

Ferns, club mosses, horsetails, and whisk ferns are seedless vascular plants that reproduce with spores and are found in moist environments. Water is required for fertilization of seedless vascular plants; most favor a moist environment.

CLASSIFICATION OF THE PTERIDOPHYTES

Phylum Pteridophyta

Class Lycopodiopsida

Order Lycopodiales, the club mosses and ground pines, approximately 400 species

Order Selaginellales, the spike mosses, approximately 450 species

Order Isoetales, the quillworts, approximately 130 species

Class Equisetopsida, the horsetails or scouring rushes, 15 species

Class Psilotopsida, the whisk ferns, approximately 12 species

Class Polypodiopsida (Ferns), the true ferns, approximately 10,000 species

Material:

Division Tracheophyta – vascular plants, tracheophytes

Class Polypodiopsida – leptosporangiate ferns

Order Polypodiales Family Dryopteridaceae – wood ferns, woodferns

Genus Dryopteris Adans. – shieldfern, woodfern

Objects:

Herbarium and permanent preparation of *Dryopteris filix-mass*

Objective:

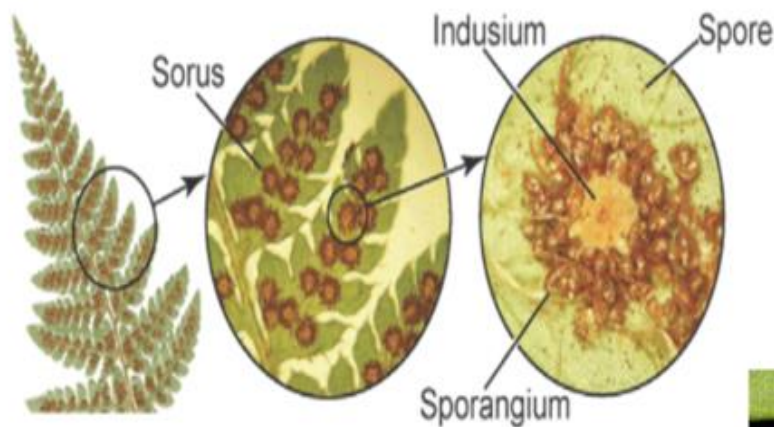
To investigate the structural features of *Dryopteris filix - mass*

Tasks of work:

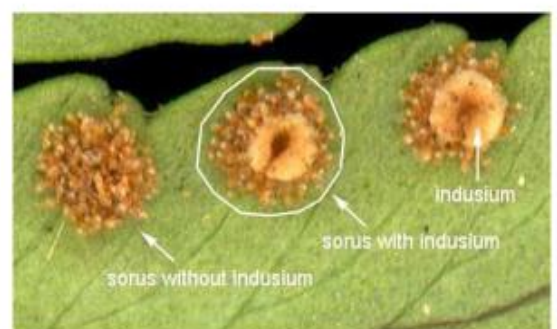
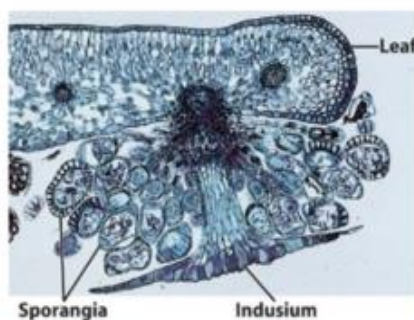
Draws the appearance of the shoots of *Dryopteris filix – mass*

Draw the structure of the sorus, prothallus and Gametophyte

Draw the life cycle of *Dryopteris filix – mass*



A flap of tissue that protects the sorus in some ferns. When spores are mature and ready for release, the indusia usually shrivel or bend backwards to expose the sporangia.

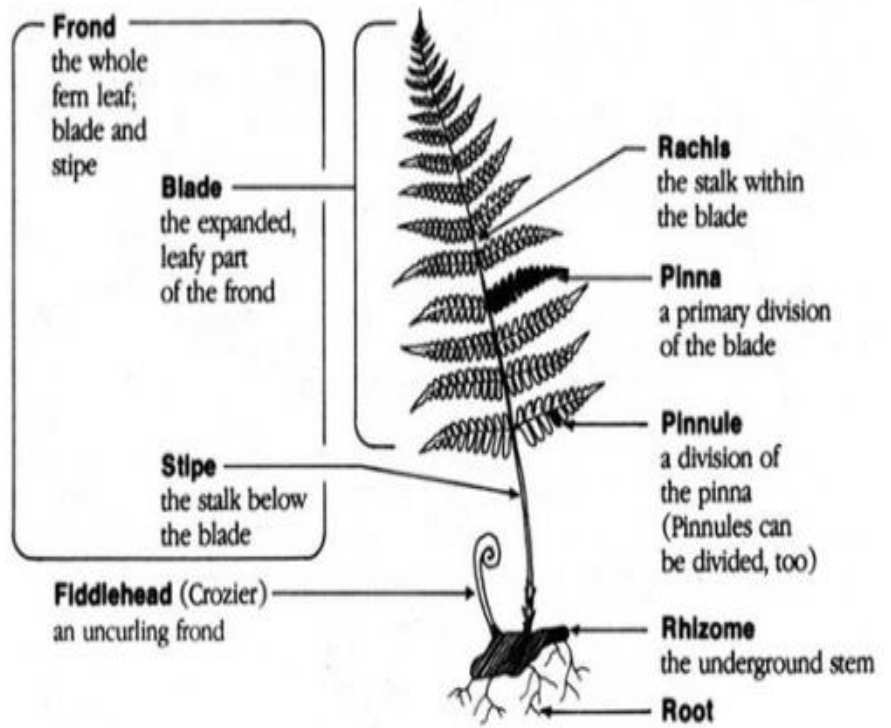


The genus *Dryopteris*

included 250 species that are distributed in tropical, subtropical and north temperate regions of the world. They usually grow in moist, cool and shady places. *Dryopteris* is herbaceous, perennial and rhizomatous.

The sporophytic plant body is differentiated into **roots, rhizomatous stem and leaves.**

The **primary root** is **ephemeral**, and is **replaced** by a large number of **adventitious roots** growing from the leaf bases. The roots are small and branched.



Dryopteris sp.

Dryopteris is a homosporous fern.

The **sori** are borne in two rows on two sides of the median vein of a pinnule in-between the margin and the midrib.

Each **sorus** is covered by a kidney-shaped **indusium**. A number of stalked sporangia arise from the central placental tissue. Sori are of mixed type i.e., sporangia arise without any order of development.

Dryopteris is a homosporous fern.

The **sori** are borne in two rows on two sides of the median vein of a pinnule in-between the margin and the midrib.

Each **sorus** is covered by a kidney-shaped **indusium** (Fig.13). A number of stalked sporangia arise from the central placental tissue. Sori are of mixed type i.e., sporangia arise without any order of development.

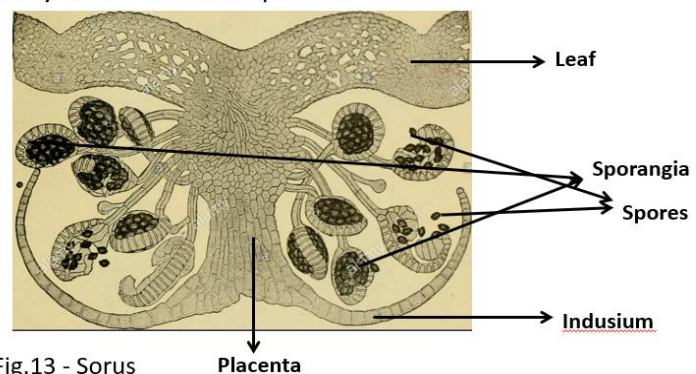


Fig.13 - Sorus

A haploid spore is the first cell of sexual or gametophyte generation. Under suitable moist condition, each spore germinates into a **gametophyte called prothallus** (Fig.15). It is a flat, green, non-vascular heart shaped structure with about 5- 13 mm in diameter. The dorsal surface is smooth while ventral surface contains unicellular rhizoids and sex-organs. Prothallus has a narrow posterior end and a distinct apical notch at anterior end.

