Paper BOT-HC-2026 Unit 1-

Archegoniate

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What is Archegoniate?

Lower plants are earlier grouped as-

1. **Cryptogams (**hidden –wedded) termed so due to lack of knowledge about their sexuality- includes lower plants such as algae, fungi, bryophytes and pteridophytes.

   -> Algae and Fungi= Lower cryptogams

   -> Bryophytes and pteridophytes= Higher cryptogams

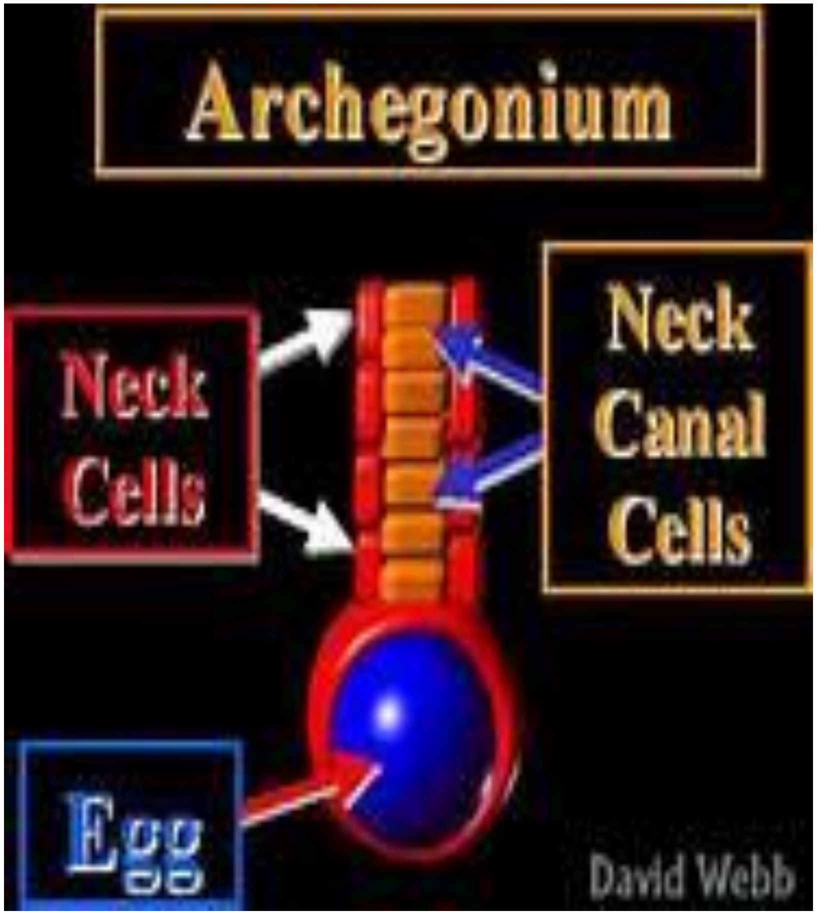
2. **Phanerogams** (open –wedded) includes higher plants.

