as compound laticifers.
- They originate from a series of cells and these cells are arranged end to end
- The common wall between the cells may be intact or disorganized.
- Articulate laticifers resemble the xylem vessels and thus they are called latex vessel
- There are two types of articulate laticifers:

(i). Articulate anastomosing
(ii). Articulate non- anastomosing

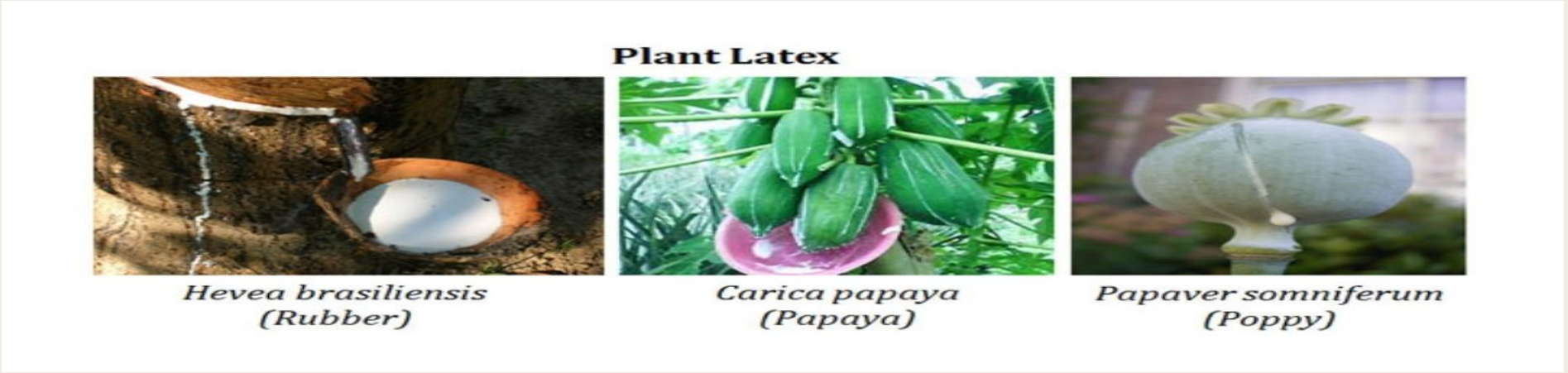

Latex vessel
Latex tube

(i). Articulate anastomosing

- In articulate anastomosing laticifers, lateral connections are established with similar laticifers to form reticulate (network) structures.
- Example: *Hevea, Manihot*

(ii). Articulated non-anastomosing:

- In articulate non-anastomosing laticifers, NO lateral connections are established.
- Examples: *Ipomoea, Musa, Convolvulus*



Cell structure of laticifers

- Laticifer cells contain living protoplast.
- Vacuoles are well developed and it stores the latex.
- Cells usually multinucleate (coenocytic).
- Latex may be milky white or coloured or colourless.
- Milky white latex : *Euphorbia, Hevea*
- Courless latex : *Nerium*
- Orange/ Yellow latex: *Papaver*

Chemical composition of latex

- Plant latex is a mixture of many organic compounds.
- They contain carbohydrates, organic acids, alkaloids, terpenes, resins and enzymes.
- Latex of *Papaver somniferum* contains alkaloids (morphine, codeine).
- Latex of *Carica papaya* contains digestive enzyme papain.
- Latex of *Hevea* contains rubber. The rubber particles are suspended in the latex. When latex is removed from the plants the rubber particles clumps tougher.

- ***Thank you!***