Division : Pteridophyta

- **First Vascular Plants**
- **First land plants**
- Found in cool, damp, shady places
- **Main plant body is a sporophyte which is differentiated into true root, stem and leaves and is green**
- Adventitious roots
- Sporophytes bear **sporangia** that are subtended by leaf-like appendages called **sporophylls**
- In some cases sporophylls may form distinct compact structures called **strobili** or **cones**
- Gametophyte is the sexual or haploid stage of the pteridophyte and it develops from the spore produced on the sporophyte by meiosis in sporangia.
- **Gametophytes are independent inconspicuous short-lived multicellular green free-living, mostly photosynthetic thalloid gametophytes called prothallus**
- **Gametophyte and sporophyte are nutritionally independent of one another.**
- Leaves are small (microphylls) as in ***Selaginella*** or large (macrophylls) as in **ferns.**
- Used for medicinal purposes and as soil-binders.
- Also frequently grown as **ornamentals.**
- **Aquatic pteridophytes :** *Azolla, Salvinia , Marsilia*

Heterosporous pteridophytes :

- Certain pteridophytes ***Selaginella, Marsilia, Azolla, Salvinia*** produce haploid meiospores of different sizes (**small** = megaspores; **small** = microspores).
- The microspores develop into small microgametophytes and the megaspores develop into larger megagametophytes.

Classification : The pteridophytes are classified into four classes:

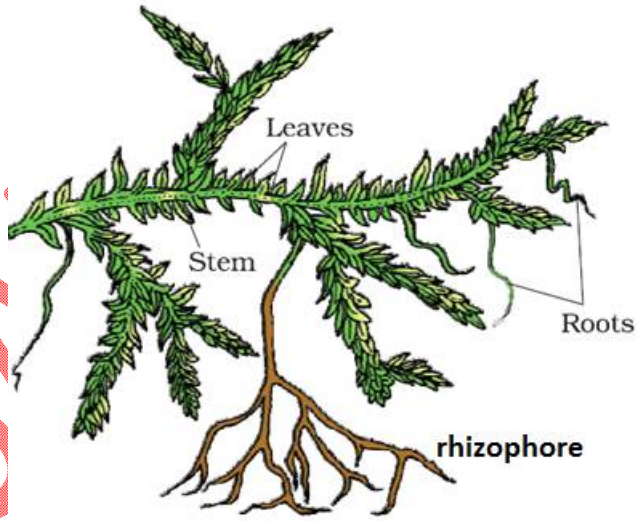
Characters	Psilopsida	Lycopsida	Sphenopsida	Pteropsida
Common members	**Whisk ferns**	**Club Mosses Spike mosses Bird nest moss**	**Scouring rushes Horsetails**	**Ferns**
Main Plant body (sporophyte)	No leaf No root Stem **green** **Rhizoids present**	Root , Stem, Leaf **Microphyllous leaf**	Root Stem Leaf **Leaf very minute** Stem Hollow, jointed have ridges and furrows, silica deposition	True root , stem, leaf Stem underground rhizome **Leaf megaphyllous** **show circinate vernation** (coiling of young leaves) Leaf is both photosynthetic and reproductive
Types of spores	Homosporous	Mostly homosporous **Some heterosporous**	Homosporous	Mostly homosporous **Some heterosporous**
Sperms	Multiflagellated	Biflagellated	Multiflagellated	Multiflagellated
Reproduction	Produce sporangia	Produce cones	Produce cones	Produce sporangia
Examples	**Mostly Fossils** *Rhynia* *Psilophyton* **Living** *Psilotum,* *Tmesipteris*	*Lycopodium* *Selaginella*	*Equisetum*	*Dryopteris* *Pteris* *Azolla* *Salvinia* *Marsilea* *Adiantum* ***Ophioglossum*** (Adders tongue ferns)

Selaginella :

- Commonly called **Little club moss** or **Spike moss** or **Bird nest moss**
- **Resurrection plant**
- Show **cespitose habit** - turns brown and curls up in a ball during drought.
- **Leaves** have a small, scalelike outgrowth, called a **ligule**
- Vegetative reproduction by fragmentation, bulbils, tubers
- **Sexual reproduction is by Cones**
- ***Selaginella* is heterosporous**
- Some species show **seed habit -** *Seleginella rupestris*
- *Selaginella bryopteris* is called sanjeevani

