EDO UNIVERSITY IYAMHO
Department of Biological Science,
Plant Biology and Biotechnology Unit. PBB 213

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Lectures: Monday, 10am – 12.10 pm, LT1, phone: (+234) 8031983621

Description: This course is intended to give the students a thorough knowledge of the concept of Bryophytes and Pteridophytes through studies relating to taxonomy and ecology of Bryophytes and Pteridophytes. This course covers theoretical and practical approach to Lower Plant classification and identification.

Prerequisites: Students should be familiar with the knowledge of classification of Plants and their relationship in the environment.

Assignments: We expect to have 2 individual homework assignments throughout the course in addition to a Mid-Term Test and a Final Exam. Home works are due at the beginning of the class on the due date. Home works are organized and structured as preparation for the midterm and final exam, and are meant to be a studying material for both exams. There will also be a project on plant species collection and identification.

Grading: We will assign 10% of this class grade to home works, 10% for the projects, 10% for the mid-term test and 70% for the final exam. The Final exam is comprehensive.

Textbook: The recommended textbook for this class is as stated:
Title: *Botany for degree Student*
Authors: A. C. Dutta
Publisher: Oxford University Press
Year: 2005

Title: *Principles of Botany*
Authors: Uno, G, R Storey, R Moore
Publisher: McGraw Hill Higher Education
Year: 2001

Lectures: Below is a description of the contents. We may change the order to accommodate the materials you need for the projects.

BRYOLOGY

Bryology is the branch of botany concerned with the scientific study of bryophytes (mosses, liverworts, and hornworts). Bryologists are people who have an active interest in observing, recording, classifying or researching bryophytes. The field is often studied along with lichenology due to the similar appearance and ecological niche of the two organisms, even though bryophytes and lichens are not classified in the same kingdom. Bryophytes were first studied in detail in the 18th century. The beginning of bryology really belongs to the work of Johannes Hedwig, who clarified the reproductive system of mosses and arranged a taxonomy. Areas of research include bryophyte taxonomy, bryophytes as bioindicators, DNA sequencing, and the interdependency of bryophytes and other plant and animal species. Among other things, scientists have discovered parasitic bryophytes such as Cryptothallus and potentially carnivorous liverworts such as Colura zoophaga and Pleurozia.

Bryophytes:

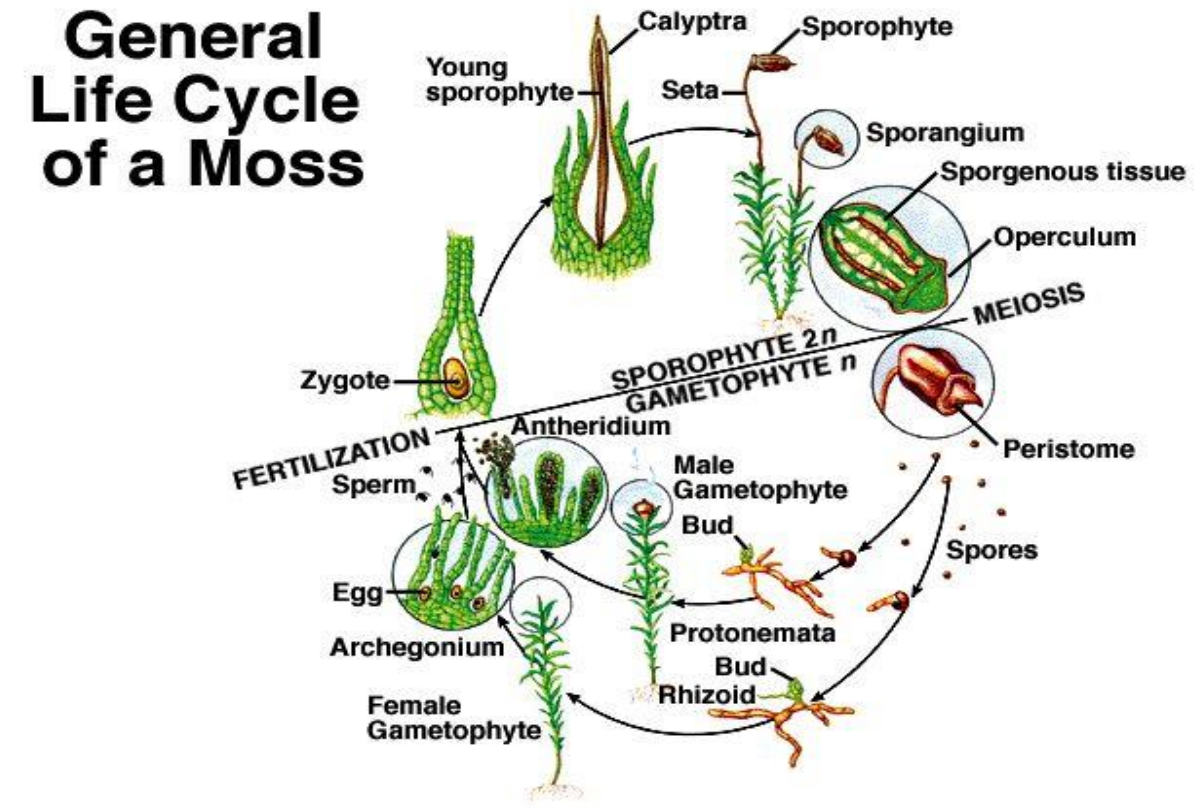
Brtophytes are simple terrestrial plants that lack vascular tissues and include the following divisions: liverworts (Hepaticae) examples *Marchantia polymorpha*, *Riccia discolor*, *Ricciocarpus natans*, Hornworts (Anthocerotae) examples *Anthoceros punctatus* and the mosses (Musci) examples : *Funaria hygrometrica*, *Polytrichum commune*, *Barbula indica*.

