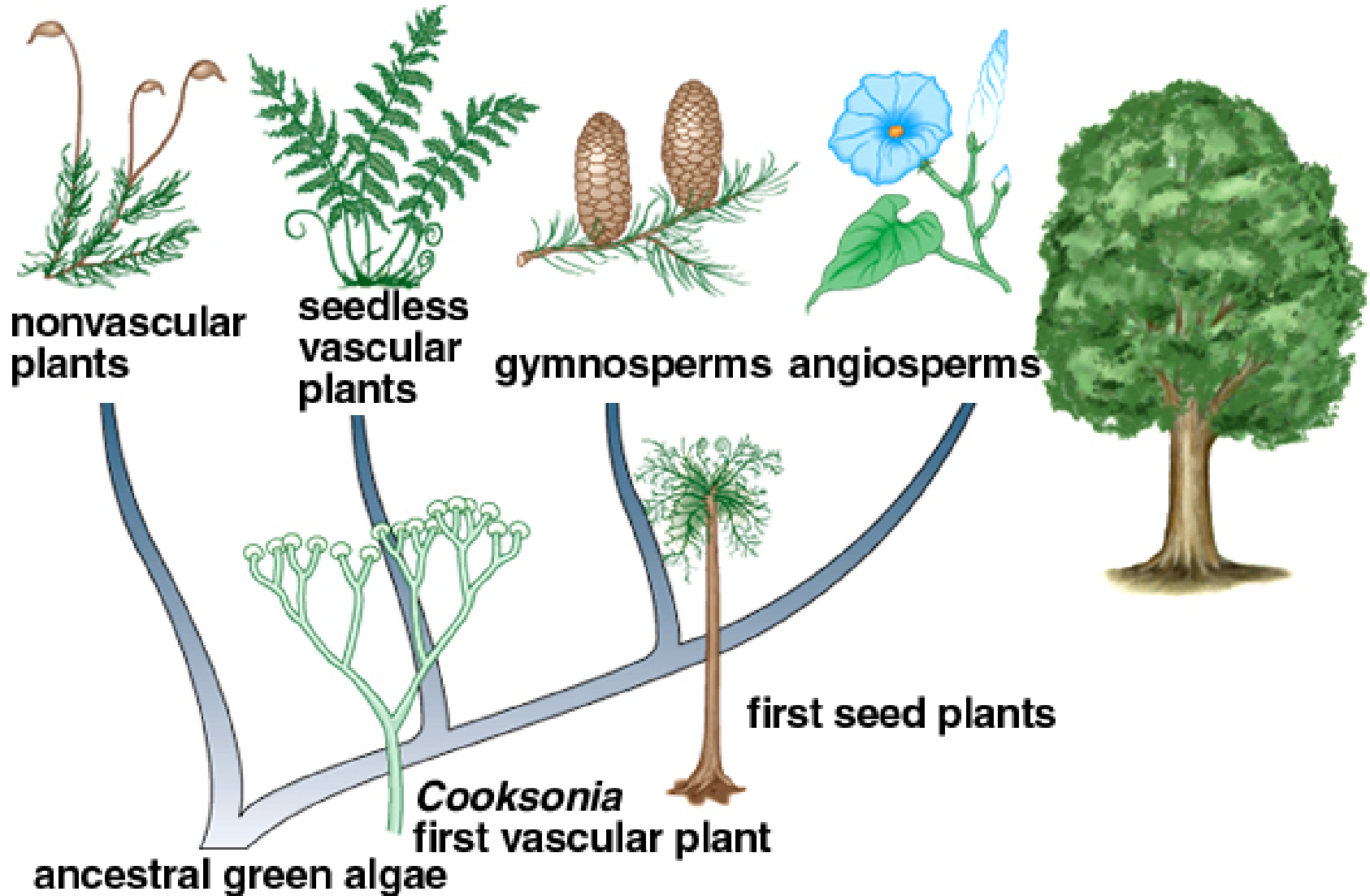
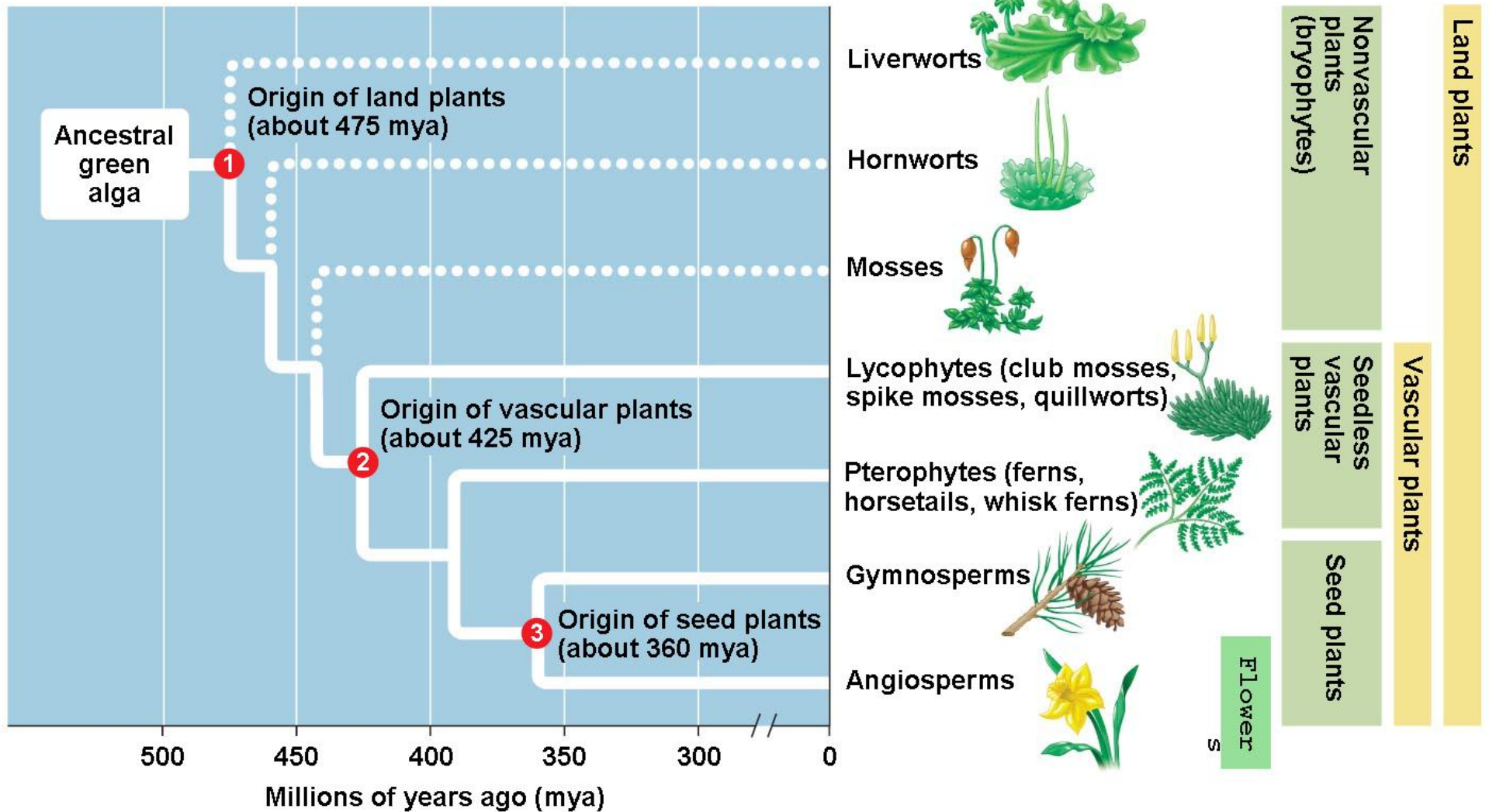


Evolution of the major groups of plants (simplified)