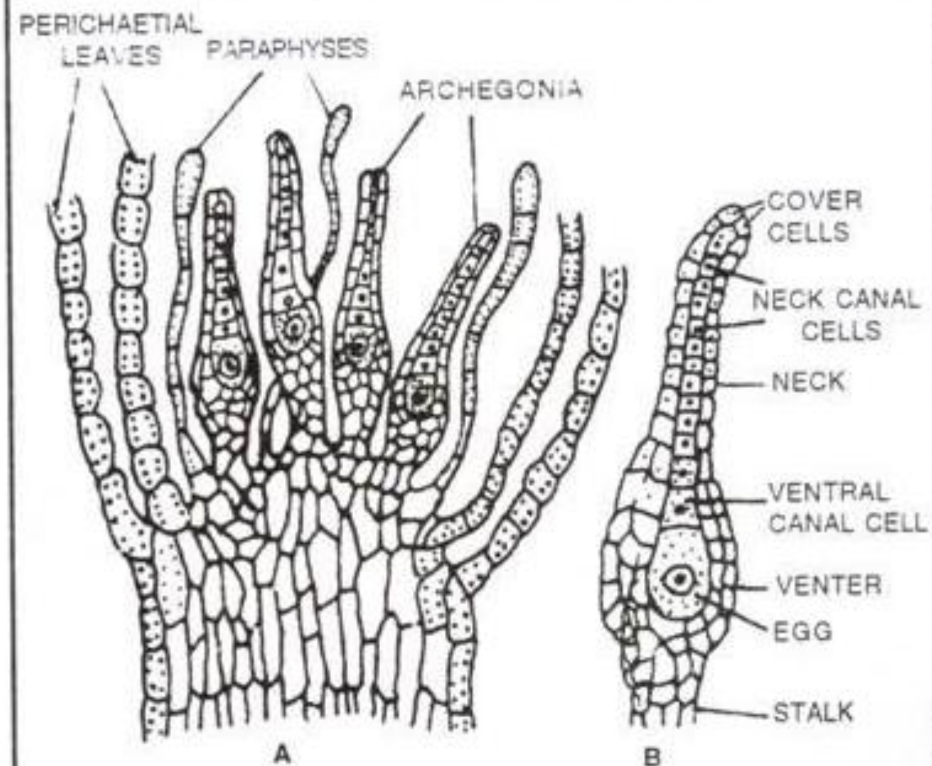
Present day-

Bryophytes, pteridophytes and gymnosperm share a common female sex organ i.e. archegonium, hence grouped in **Archegoniatae.**

Archegonium: from Greek **arkhegonos** = original parent.

Archegonium: Small, multicellular, flask shaped, egg producing organ





Archegonial head of *Funaria*. **A** : L.S. of archegonial shoot ; **B** : An archegonium





Pictures source internet

General characters of Archegoniates:

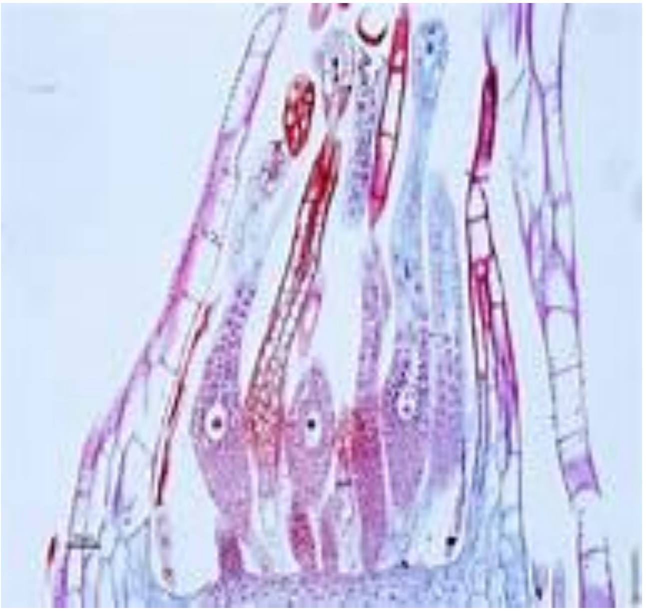
1. It includes both living and fossil plants.
2. Female sexual organ called archegonium is present in all members of the group.
3. Male sexual organ called antheridium is present in all members of the group..
4. The archegoniates seem too have originated from a monophyletic group of ancient stock of aquatic green algae.
5. The presence of Chloroplasts containing chlorophyll a, b and carotene.
6. The presence of multicellular gametophytic and sporophytic generation.
7. Presence of Heteromorphic alternation of generation.
8. The morphological reduction of the sexual or the gametophytic phase was evident in the life cycle of archegoniate.
9. Provides protection to their embryo.
10. Male gametes are flagellated and motile in bryophytes, pteridophytes, (Cycadales, Ginkgoales) while the female gamete (egg) is non-motile.