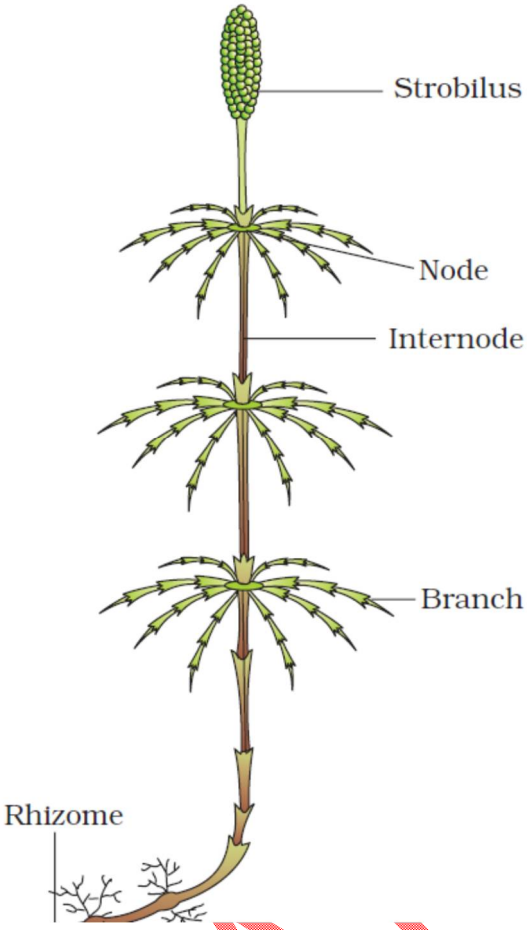
Rhizophore

- Special structure
- Leafless colourless cylindrical structure
- Grows downward
- Produce roots at apex
- Morphological nature is disputed – 3 views
  - **Capless root -** + ve geotropic Leafless Anatomy
  - **Leafless shoot -** Exogenous origin No Root cap No root hairs
  - **Organ sui generis –** New organ



Horsetails :

- *Equisetum* is one of the easiest plants to recognize
- Has **jointed, ribbed** and **hollow stems** impregnated with so much **silica**
- At each stem node there is a ring of small leaves fused in a sheath
- Aerial shoots arise from an extensive rhizome system
- Horsetails are also called **arthrophytes** ("jointed plants")
- **The stem is the main photosynthetic organ**.



Life cycle of a fern : *Dryopteris filix-mas*

Male shield fern

The ferns are found in the shady and moist places both in the hills and in the plains.

