# Basics of Botany

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# Classification of living organisms

- In Linnaeus' time a **Two Kingdom** system of classification
  - ***Plantae***: all plants
  - ***Animalia:*** all animals.
- But this system did not distinguish between
  - The eukaryotes and prokaryotes,
  - Unicellular and multicellular organisms
  - Photosynthetic (green algae) and non-photosynthetic (fungi) organisms.

# A Five Kingdom Classification.

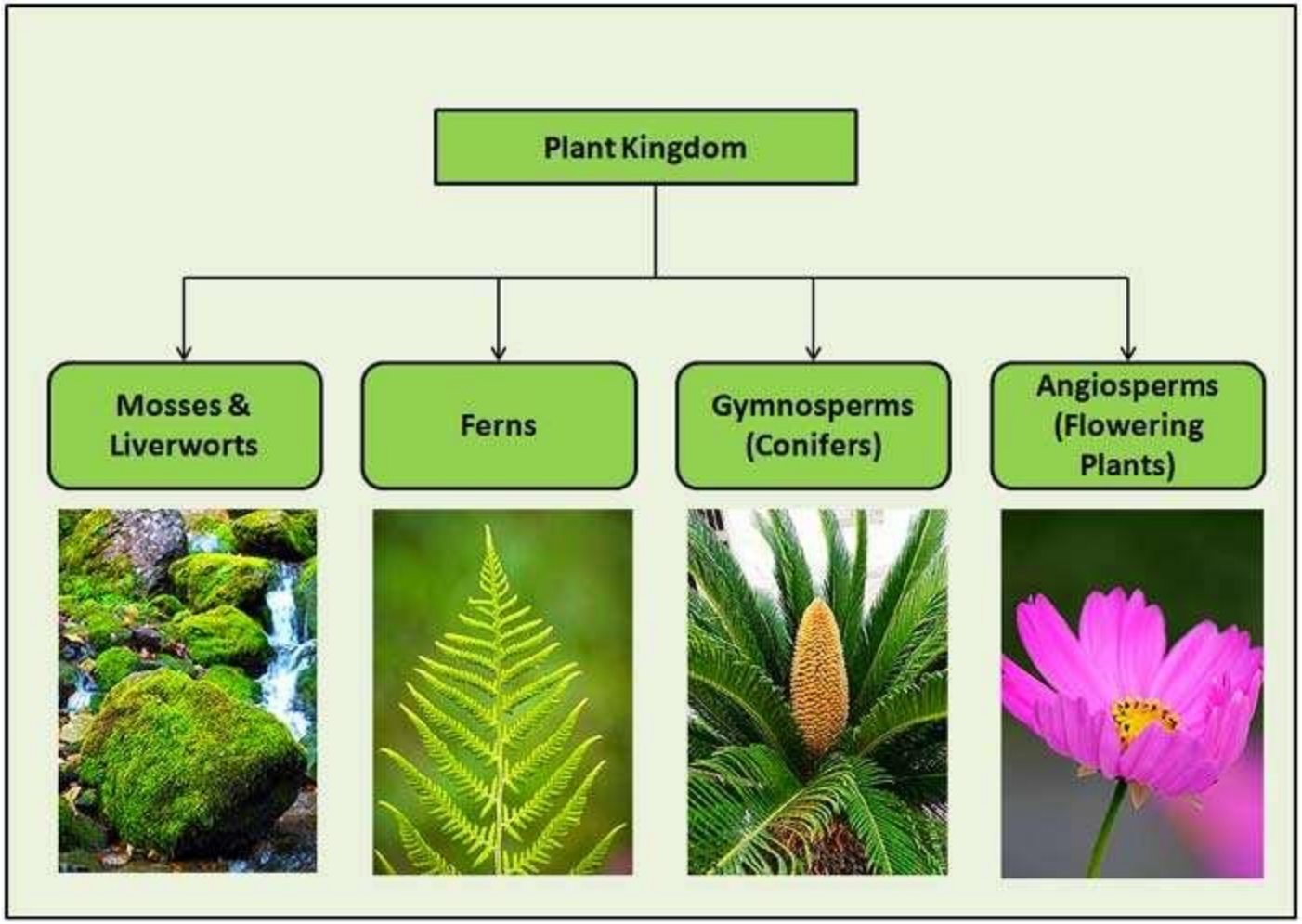
- R.H. Whittaker (1969) proposed a Five Kingdom Classification.
- The kingdoms were named
  - Monera,
  - Protista,
  - Fungi,
  - Plantae
  - Animalia.
- The main criteria for classification
  - Cell structure,
  - Body organization,
  - Mode of nutrition,
  - Reproduction and
  - Phylogenetic relationships.