Gametophyte:

A haploid spore is the first cell of sexual or gametophyte generation. Under suitable moist condition, each spore germinates into a **gametophyte called prothallus** (Fig.15). It is a flat, green, non-vascular heart shaped structure with about 5- 13 mm in diameter. The dorsal surface is smooth while ventral surface contains unicellular rhizoids and sex-organs. Prothallus has a narrow posterior end and a distinct apical notch at anterior end.

The rhizoids arise from the ventral side of the posterior end which helps in anchorage, absorption of water and nutrients from soil. Prothallus is short lived and dies in drought conditions.

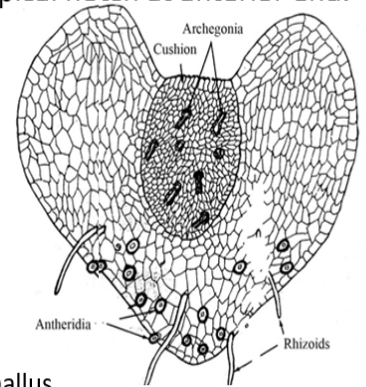
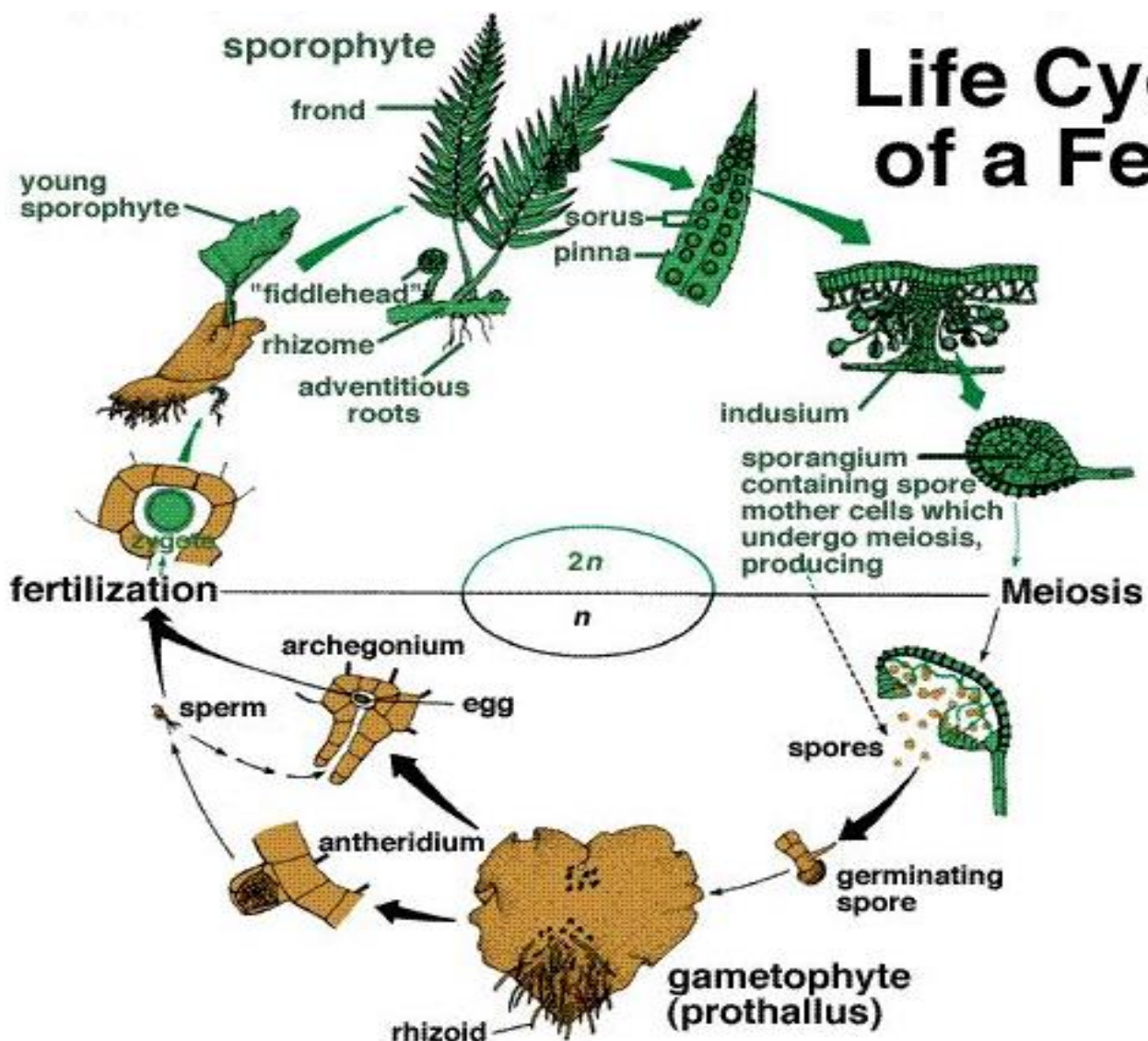


Fig.15 - Prothallus

Life Cycle of a Fern



General characteristics of the Mosses, Lycopodium, Horsetails

Material:

Division Hepaticophyta – Liverworts

Class Hepaticopsida

Order Marchantiales

Family Marchantiaceae

Genus *Marchantia*, **Species** *M. polymorpha*

Objects:

Herbarium of *Marchantia polymorpha*

Permanent preparations of antheridium and archegonia.

Objective:

To familiarize with the structural features of *Marchantia polymorpha*

Tasks of work:

Recognize and draw an appearance of a thallus, antheridium and archegonia.

Denote dichotomous branching of a thallus, gemma cups.

Recognize and draw Liverwort Life Cycle, cross section of gemma cup, antheridium and archegonia.

Vegetative Reproduction:

In *Marchantia* it is quite common and takes place by the following methods:

By Gemmae:

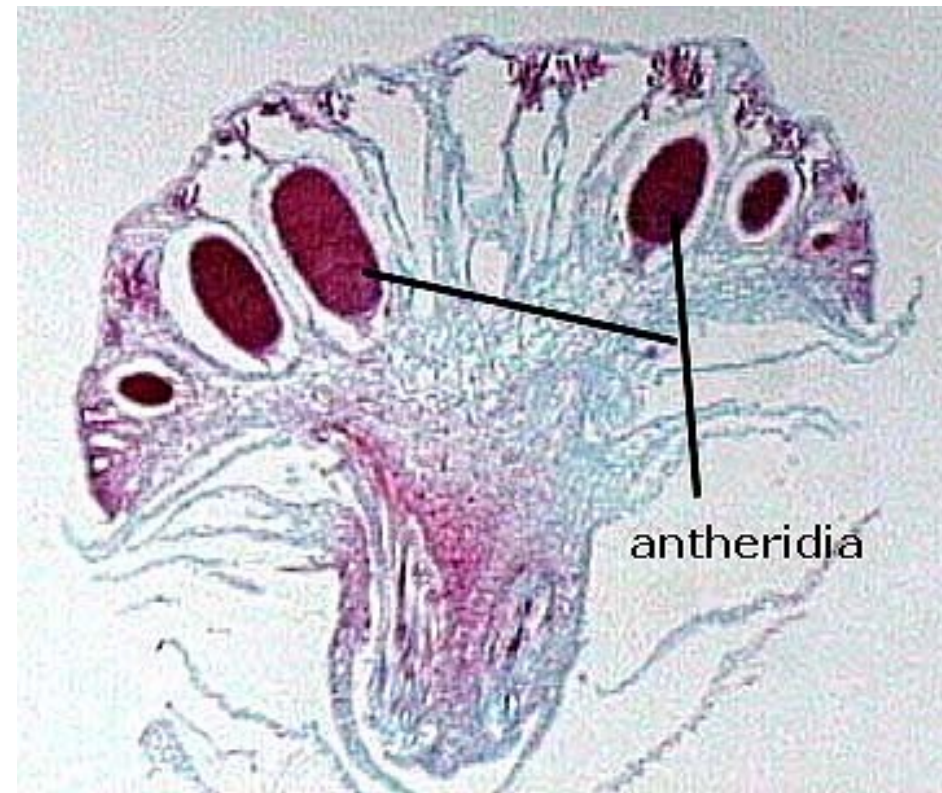
The cup like structures is found on the midrib of dorsal surface. Within gemma cup small stalked structures are formed called gammae. The gammae are asexual reproductive structures, which are made up of parenchymatous cells. On the lateral side of gemmae notch is present. The cells of the gammae are filled with chloroplast. When the gemmae fall on the ground, they produce new plant body.