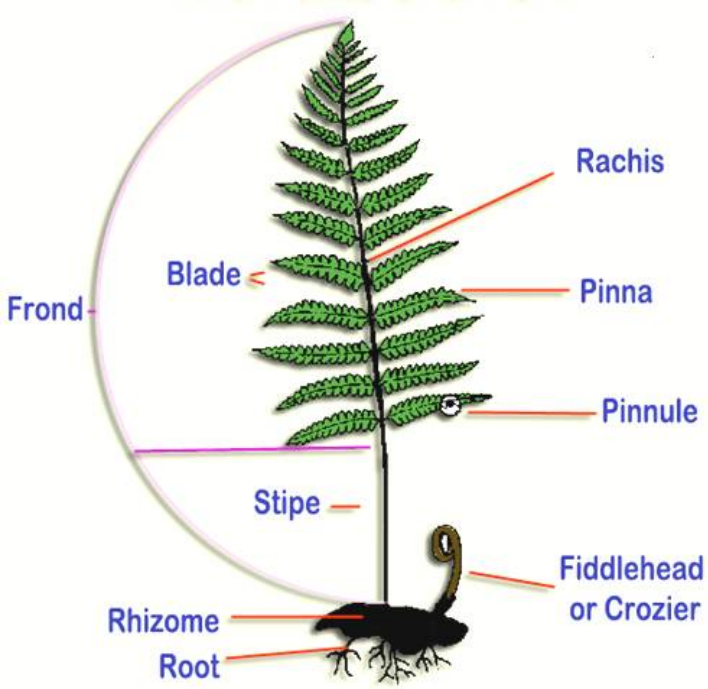
Stem

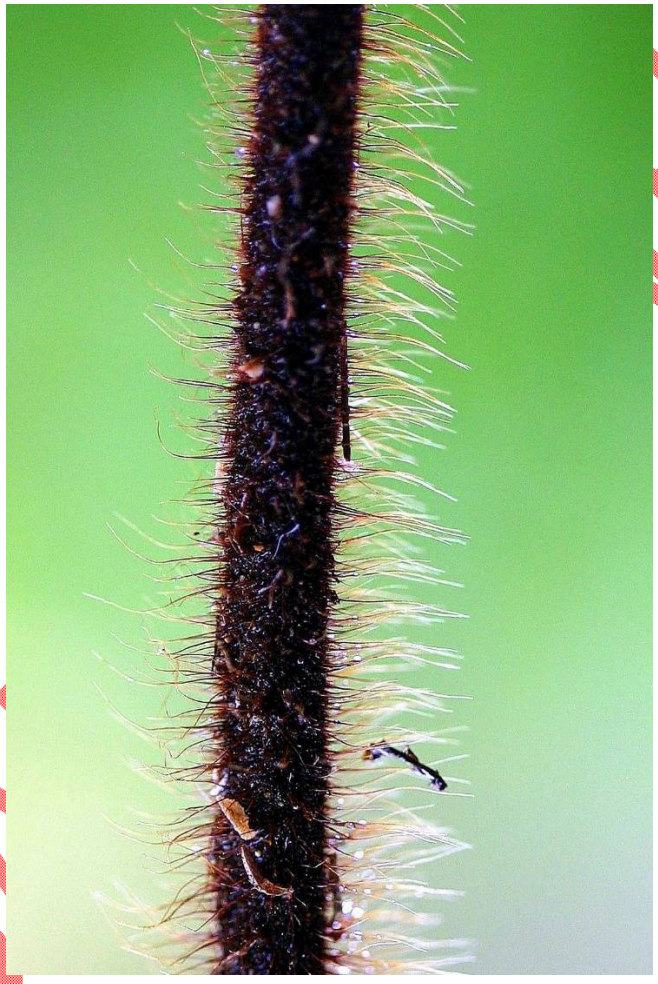
- Unbranched rhizome
- Oblique growth
- Only apical part come above
- Irregular outline
- Covered by leaf bases
- Ad roots all over surface
- In young leaves, both the rachis and the petiole are covered with small, brown, hairy scales known as **ramenta.**

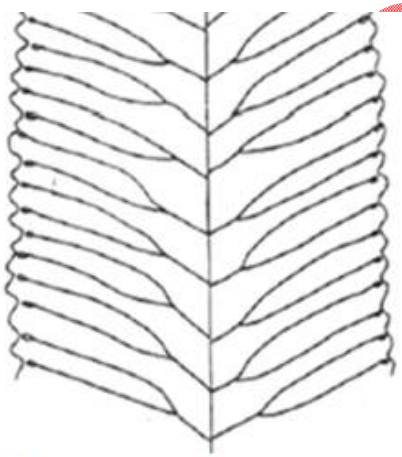
Leaf

- Large size / megaphyll called frond
- **Bipinnate compound -** one to three feet in length.
- Show circinate vernation – coiling of young leaves

- Young leaves are commonly referred to as **“fiddleheads”**
- This type of vernation **protects the delicate embryonic leaf tip during development**
- Each leaf is composed of **numerous leaflets or pinnae.**
- Pinna show -- **furcate open dichotomous venation**
- Do not shed but decay
- Sori present on undersurface in 2 rows on 2 side of midvein (on abaxial surface)