# Characteristics of the Five Kingdoms

| Characters | Five Kingdoms | | | | |
|---|---|---|---|---|---|
| | **Monera** | **Protista** | **Fungi** | **Plantae** | **Animalia** |
| Cell type | Prokaryotic | Eukaryotic | Eukaryotic | Eukaryotic | Eukaryotic |
| Cell wall | Noncellulosic (Polysaccharide + amino acid) | Present in some | Present with chitin | Present (cellulose) | Absent |
| Nuclear membrane | Absent | Present | Present | Present | Present |
| Body organisation | Cellular | Cellular | Multiceullar/ loose tissue | Tissue/ organ | Tissue/organ/ organ system |
| Mode of nutrition | Autotrophic (chemosyn-thetic and photosynthetic) and Hetero-trophic (sapro-phytic/para-sitic) | Autotrophic (Photosyn-thetic) and Hetero-trophic | Heterotrophic (Saprophytic/ Parasitic) | Autotrophic (Photosyn-thetic) | Heterotrophic (Holozoic/ Saprophytic etc.) |

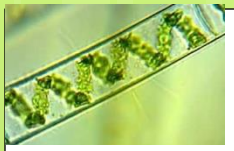
# Classification of Plants

- Plants into two major groups:
  - Non-vascular: Composed of early plants.
    - Plants lack vascular tissues that can help them transport water and nutrients.
    - They are considered to be the earliest living plants in the planet.
    - The most common non-vascular plants: Bryophyta
  - Vascular (tracheophytes): Plants which had developed a vascular system.
    - Possess vascular tissues (xylem and phloem) that aid them to transport water and minerals.
    - Plants like the members of the Phylum
      - Pteridophyta
      - Gymnosperms and
      - Angiosperms.


Plant Kingdom
Mosses & Liverworts
Ferns
Gymnosperms (Conifers)
Angiosperms (Flowering Plants)

# The basic parts of a flowering

- Plant include
  - Leaves,
  - Stem,
  - Root,
  - Flower, and
  - Seeds.



