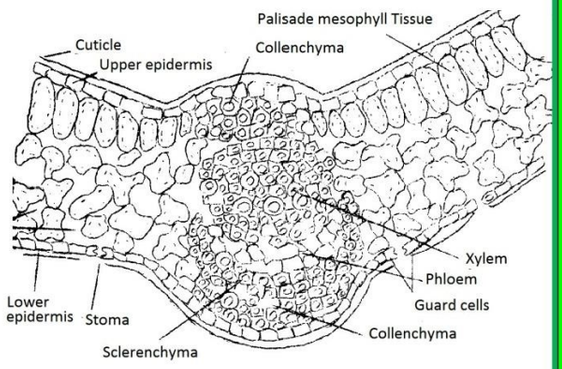
AL 1991/Bot

1. **By means of fully labeled diagrams only describe the structure of a typical dicotyledonous leaf as seen in cross section through the mid rib.**
2. **Indicate the functions of each part you have labeled.**

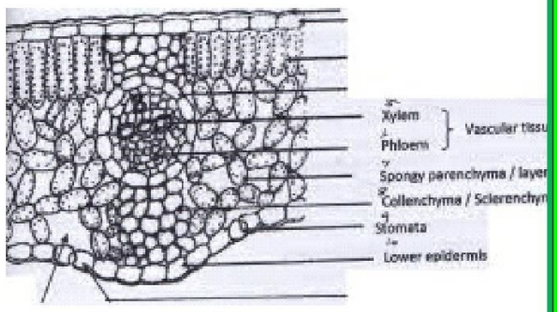
- Epidermis – control water loss and protection.
- Upper epidermis - Control water loss and protection.
- Collenchyma - provides support
- Palisade mesophyll tissue- Photosynthesis
- Spongy mesophyll tissue- Photosynthesis
- Xylem - Transport of water and minerals
- Phloem - Transport of synthesized food.
- Sclerenchyma (Bundle sheath) - Provides support/protects vascular tissues
- Air spaces - Aeration
- Lower epidermis- control water loss
- Stoma- control water loss
- Guard cells - control diameter of stoma



AL/2019

(a) Describe the histological structure of a typical dicotyledonous leaf as observed In a transverse section and state the functions of different structures seen.

- Outermost layer is epidermis (is found In both sides of the leaf /upper and lower epidermis
- which is single layered and
- covered with cuticle.
- Stomata are found in the epidermis.
- They are surrounded by guard cells.
- Mesophyll is composed of parenchyma cells and
- are found between upper and lower epidermis.
- On the upper part of the leaf/ just) beneath the upper epidermis,
- (mesophyll cells called) palisade layer is present
- consisting of (one or more layers of) elongated cells.
- Spongy layer (consisting of loosely arranged parenchyma cells)
- with air spaces /intercellular spaces
- located between palisade layer and lower epidermis.
- Mesophyll cells contain chloroplasts.
- Vascular tissue/ vascular bundles /veins consist of xylem and phloem.
- Outer layer of a vein is a bundle sheath layer/ cells.
- <u>Sclerenchyma/ collenchyma</u> present (in upper and lower sides of the main vein).



Functions

- Cuticle - prevents water loss/ protection
- Epidermis -protection
- Stomata -exchange of gasses/ transpiration
- Spongy parenchymal /air space -exchange of gases/ storages of gases
- Mesophyll/ palisade/ spongy tissue -photosynthesis.
- vein/ vascular bundle/xylem/ phloem -transport
- Sclerenchyma/ Collenchyma -Support
- Guard cells -controlling gas exchange / transpiration

sampath lankadheera
0777 211 384
0779 925 362

Sampath Ology
TRULY AMAZING BIO CLASS IN EM
Memo Max
MEMORY MAXIMIZING PROGRAM
We offer premium learning experience
Biology
ENGLISH MEDIUM
Live Biology
UNIT 04
Plant form and Function
4.2.1 Investigate the soot architecture and light capture
SAMPATH LANKADHEERA
B.Sc. (Hons), M.Sc.
Visit : https://advanceonlineclass.com