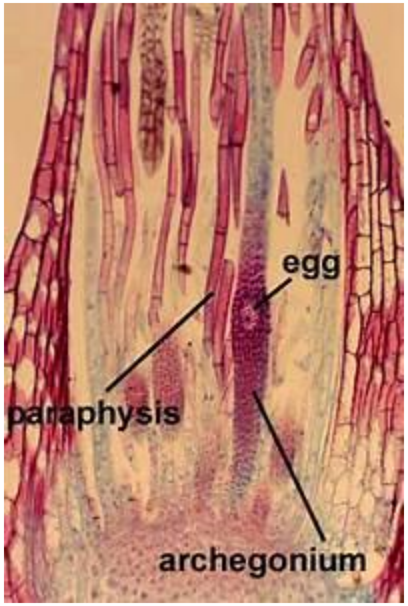
11. Bryophytes and Pteridophytes depend upon the presence of "fluid water" for fertilization.
12. In gymnosperms, pollen grains germinate to form a pollen tube (siphonogamy) which is not dependent on external fluid water to reach the archegonial neck.
13. The transmigration of plants to the land habit led to specialization coupled with varied spore dispersal mechanisms leading to their successful spread on land with genetic variation.
14. Plants adapted to life on land by internalizing the external atmosphere and exploring the soil in an intensive way.
15. Spores also became resistant to desiccation through further specialization in seed plants.
16. Differentiated rhizoids and roots to provide strong anchorage and efficient supply of water and mineral nutrients.
17. Increased the green surface area to provide more chlorophyll for efficient photosynthesis.
18. Developed an efficient vascular system to provide water to every part of the plant body.
19. Evolved the mechanism of transpiration to regulate the internal temperature.

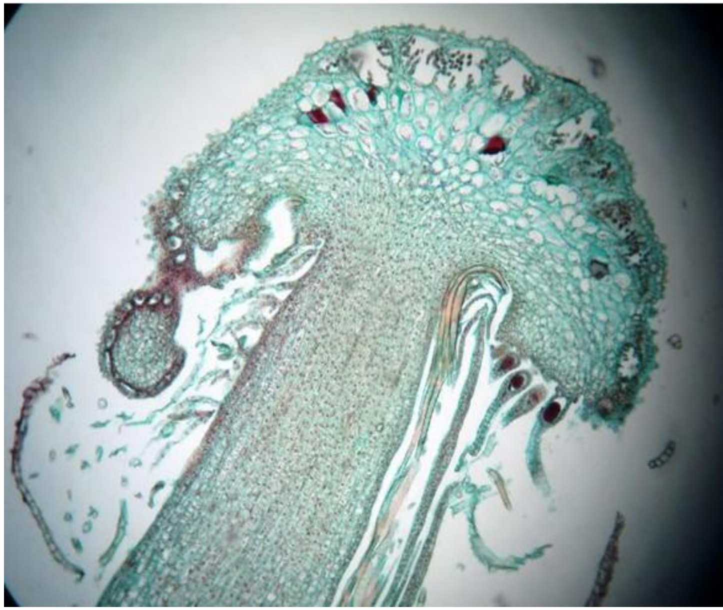
20. Developed waxy cuticle to restrict water loss and formed stomatas to regulate gaseous exchange.

21. Differentiated tissues with thickened cell walls (collenchyma) and lignified walls (sclerenchyma) to support the erect habit.

22. The archegoniates evolved several adaptive strategies to survive on land.







Transition to land habitat

- The transition from aquatic habitat to land occur probably from middle Ordovician to early Silurian period.
- Certain significant changes took place that help the transition to adapt the land habit at primarily comprising of climatic changes, the formation of soil etc.
- Development of special cells for water and nutrient uptake.
    1. Some elongated cells developed and organized along the length of the plant took part in the conduction of water from base to tip.
    2. Some water conducting cells in early fossils had cell walls, with thickened rings containing lignin. These thickening are formed to avoid cells being collapsed and these are helical, spiral, reticulate etc.
    3. Later tracheids and pits were developed with tapering ends
- Various measures developed to protect plants against desicassion, injuries and infections

