

# **BIO414 (CRYPTOGAMIC BOTANY II)**

**WEEK 14**

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# **STRUCTURES OF FERNS**

**Stems:** Most often an underground creeping rhizome, but sometimes an above-ground creeping stolon, aerial shoot from a plant with the ability to produce adventitious roots and new offshoots of the same plant or an above-ground erect semi-woody trunk reaching up to 20 m in a few species.

**Leaf:** The green, photosynthetic part of the plant. In ferns, it is often referred to as a frond, but this is because of the historical division between people who study ferns and people who study seed plants, rather than because of differences in structure. New leaves typically expand by the unrolling of a tight spiral called a crozier or fiddlehead. This uncurling of the leaf is termed circinate vernation.

Leaves are divided into two types;

**Trophophyll:** A leaf that does not produce spores, instead only producing sugars by photosynthesis. Analogous to the typical green leaves of seed plants.

**Sporophyll:** A leaf that produces spores. These leaves are analogous to the scales of pine cones or to stamens and pistil in gymnosperms and angiosperms, respectively. Unlike the seed plants, however, the sporophylls of ferns are typically not very specialized, looking similar to trophophylls and producing sugars by photosynthesis as the trophophylls do.

**Roots:** The underground non-photosynthetic structures that take up water and nutrients from soil. They are always fibrous and are structurally very similar to the roots of seed plants.

**The gametophytes of ferns, however, are very different from those of seed plants. They typically consist of;**

**Prothallus:** A green, photosynthetic structure that is one cell thick, usually heart- or kidney-shaped, 3-10 mm long and 2-8 mm broad.

The thallus produces gametes by means of:

**Antheridia:** Small spherical structures that produce flagellate sperm.

**Archegonia:** A flask-shaped structure that produces a single egg at the bottom, reached by the sperm by swimming down the neck.

# **REPRODUCTION**

## **Reproduction by Spores**

Ferns and horsetails have two free-living generations:

1. a diploid sporophyte generation (spore-producing plant) and
2. a haploid gametophyte generation (gamete-producing plant).

Plants we see as ferns or horsetails are the sporophyte generation. The sporophyte generally releases spores in the summer.

Spores must land on a suitable surface, such as a moist protected area to germinate and grow into gametophytes.

The mature gametophyte of many of our ferns looks like a little flat green heart, about the size of a fingernail.

Male and female reproductive structures develop on the lower surface of the same, or more often, on different gametophyte plants.

At sexual maturity, the male structures release sperm that swim through the film of water of the moist habitat to fertilize the egg in the female structure.

Horsetail gametophyte processes are similar, but they look more like little green ragged mounds.

Many gametophytes usually grow in close proximity to each other, and in most ferns and horsetails the sperm of one gametophyte is most likely to fertilize the egg of a different gametophyte.

This fertilized egg develops into an embryo, which is the beginning of the diploid sporophyte generation.

The first tiny leaf of the sporophyte emerges from the bottom of the gametophyte (which disintegrates) and grows upward and soon becomes a plant we see as a fern or horsetail.



## Life Cycle

Ferns have a life cycle often referred to as alternation of generations, characterized by a diploid sporophytic and a haploid gametophytic phase.

Unlike the gymnosperms and angiosperms, in ferns the gametophyte is a free-living organism. The life cycle of a typical fern is as follows;

1. A sporophyte (diploid) phase produces haploid spores by meiosis;
2. A spore grows by cell division into a gametophyte, which typically consists of a photosynthetic prothallus, a short-lived and inconspicuous heart-shaped structure typically two to five millimeters wide, with a number of rhizoids (root-like hairs) growing underneath, and the sex organs.
3. The gametophyte produces gametes (often both sperm and eggs on the same prothallus) by mitosis.
4. A mobile, flagellate sperm fertilizes an egg that remains attached to the prothallus
5. The fertilized egg is now a diploid zygote and grows by mitosis into a sporophyte (the typical "fern" plant).

## **REFERENCES**

Url1. <https://en.wikipedia.org>.

Url2. <https://www.newworldencyclopedia.org>.