Longitudinal section of a gemma cup. The gemmae are the dark structures, which in sectional view appear more or less lens-shaped.



Gemma cup of *Marchantia*



Antheridium of *Marchantia*

Archegonia

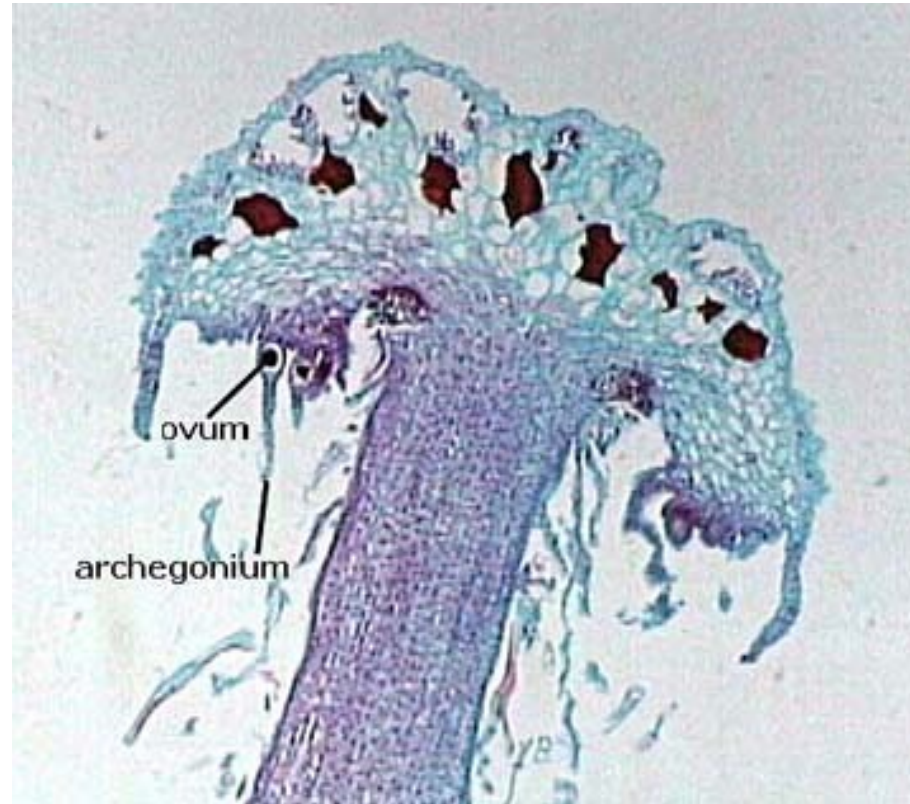


venter

egg

neck

canal cell

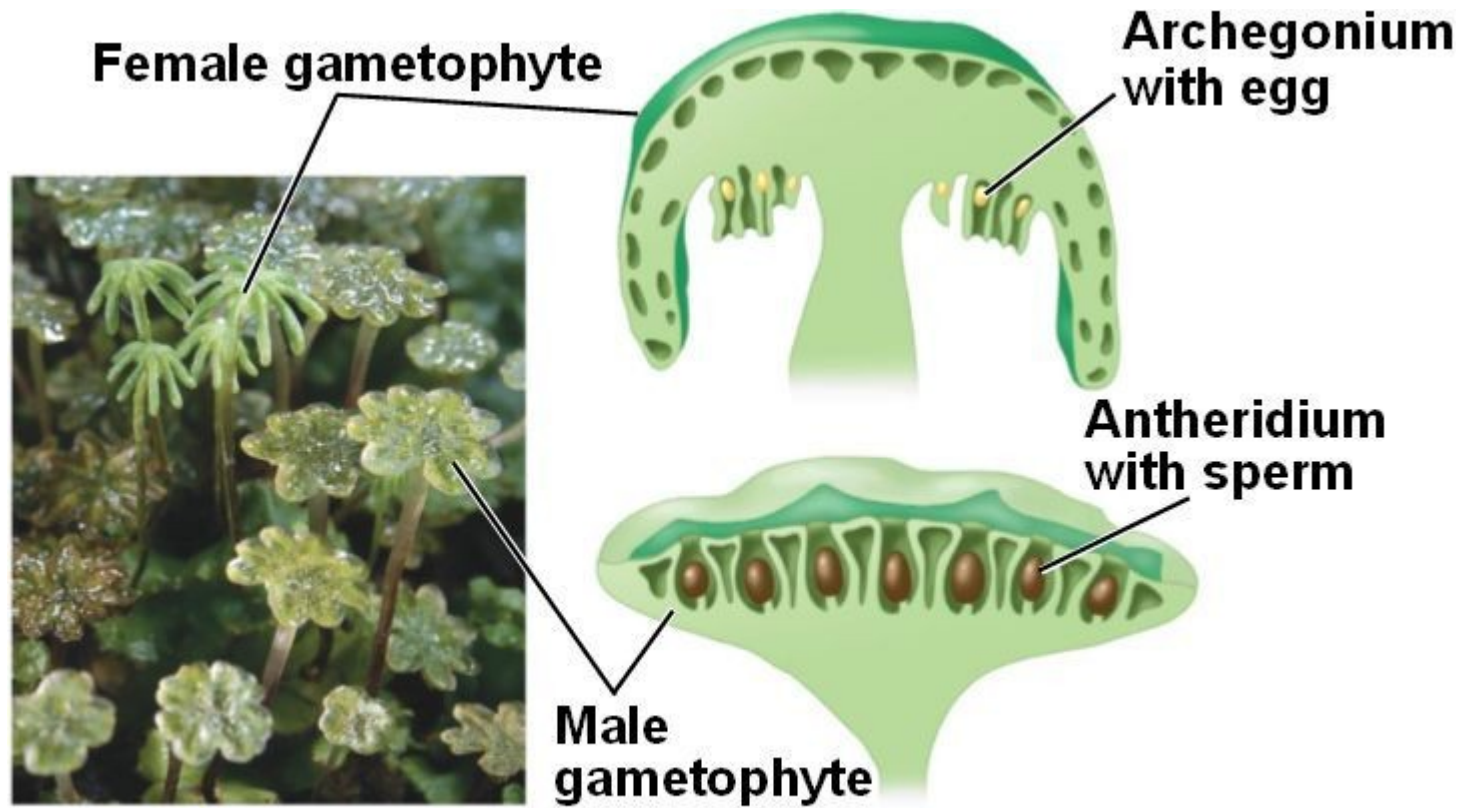


ovum

archegonium

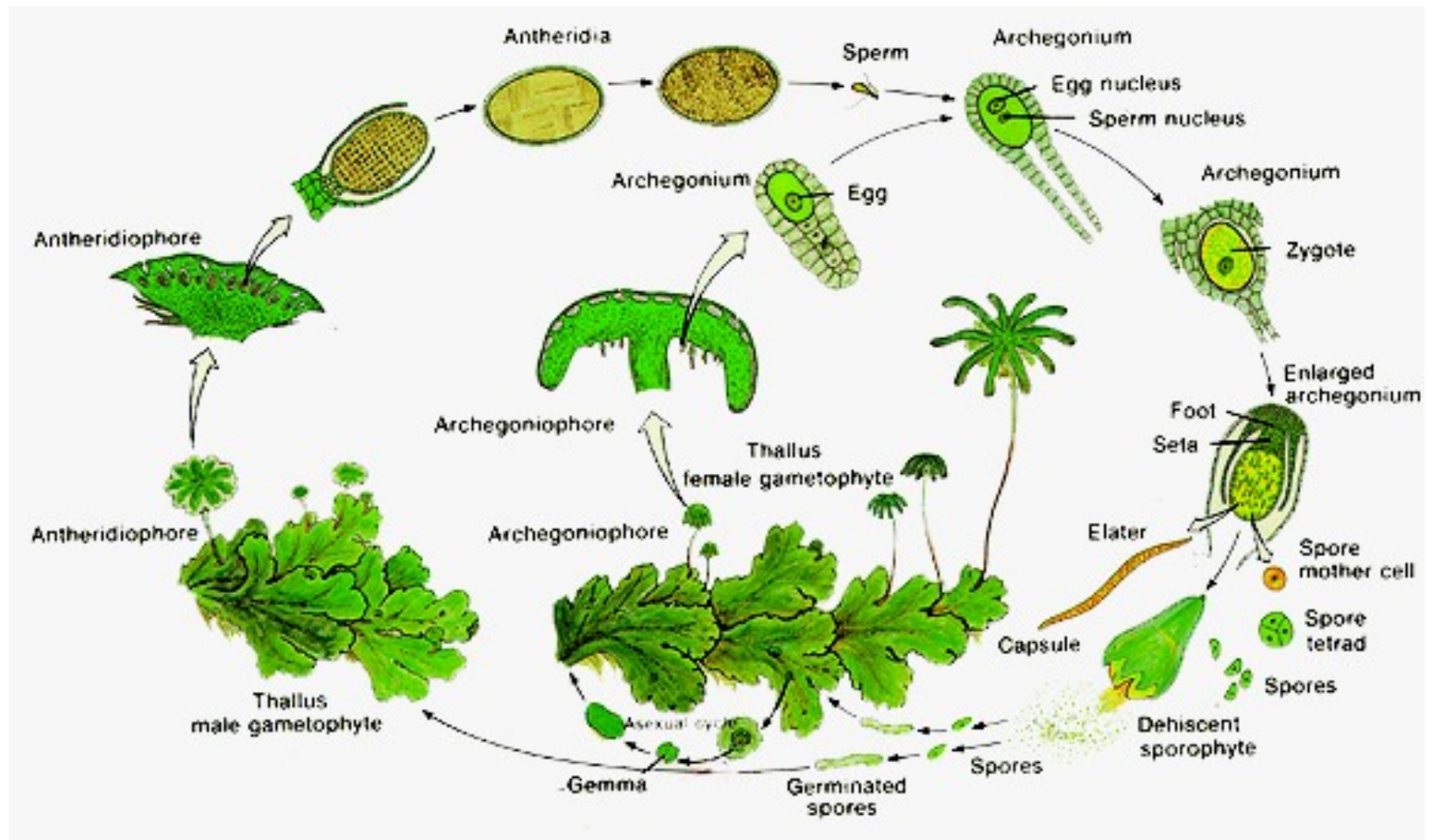


Archegoniophore of Marchantia.

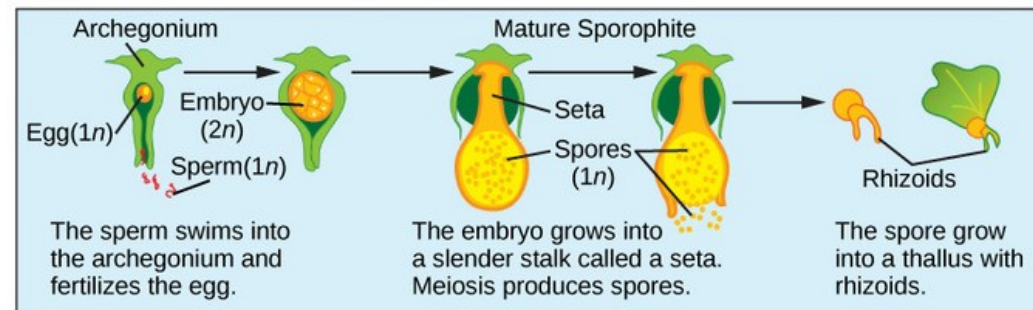


Archegonia and antheridia of *Marchantia* (a liverwort)

Liverwort Life Cycle: The life cycle of a typical liverwort follows the pattern of alternation of generations. Spores are released from sporophytes and form the gametophyte. Male gametes fertilize female gametes to form a zygote, which grows into a sporophyte. This sporophyte disperses spores with the help of elaters; the process begins again.