MEMORY MAXIMIZING PROGRAM Live Biology

Biology

New Syllabus

SAMPATH LANKADHEERA

Unit 04 — 4.2.1 Investigate the soot architecture and light capture Leaf

ADVANCED LEVEL

Biology

Unit - 04

4.2.1 Investigate the soot architecture and light capture Leaf

Print 2024 May

© SAMPATH LANKADHEERA

Published by

Sampath Biology *59/4 Muruthalawa Rd. Gannoruwa*

www.facebook.com/samathlankdheera
www.youtube.com/c/Sampathlankadheera

AL 1991/Bot

1. By means of fully labeled diagrams only describe the structure of a typical dicotyledonous leaf as seen in cross section through the mid rib.
2. Indicate the functions of each part you have labeled.

AL/2019

(a) Describe the histological structure of a typical dicotyledonous leaf as observed In a transverse section and state the functions of different structures seen.

ADVANCED LEVEL

Biology

THEORY

in English Medium

New Syllabus

4.2.1 Investigate the soot architecture and light capture

Unit 04 Leaf

Smart Note

SAMPATH LANKADHEERA

B.Sc. Hons. M.Sc. (Biotechnlogy)

We offer premium learning experience

4.2.1 : Investigates the shoot architecture and light capture

Number of Periods : 01

Learning Outcomes :

- states various adaptations seen in plants to maximize capturing of light
- carries out experiments to observe cross section of mesophytic dicot leaf with special reference to adaptations for photosynthesis

Suggested Teaching-Learning Process

- Illustrate anatomical features of the dicot leaf using diagrams.
- Explain the adaptations found in dicot leaves to maximize capturing of light.
- Let students observe cross section of a mesophytic dicot leaf and let students identify adaptations for photosynthesis.
- Explain how the length of stem, their branching pattern, leaf size and its structure and arrangement of leaves on the stem help capture maximum amount of sunlight to increase the e翮 ciency of photosynthesis.
- Guide students to prepare a poster to demonstrate light capturing techniques in plants.

Assessment and Evaluation

- Assess posters using the following criteria
- Attractiveness
- Number of examples
- Diversified techniques of light capturing

3. Size of the leaf vary, based on the place where the plant grows. Select corrects statement/s
   (A) Leaves range in length from 1.3 mm to 20 m.
   (B) Largest leaves are found in deserts.
   (C) Smallest leaves are found in plant species inhabiting dry or very cold environments.
   (D) Species represent extreme examples of a general correlation observed between water availability and leaf size.
   (E) The largest leaves are typically found in species from tropical rain forests, whereas the smallest are usually found in species from dry or very cold environments, where liquid water is scarce and evaporative loss is more problematic.
   (1) A,B, C (2) A,B,D (3) C only (4) A, C, D and E (5) A, B

4. Direction of the leaf is called as leaf orientation. Which of the following incorrect
   (1) Leaves may be horizontally oriented.
   (2) In low light conditions, horizontal leaves capture sunlight much more effectively than vertical leaves.
   (3) horizontal orientation may expose upper leaves to overly intense light
   (4) Intense light injures leaves and reducing photosynthesis.
   (5) light rays are essentially parallel to the leaf surfaces in dicot leaf to receives too much light, and light penetrates more deeply to the lower leaves.

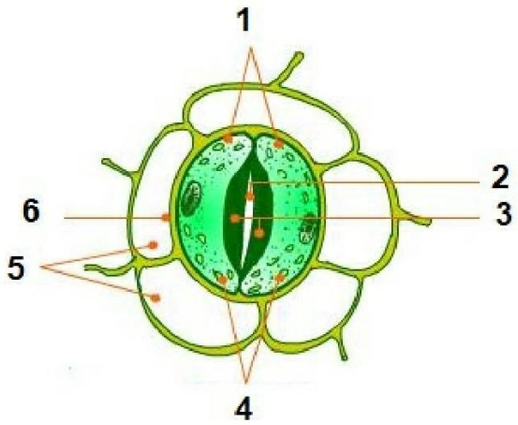
5. Incorrect about monocot leaf
   (1) Upper and lower epidermis, consist of chloroplasts and large intercellular air spaces present.
   (2) Two different types of guard cells present.
   (3) Stomata are present in both lower and upper epidermis.
   (4) Mesophyll is not differentiated into palisade and spongy layers.
   (5) Chloroplasts are abundant in all mesophyll cells.

