Complex Plants:

Chapters 22, 23 and 25

Ted-Ed Agriculture

22-1 Seed Plants

- Benefits to plants of living on land are:

  1. *Abundant Sunlight for Photosynthesis*
  2. *Free movement of carbon dioxide and oxygen*

Problems encountered by life on land are:

1. *Water and nutrients available only from the soil.*
2. *Evaporation*
3. *Tissues must be held upright*
4. *Reproduction must occur without water.*

Seed plants – designed for life on land

Seed plants exhibit numerous ***adaptations*** that allow them to survive the difficulties of life on ***land***. They evolved a variety of new adaptations that enabled them to live where ***ferns and mosses*** could not.

II. Roots, Stems, Leaves

A. The three main organs in a plant are ***roots, stems and leaves***.

Roots perform three jobs:

1. *The absorb water and nutrients*.
2. *They anchor plants*
3. *They hold plants upright*

B. ***Stems*** hold a plants ***leaves*** up to the sun.

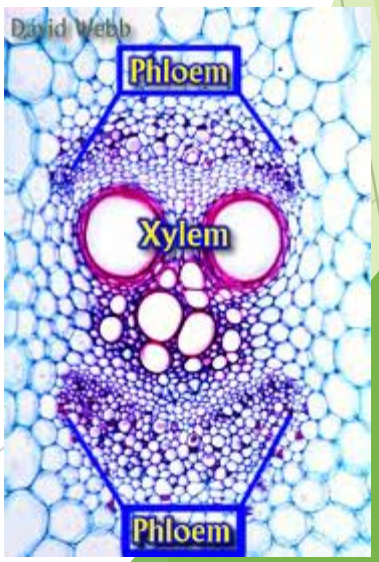
C. ***Leaves*** are vital to the process of ***photosynthesis***.

III. Vascular Tissue

Tall plants face a challenge, ***water*** must be lifted from ***roots*** to ***leaves*** and ***compounds*** produced in ***leaves*** must be sent to the ***roots***.

A. ***Xylem*** is responsible for carrying ***water*** and ***nutrients*** up. They have thick ***cell walls*** so also provide ***strength*** to the woody parts.

B. ***Phloem*** carries the products of ***photosynthesis*** from one part of the plant to another.



IV. Reproduction Free From Water

- The seed plants you see around you are members of the *sporophyte* generation.
- *Flowers* and *cones* are the reproductive structures where the *gametophyte* generation of the seed plant develops.
- Male gametophytes are called *pollen grains*. Pollen grains are carried to the female gametophyte so no *water* is required.
- *Seeds* protect the zygotes of seed plants. They are surrounded by a *seed coat* so can wait until *conditions* are right

23-5 Leaves

The leaves of green plants are the world's oldest *solar energy collectors*. Leaves are also the world's most important *manufacturers of food*.

I. Leaf Structure

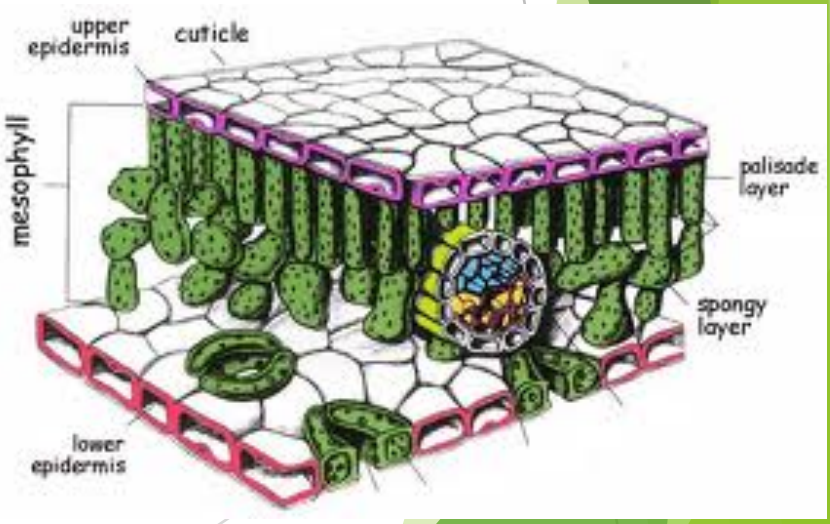
A. Leaves consist of two parts: ***the blade*** and ***the petiole***.