Liverwort Life Cycle



Material:

Phylum- Bryophyta (Mosses)

Class- Bryopsida = Musci (True Mosses)

Order- Polytrichales

Family- Polytrichaceae

Genus- *Polytrichum* (Hair-cap Mosses), Species – *P. commune*

Objects:

Herbarium and permanent preparation of *Polytrichum commune*

Objective:

To investigate the structural features of *Polytrichum commune*

Tasks of work:

Draw the appearance of the shoots of *Polytrichum commune*.

Draw and denote a moss sporophyte, showing the seta (stalk), capsule (sporangium), operculum (cap), peristome teeth, and spores.

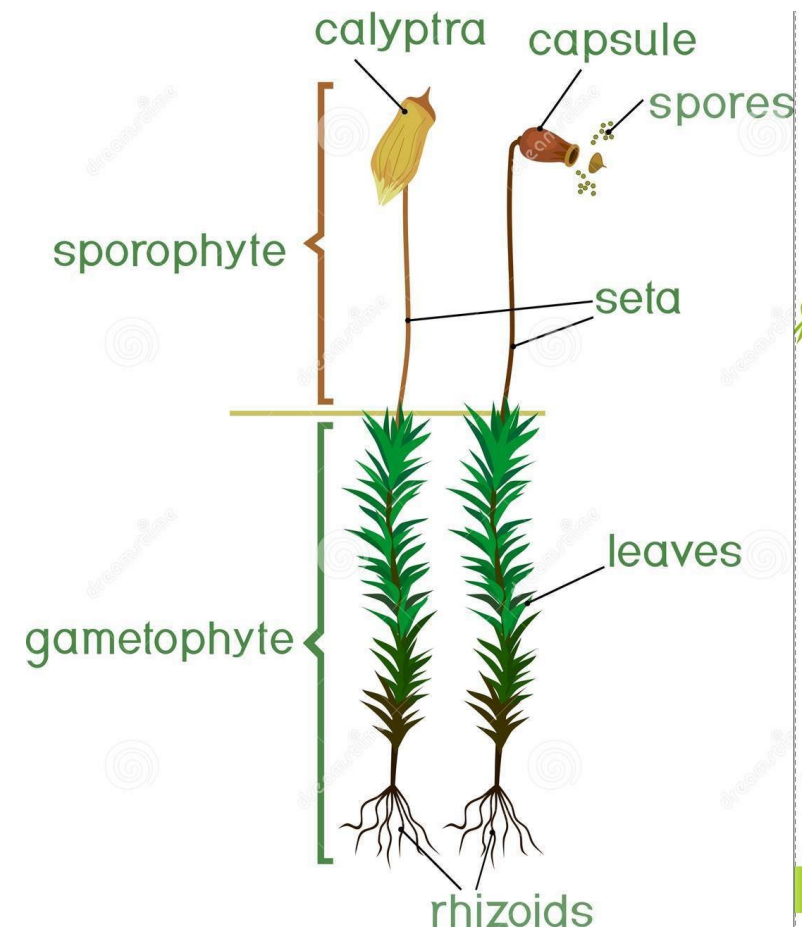
Draw Life Cycle of *Polytrichum commune*