6. Which of the following conditions affect the opening of stomata?
   (A) Flowing of K+ ions from guard cells to typical epidermal cells.
   (B) When water potential of the guard cells are lower than that of neighboring cells.
   (C) When guard cells take water from active absorption
   (D) When starch concentration of guard cells increase.
   (E) When R^H of atmosphere rise.

7. Incorrect about stomata
   (1) Stomata are pores surrounded by guard cells in the epidermis of the leaves and stems of plants which can open and close.
   (2) Guard cells are modified epidermal cells which have a distinct shape and are the only epidermal cells that contain chloroplasts.
   (3) Stomata present in all land plants including angiosperms.
   (4) The guard cell walls are unevenly thickened. The inner cellulose wall is thicker and less elastic than the outer wall.
   (5) Some of the cellulose microfibrils are radially arranged to form inelastic hoops around guard cells.

8. Which statement is false about stomatal mechanism.
   (1) This response is triggered by illumination of blue-light receptors in the plasma membrane of guard cells.
   (2) During the day time, Light stimulates the guard cells actively accumulate K+ from neighboring epidermal cells, thus lowering their water potential that leads to the inflow of water by osmosis from the surrounding epidermal cells.
   (3) The accumulation of K+ in the guard cells requires the energy which is provided by the transfer of electrons during photosynthesis of the chloroplast in guard cells.
   (4) Stomatal closing occurs by loss of K+ from guard cells to neighboring epidermal cells.
   (5) Abscisic acid (ABA) result K+ influx.

4. Following diagram shows the structure of stomata label it.



5. State whether following facts open, close or does not affect stomatal opening

Increase of humidity	
Atmospheric CO2	
Decrease of CO2 in substomatal cavity	
Internal clock in the guard cells	
Increase of wind	
High temperature	
Low light intensity	

MCQ

1. Select incorrect statement.
   (1) Length of the stem and branching pattern are designed to capture maximum light.
   (2) Plants grow tall to avoid shading from neighboring plants.
   (3) Most tall plants have thick stem with strong mechanical support.
   (4) Woody plants undergo primary growth thereby make their tall stem stronger
   (5) Vines rely on other objects to reach higher levels to capture more light.

2. There is a variety in branching pattern in plants. Which of the following is incorrect.
   (1) Some plants are un-branched and still others are well branched.
   (2) Plants have infinite amount of energy to devote to shoot growth.
   (3) Short plants at the risk of being shaded by taller plants.
   (4) If most of the energy goes into growing tall, the plants are not optimally harvesting sunlight.
   (5) This variation in branching pattern enables the plant to absorb maximum light in the ecological niche it occupies.

Stem

- The length of stems and their branching patterns are two architectural features affecting light capture.
- Plants grow tall to avoid shading from neighboring plants.

Stem

- Most tall plants have thick stem with strong mechanical support.
- Woody plants undergo secondary growth thereby make their tall stem stronger.
- Vines rely on other objects to reach higher levels to capture more light.

Branching Pattern

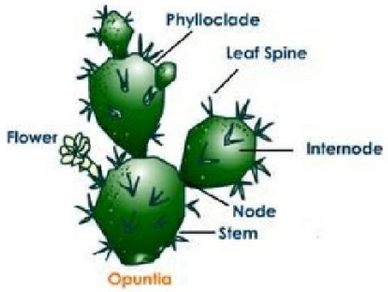
- There is a variety in branching pattern.
- Some plants are unbranched and still others are well branched.
- This variation in branching pattern enables the plant to absorb maximum light in the ecological niche it occupies

Leaves

Leaf size

- Size of the leaf vary, based on the place where the plant grows.
- Largest leaves are found in plants growing in rain forests.
- Smallest leaves are found in plant species inhabiting dry or very cold environments.