Algae

Fungi

Bryophytes

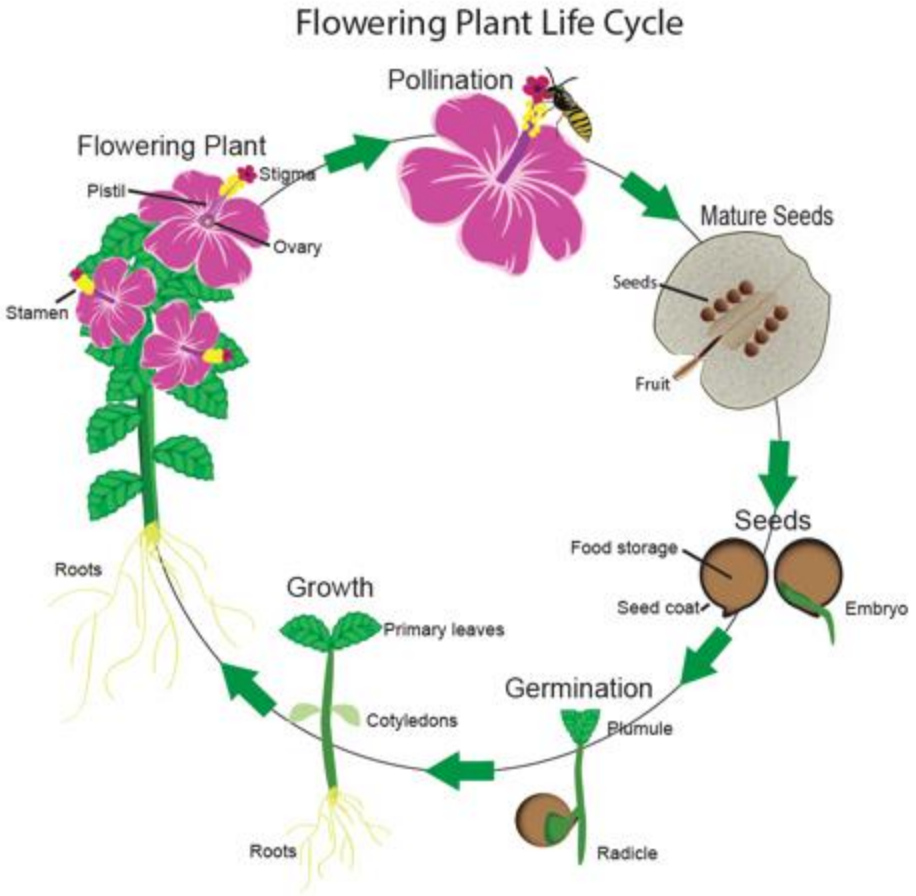
Pteridophytes

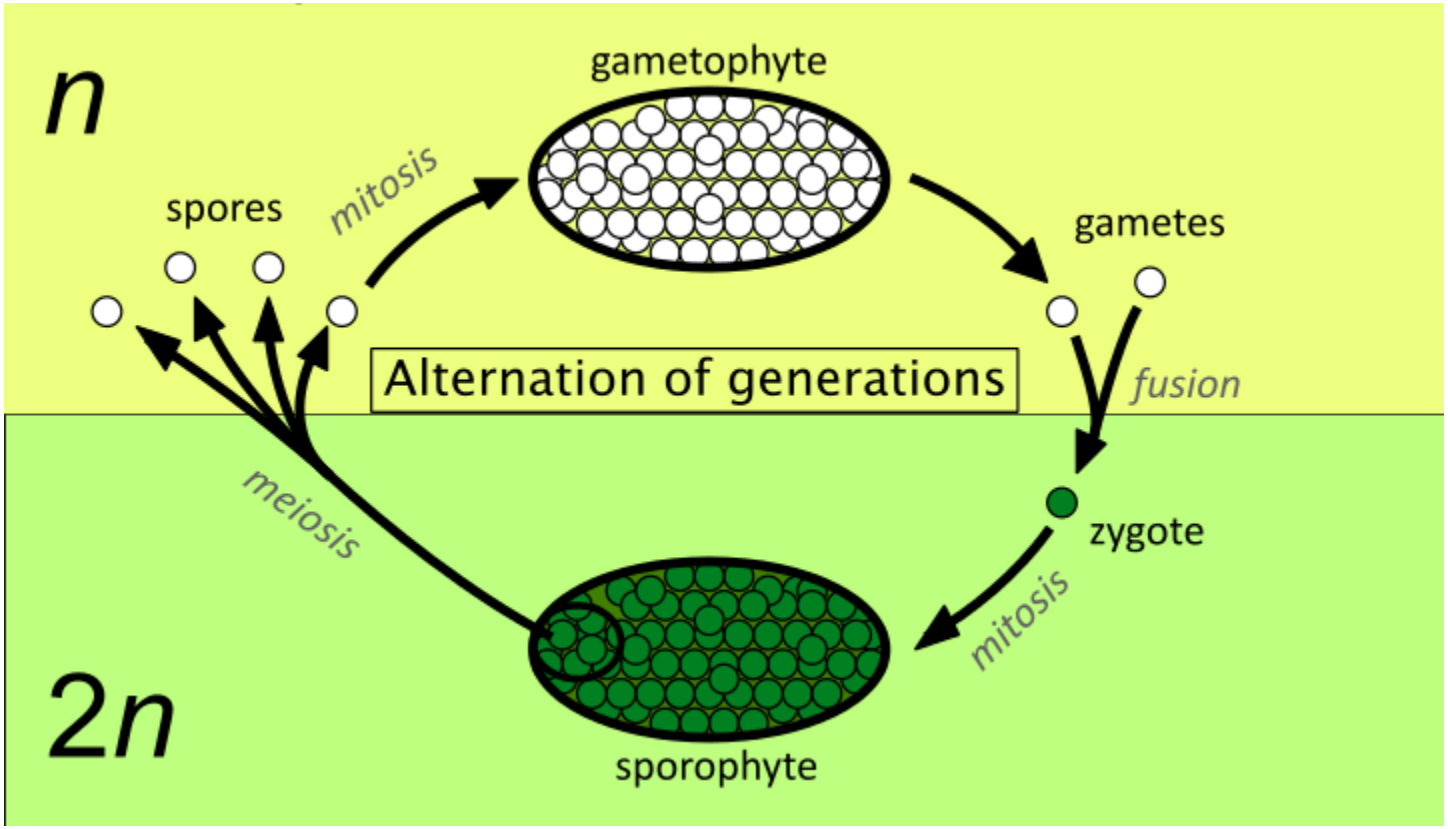
Gymnosperm

Angiosperm

# Plant life cycle

- It comprises
  - Seed germination,
  - Seedling growth,
  - Plant maturity,
  - Flower development,
  - Fertilization, and
  - Seed production.

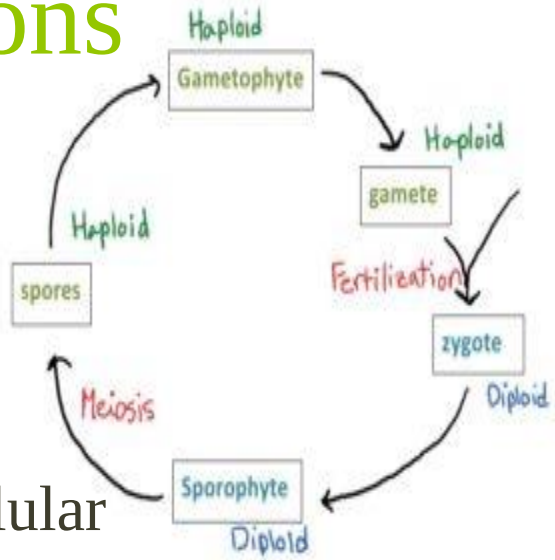



n
gametophyte
spores
mitosis
gametes
Alternation of generations
fusion
meiosis
zygote
mitosis
2n
sporophyte

# The life cycles of all sexually reproducing plants

- It follows a pattern of alternation between
  - a haploid, sexual generation called gametophyte with
  - a diploid, asexual generation called sporophyte.

# Alternation of generations




- Plants have distinct
  - Haploid sexual and
  - Diploid asexual stages.
- A multicellular haploid gametophyte (n chromosomes) alternates with a multicellular diploid sporophyte (2n chromosomes).
- A mature sporophyte produces haploid spores by meiosis, a process which reduces the number of chromosomes to half, from 2n to n.
- It is the alteration between a diploid (2n) generation of sporophytes and a haploid (n) generation of gametophytes.

- The haploid spores germinate and grow into a haploid gametophyte.
- At maturity, the gametophyte produces gametes by mitosis, which does not alter the number of chromosomes.
- Two gametes (originating from different organisms of the same species or from the same organism) fuse to produce a diploid zygote, which develops into a diploid sporophyte.
- This cycle, from gametophyte to sporophyte (or equally from sporophyte to gametophyte), is the way in which all land plants and many algae undergo sexual reproduction.