Polytrichum commune, hairy cap moss

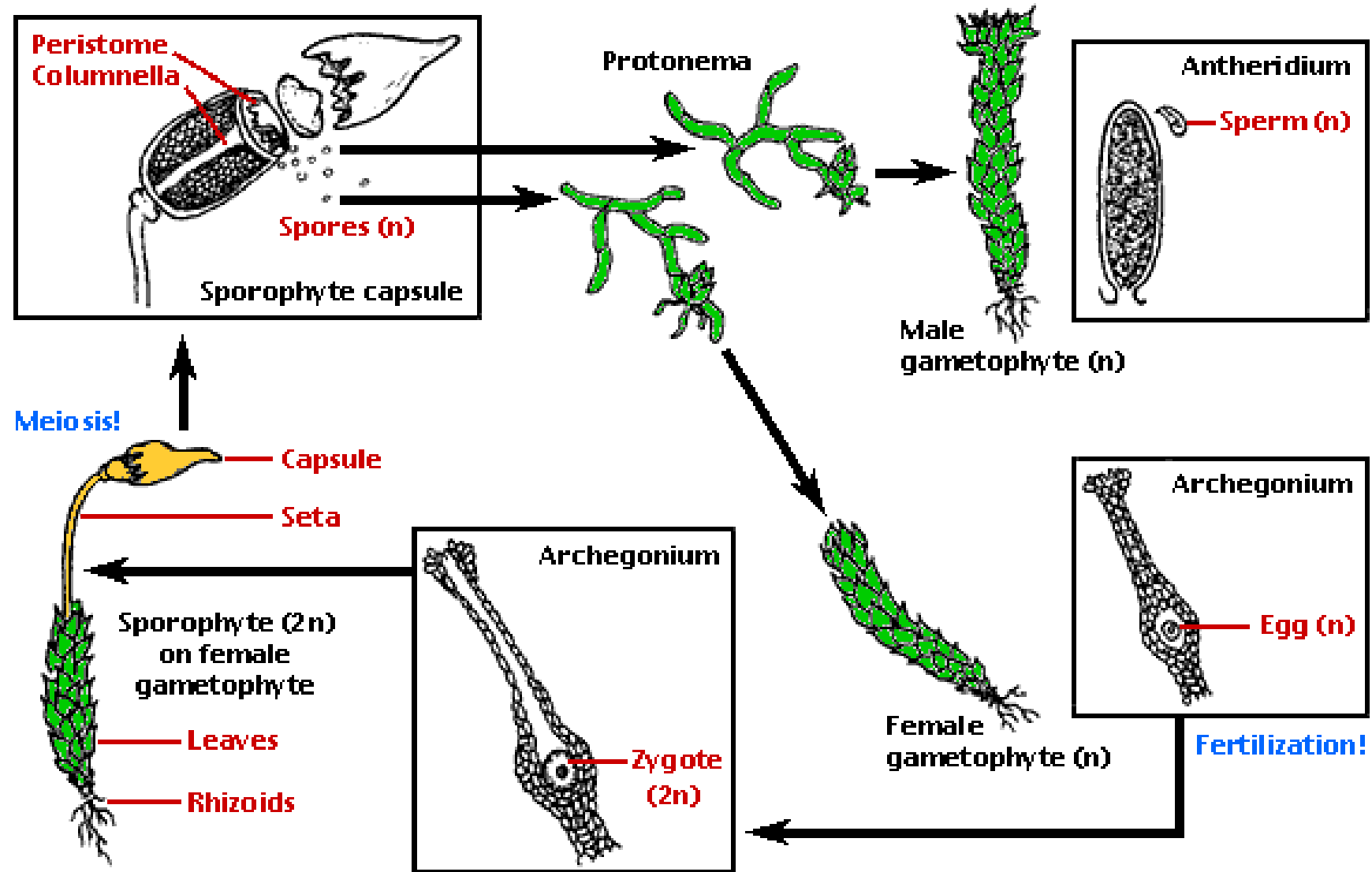
Sporophyte

Gametophyte



Polytrichum commune

Life cycle of mosses: The alternation of generations cycle begins when the gametophyte germinates from a haploid spore and forms a protonema. Apical meristem-like cells divide and give rise to the gametophores. The archegonium (female organ) and antheridium (male organ) develop on separate gametophores. After fertilization, the zygote divides and grows into a sporophyte, which stays attached to the gametophyte. Spores released from the sporophyte germinate and produce gametophytes; the process begins again.



Life cycle of *Polytrichum commune*

Material:

Division Lycopodiophyta – Lycopods

Class Lycopodiopsida

Order Lycopodiales

Family Lycopodiaceae – Club-moss family

Genus *Lycopodium* – clubmoss

Objects:

Herbarium of *Lycopodium* sp.

Permanent longitudinal section preparation of *Lycopodium* sp. strobilus.

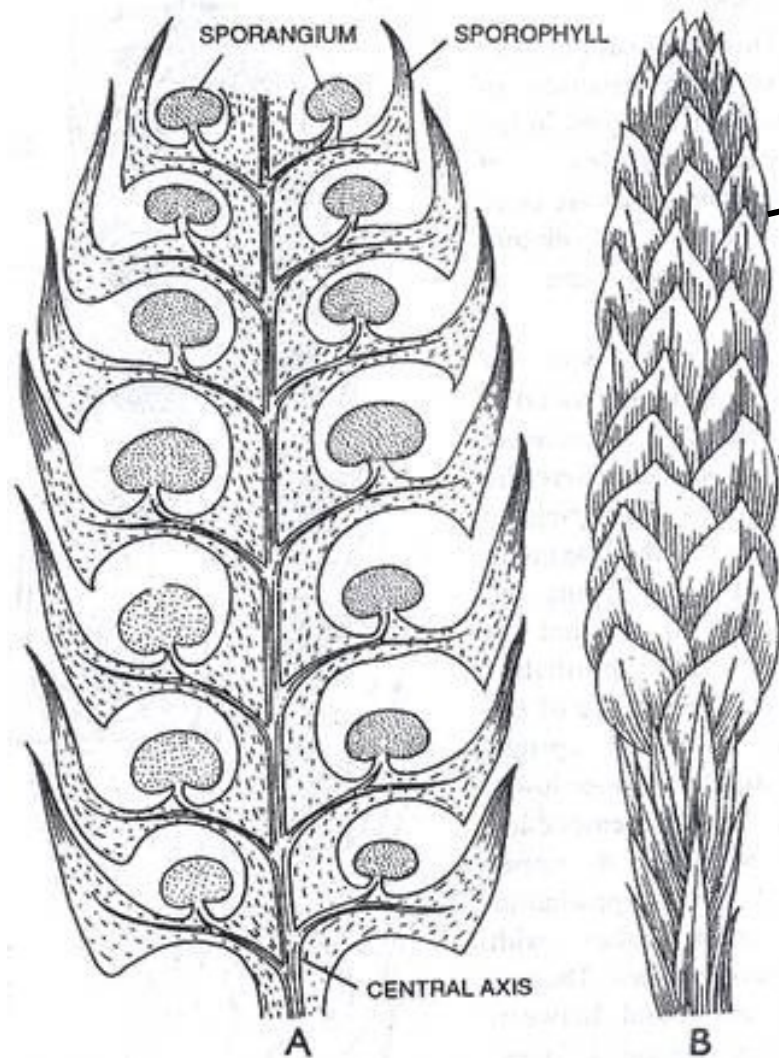
Objective:

To investigate the structural features of *Lycopodium* sp.

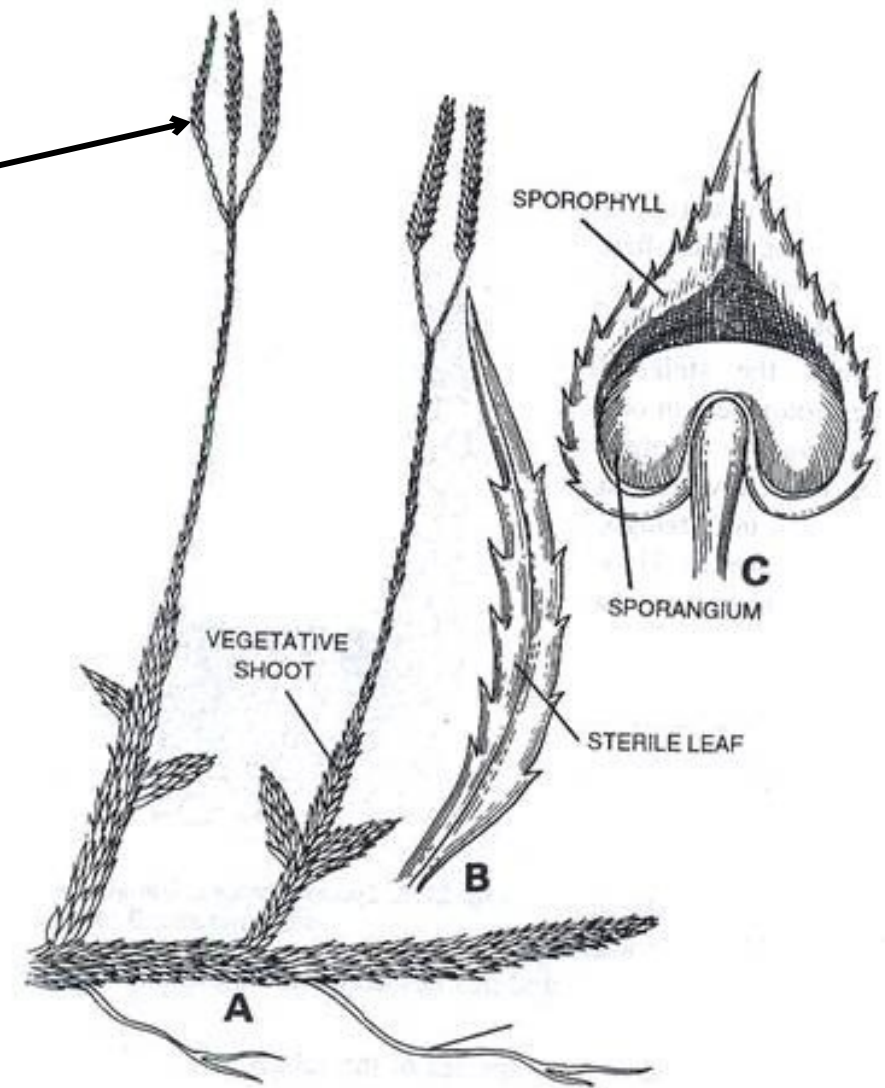
Tasks of work:

Draw and denote a *Lycopodium* shoot, showing the strobilus. Make an outline drawing of a strobilus longitudinal section, showing the sporophylls and sporangia.