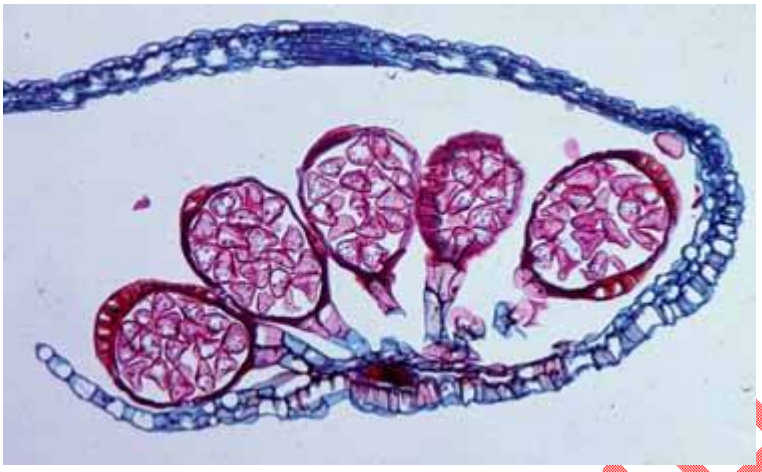


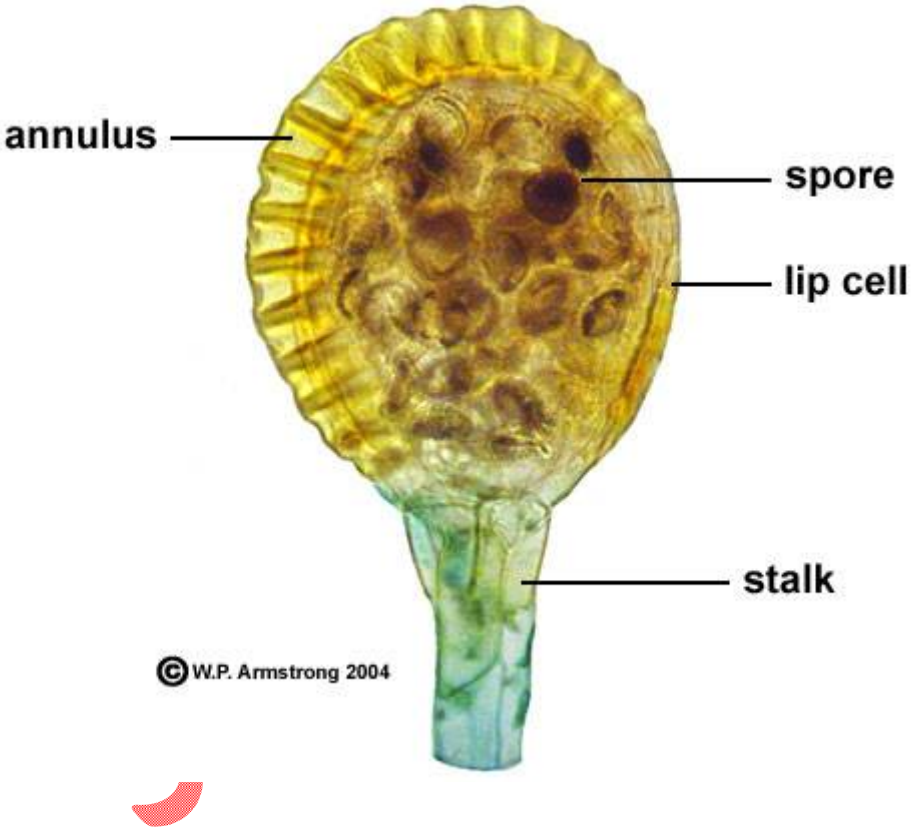
Furcate venation
(open dichotomous)