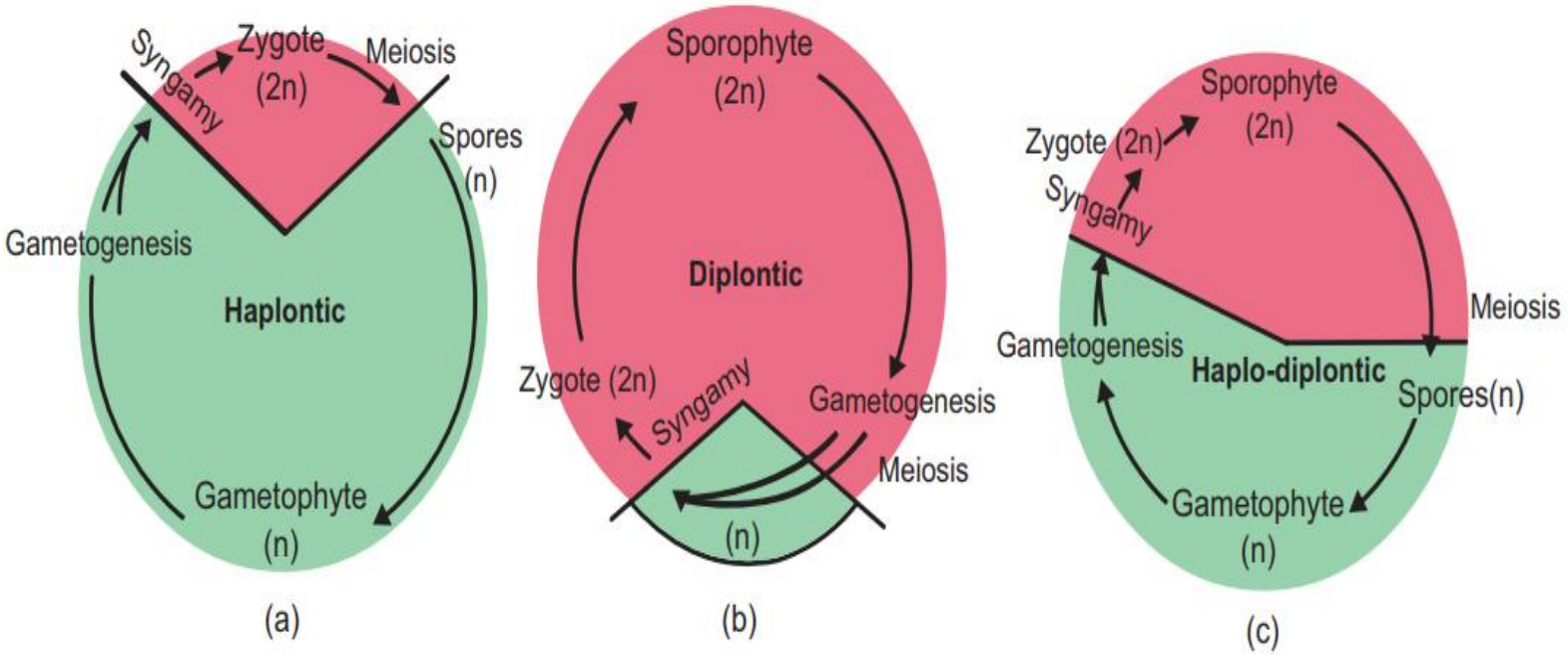
# Fundamental elements

- Two single-celled haploid gametes (each containing n unpaired chromosomes) fuse to form a single-celled diploid zygote (containing 2n chromosomes).
- The single-celled diploid zygote germinates, dividing by the normal process (mitosis), which maintains the number of chromosomes at 2n.
- The result is a multi-cellular diploid organism, called the ***sporophyte*** (at maturity it produces spores).
- When it reaches maturity, the sporophyte produces one or more sporangia (singular: sporangium) which are the organs that produce diploid spore mother cells (sporocytes).
- These divide by meiosis that reduces the number of chromosomes by a half. This initially results in four single-celled haploid spores, each containing n unpaired chromosomes.
- The single-celled haploid spore germinates, dividing by the normal process (mitosis), which maintains the number of chromosomes at n. The result is a multi-cellular haploid organism, called the gametophyte (it produces gametes).
- When it reaches maturity, the gametophyte produces one or more gametangia (singular: gametangium) that produce haploid gametes.

# Types

- two types- isomorphic and heteromorphy.
- In ***isomorphic*** (or homologous) type both the alternating generations are morphologically similar,
- In ***heteromophic*** (or heterologous) type of alternation of generations both the generations of life cycle are morphologically dissimilar.
- In the life cycle, any one of the two generations is found to be always more conspicuous and survive a greater proportion is called as dominant generation.
- In algae and bryophytes: Gametophyte is dominant and visible.
- In pteridophytes, gymnosperms and angiosperms: The plant body is a sporophyte which is dominant and the gametophyte generation is less conspicuous.