Draw life cycle of *Lycopodium*.

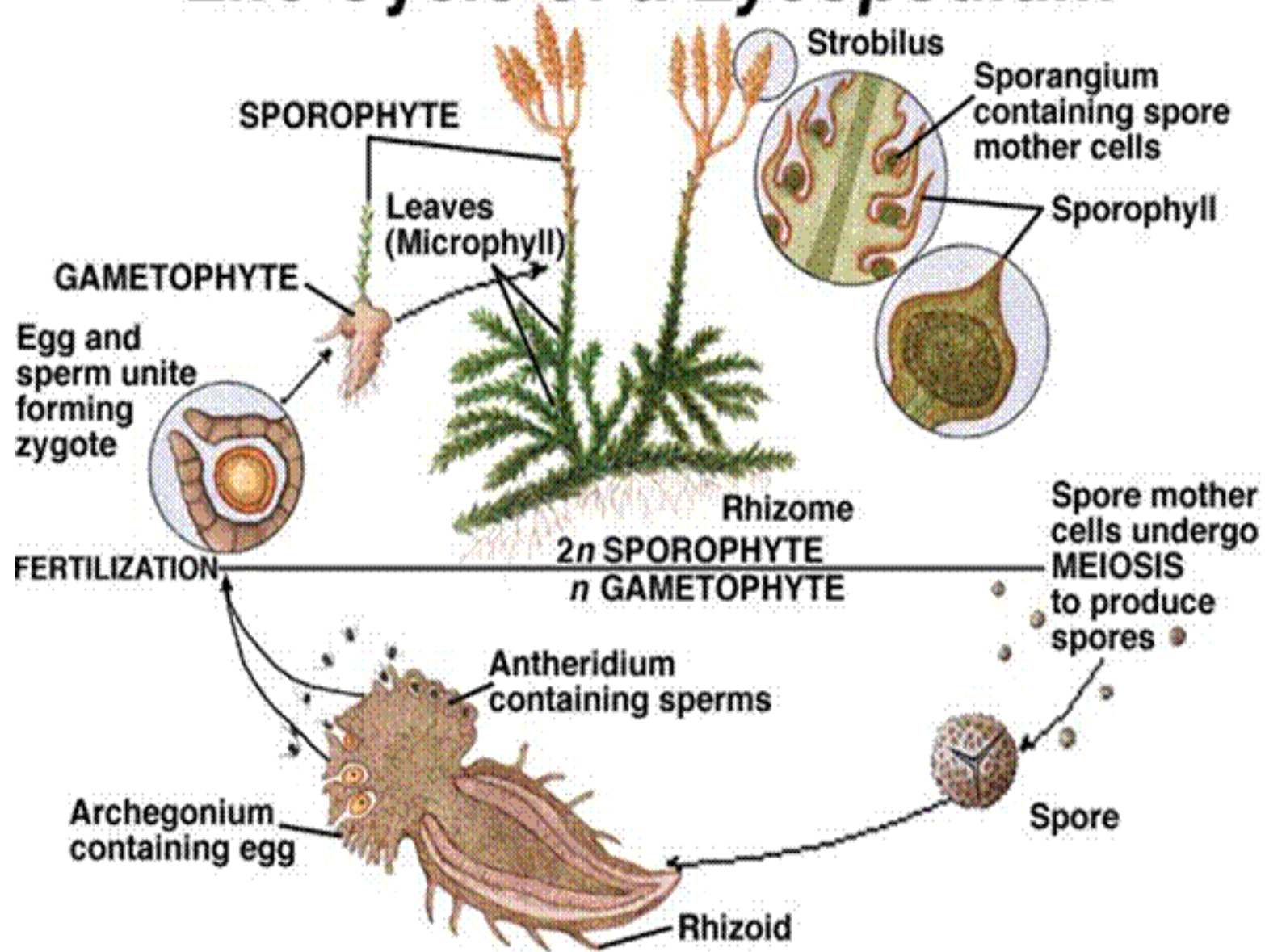


Lycopodium sp., A - strobilus bearing sporophylls and sporangia, B - strobilus



Lycopodium sp., A - shoot bearing strobili, B - sterile leaf, C - sporophyll with sporangium

Life Cycle of a *Lycopodium*



Material:

Division Lycopodiophyta – Lycopods

Class Lycopodiopsida

Order Selaginellales

Family Selaginellaceae - Spike-moss family

Genus *Selaginella* – spikemoss

Objects:

Herbarium of *Selaginella* sp.

Objective:

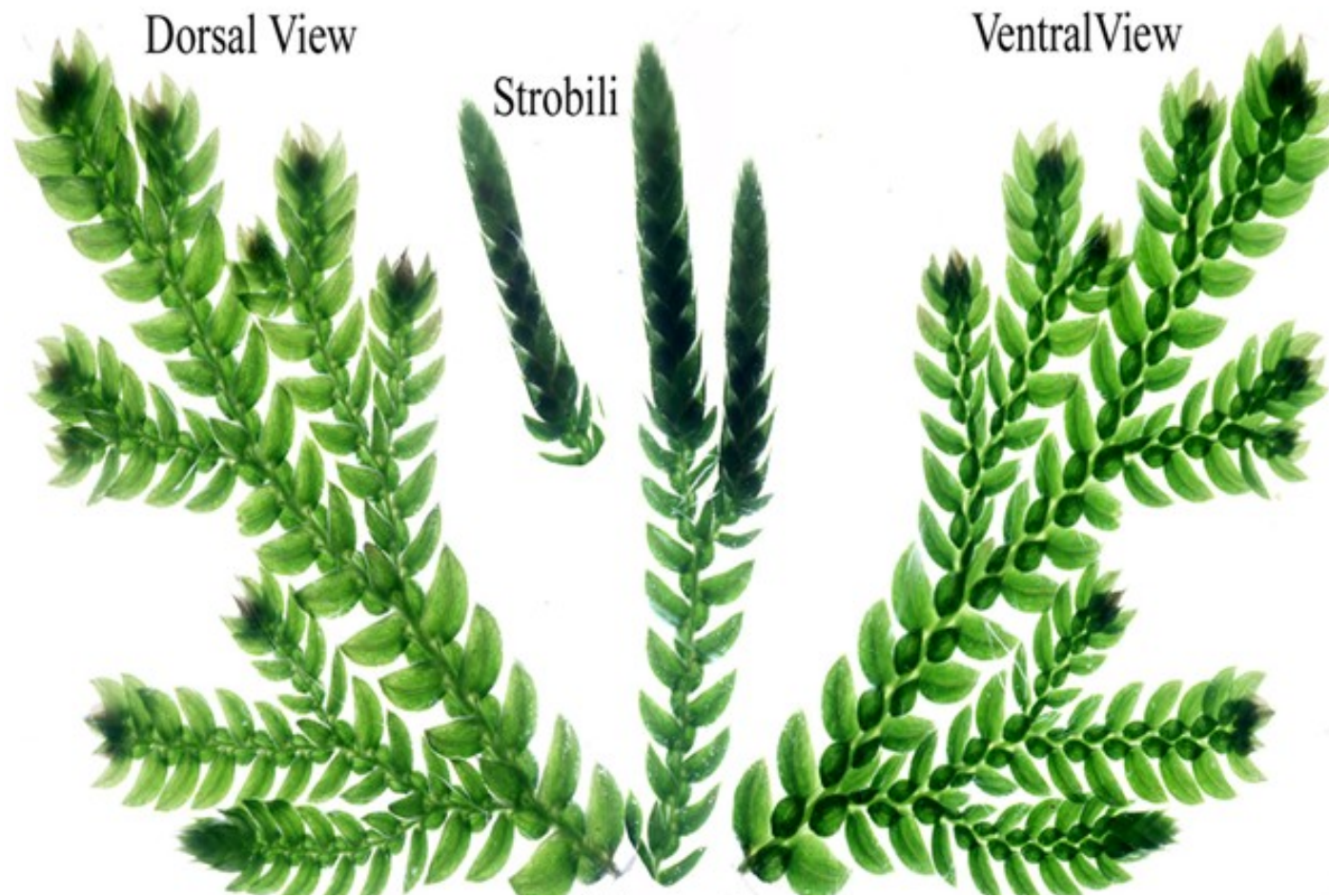
To investigate the structural features of *Selaginella* sp.