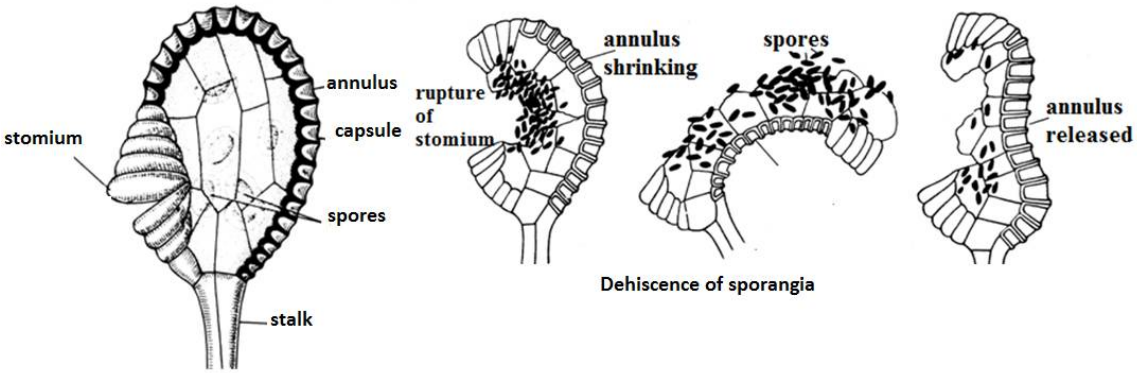
Spore producing organs :

- The sporangia are produced in sori situated on the leaves, known as sporophylls.
- The sori are found on the lower surface of pinnae of the leaves.
- The small kidney-shaped sori of sporangia are arranged in two rows on the underside of the pinnules of the leaf.
- The sporangia of a sorus are attached to a swollen placenta by their stalks.
- A delicate membranous structure, known as **indusium** also arises from the placenta and covers the sorus of sporangia like a hood.
- Each sporangium is composed of a **multicellular stalk** and a **capsule.**
- Capsule have many **spore mother cells** which produce **haploid spores by meiosis**
- The sporangium bursts by a special mechanism.

- Violent discharge of spores like catapult / sling mechanism .
- The gametophytic stage of the fem begins from this spore.







Germination of spore and development of gametophyte

- **Called prothallus**

Prothallus is

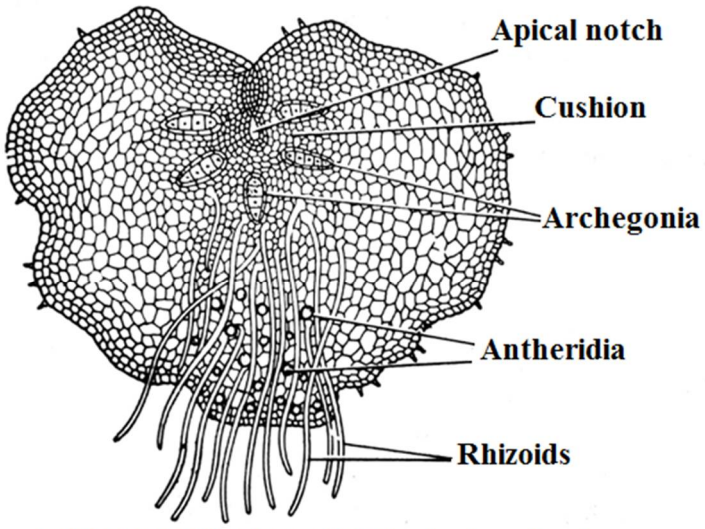
- **Dorsoventrally flat**
- **Green, Autotrophic, Independent**
- **Cordate (heart shaped)**
- **Short lived , Reduced , Small -**1/8 to 1/3 of an inch in diameter.
- Have **unicelluar rhizoids**
- **Monoecious** - Sex organs on **adaxial / ventral surface**
- In the normal prothallus the **archegonia develop around the notch** upon the cushion and the **antheridia in the basal region** of the prothallus