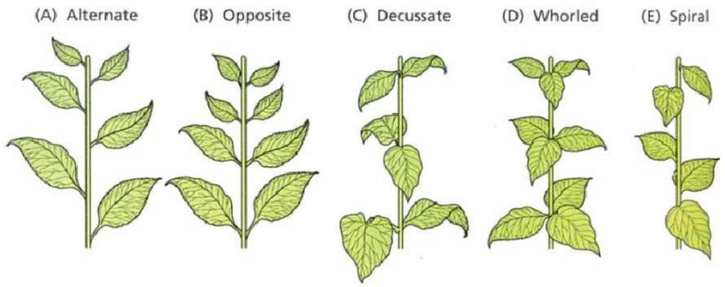
needle-like
e.g. *Pinus*



Opuntia

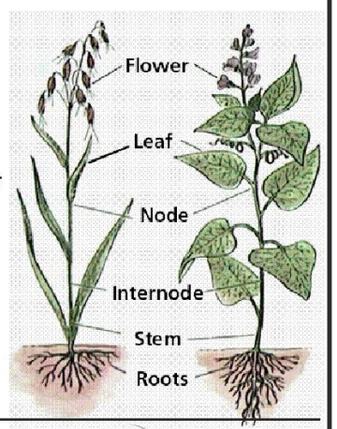
Phyllotaxy

- This is the arrangement of leaves on the stem.
- The arrangement may be one leaf, two leaves or several leaves per node.
- Phyllotaxy helps the plant to capture maximum sunlight.



Leaf orientation

- Leaves may be horizontally oriented.
- They capture light e翩 ciently in low light conditions.
- Some plants have vertically arranged leaves. Eg. Grasses
- This is to avoid the possible damage caused by exposure of leaf to the over intense light. When leaves are nearly vertical, light rays are parallel to the leaf surfaces, so no leaves receive too much of light .



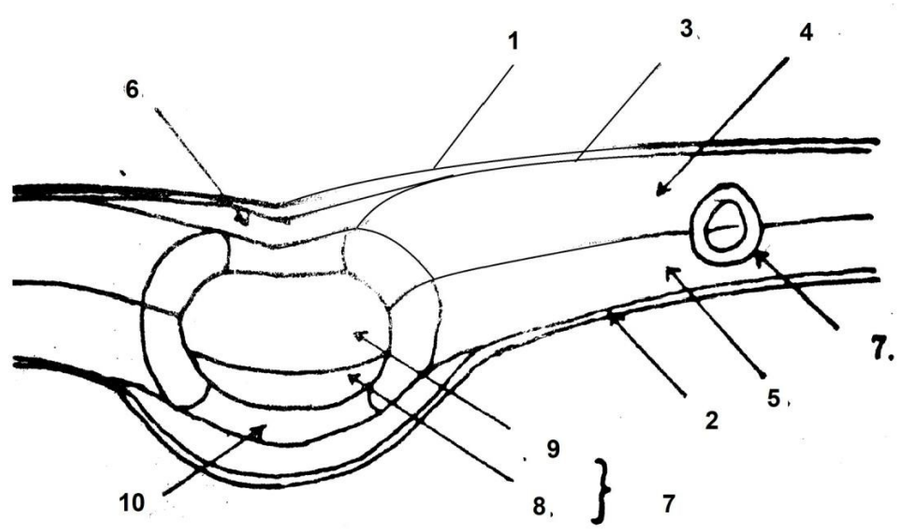
1. What is phyllotaxy

.....

.....

.....

2. Following diagram shows line diagram of a dicot leaf. Label all parts.



.....

.....

.....

.....

.....

.....

3. State differences

Dicot Leaf	Monocot Leaf

PRACTICAL NO.19

Observation of the structure of stomata and lenticels through light microscope

Objectives

- Students should be able to

1. Identify the structure of stomata,
2. Identify the structure of lenticels,
3. Draw and label diagrams of stomata and lenticels.