B. Blades are adapted to the specific ***environments*** in which the live.

Adaptations range from ***simple*** to ***compound***.

Leaves contain specialized tissues such as:

1. *Epidermal Cells*
2. *Inner layers of parenchyma cells*
3. *Vascular tissues*



II. Epidermis: Controlling Water Loss

A. Epidermal cells are ***tough*** and do not contain ***chloroplas***

Together with the ***Cuticle***, this layer protects delicate leaf slowing down the loss of ***water*** through ***evaporation***.

B. BUT, plants still need to "breathe" just as we do. They need to:
   1. *Exchange CO_2 for O_2 during photosynthesis.*
   2. *Exchange O_2 for CO_2 in order to function (like us).*

C. Leaves must stay ***moist*** to carry out these gas exchanges. Seed plants solve this problem by balancing their need for ***gas exchange*** with ***water conservation***. They use small openings called ***stomata***. ***Stomata*** are generally located on ***the undersides of leaves***.

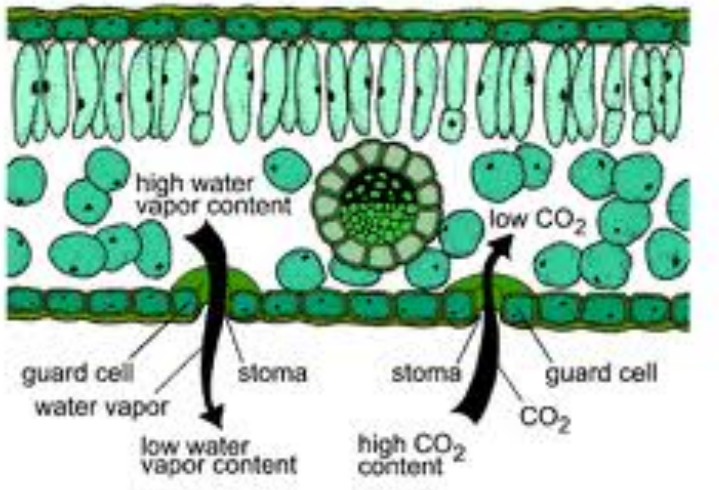
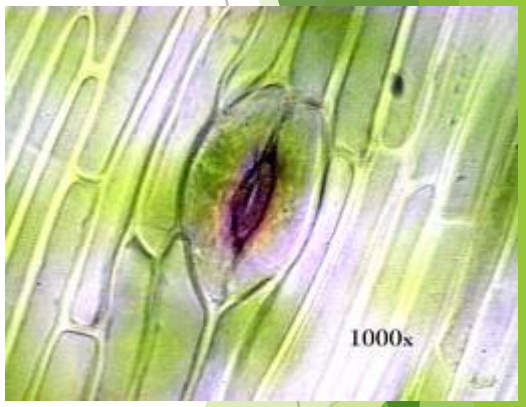
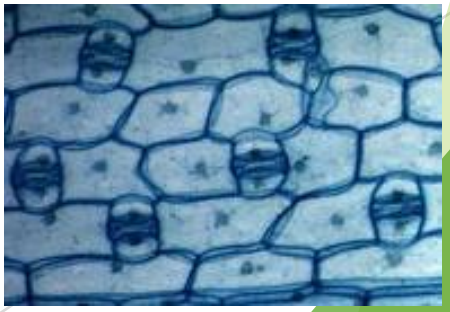


Figure 25. Stomata open to allow carbon dioxide (CO_2) to enter a leaf and water vapor to leave.

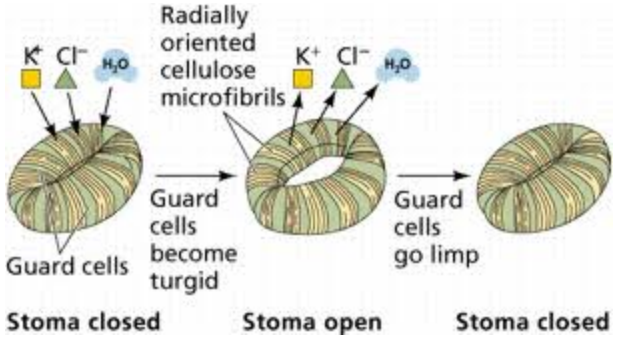




D. The specialized cells on either side of a stoma are called *guard cells*.

When water pressure is high, the cells *are forced into a curved shape, opening the stoma*.