Land Plants fall into two major groups

- Non vascular
- Vascular

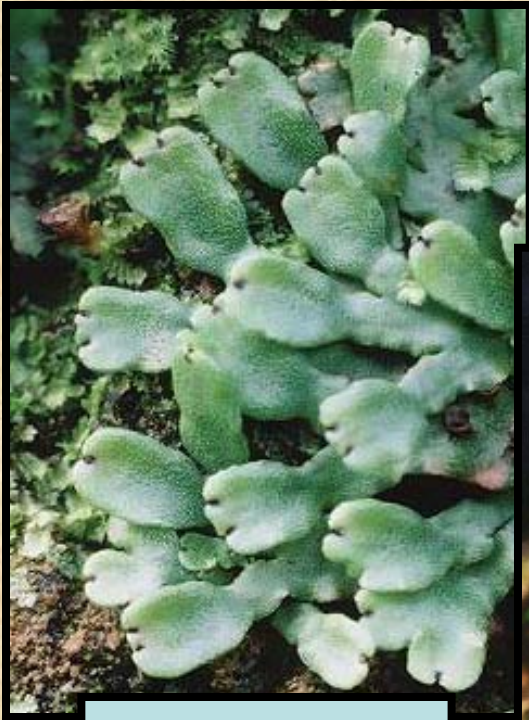


Non-Vascular Plants



- Lack vascular tissue
- Very small
- Known as the bryophytes

The Bryophytes



Liverworts



Hornworts



Mosses

Liverworts



Liverworts

Thallose



Leafy



Mosses

- True mosses
- Sphagnum (Peat) mosses
- Granite mosses



Mosses

- True mosses
- Sphagnum (Peat) mosses
- Granite mosses



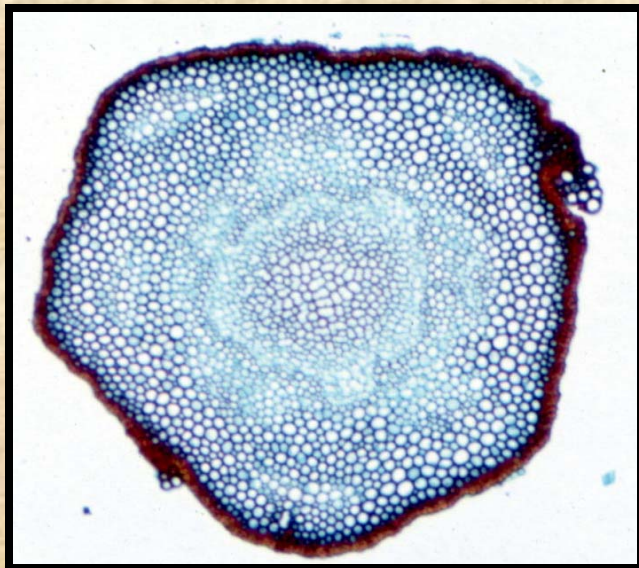
True Mosses

- Consists of structures resembling leaves stems and roots



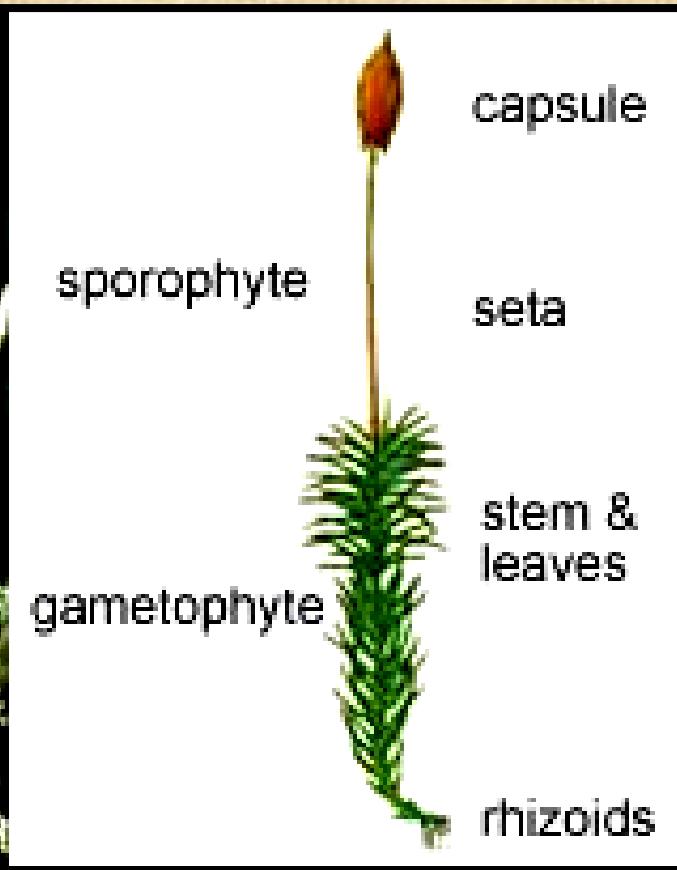
True Mosses

- “Leaves” have no veins
- “Stems” have no vascular tissue



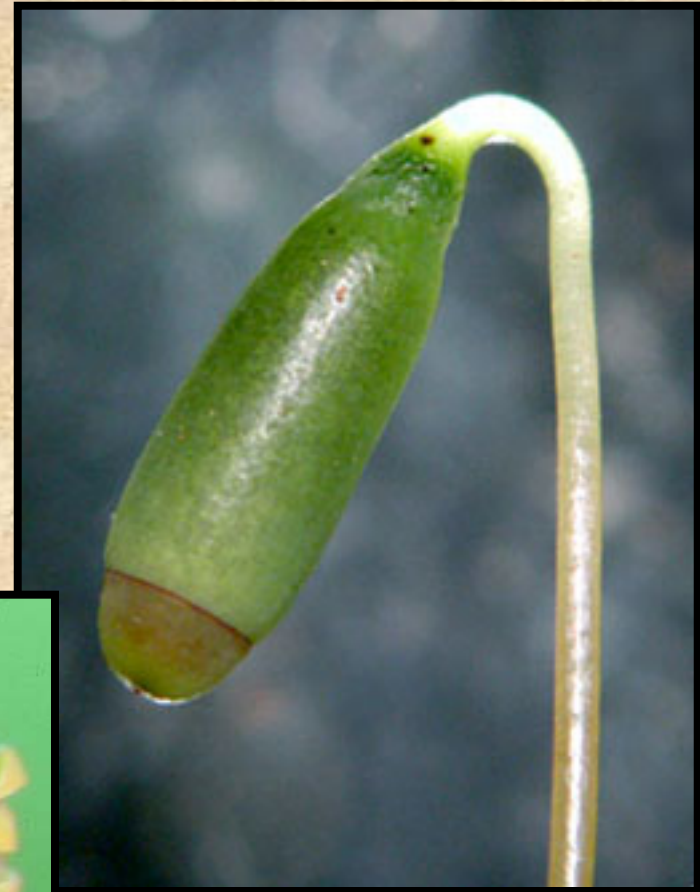
True Mosses

- Reproduces by spores
- Produced in a capsule



True Mosses – The Sporophyte

- When operculum is shed peristome teeth are exposed
- Peristome regulates spore dispersal



