21-1 Plants Invade the Land

The Demands:	What land plants must do:
Provide cells with a constant water supply	a) find water b) Deliver it to all cells c) Protect against water loss by evaporation
Expose food-making parts to sunlight	need rigid supports to hold up & expose leaves
Different tasks performed in distant plant parts: a) roots take up water & nutrients b) leaves make food	Need a transport system: a) water/nutrients upward b) sugars made by photo-synthesis downward
For reproduction, gametes must find each other	Need a mechanism to deliver sperm that DOESN'T involve having them swim

21-2 The Mosses, Liverworts, and Hornworts

I. Introduction

A. Need *water* for reproduction to occur

B. Thrive only in wet areas: *swamps*, *marshes*, *near streams*, *in rainforests*

C. All less than a few *centimeters* tall

D. Mosses:

1. **Each plant has:**

   a) A thin, upright *shoot* like a stem with tiny *Leaves* called the Gametophyte

   b) From base of the shoot grow *rhizoids* that anchor the plant

   c) Shoots may be topped with a brown flag-like

   structure called a *Sporophyte*

II. Physical Characteristics of Bryophytes

A. Water Conduction

1. Lack tubes
2. Water passes between cells by *osmosis* and *surface tension*
3. These methods work: *over short distances* only
    - can't grow *tall*
4. Lack a protective surface covering to prevent evaporation
5. "Leaves" only *one cell* thick; dry out *quickly*
6. Lack true roots: *rhizoids* anchor, but don't *absorb* and *transport* water & minerals

B. Reproduction

1. Sperm must *swim* to the egg, using *flagella* to propel themselves

2. Moss environment must be wet for: *at least part of the year*

The Moss Life Cycle – Alternation of Generation

But before we get into the notes, let's look at a summary animation first!

II. Alternation of Generations in Mosses

A. Life Cycle Stages:

1. At the tips of the gametophyte:
   a) *Antheridium*: makes sperm

Archegonium: makes eggs

2. Fertilization

a) Sperm swims to *archegonium*

b) Plants must be covered with *rainwater* or *dew*

c) Gamete fusion produces a *zygote* (diploid:“2n”)

3. Growth of 2n (Diploid) Generation

a) Zygote grows into *sporophyte*

b) Its *water and nutrients* are supplied by female gametophyte

c) Sporophytes cannot live *independently*

d) *Capsule* at end of stalk makes haploid (1n) *spores* by *meiosis*

4. Spore Release

    a) When *ripe*, capsule shakes out spores

    b) Spores *carried* off by *wind* and *water*

5. Growth of 1n (Haploid) Generation

a) Spores that land in moist places germinate into a *protonema*

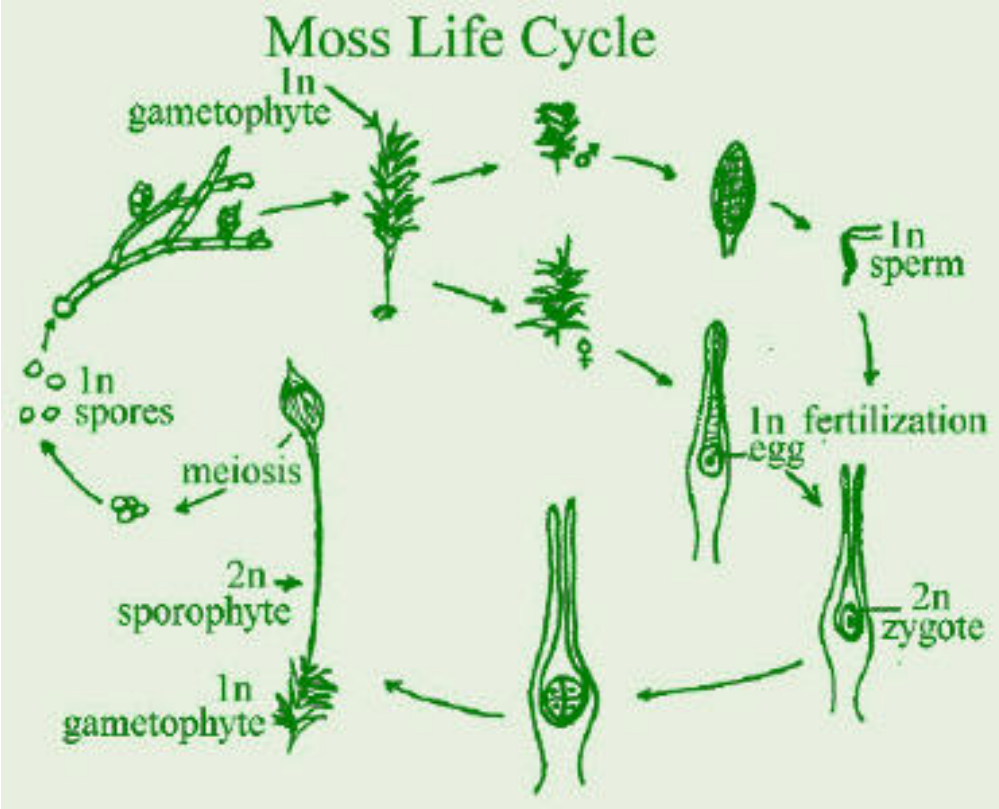
b) Protonema = mass of *tangled green filaments* (look like algae!)

c) This grows *rhizoids* into soil and *shoots* into the air that develop into moss *gametophytes*

d) The cycle begins again!