1. Development of cuticle
2. Development of sporopolenin

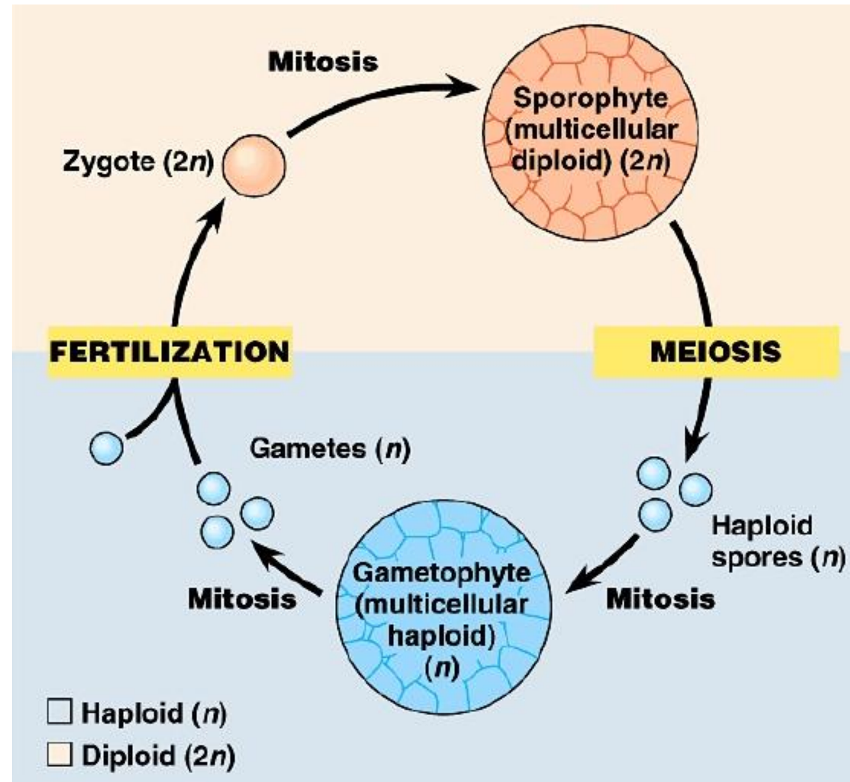
3. Origin and development of stomata

4. Development of special mechanical tissues such as schlerenchyma, collenchyma etc.

- Development of anchoring system with the development of rhizoids, later developed into root system.
- Development of special photosynthetic tissue in aerial stem i. e. leaves.
- Development of reproductive mood that does not primarily depends upon external water condition- production of spores in stead of gametes.
- Protection of the zygote- the development of the zygote occurs within the megasporangium.
- Origin of alternation in generation.

What is Alternation of Generations?

All plants undergo a life cycle that takes them through both haploid and diploid generations. The multicellular diploid plant structure is called the sporophyte, which produces spores through meiotic (asexual) division. The multicellular haploid plant structure is called the gametophyte, which is formed from the spore and give rise to the haploid gametes. The fluctuation between these diploid and haploid stages that occurs in plants is called the alternation of generations.



- First time demonstrated by Hofmeister(1851)
- The haploid plant body produces gametes and hence represents gametophytes.
- The zygote divides by mitosis to produce a diploid sporophytic plant body and this plant body produces haploid spores by meiosis, which again divides by mitosis to produce haploid plant body.

<u>Different plant groups representing gametophytes and sporophytes differ in the following patterns:</u>

Accordingly there are three types of life cycle

1. Haplontic
2. Diplontic
3. Haplodiplontic

Alternation of generations in different plants

- Depends on type of plant
- Bryophytes(mosses and ferns) - dominant generation-haploid phase
  - main plant body is composed of gametophyte
- Pteridophytes and gymnosperms - dominant generation- diploid phase
  - main plant body is composed of sporophyte.

Significance:

- Better chance for survival
- Better adapted to environment
- Newer varieties develop
- Variations are produced during meiosis