# Life Cycle Pattern




Life cycle patterns in plants a) Haplontic, b) Diplontic, c) Haplo-diplontic

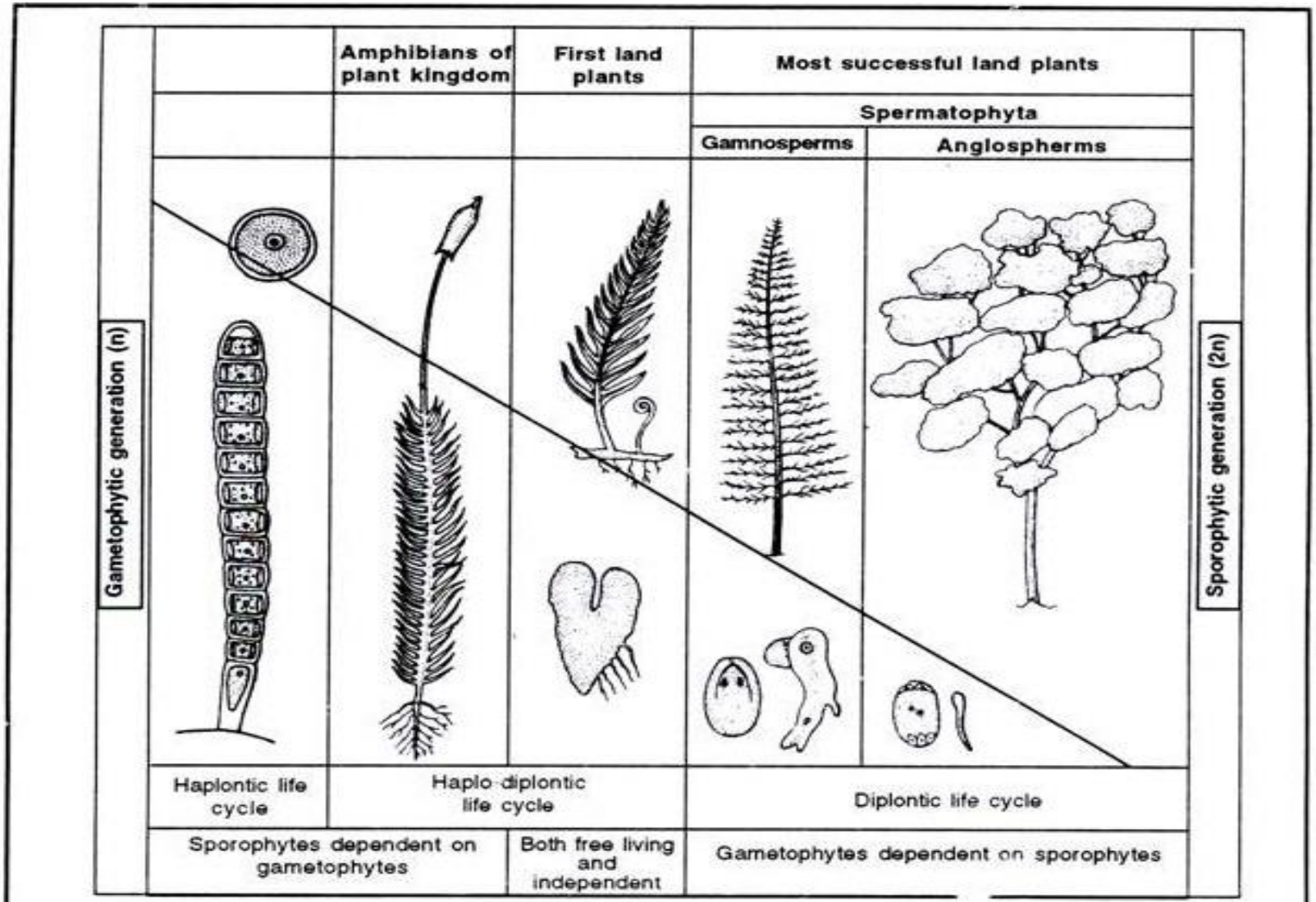



**Figure 4.2** Diagram showing gradual elaboration of sporophytic generation and degeneration of gametophytic generation in plant kingdom.