B. Summary:

1) Gametophyte (1n) is the *dominant*, obvious stage
2) Fertilization requires *standing water*
3) Sporophyte is dependent upon *gametophyte*



21-3 The Ferns and the First Vascular Plants

I. Introduction to Tracheophyta

A. "True" Land Plants because they: *have evolved ways of freeing themselves from dependence upon wet environments*

How did they do it?

1. **Vascular tissues: 2 types:**
   a) ***Xylem*: moves water from roots to rest of plant**
   b) **Phloem: *transports nutrients & photosynthetic products***

2. ***Tracheid* cells in xylem have thick, strong walls that help plants *stand up against gravity***

3. **True roots have transport tissue in a central *vascular cylinder***

4. **True leaves have:**
   a) veins (def'n): ***bundles of vascular tissue***
   b) cuticle (def'n): ***waxy covering that prevents water loss***

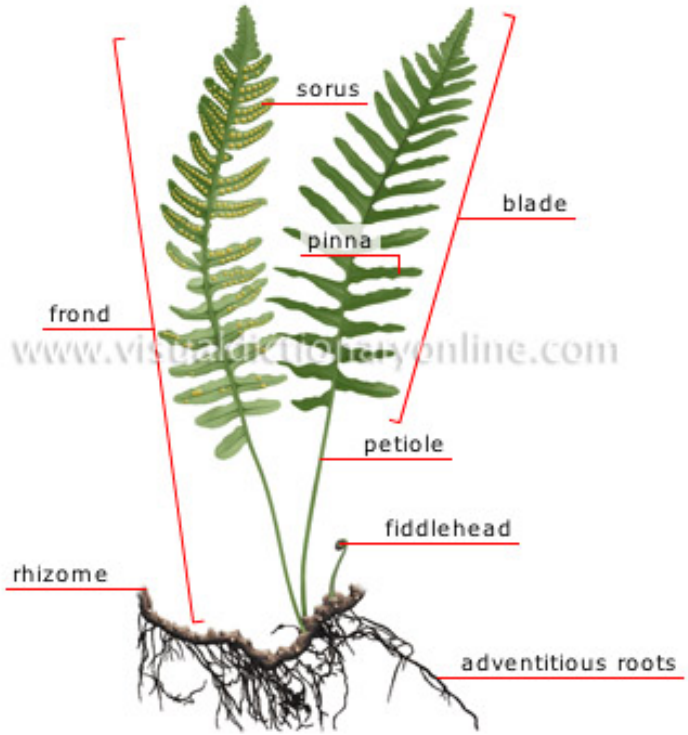
II. Club Mosses and Horsetails

A. The only living descendants of *large*, *ancient landplant groups*
B. Some grew up to *40* m tall!
C. Some fossilized into *huge coal beds*
D. Sketch a horsetail: Label its stem and leaves:

III. Physical Characteristics of Ferns

A. Organs:

1. Have true *vascular tissues*
2. True roots
3. Underground stems called *rhizomes*
4. Large leaves called *fronds*



B. Size & Habitat

1. Up to *1 metre* tall in North America

2. Found in *wet*, or *seasonally wet* places (e.g. rainforests of *Pacific Northwest*)

IV. Alternation of Generations in Ferns

A. Life Cycle Stages:

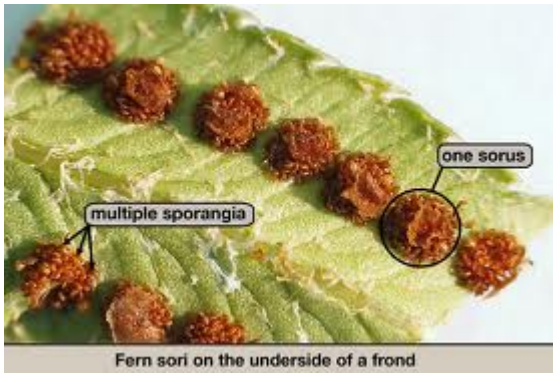
1. Spore Production/Release:

