EARLY VASCULAR PLANTS
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Domain: Eukarya
Kingdom: Plantae
Phylum: Lycopodiophyta
  Class Lycopodiopsida (club moss)
Phylum: Pteridophyta
  Class Psilotopsida (whisk ferns)
  Class Equisetopsida (horsetails)
  Class Marattiopsida (ferns)
  Class Polypodiopsida (ferns)
About 1,150 living species
- The oldest living vascular plants - about 400 million years old
- Sister group to all vascular plants
- Resemble true mosses but differ from them by having a vascular system
- Many are epiphytes - they grow on other plants without harming them
- Some club mosses, like the Lycopodium, have stiff and prickly stems.
- Internal vessels strengthened with woody fibers
- Homosporous or heterosporous
- Can grow to more than 7 ft
- Club mosses have true roots, stems and leaves.
- Microphylls - leaves are small with a single vein.
- Spores are produced in strobili, a cluster of many spore-producing leaves called sporophylls.
Lycophytes have more than one way in which the vascular tissue in stems can be arranged.

Stele varies from a Haplostele to an Actinostele to a Plectostele.

Actinostele is the most common arrangement of vascular tissue in Club Mosses.
Whisk ferns and horsetails were long believed to be distinct phyla that were transitional between bryophytes and vascular plants. Today they are considered to be the closest living relatives to ferns, and they are grouped as pterophytes.
Two genera

The least complex among all terrestrial vascular plants

No differentiation between roots and shoot

No leaves

Have rhizoids similar to those of mosses

Homosporous

Gametophytes form symbiotic associations with fungi for nutrient absorption
- Fossil forms extend back 300 million years
- Consists of only one genus
- More complex than whisk ferns and less complex than ferns
- Stem is ribbed
- Scalelike leaves
- Homosporous
- The epidermal cells of the ribs have silica deposits
FERNS

- Two classes with about 11,000 living species
- Closest relatives to seed plants
- Fossil records extend back 350 million years
- Some ferns can reach a height of 24 m
The dominant form of ferns is sporophyte. It consists of underground stem, rhizome, roots, and leaves. The leaves are referred to as fronds. They develop at the tip of the rhizome as rolled-up coils ("fiddleheads") that unroll and expand as they mature.
FERN SPORANGIA

- Sporangia are grouped in clusters called sori.
- Sporangia are clusters of small, brownish structures usually found on the underside or along the edges of fronds.
- Fronds that have spores are called sporophylls. Other fronds, trophophylls, are sterile and do not make spores.
- Many people mistake these for signs of disease.
Most ferns have some type of siphonostele.

- pith
- epidermis
- cortex
- endodermis
- leaf gap - the space in the vascular bundle
FERN LIFE CYCLE

MEIOSIS

Sporangium

Mature sporophyte

New sporophyte

Zygote

Mitosis

Gametophyte

Spore

Young gametophyte

Antheridium

Archeogonium

Egg

Sperm

FERTILIZATION

Haploid (n)

Diploid (2n)
HORSETAIL LIFE CYCLE

Life Cycle of *Equisetum*

- Fertilization
- Zygote
- 2n Sporophyte
- Gametophyte
- Archegonium
- Egg
- Sperm
- Antheridium
- Rhizoid
- Sporangium
- Sporangiophore
- Strobilus
- Vegetative shoot
- Root
- Rhizome
- 2n Sporophyte
- Gametophyte

Spore mother cells undergo MEIOSIS to produce spores.
Selaginella is one of the largest club moss groups.

Club mosses reproduce using spores.

Spores are produced in small cones or at the junctions between leaves and stems.
The resurrection plant, a lycophyte, lives in places with long seasons of drought.

Most people believe the plant is dead.

When water is present, the plant comes back to life and uncurls its leaves which then turn green.
- **Fiddleheads**: curled fronds of a young fern. Also called a crozier.

- Fiddleheads are harvested for use as a vegetable. The soft uncurling fronds of fiddlehead ferns can be boiled or steamed for eating.

- Fiddleheads resemble the peg of a fiddle or violin

- They grow up towards the light and uncurl to open into a long feathery shape
Fern and club moss spores are very small, fine particles.

Spore dust from ferns and club mosses can be used for dusting fingerprints.

Spore dust can also be used to smooth and seal wooden items like guitars and violins.

Spores from Stag’s horn club moss easily catch fire and have been used to make fire works.
Horsetail stems have tiny grains of silica which were once used for scouring and polishing.

In many countries, horsetails are traditionally used to make scouring pads.

The horsetail Equisetum hyemale can be used as a natural sandpaper.
What are the three early vascular plants that were mentioned?

Where on a fern are the sporangia usually found?

What other name can fiddleheads of ferns be called?

What can spore dust be used for?

What can horsetail silica be used for?