Sphagnum (Peat) Mosses

- Grow in Bogs
- Bogs may cover huge areas



- Moss absorbs water
- Water is acidified by the moss

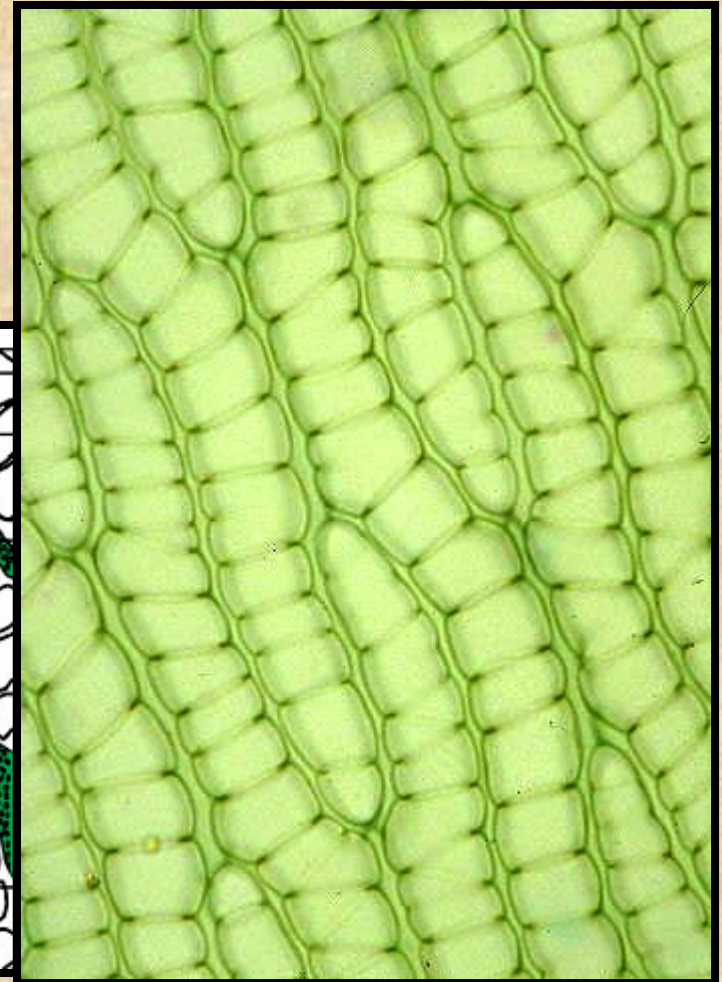
Sphagnum (Peat) Mosses

- Unique leaf structure allows leaves to absorb large quantities of water



Sphagnum (Peat) Mosses

- Unique leaf structure allows leaves to absorb large quantities of water



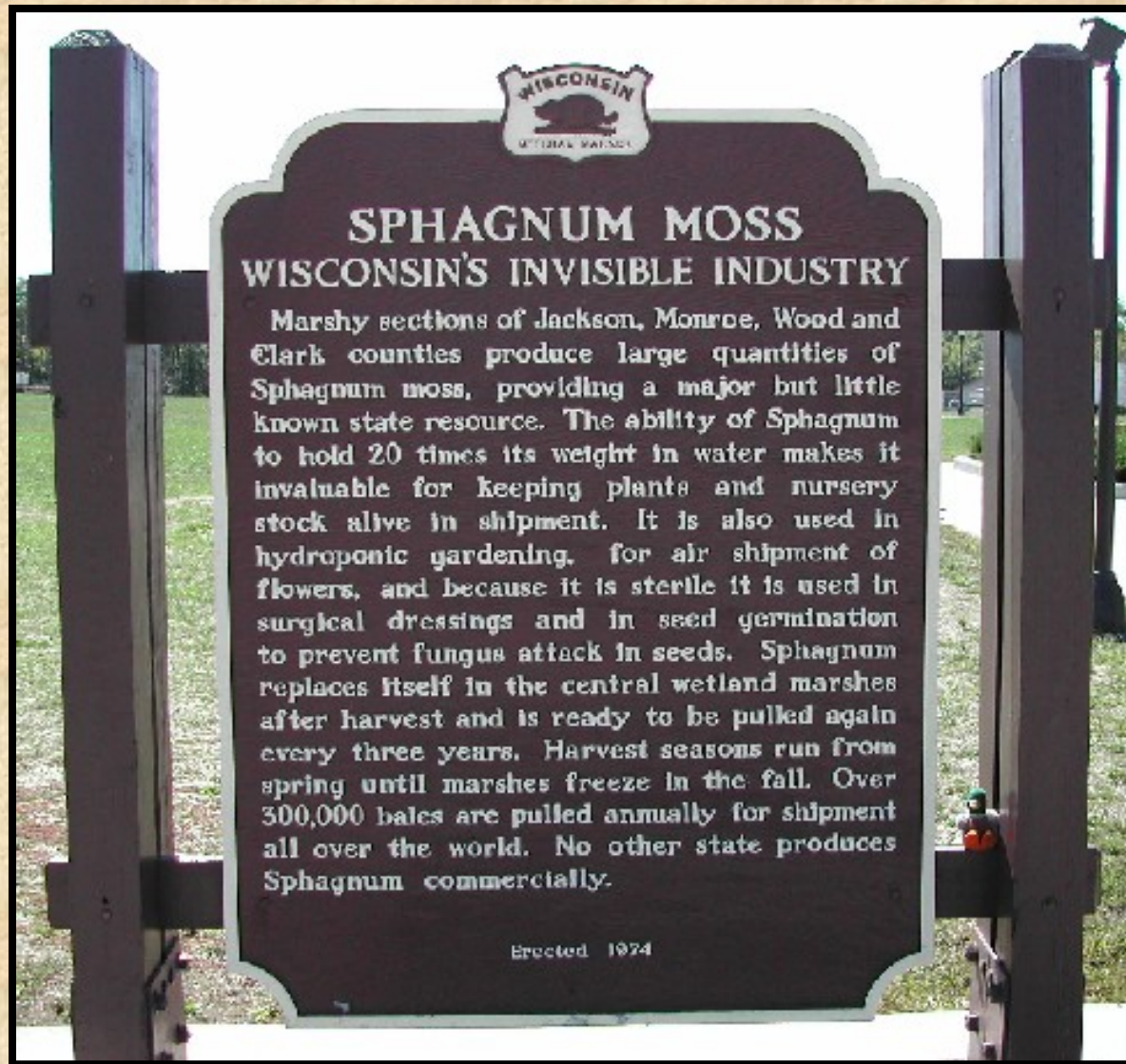
Sphagnum (Peat) Mosses

- Thick deposits of partially decomposed moss accumulates

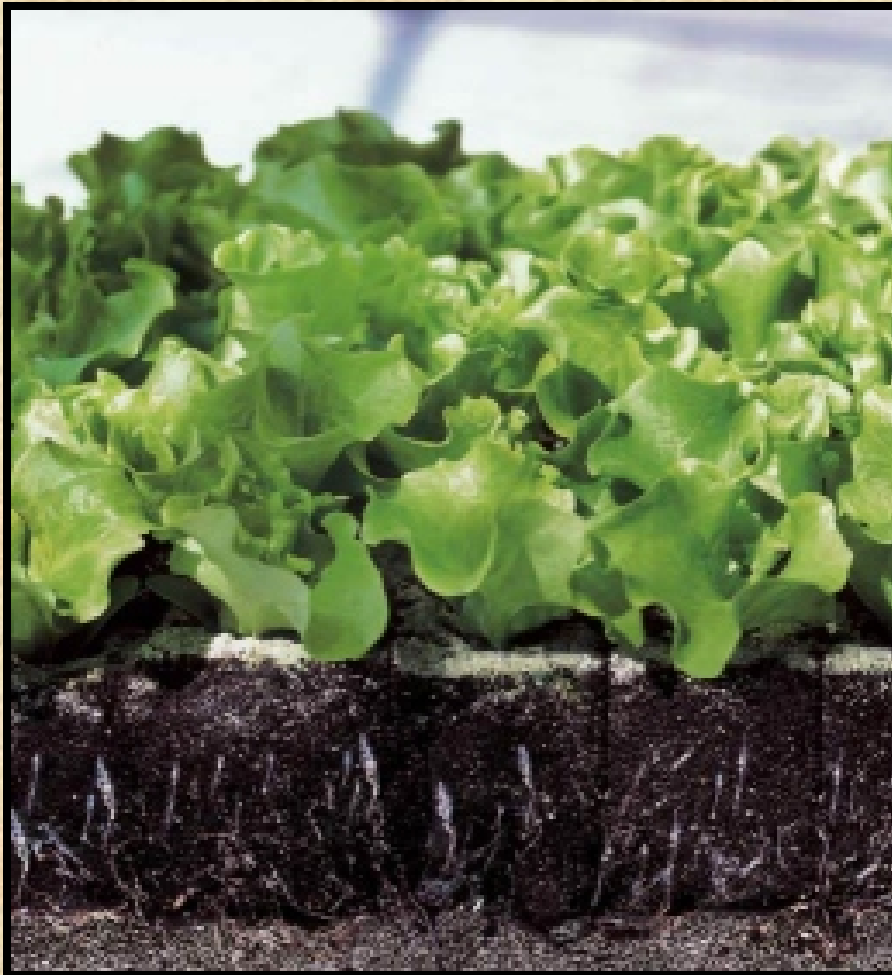


- Deposits are known at Peat

Sphagnum and Peat are Harvested for Agriculture and Fuel



Acid pH and capacity for water retention make sphagnum a popular soil amendment



Sphagnum (Peat) Mosses

- Peat has been harvest for centuries and burned for fuel



Bodies buried in Sphagnum Bogs are well preserved

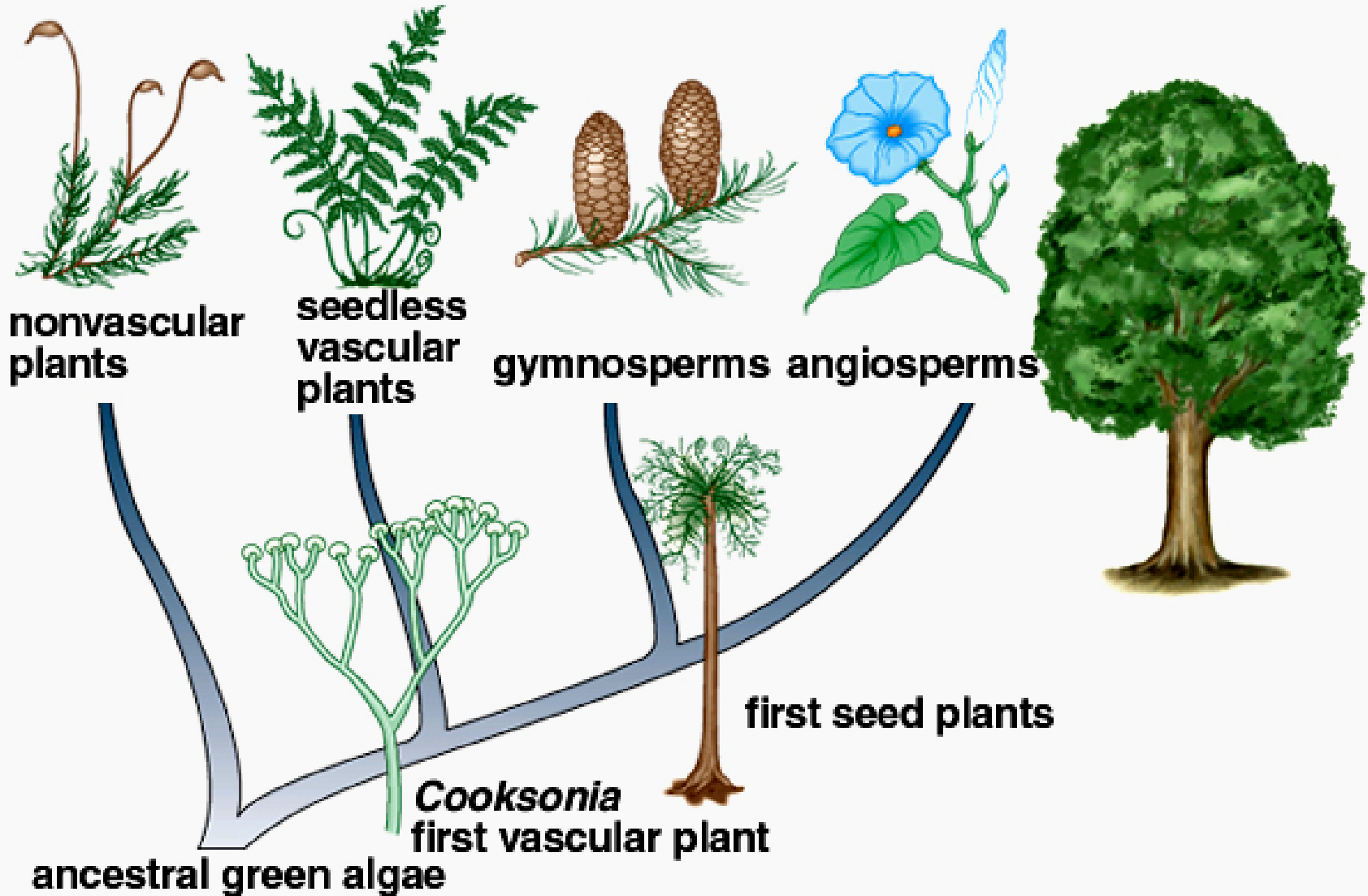


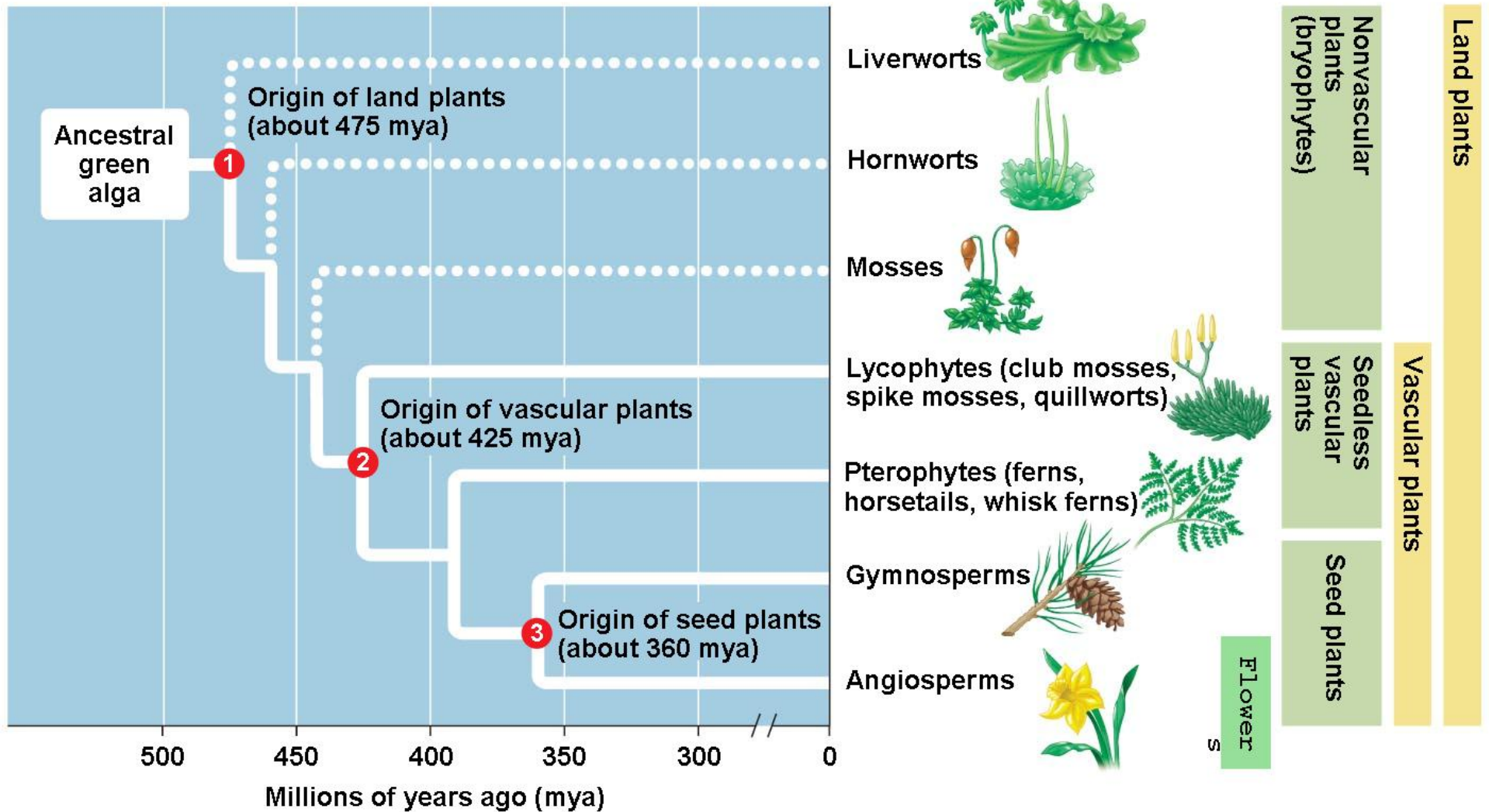
- Acid/anoxic environment retards bacterial growth

Short video Mummies Frozen in Time



Evolution of the major groups of plants (simplified)