a) Adult sporophytes produce haploid *spores* on *underside* of fronds

b) Formed in tiny containers called *sporangia*

c) Sporangia cluster together in groups called *sori*

d) When *ripe*, spores released; carried by *wind*, *water*



Fern sori on the underside of a frond

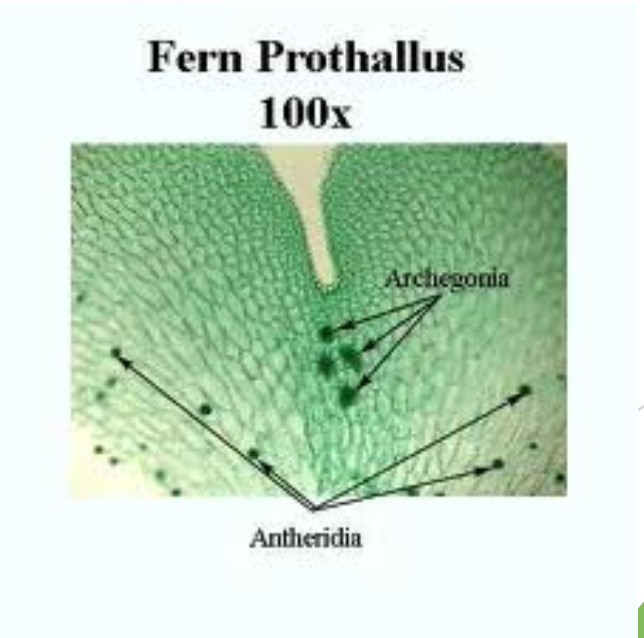
Animation of Life Cycle

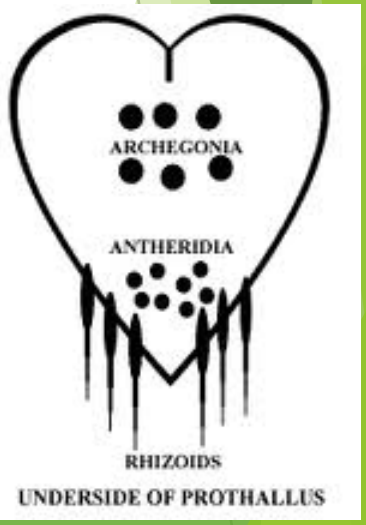
2. Growth

a) Spores develop into *haploid* (1n) *gametophytes*

b) Grow into small, heart-shaped *prothallium*

c) *Antheridia* and *archegonia* develop on underside of prothallium





3. Fertilization

a) Antheridia release *sperm*

b) Sperm must swim through *a film of water* to an *archegonium*

c) Each archegonium contains one *egg*

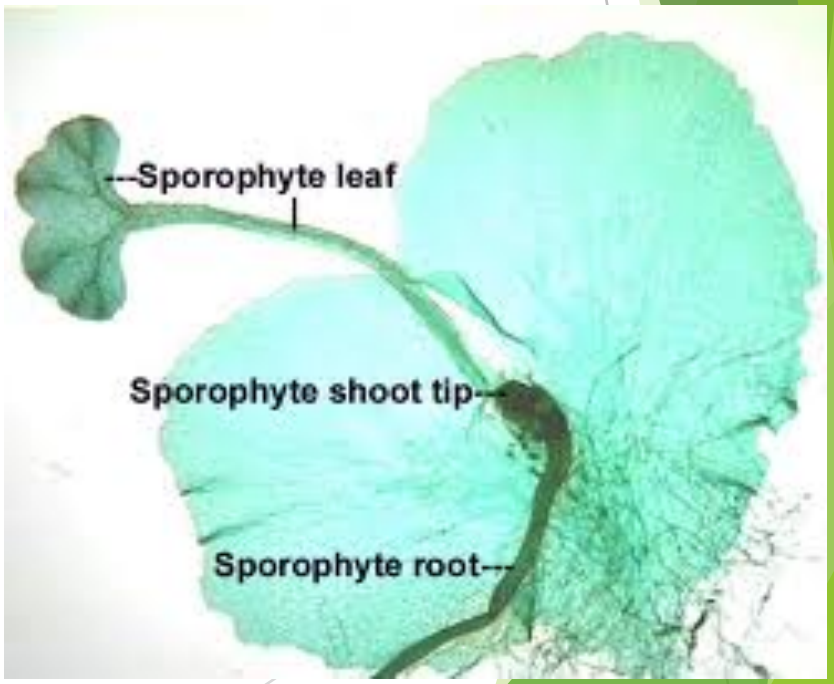
d) Fusion of gametes produces a *diploid* (2n) *sporophyte*