Life cycle of moss

General characteristics of the bryophytes

1. The gametophyte generation is prominent just like in the lower plants
2. Embryos are produced
3. The sporophyte generation is more complex than in the lower plants
4. The gametophyte is multicellular
5. The male gametangium is the Antheridium while the female is the Archegonium
6. The female gametangium is divided into two regions, the venter and neck.
7. The antheridium produces motile sperm cells
8. The leafy gametophyte in the moss produces the gametes
9. The sporophyte generation grows from the tip of the gametes

10. The sporophytes generation produces spores
11. Bryophytes do not have true xylem and phloem. However, some mosses have special water-conducting cells in the center of the stem called Hydroids. Others have food conducting cells surrounding the hydroids called Leptoids
12. These organisms require external water in the form of dew or rain to move their sperm during reproduction.
13. Alternation of generation is more prominent in bryophytes than in most other organisms.



Life cycle of a moss

PTERIDOLOGY

The **Pteridology** Is the study of ferns, Pterophyta plants without seeds or flowers. Unlike trees and plants, ferns have reproductive cells called haploid spores.

The haploid spores grow as small organisms that undergo fertilization and grow the fern plant directly outside the haploid gametophyte, similar to the stem growing outside a moss.

Having a large sporophyte allows ferns to produce many more spores than a moss could- recall that each sporophyte on a moss only carried one sporangia. Producing many more propagules increased fern presence and dominance. Besides having a larger sporophyte generation, ferns have many important adaptations that increase their capabilities above the mosses. Ferns have roots, which, unlike moss rhizoids, not only anchor, but take up nutrients. Ferns are vascular plants, with lignified vascular tissues. These allow active water transport. That water transport along with the strength of the ligified cells allow ferns to be much larger than their moss ancestors. At one point, ferns and fern trees were the most advanced plant life, and grew even larger than ferns today do, with great size and variety of ferns. There were no flowering plants in the early cretaceous- the first forests of the dinosaurs were composed of fern trees.

Evolution and ferns

Ferns have a big advantage over the mosses in their vascular tissue. They can grow taller, and can exist in more diverse environments. This is a trend that will continue in evolution, eventually leading to the rise of such large sporophyte generations as the great sequoia trees. But if ferns are so much fit for survival, why are there still mosses? And if a larger sporophyte generation is fit, why haven't sequoias become dominant enough to eliminate the ferns? While there are clear benefits to a larger sporophyte generation, in some recurring natural situations, natural selection favors mosses over ferns or ferns over trees. Spores are better at spreading by wind than many seeds are, for instance. So while in the long term, the protection of a seed allows seed plants to be dominant on the planet, in many situations the lightness and transport of a spore is still efficient in spreading ferns.

Pteridophytes (Seedless plants)

The pteridophytes are ferns and their related seedless vascular plants. They have xylem (for transporting water and dissolved minerals) and phloem (for transporting photosynthetic products)

but do not produce seeds. The vascular plants survive on land due to the evolution of functional vascular tissues. The seedless plants form part of the group called Tracheophytes. Pteridophytes are characterized by the kinds of arrangement of their vascular tissue is one solid central column without any pith e.g *Lycopodium*. The siphonosteles are the ones whose xylem forms a cylinder around hollow (siphon) pith with the phloem on both sides of the xylem e.g *Marsilea*. The dictyostele are those with separate concentric vascular bundles in a network of separate bands e.g *Pteris* and *Dryopteris*.