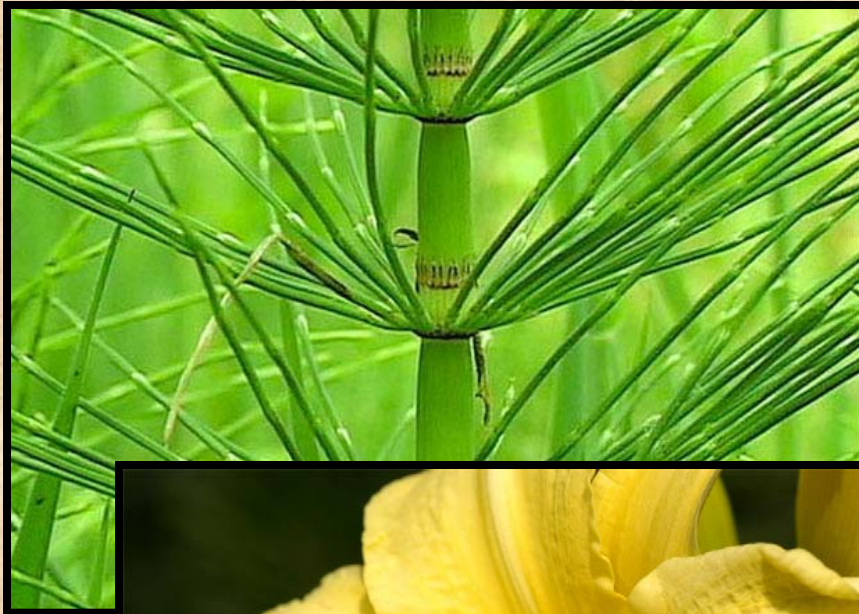


Land Plants fall into two major groups

- Non vascular
- Vascular



Vascular Plants



- Vascular tissue
- Some are seedless
- Others produce seeds

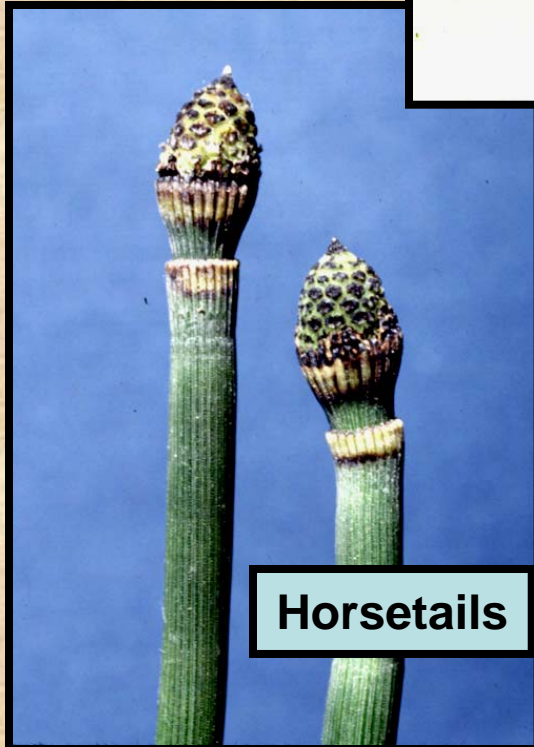
Seedless Vascular Plants



Whisk Ferns



Club/Spike Mosses



Horsetails



Ferns

Whisk Ferns



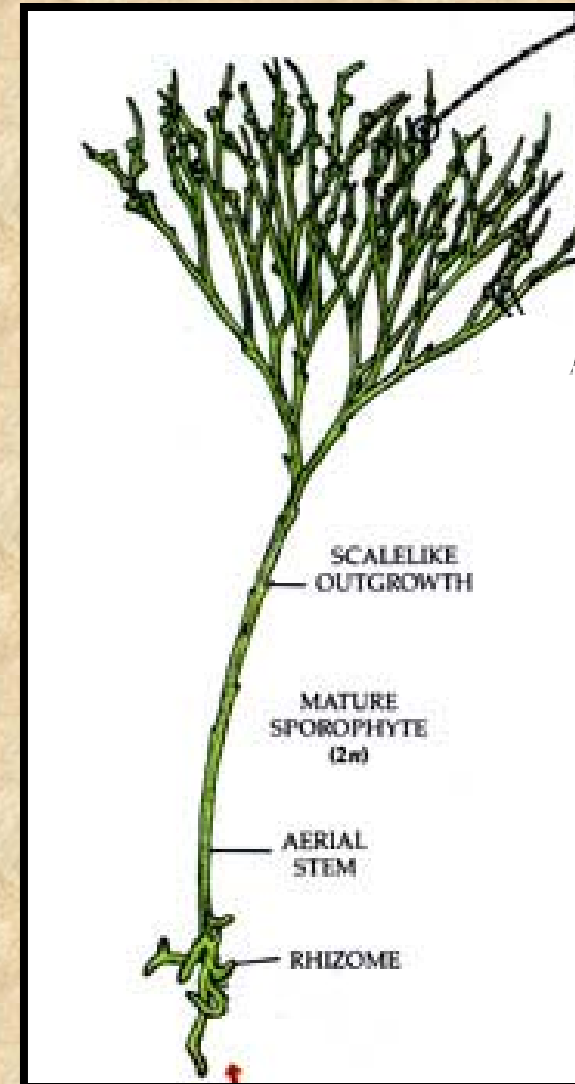
Whisk Ferns

- Dichotomous branching stems



Whisk Ferns

- No roots – underground rhizome only



Whisk Ferns

- No leaves-
stem
appendages
are called
enations

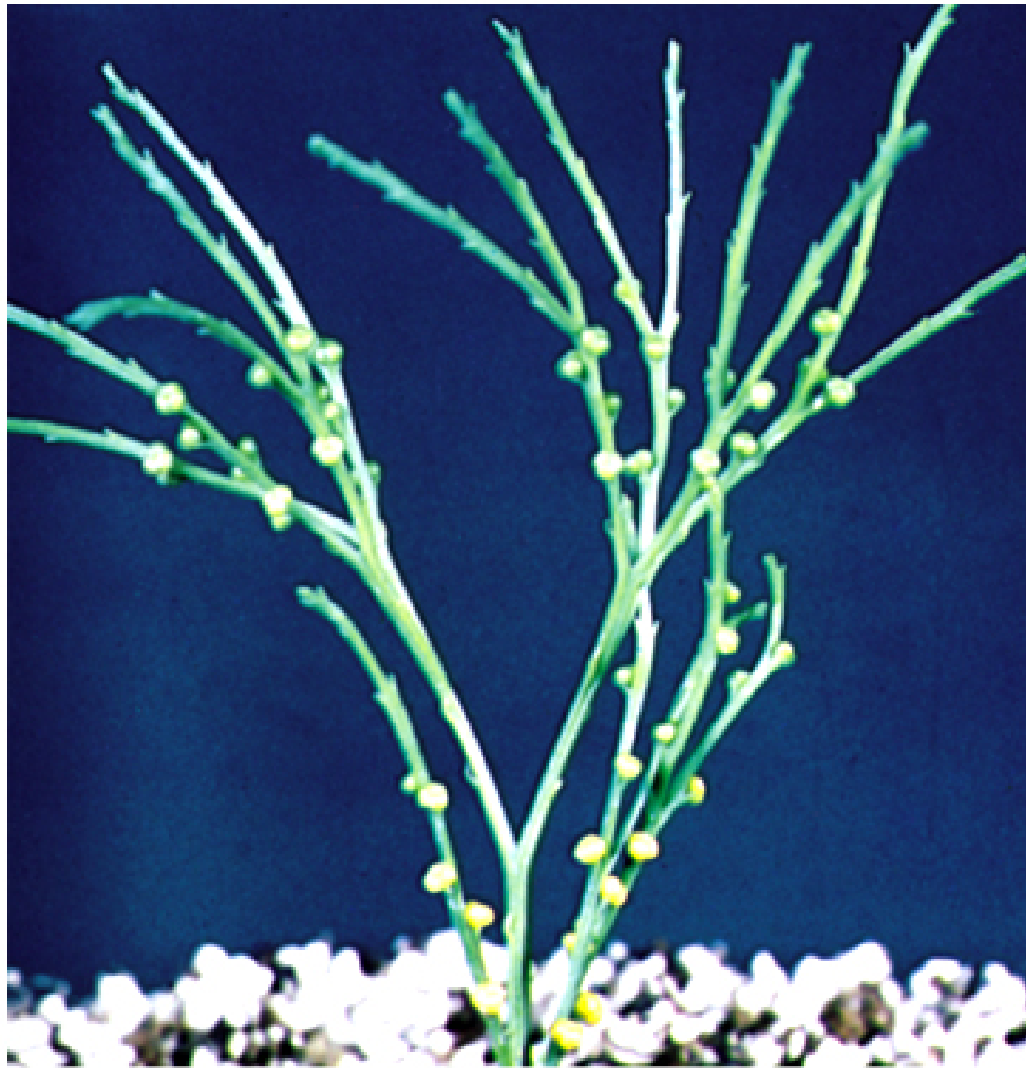


Whisk Ferns

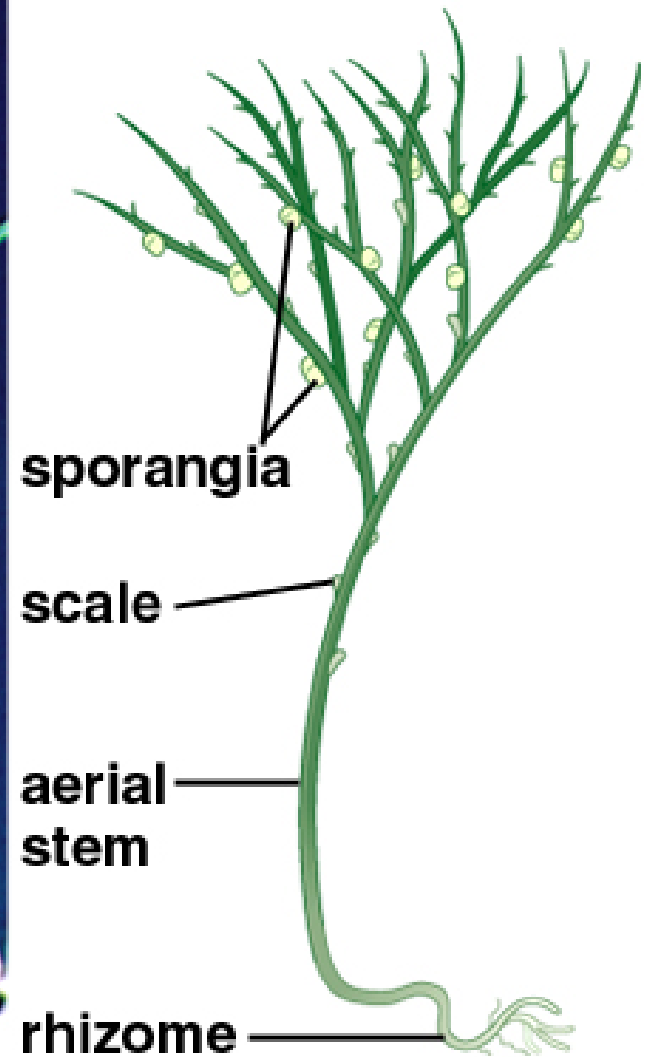
- Sporangia attached laterally on stem



Whisk fern, *Psilotum*



© CABISCO/Phototake



Native to Hawai'i

Moa, whisk fern

The sparse branches of this primitive plant reminded Hawaiians of birds' feet and inspired its name, moa (chicken). Adaptable moa grows either on the forest floor or in the trees.