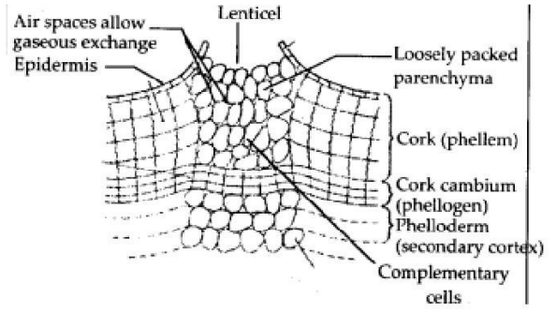
Materials and equipment

- Epidermal peel taken from a fresh leaf of betel/ Rhoeo (*Tradescantia*).
- A cross section taken from a secondary stem of *Stachytarpheta*, etc.
- A permanent slide of a transverse section of a secondary stem.
- Light microscopes.

Instructions

- Allow students to get an epidermal peel of a fresh leaf of betel/Rhoeo (*Tradescantia*).
- Allow them to get a thin cross section of a secondary stem.
- Let them observe an epidermal peel of betel/Rhoeo and cross section of a secondary stem under low power of light microscope.
- Let them observe stomata and lenticels under the high power of light microscope.
- Instruct them to record their observations.

Lenticels	Stomata
(i) Lenticels are aerating pores in the bark of plant.	Stomata are specialised epidermal Structures usually found in aerial arts of ant.
(ii) Lenticels are formed after secondary growth of plants. Eg: they a re present in woody trees.	Stomata are found in the primary structure of plants. Eg: they are present in herbs, shrubs etc.
(iii) These are mostly found on the stem region. Lenticels do not have guard cells.	These are mostly found On lower surface of leaves. Stomata has guard cells.
(Iv) these openings are not regulated	Opening and closing is regulated



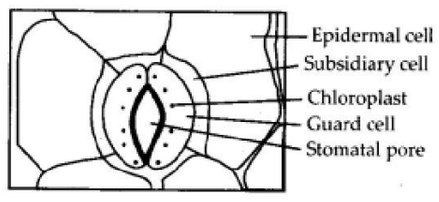


Fig.: Structure of Stomata

4.2.2 : Investigates the process of gaseous exchange in plants

Number of Periods : 04

Learning Outcomes :

- briefly describes the histological structure of typical dicot leaf
- states the major structural differences between a typical monocot leaf and a typical dicot leaf
- names the main gaseous exchange structures as stomata and lenti cells
- identifies the features of leaf for e翩 cient gaseous exchange
- relates the structure of Stomata to its function
- briefly explains mechanism of opening and closing of stomata using K+ influx
- briefly explains the factors affecting the opening and closing of stomata (light, CO_2 concentration in sub - stomatal cavity, drought, high temperature, wind, production of ABA)
- identifies the structure of stomata and lenticels through microscope (Practical work)

Suggested Teaching-Learning Process

- Describe the major structural features of monocot and dicot leaves using diagrams/ microscopic specimens and micrographs.
- State leaves of plants as the main surface for gaseous exchange.
- Discuss how gases can exchange through stomata, lenticels and thecuticle.
- Guide students to observe epidermal peels of mesophytic dicot and grass leaves under the microscope.
- Guide students to prepare a slide with dicot epidermal peel and draw a fully labeled diagram of stomata by observing it under the high power of a light microscope
- Guide students to observe stomata under high power and to compare the surface view of a dicot and grass leaf.
- Discuss the shapes, patterns of thickening of cell walls and the presence of chloroplasts in the guard cells in relation to their function.
- Explain the mechanism of the opening and closing of stomata using K+influx hypothesis.
- Discuss how different factors relate to the functioning of stomata
- Explain the role of ABA in stomatal closure under water stress conditions

Assessment and Evaluation

- Assess student's drawings for
- Accuracy
- Correct proportion
- Correct labeling
- Neatness