Psilotophyta: the *Psilotum* also known as the whisk fern and *Tmesipteris* are common members of the group. They comprise the smallest of all living plant divisions as well as the most primitive of vascular plants

Lycopodiophyta: this is the group called the club and spike moss, the former being *Lycopodium* and the later *Seleginella*. The lycopods have true roots and spiral phyllotaxy of the leaves. The sporophyte plant is green, has green sharp pointed leaves. The terminal axis of the plant has meristematic cells that divide to produce new cells. Cone shaped sporangia are borne on most of the leaves and as such are called Sporophylls. The sporophyll forms a spike at the tip of stem or branch and is called the Strobilus. Sporangia that produce spores that are similar in shape and size are said to be homosporous while the ones that produce different types are heterosporous. The larger spores are termed megaspores and produced in megasporangium. The smaller spores are microspores produced in microsporangium. The megaspore germinates to produce the female gametophytes plants while a microspore germinates to produce the male gametophyte. These gametophytes develop outside their spore walls (exosporic) as different from those of higher plant that are endosporic. The haploid spores germinate to give rise to underground bisexual gametophyte having the antheridia and archegonia. Fusion takes place and a fertilization yield an Oospore. This diploid Oospore develops into the sporophyte plant and the alternation of generation begins again. Example include: *Lycopodium obscurum, Lycopodium clavatum* and *Lycopodium cernuum, Selaginella pallescens, Salleginella trifurata*.

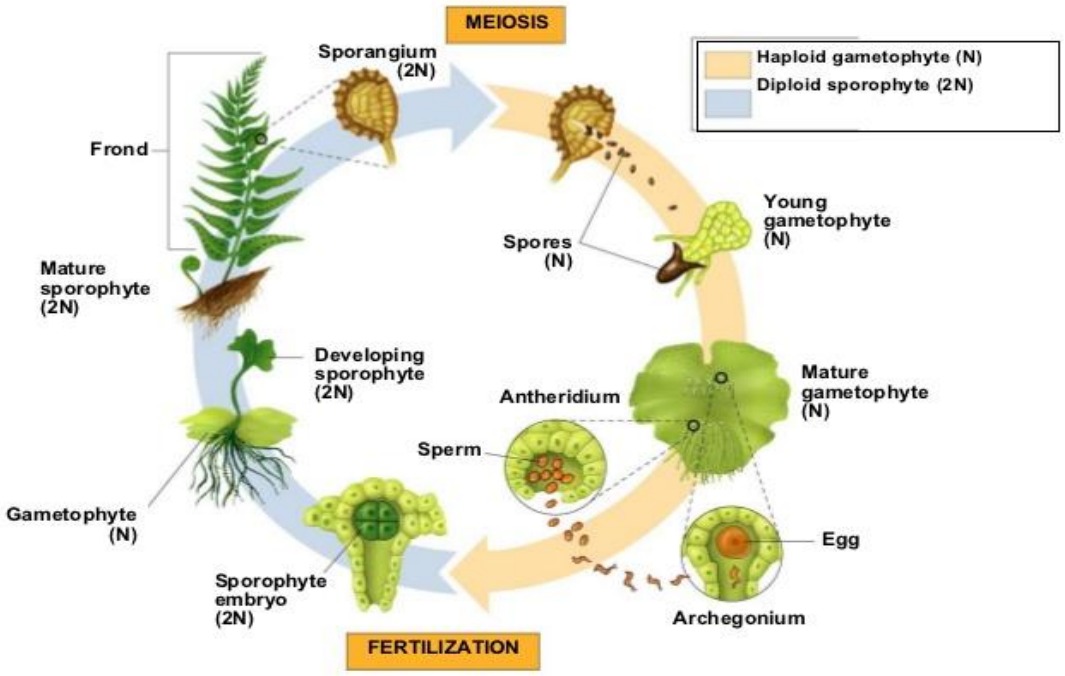
Equisetophyta (Sphenophyta): The major surviving plants in this division include *Equisetum*, called the horsetail. Equisetum plants are also termed scouring rushes because the epidermal cells have silica, thus the plant feels abrasive.

Pterophyta: These are the ferns. This is the largest group among the seedless vascular plants. Ferns are shade and moisture-loving plants whose stems are either upright or in the form of a rhizome. Leaves are conspicuous, also called fronds. Examples of ferns include *Nephrolepis biserrata, Pteris togoensis, Diplazium sammatii* and *Pteridium aquilinum.*

Characteristics of Pteridophytes

1. The sporophytes of the fern plant is the dominant over the smaller and nutritionally independent gametophyte
2. The sporophytes are photosynthetic, long-lived and highly branched
3. The gametophytes are either photosynthetic or obtain their nutrition from decaying organic matter.
4. The cells of these plants have chlorophylls a and b and carotenoids
5. The cell wall is principally cellulose and the storage carbohydrates is starch
6. The secondary cell walls of fern plants have cellulose and lignin that enables them to grow tall
7. Stomata are present and function effectively to prevent water loss.
8. The sporophytes of seedless plants undergo meiosis to produce haploid spores. Each of the spores germinates and grows into haploid gametophytes that produce gametes. The gametes fuse become the diploid zygote and develops into the sporophytes

The Life Cycle of a Fern



General life cycle of a fern