Psilotum nudum

Illustration by John Dawson





Seedless Vascular Plants



Whisk Ferns



Club/Spike Mosses



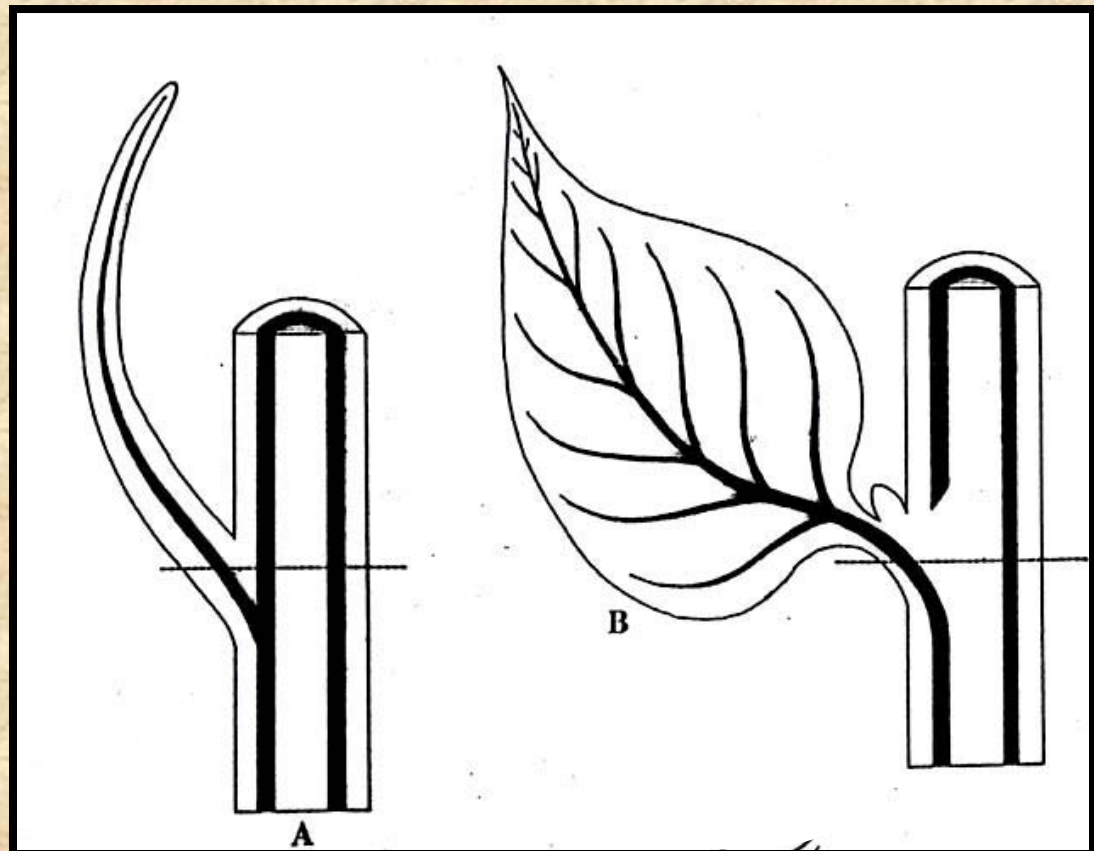
Horsetails



Ferns

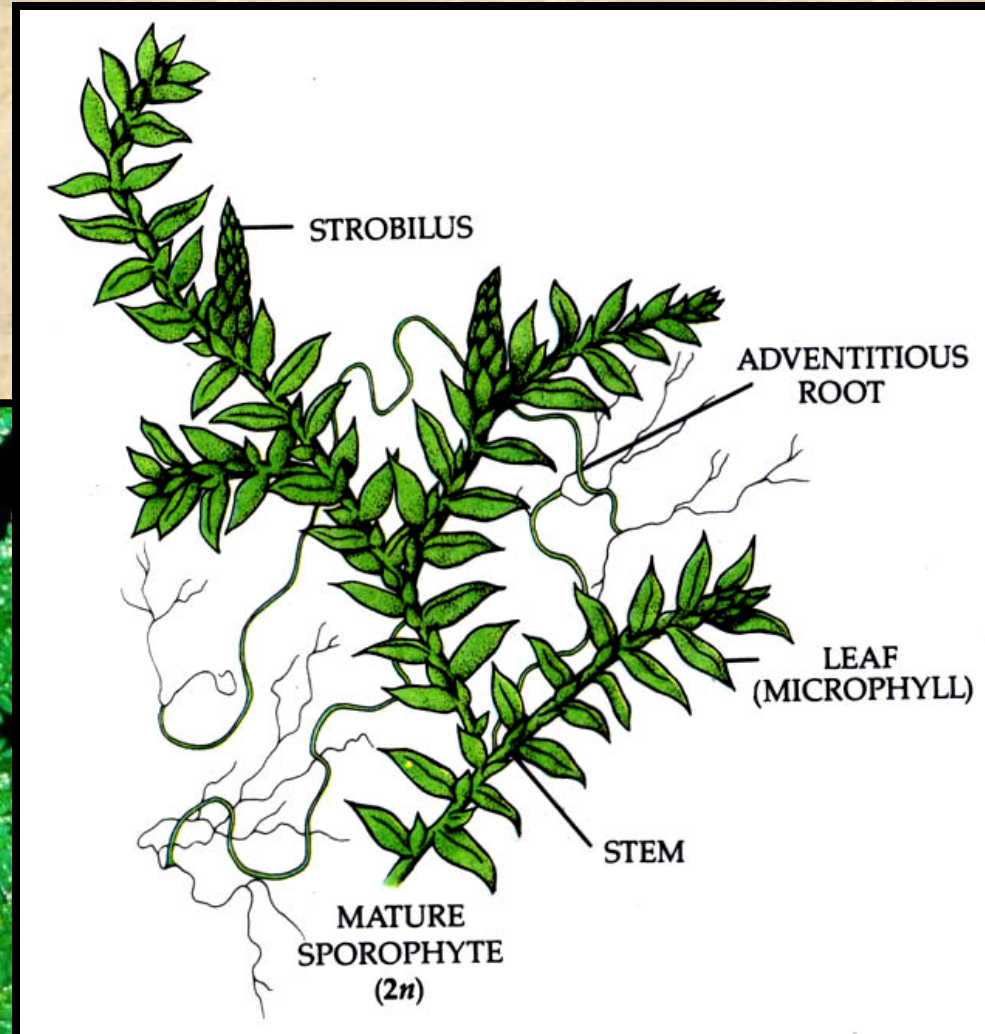
Plants with leaves have either microphylls or megaphylls

- Microphylls have a single vascular strand
- Megaphylls have a network of vascular strands



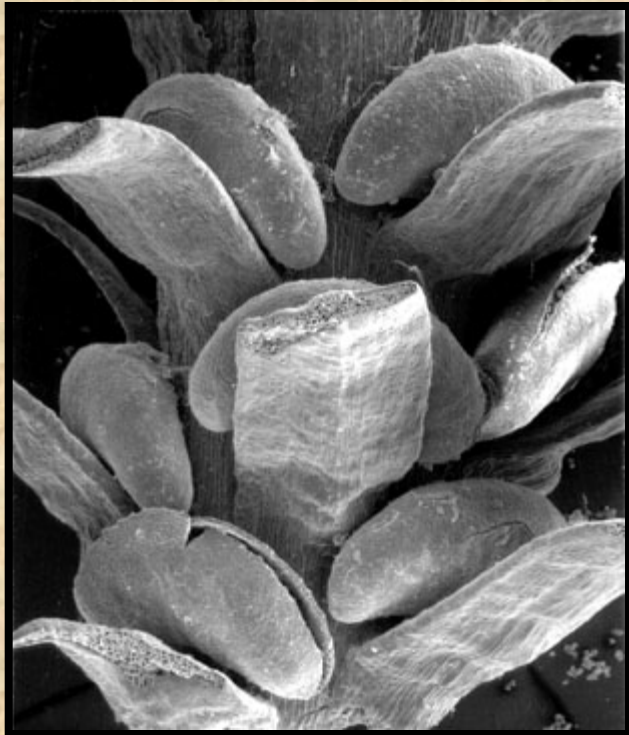
Club and Spike Mosses

- Stems, roots and leaves
- Leaves are microphylls



Club and Spike Mosses

- Sporangia produced in axils of leaves



Club and Spike Mosses

- Sporangia produced in axils of leaves



Phyllotactic Transitions in *Diphasiastrum digitatum*

Xiaofeng Yin

RESEARCH GOALS:

Characterize phyllotactic patterns of *D. digitatum* at the level of the shoot apical meristem over three years of development.

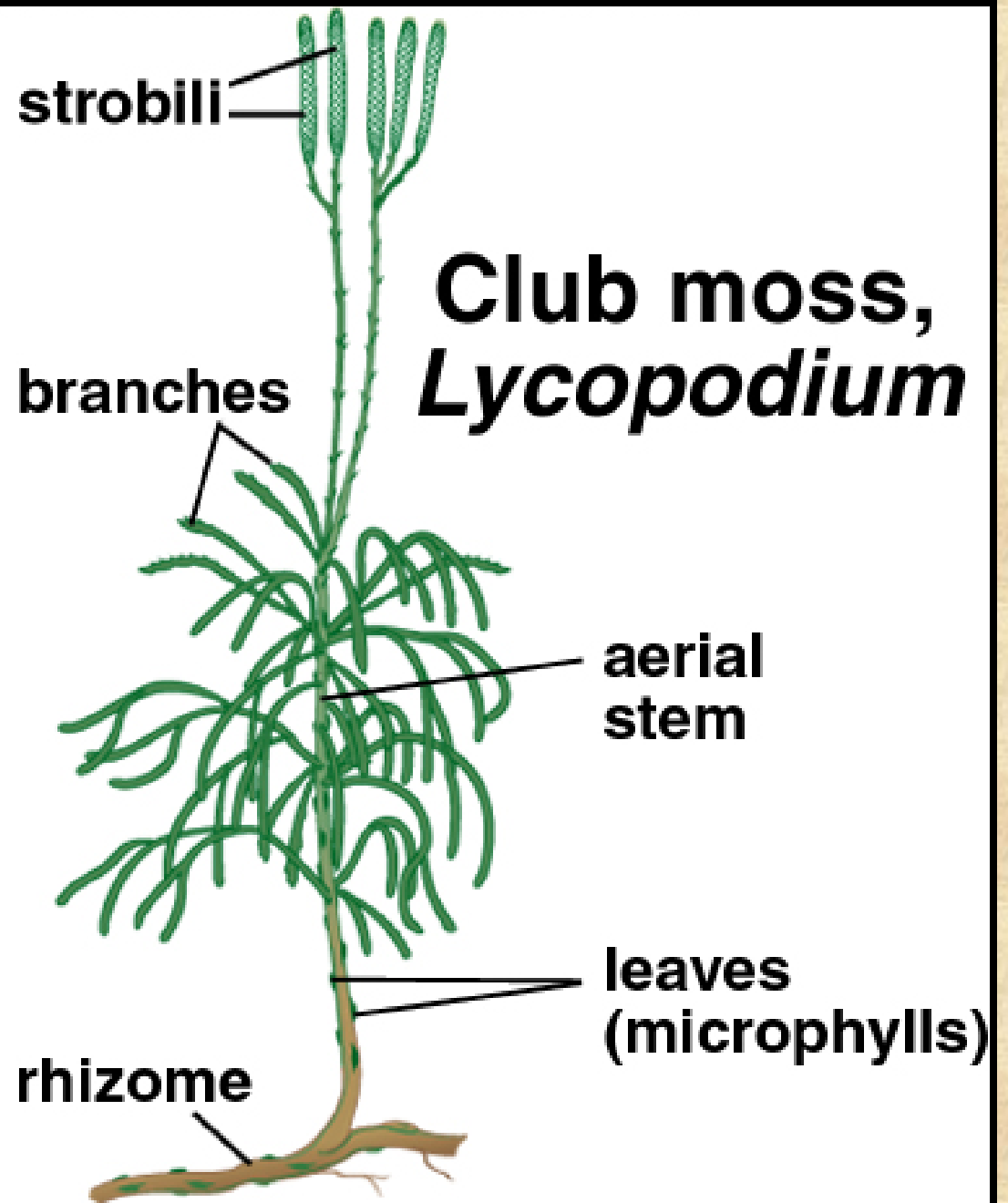
Identify phyllotactic pattern transitions of *D. digitatum* at the level of the shoot apical meristem (SAM).