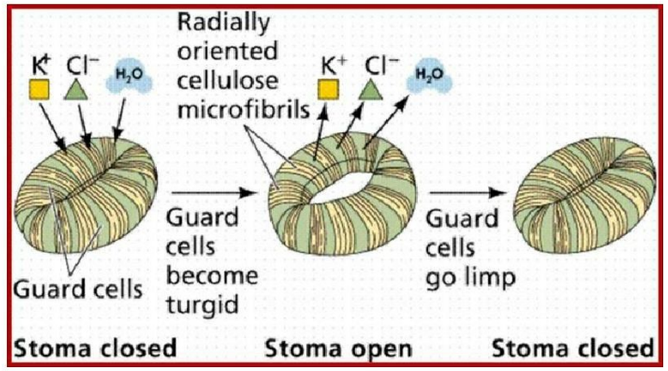
Process of Gaseous Exchange in Plants

Anatomy of typical dicot and monocot leaves

- In most vascular plants, leaves are the main photosynthetic organs.
- Epidermis is usually a single cell layer.
- The exchange of gases occurs through stomata in the upper and lower epidermis.
- Epidermis is usually a single cell layer.
- In between the upper and lower epidermis, there is a ground tissue called the mesophyll.
- This tissue consists of parenchyma cells, specialized for photosynthesis.
- In most vascular plants, leaves are the main photosynthetic organs. The exchange of gases occurs through stomata in the upper and lower epidermis.

Dicot Leaves

- In dicot leaves, stomata are, mainly found in the lower epidermis.
- The mesophyll consists of two distinct layers called palisade and spongy.
- Palisade mesophyll consists of elongated cells that are arranged in one or more layers.
- This can be found in the upper part of the leaf, just beneath the upper epidermis.
- The spongy mesophyll can be found between the palisade layer and lower epidermis.
- They are loosely arranged with many air spaces.
- Spongy mesophyll cells have less chloroplasts than in palisade mesophyll cells.
- The vascular tissue of the leaf is continuous with vascular tissue of the stem.
- Veins in the leaf is highly branched (net like venation) in the mesophyll layer.
- Each vein is protected by a bundle sheath layer.

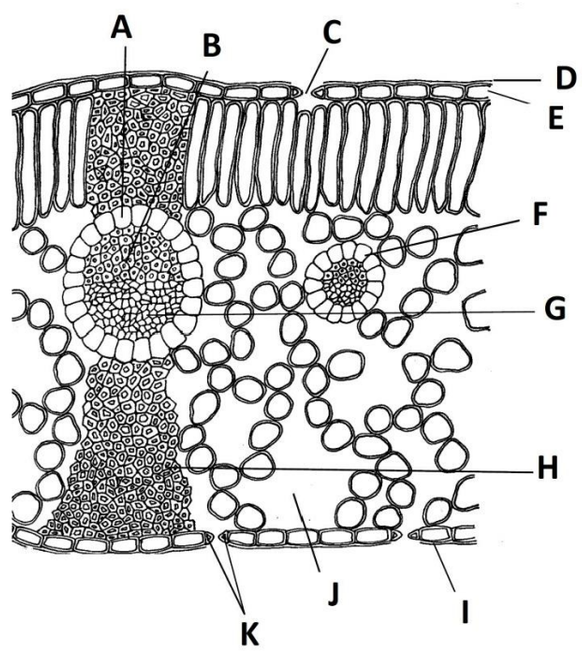


Role of ABA in stomatal closure in drought

- ABA is produced in roots and leaves in response to water deficiency.
- Production of ABA leads to close the stomata by removal of K+ in guard cells.
- This prevents the wilting of the plant.

Factors Affecting Stomatal Action

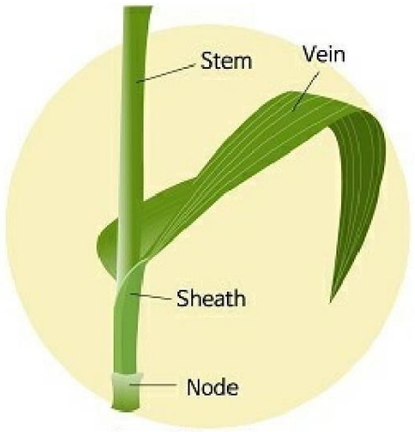
1. Stomata open during day and mostly closed at night. Light stimulates accumulation of K+ in guard cells.
2. Decrease in CO2 concentration in sub-stomatal cavity lead to open stomata.
3. Internal clock in the guard cells controlling their daily rhythm of opening and closing of stomata.
4. Environmental stresses such as drought, high temperature and wind can cause stomata to close during the day time.