When water pressure is low, *the cells spring together and close the stoma*.



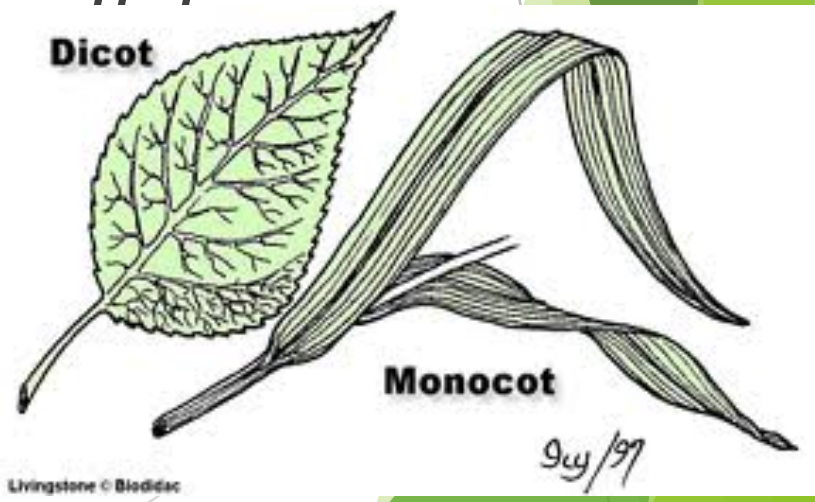
E. Each type of plant has guard cells that balance *water loss* against *the need for CO_2*.

III. Vascular tissues: The Veins of a leaf

A. Vascular tissue in leaves is directly connected to the vascular tissues of stems.

In monocot leaves, *veins run pa*

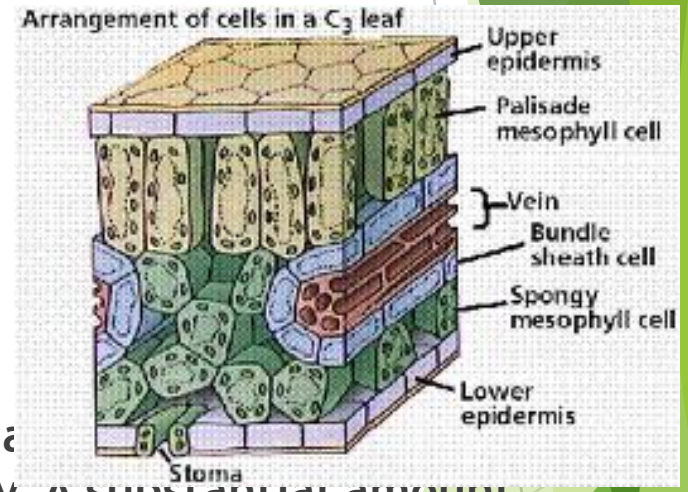
In dicot leaves, *they have different patterns*.



IV. Mesophyll Tissue: The food factory of the leaf

A. Most leaf tissue is called ***mesophyll***. This is separated into two layers:

1. *Palisade layer*
2. *spongy mesophyll*



B. The surfaces of the mesophyll layer a
gases can ***enter and leave*** the cells easily. A substantial amount of water is still lost to the outside through ***evaporation***.