1. *Diphasiastrum digitatum* has horizontal rhizomes with spirally arranged lycophylls.
2. The rhizome gives rise to vertical aerial axes in a pseudo-distichous arrangement which also have spiral phyllotactic pattern of lycophylls.
3. Each aerial axis produces two vegetative branches every year. The vegetative branches produce photosynthetic lycophylls in a decussate phyllotactic pattern.
4. During the third and/or fourth year, some of the vegetative brachlets become radially symmetric whereas others remain dorsiventral.
5. Radially symmetric stems undergo transformation into reproductive organs (sporangiophores) which have spirally arranged lycophylls on the proximal stalk.
6. And sporophylls subtending sporangia arranged in a tricussate phyllotactic pattern on the distal stalk.





© Steve Solum/Bruce Coleman, Inc.



Club moss, *Lycopodium*

Native to Hawai'i

Wāwae'iole

Small cones on the curved branch tips inspired the Hawaiian name "rat's foot." Rheumatism was treated by bathing in an infusion made from this primitive clubmoss.



Lycopodiella cernua

Illustration by John Dawson



Seedless Vascular Plants



Whisk Ferns



Club/Spike Mosses



Horsetails



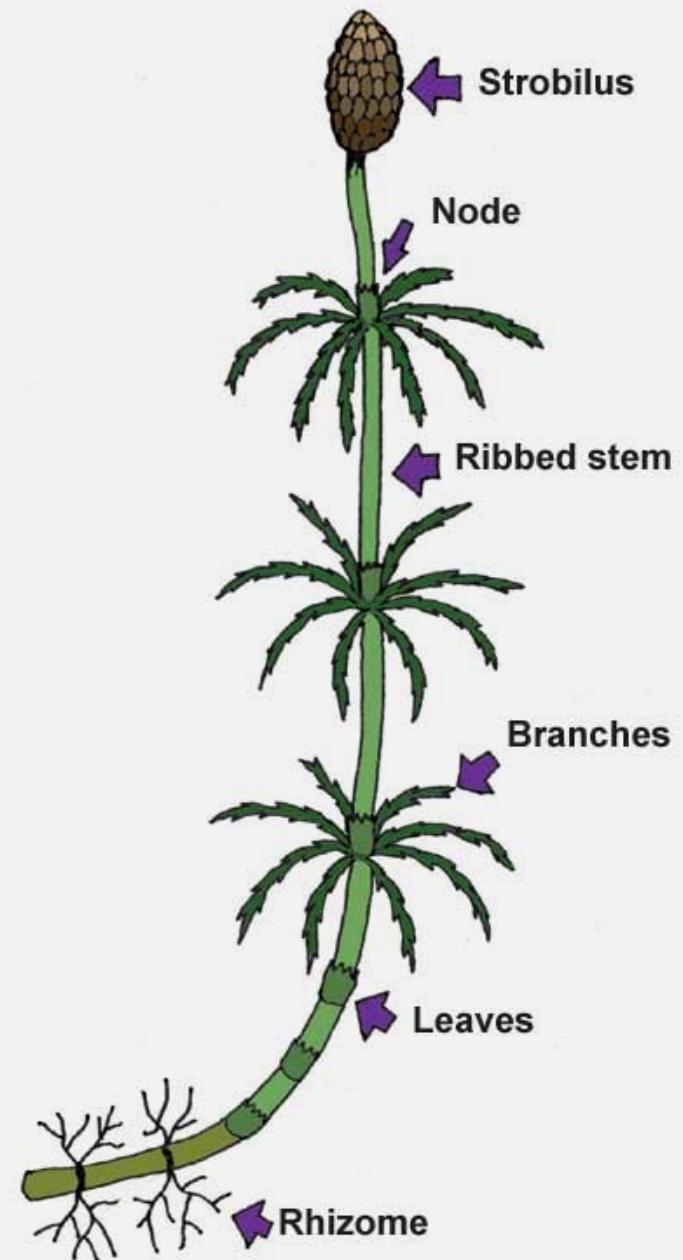
Ferns

Horsetails and Scouring Rushes



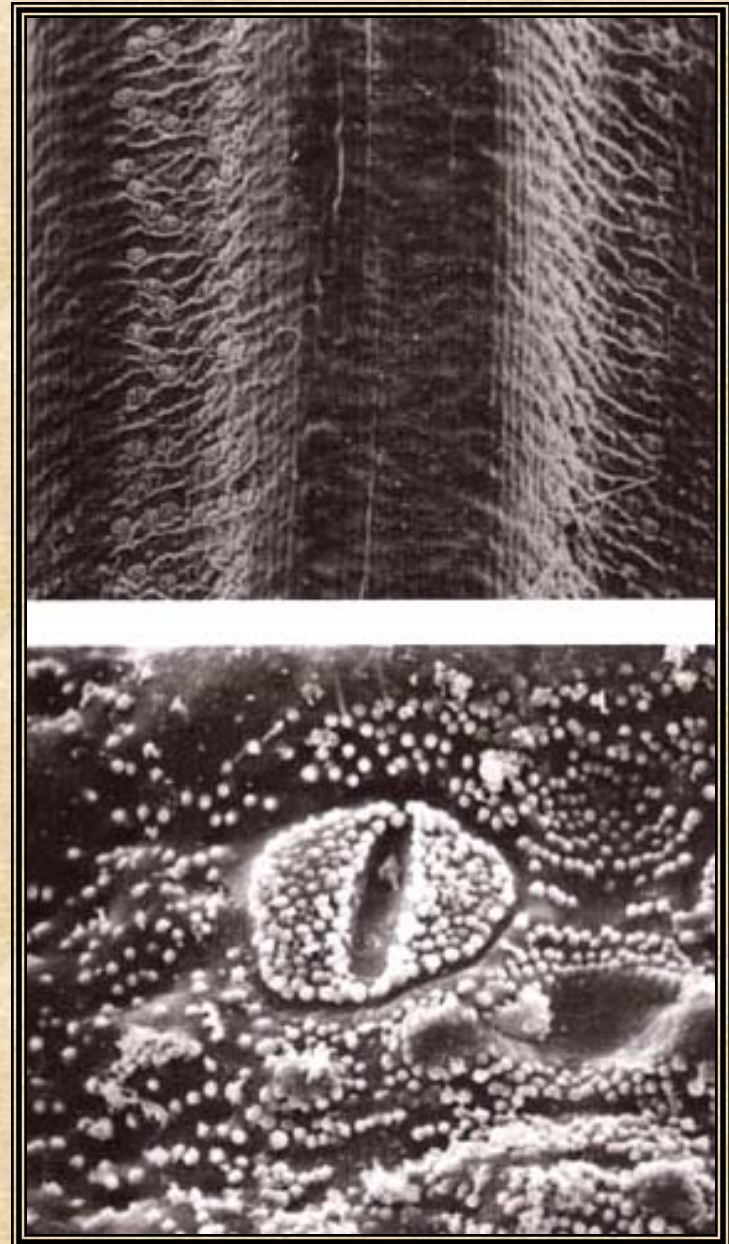
Horsetails and Scouring Rushes

- Stems jointed
- Branches whorled around stem



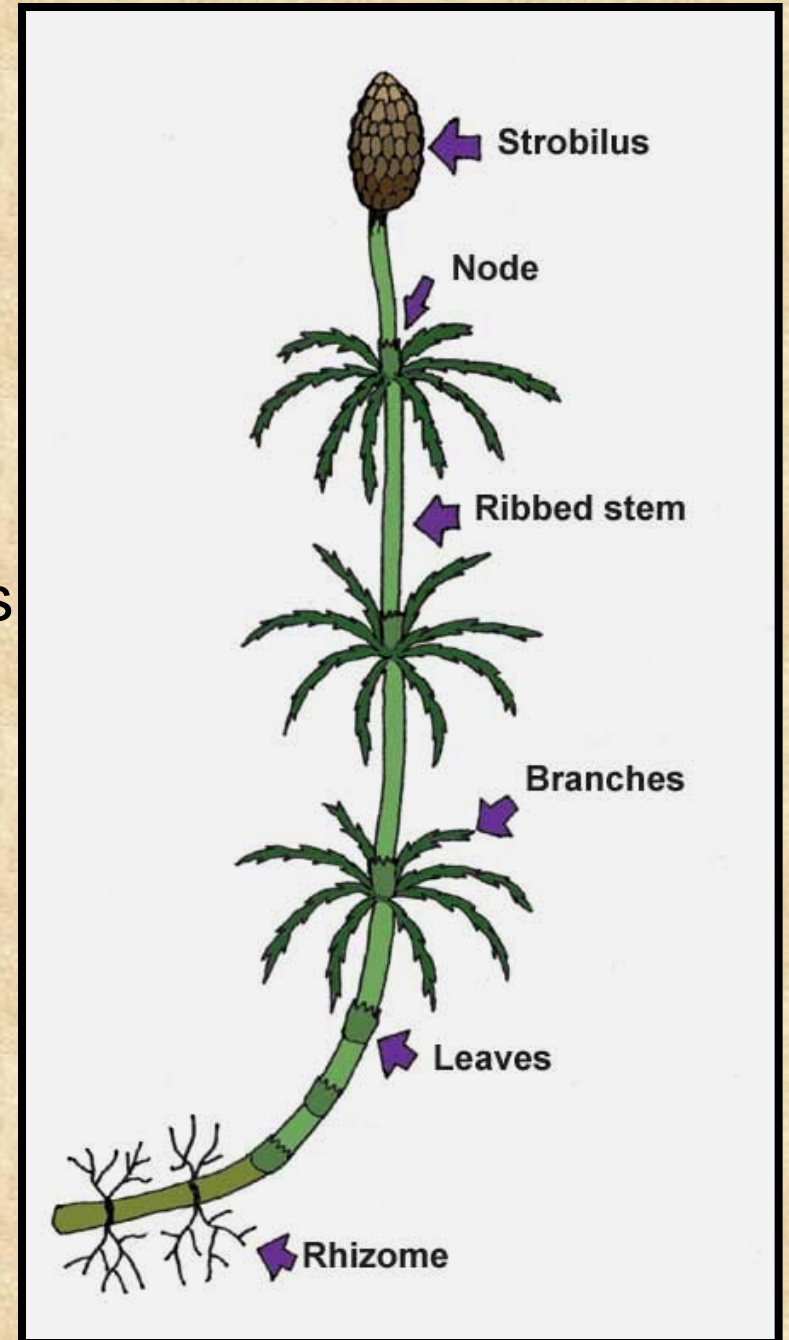
Horsetails and Scouring Rushes

- Stems ribbed
- Silica in cells of the epidermis



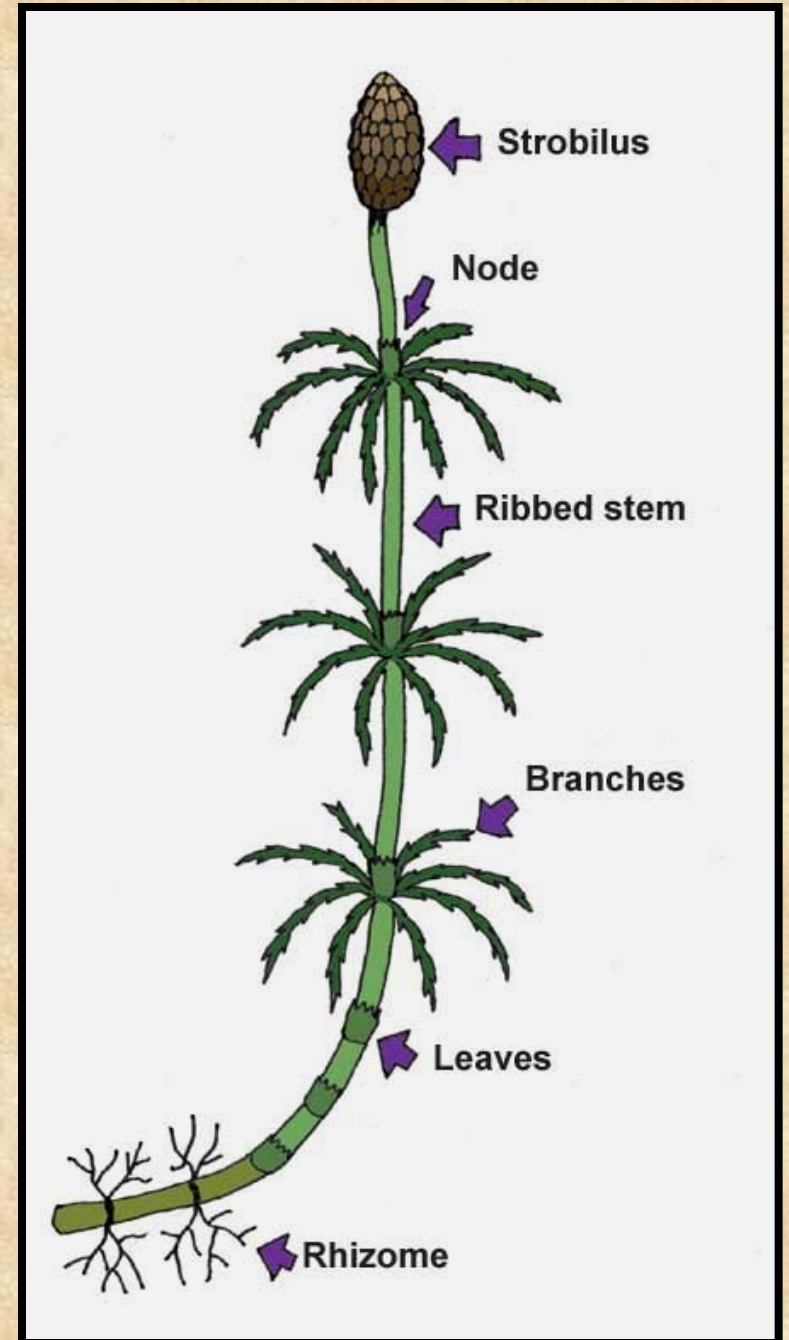
Horsetails and Scouring Rushes

- Leaves small
- Reduced megaphylls
- Whorled at nodes
- Underground rhizome with Roots



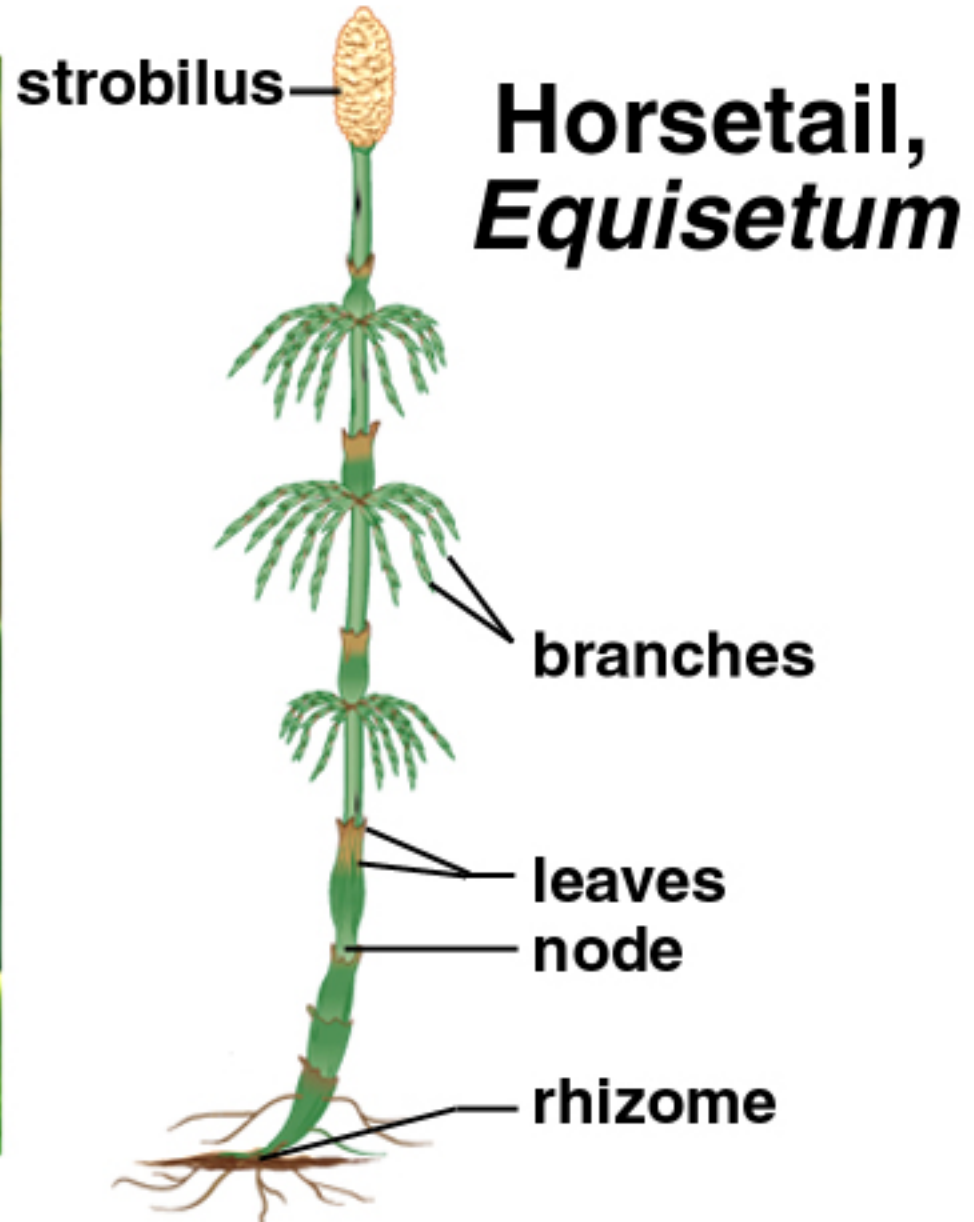
Horsetails and Scouring Rushes

- Spores produced in terminal strobilous





© Robert P. Carr/Bruce Coleman, Inc.



Horsetail, *Equisetum*

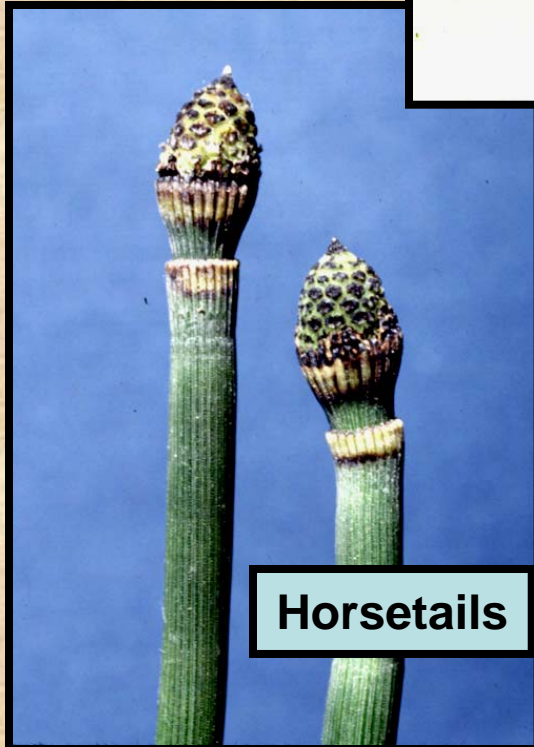
Seedless Vascular Plants



Whisk Ferns



Club/Spike Mosses



Horsetails



Ferns

Ferns



© John Gerlach/Visuals Unlimited

Maidenhair fern,
Adiantum pedatum



© Walter H. Hodge/Peter Arnold, Inc.