Tasks of work:

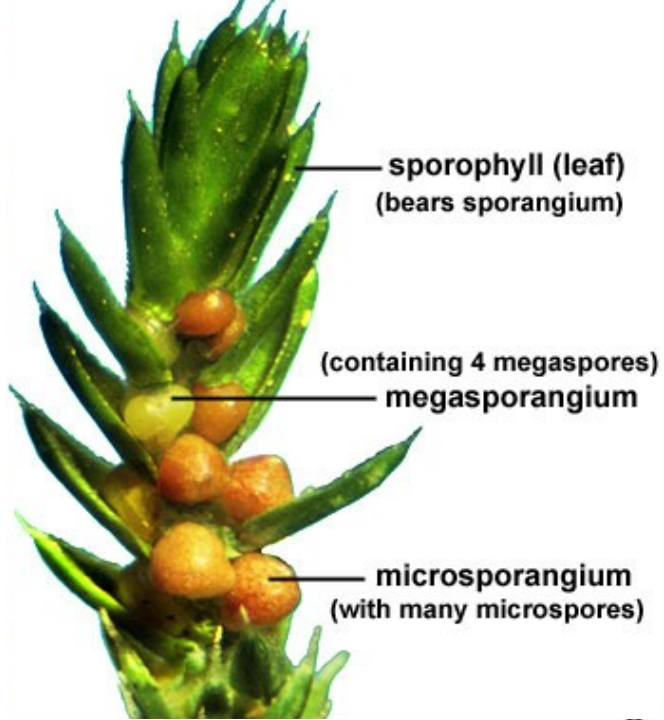
Draw and denote a *Selaginella* sporangia. Observe the longitudinal-section of *Selaginella*, showing microsporangia, with microspores, and megasporangia, with megaspores.

Note the vast difference in spore size.

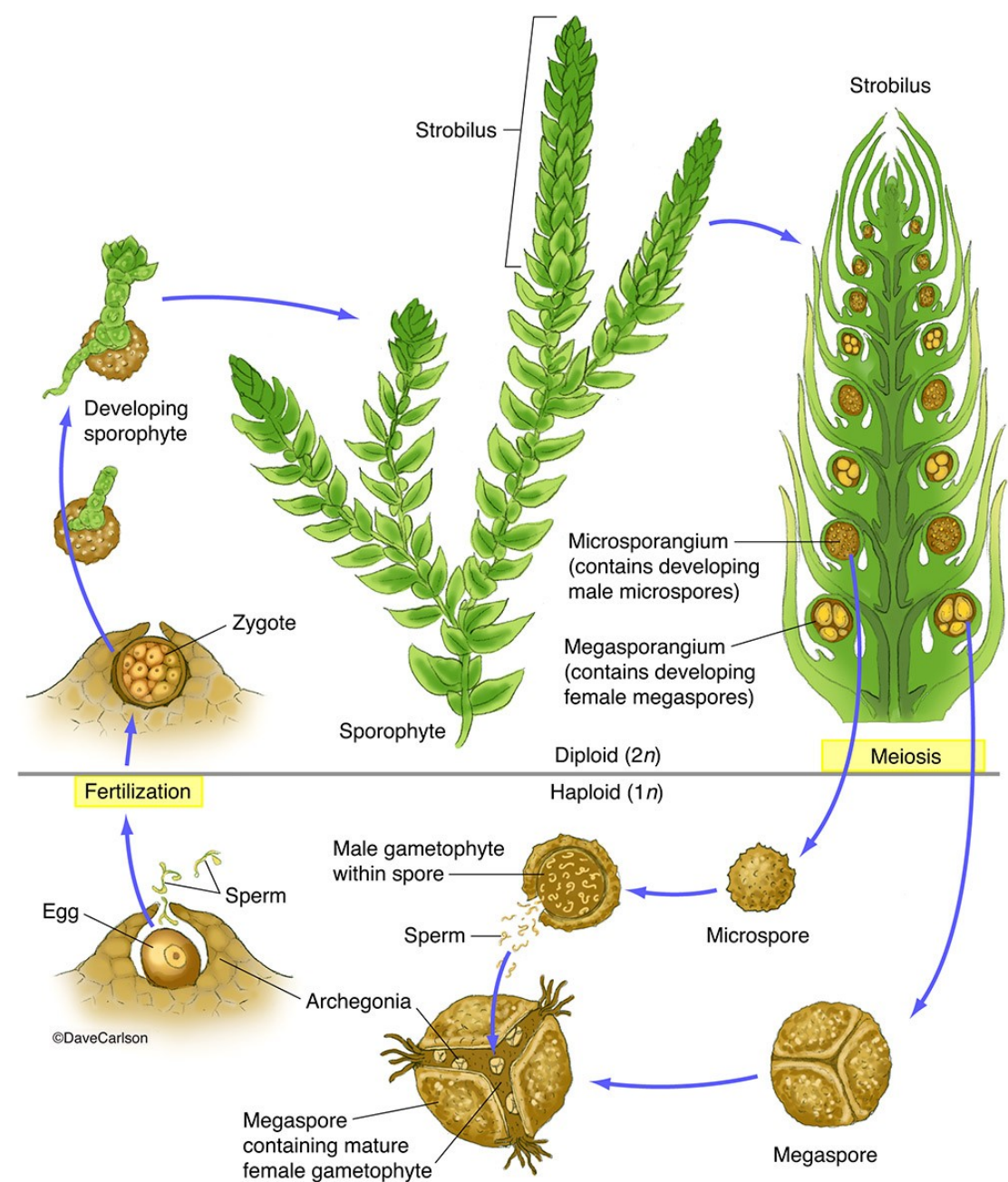
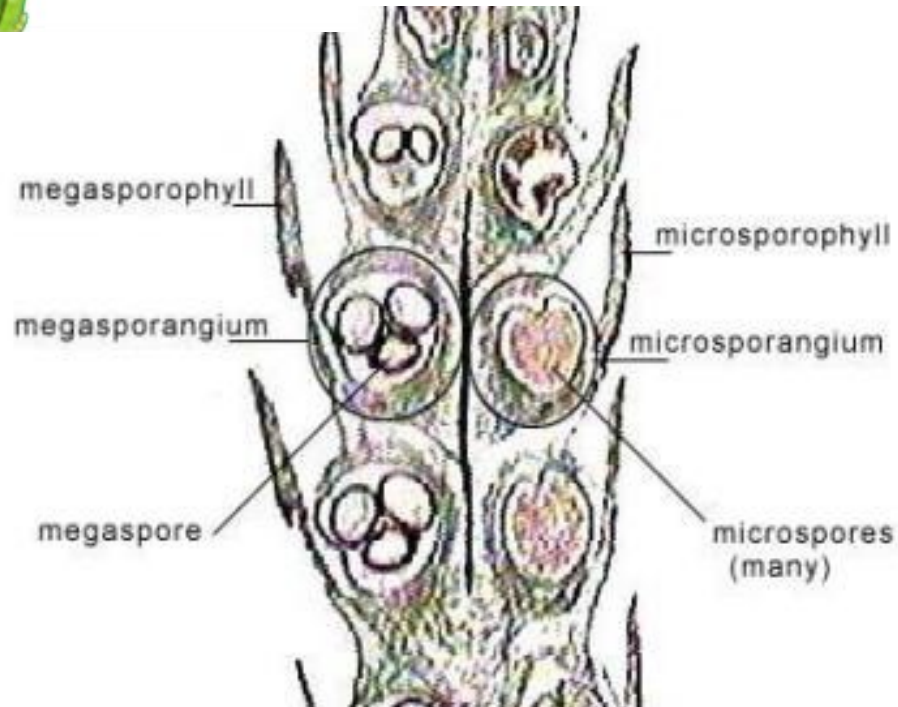
Draw life cycle of a *Selaginella*.