25-1 Cones & Flowers as Reproductive Organs

I. **Introduction**

A. Sexual Reproductive Organs

1. Gymnosperms have ***cones***

2. Angiosperms have ***flowers***

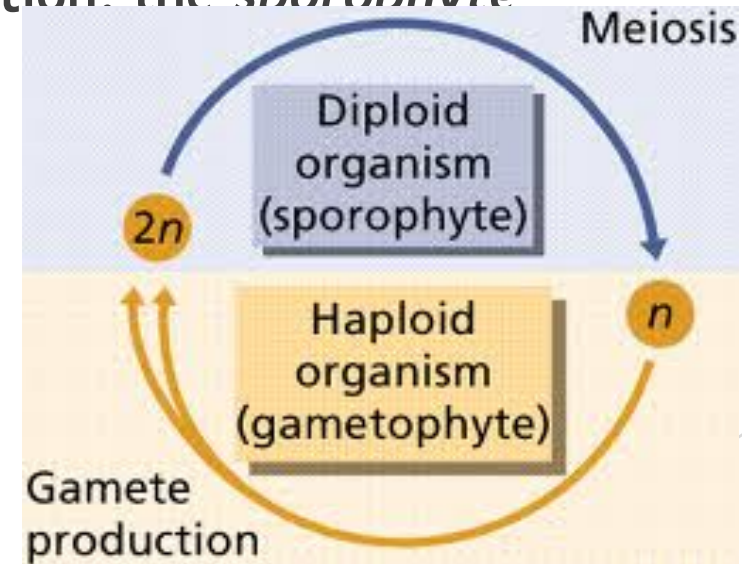
B. Review: Plant Life Cycles

1. Two generations

   a) diploid (2n) ***sporophyte***

   b) haploid (1n) ***gametophyte*** which produces ***male*** and ***female*** gametes

2. Fusion of gametes forms a ***zygote*** that grows into the next generation, the *sporophyte*



C. Sizes in Seed Plants

1. Dominant generation (the one that is ***large*** & ***obvious***) = ***sporophyte***

2. Gametophyte is ***hidden*** in the cones/flowers

D. Advantages of Cones/Flowers

1. Enable ***seed*** plants to reproduce without standing ***water***

2. An adaptation that helps them survive: ***the dry conditions of life on land***

22-2 Evolution of Seed Plants

I. **Gymnosperms**

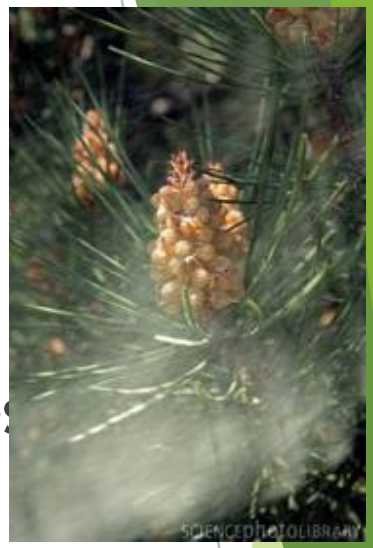
Gymno **means naked,** ***sperm*** **means seed.**

There are three classes of gymnosperms:

1. ***Cycads***

2. ***Ginkgoes***

3. ***Conifers***



Reproductive structures are

called ***cones***.

Male cones produce male gametophytes called ***pollen***.

Female cones produce female gametophytes called ***eggs***

- ***Cycads*** are palm like plants. They only grow in ***tropical*** and ***subtropical*** places.

- ***Ginkgoes*** are represented by one species, *Ginkgo biloba*. It is a living ***fossil***.

II. Conifers

Are the most *abundant* gymnosperms today.

A. The leaves are called *needles*. Conifers appear to be "*evergreen*" because older needles drop off but are gradually replaced.

B. Male cones, or ***pollen cones***, and female cones, or ***seed cones***, contain the very small gametophytes.

In the ***Spring***, pollen cones release millions of dustlike pollen grains to be carried by the ***wind***. These land on seed cones and ***fertilize*** them. The zygotes grow into seeds on the ***scales*** of the seed cones.

from ….. 25-1 Cones & Flowers as Reproductive Organs

II. Life Cycle of Gymnosperms

A. Pine Tree Example

1. Tree grew from a zygote contained in a *seed*

2. It is the *diploid* (2n) *sporophyte* generation

3. Seedling matures, makes two types of cones:

a) Male: contain microsporangia that produce pollen (male gametophyte)

b) Female: contain megasporangia that produce ovules (female gametophyte)