Hart's tongue fern,
Campyloneurum
scolopendrium



© Forest W. Buchanan/Visuals Unlimited

Royal fern,
Osmunda regalis

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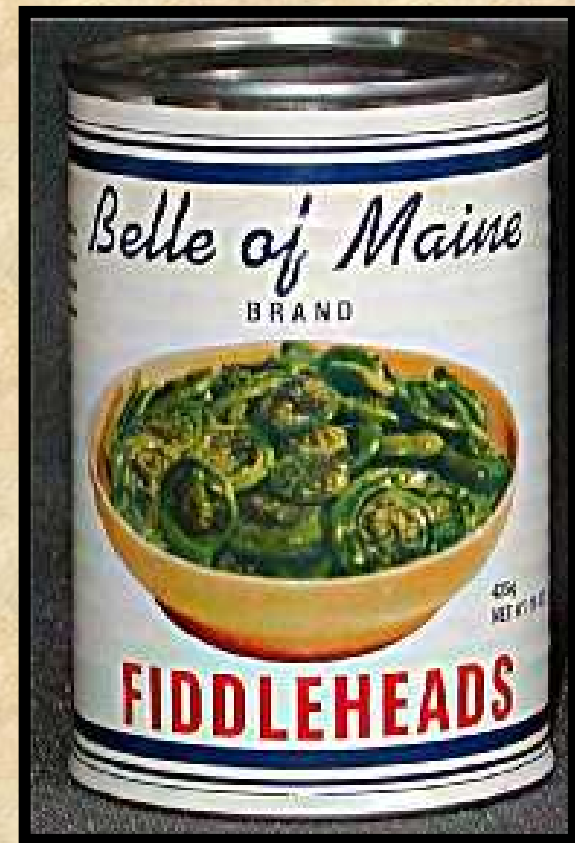
Ferns show
great diversity
of form



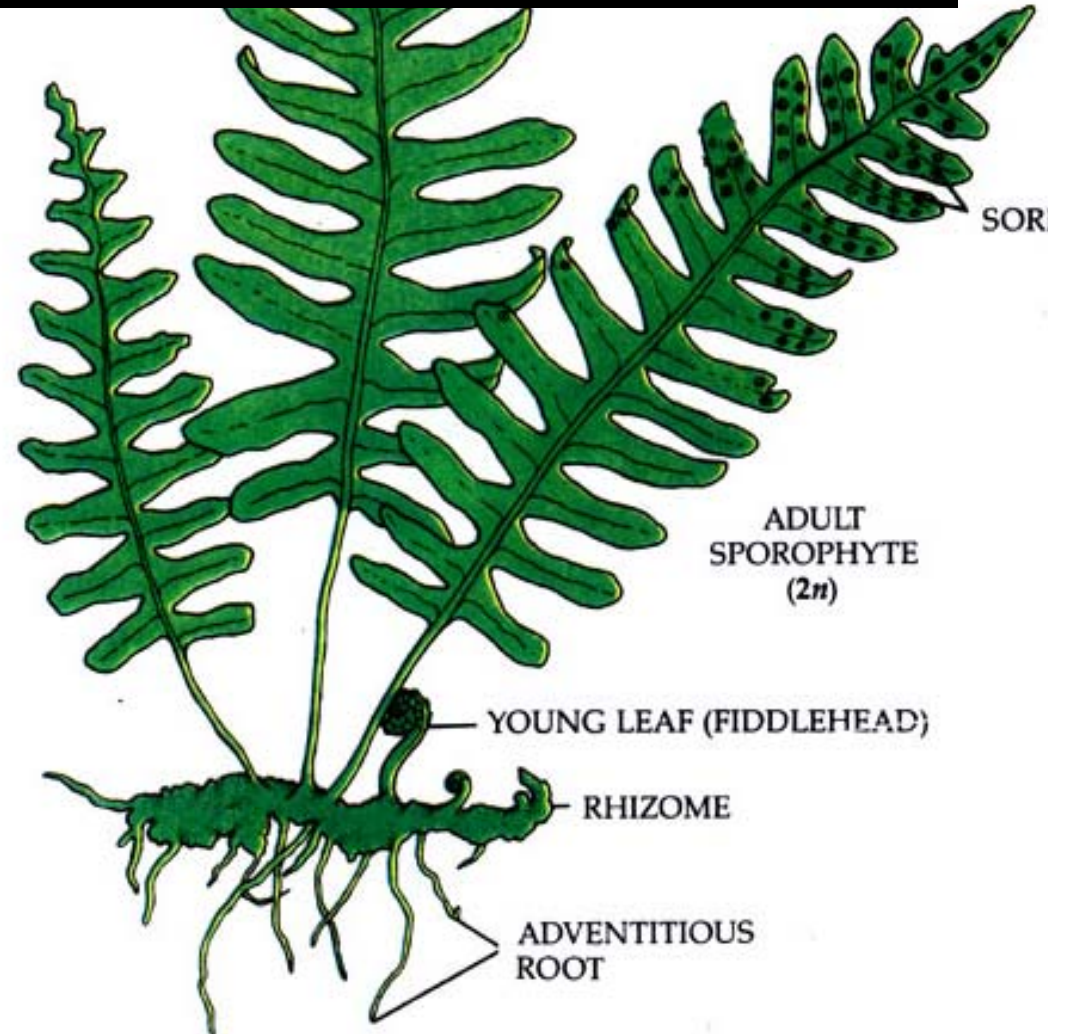
Ferns have
megaphylls



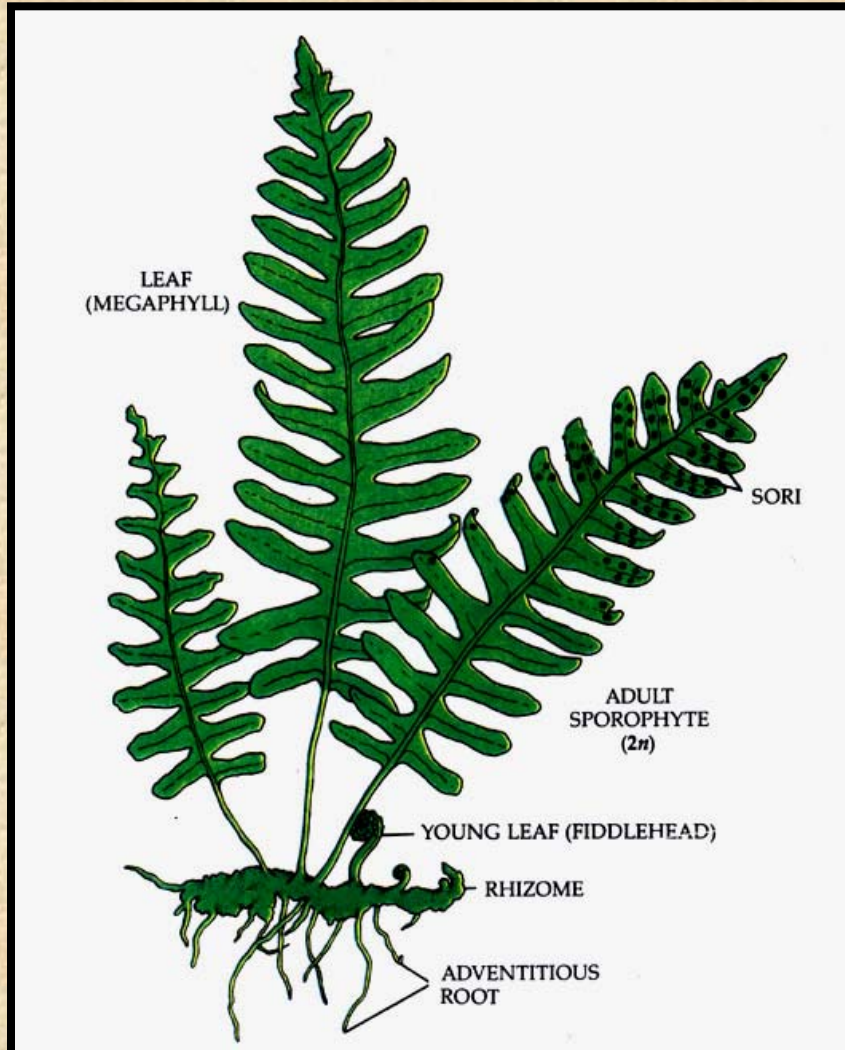
Young fern
megaphylls are
called
fiddleheads



Fern stems grow vertically or horizontally



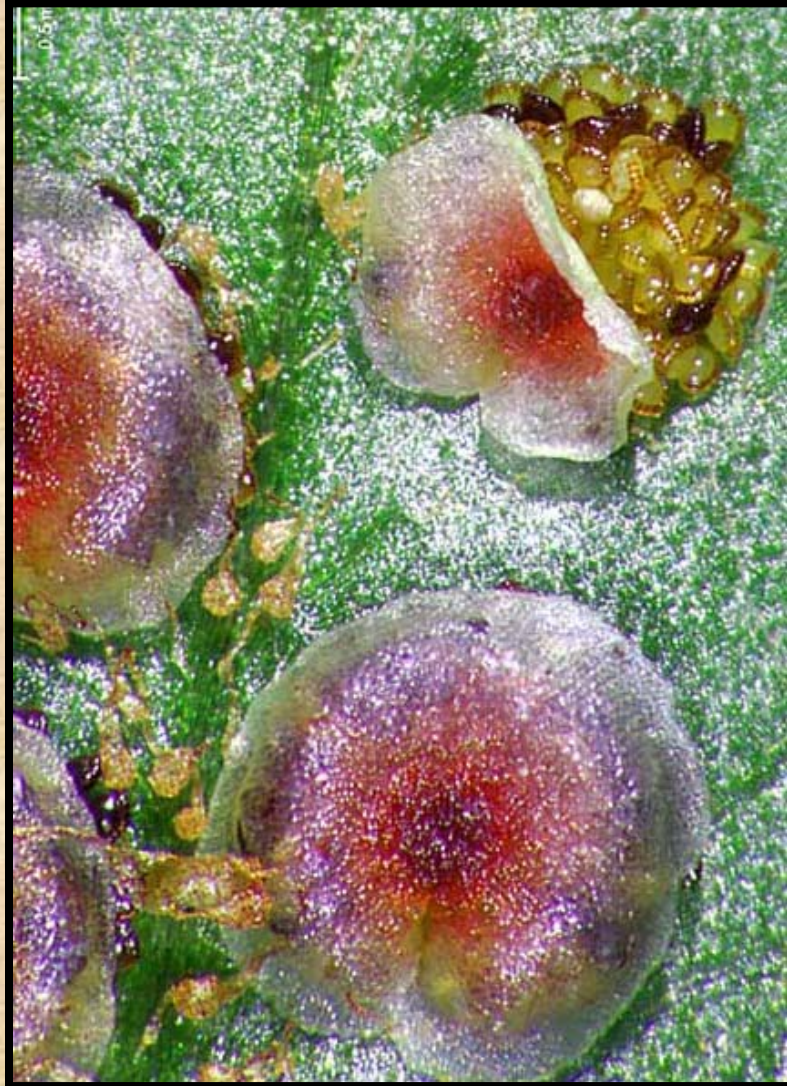
Spores are produced on underside of megaphylls



Spores are produced in clusters called Sori



Sori of many ferns are covered by an indusium



Sori of many ferns are covered by an indusium



Seedless Vascular Plants

PLANT	ROOTS	STEMS	LEAVES	SPORANGIA
Whisk Ferns	None	Dichotomous branching	None	Lateral
Club/Spike Mosses	Yes	Yes	Microphyll	Axil of microphyll
Horsetails	Yes	Ribbed and Jointed	Reduced megaphyll	Terminal strobilous
Ferns	Yes	Vertical or horizontal	Megaphyll	Underside of megaphyll