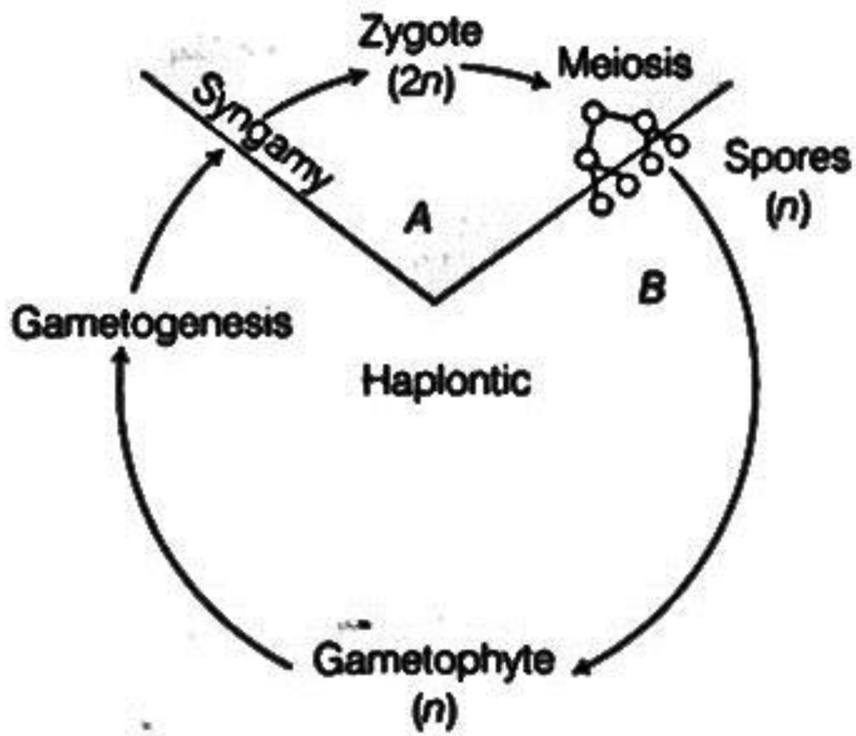
1. **Haplontic**

•The dominant, photosynthetic phase in such plants is the free-living gametophyte.

• Sporophytic generation is represented only by the one-celled zygote and free-living sporophytes are absent.

•Haploid spores are formed by meiosis, which divide mitotically to form the gametophyte.

•Examples-Volvox, Spirogyra and some species of Chlamydomomas, mosses

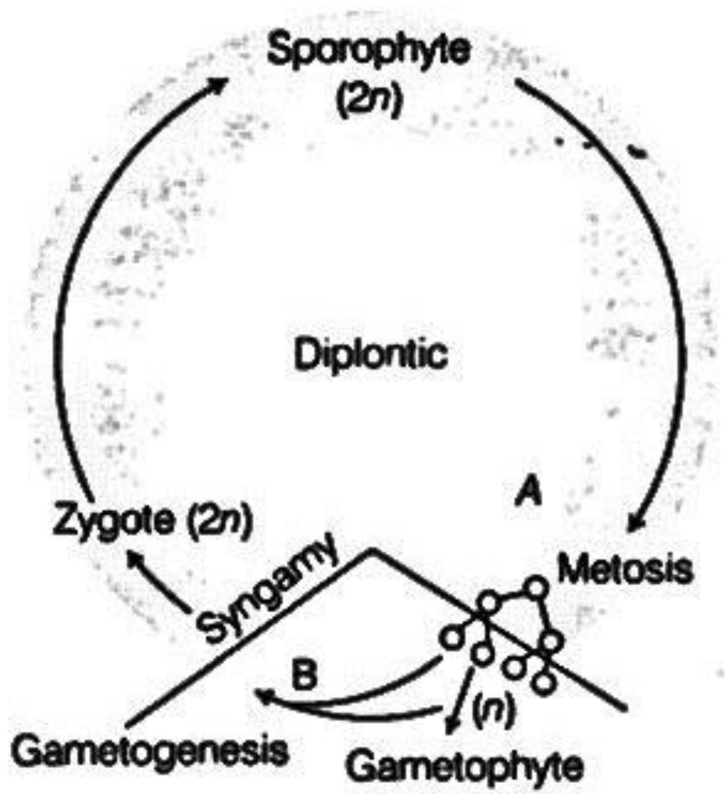


2. **Diplontic**

•Here, the diploid sporophyte is the dominant, photosynthetic, independent phase of the plant.

•The gametophytic phase is represented by the single to few-celled haploid gametophyte.

•For example- gymnosperms and angiosperms.