***Selaginella*: plant body, strobilus**



Strobilus of *Selaginella* sp.



Life cycle of *Selaginella*

Material:

Division Equisetophyta – Horsetails

Class Equisetopsida

Order Equisetales

Family Equisetaceae – Horsetail family

Genus *Equisetum* – horsetail

Objects:

Herbarium of *Equisetum sp.*

Permanent preparation of *Equisetum* strobilus.

Objective:

To investigate the structural features of *Equisetum sp.*

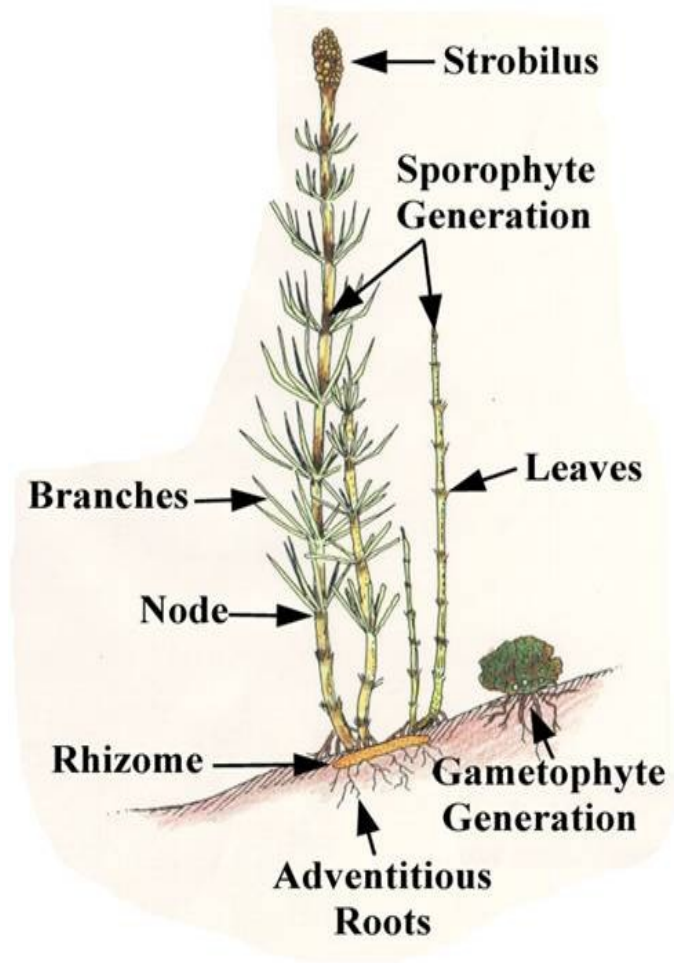
Tasks of work:

Draw and label a close-up of the ridged stem, whorled leaves, and (if present) lateral branches

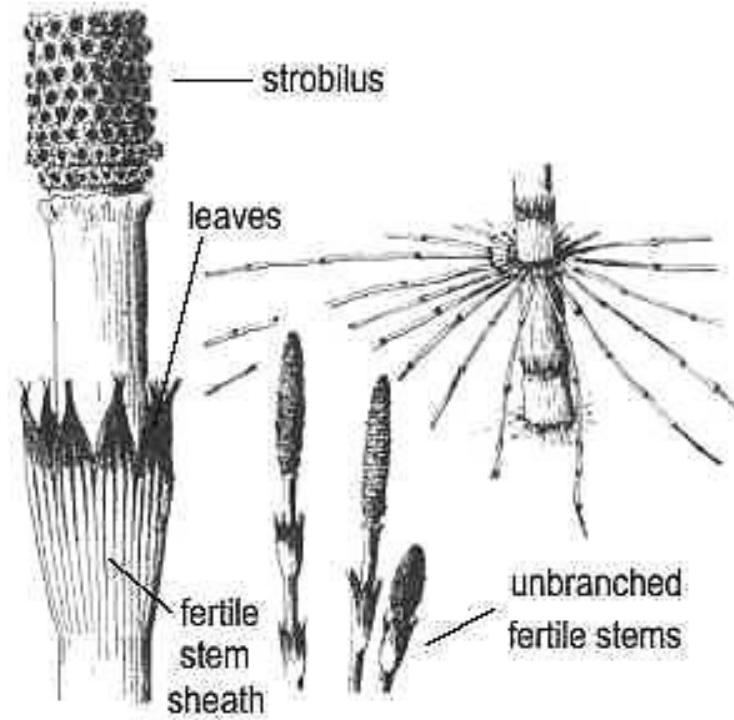
Observe the strobilus (cone) of *Equisetum*. Observe a sporangiophore with sporangia.

Make a wet mount of the spores and view with the compound microscope. Draw and label the strobilus, sporangiophore, and spore.

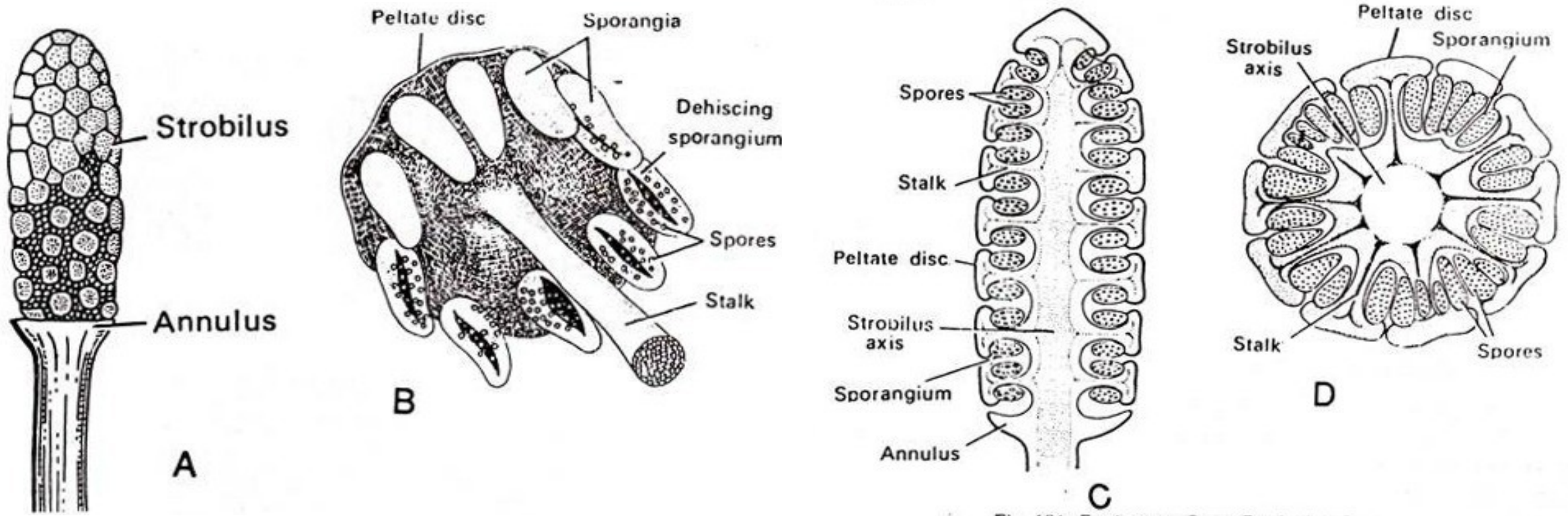
Draw life cycle of *Equisetum*.



Equisetum plantbody



Equisetum: spores



Equisetum: A - cone, B - ventral view of sporganiophore , C - longitudinal-section of cone, D - cross-section

Life Cycle of *Equisetum*