Antheridia

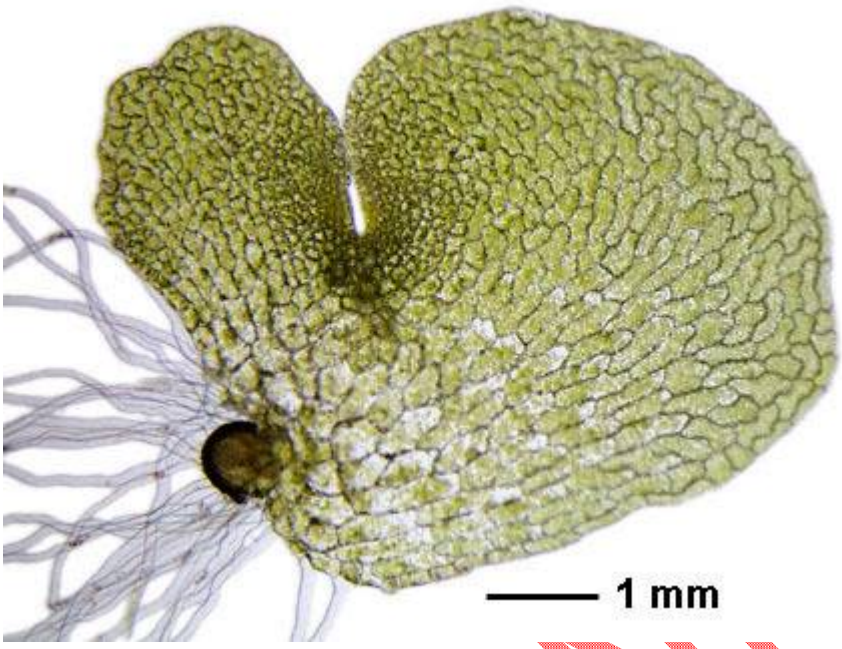
- At posterior end
- Globular
- Sperm –multiflagellated

Archegonia

- On anterior end below notch
- Neck curved
- **NCC - 1 binucleated**
- The mature archegonium probably secretes **malic acid,** which attracts the swimming antherozoids towards it.



FERN PROTHALLUS(Ventral surface)


1 mm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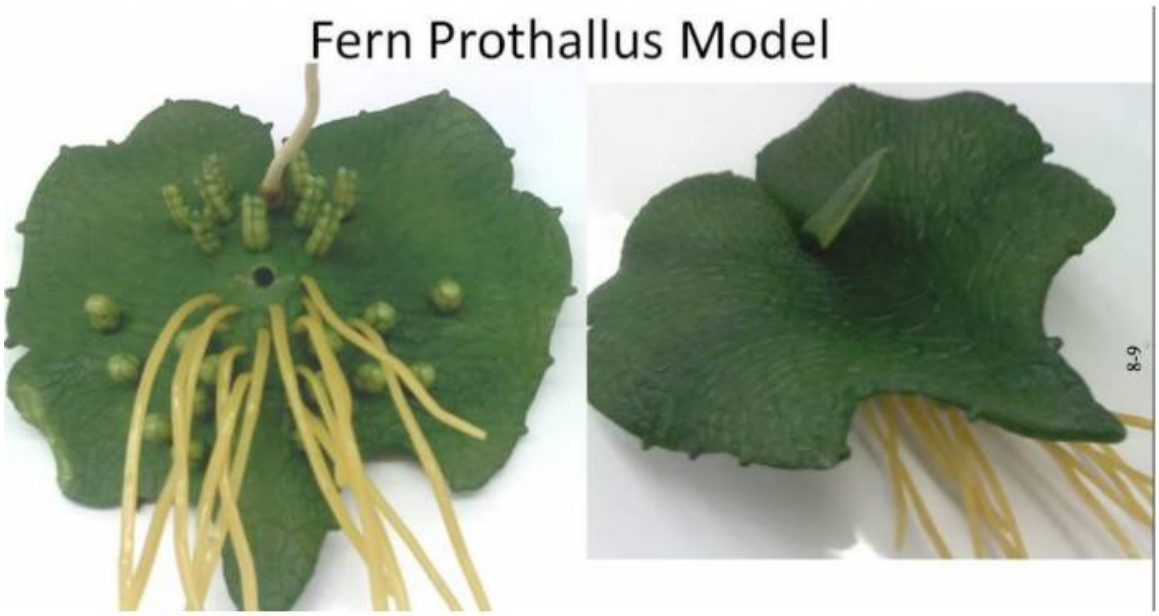

Salvinia :

- It is free floating **perennial fern** on still water.
- Fern is horizontal, floating, **branched rhizome**. Each node bears a whorl of three leaves.
- Two of them are floating while third one is submerged and highly branched.