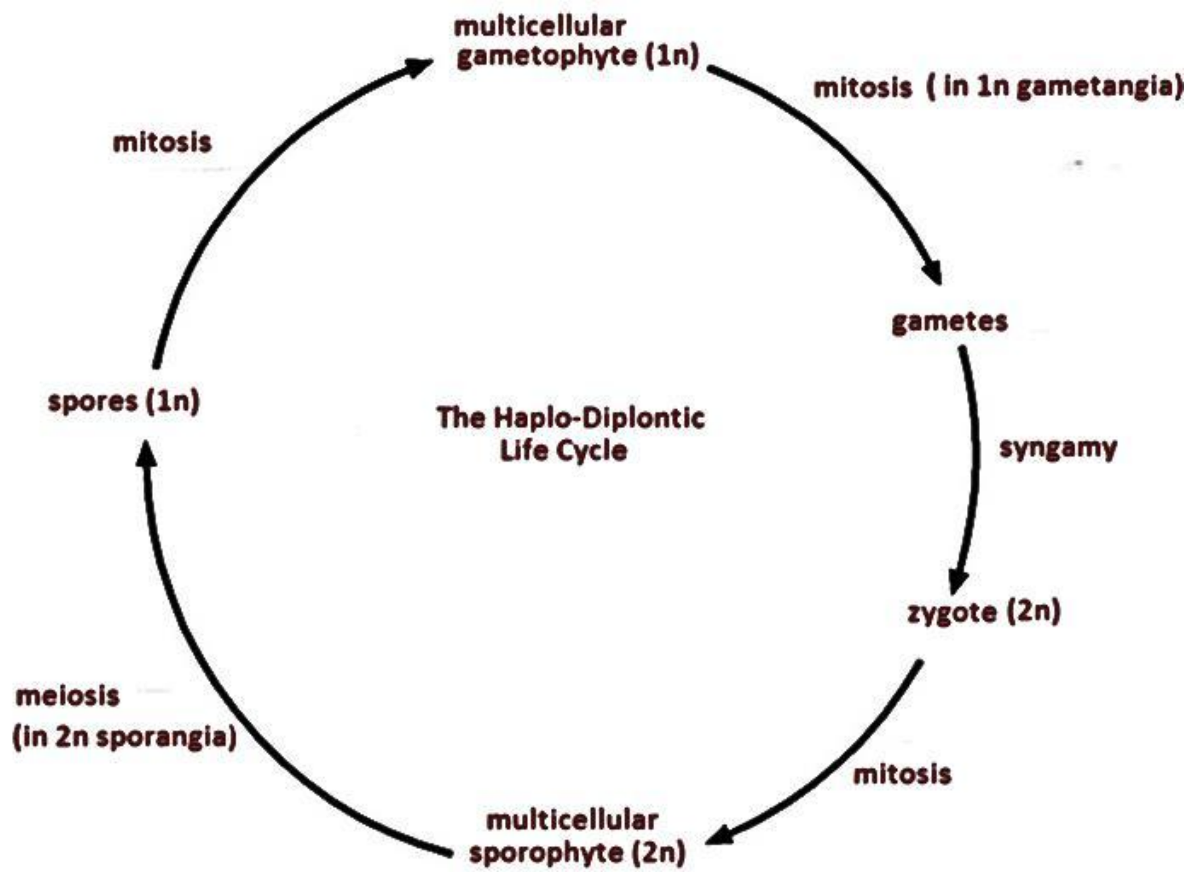


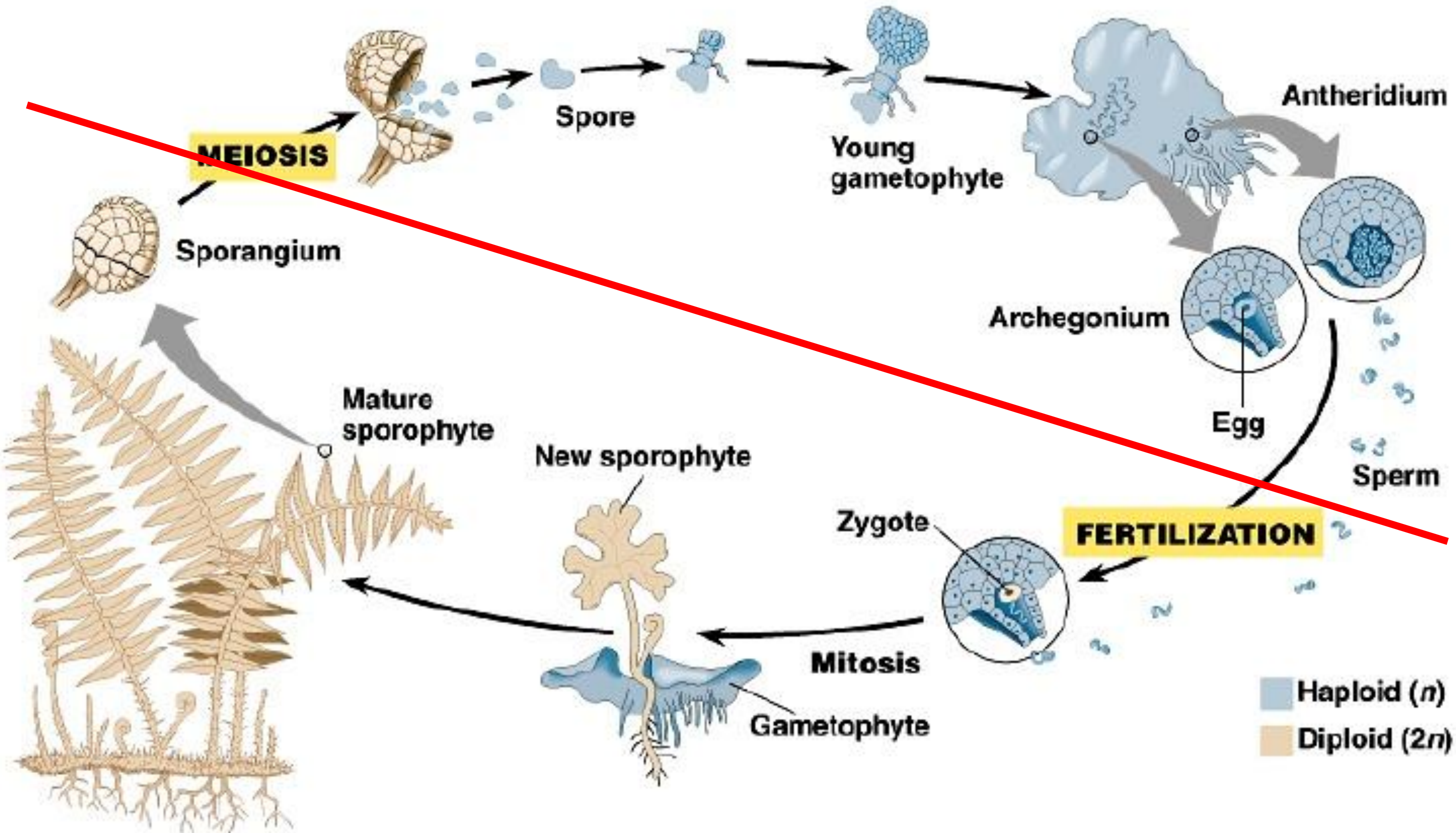
3. Haplo-diplontic

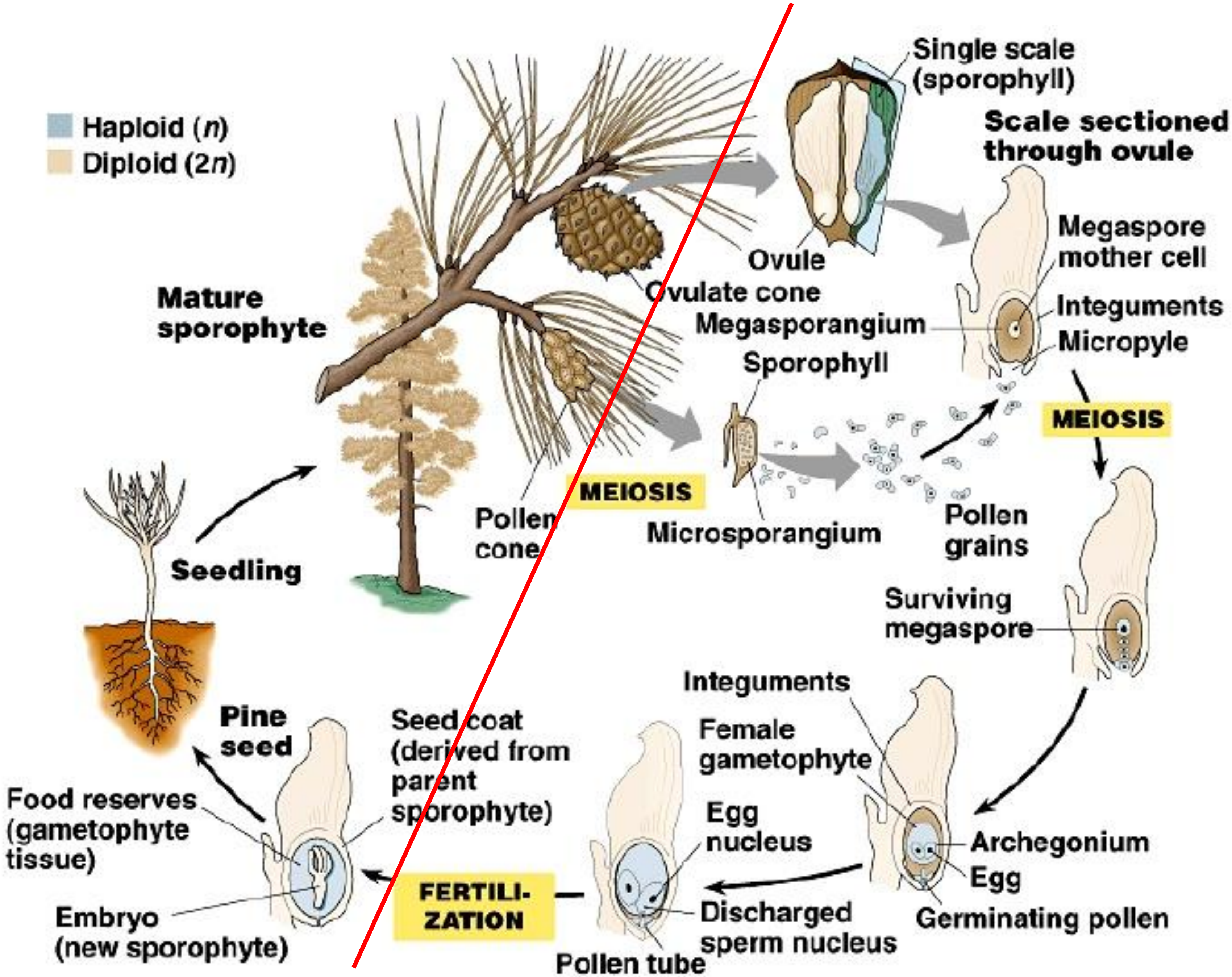
•A dominant, independent, photosynthetic, thalloid or erect phase is represented by a haploid gametophyte and it alternates with the short lived multicellular sporophyte. Example- bryophytes

•The diploid sporophyte is represented by a dominant, independent, photosynthetic, vascular plant body. It alternates with multicellular, saprophytic/autotrophic, independent but short-lived haploid gametophyte. Example- pteridophytes.

•Some alga genera such as *Ectocarpus*, *Polysiphonia*, *kelps* are haplo-diplontic.




MEIOSIS
Spore
Young
gametophyte
Antheridium
Sporangium
Archegonium
Egg
Sperm
Mature
sporophyte
New sporophyte
Zygote
FERTILIZATION
Mitosis
Gametophyte
Haploid (n)
Diploid (2n)


Haploid (n)
Diploid (2n)
Single scale (sporophyll)
Scale sectioned through ovule
Mature sporophyte
Ovule
Ovulate cone
Megaspore mother cell
Integuments
Megasporangium
Micropyle
Sporophyll
MEIOSIS
MEIOSIS
Pollen cone
Microsporangium
Pollen grains
Seedling
Surviving megaspore
Integuments
Pine seed
Seed coat (derived from parent sporophyte)
Female gametophyte
Food reserves (gametophyte tissue)
Egg nucleus
Archegonium
Egg
FERTILI-ZATION
Discharged sperm nucleus
Germinating pollen
Embryo (new sporophyte)
Pollen tube