(T.S) of typical Dicot Leaf

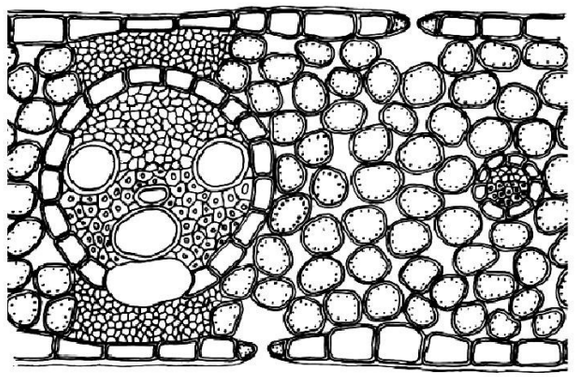
Monocot Leaves

- In monocot leaves, stomata are present in both lower and upper epidermis.
- Mesophyll is not differentiated into palisade and spongy layers.
- Chloroplasts are abundant in all mesophyll cells. Veins are parallelly arranged (parallel venation).



Mechanism of opening and closing stomata

K^+ influx hypothesis



Gaseous exchange

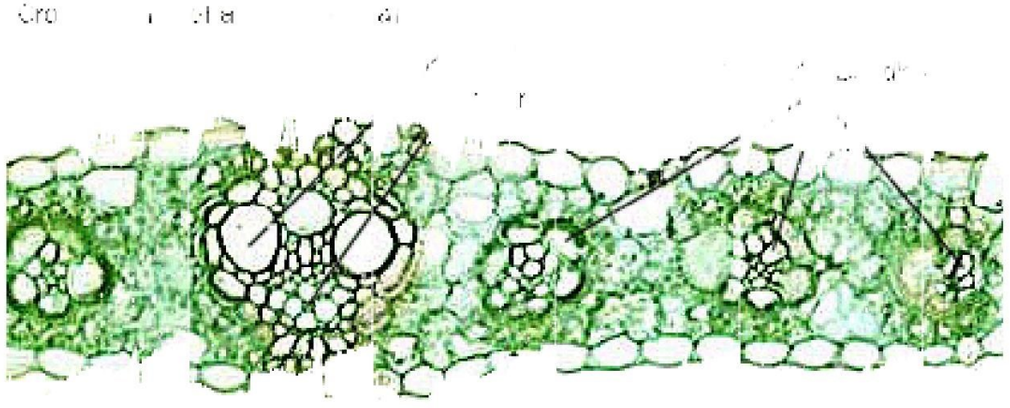
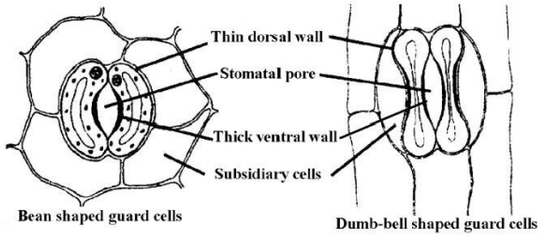


Fig. Monocotyledonae Leaf (T.S.)

Structure of Stomata



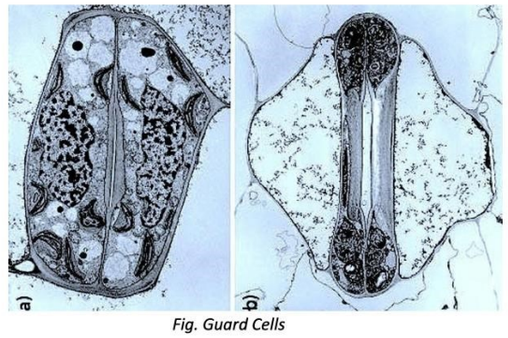


Fig. Guard Cells