B. Process

1. Pollen grains (from ***male cones***) carried by ***wind***

2. Female cones make a ***sticky secretion*** that traps ***pollen***

3. Grain splits open, grows a ***pollen tube***, which contains ***sperm***

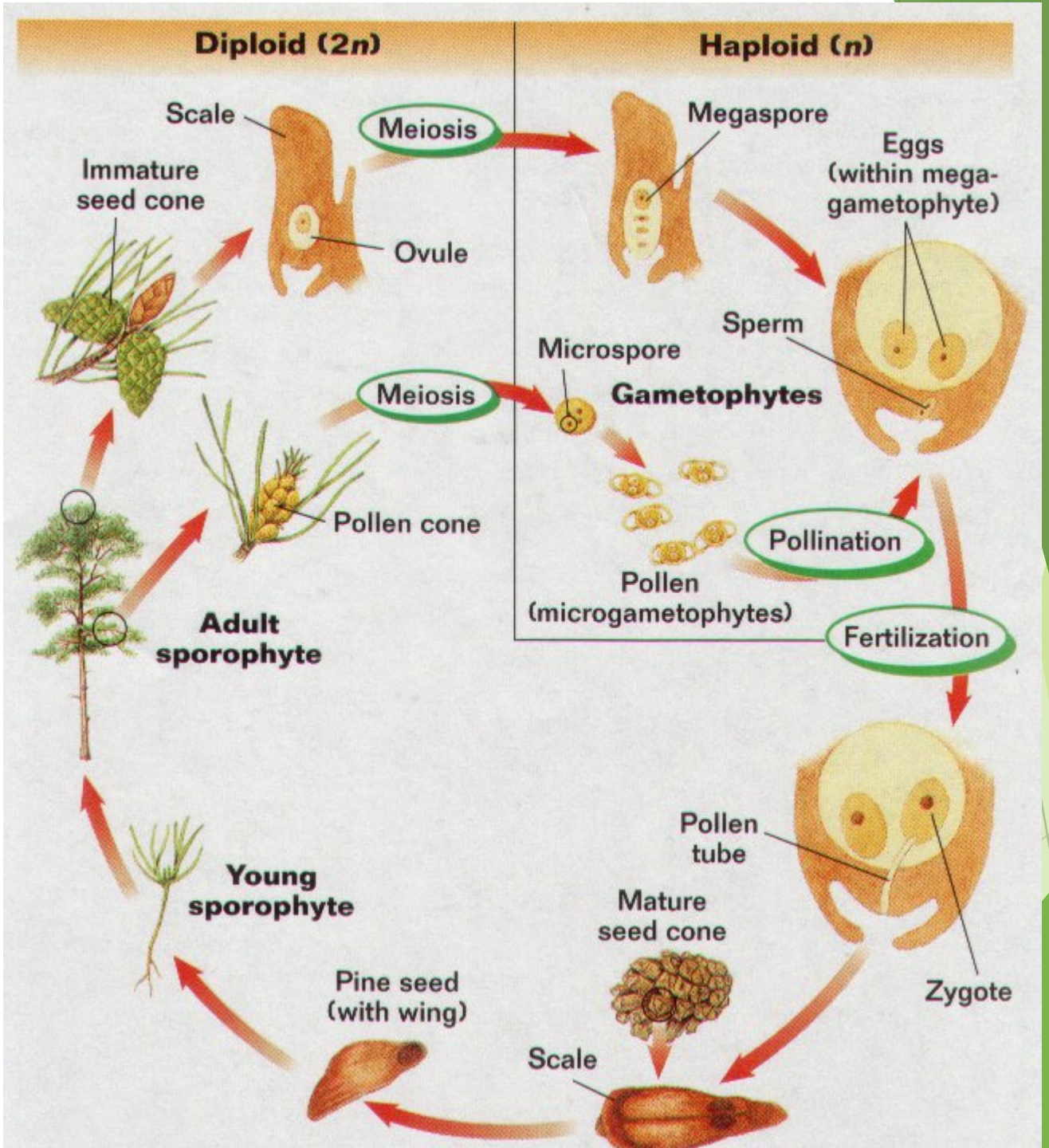
4. Pollen tube grows into the ***ovule***, located in ***female cone***

5. Sperm ***break out*** of the tube and fertilize ***egg*** in the ovule

6. Zygote grows into an *embryo*

7. Embryo is encased in a package; now called a ***seed***

a) seed = ***embryo*** plant + ***food supply*** for growth


Diploid (2n)
Haploid (n)
Scale
Meiosis
Megaspore
Eggs
(within mega-
gametophyte)
Immature
seed cone
Ovule
Sperm
Microspore
Meiosis
Gametophytes
Pollen cone
Pollination
Pollen
(microgametophytes)
Adult
sporophyte
Fertilization
Pollen
tube
Young
sporophyte
Mature
seed cone
Pine seed
(with wing)
Zygote
Scale