4. Growth

Time Lapse

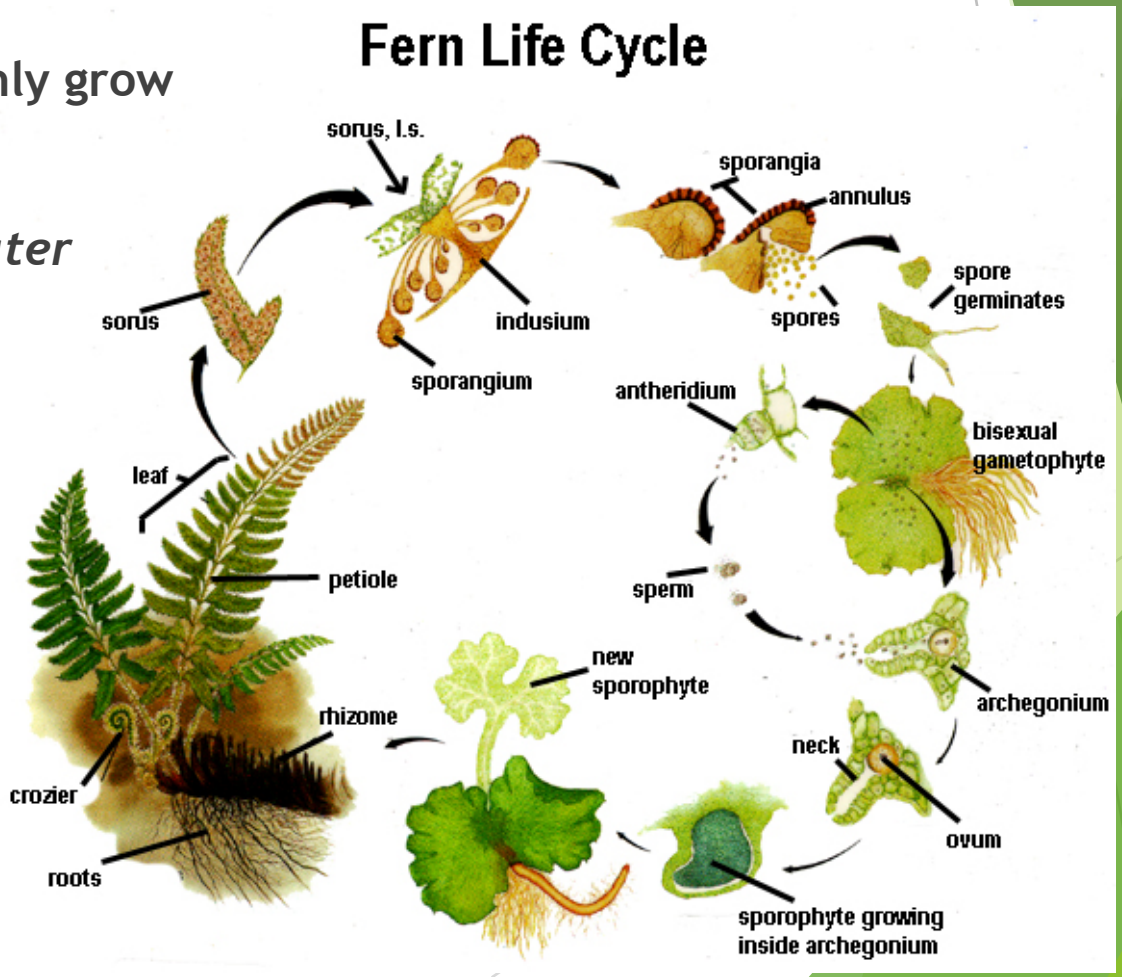
a) New sporophyte puts out *fronds*, *rhizomes*

b) Gametophyte *withers away*



B. Summary:

1. Dominant, obvious stage is the *sporophyte*
2. Sporophyte is a *well-developed land plant* with true *vascular tissue*
3. Gametophyte can only grow in *moist areas*
4. Sex still requires *water*

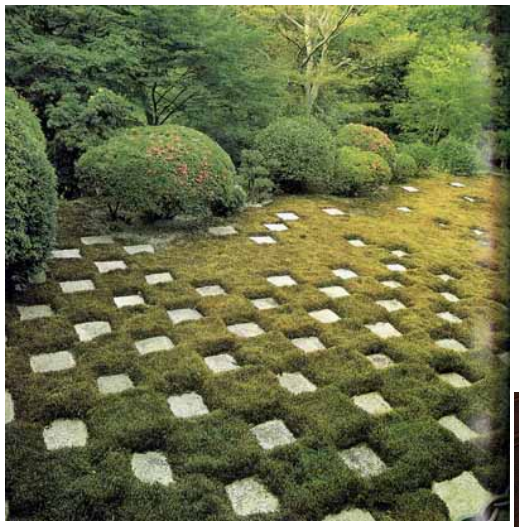


21-4 Where Mosses and Ferns Fit into the World

I. <u>Mosses: Ecological Role</u>

A. Common in *damp areas*

II. Mosses: Uses by Humans



A. Gardening
    1. Used as plants

2. Peat moss added to soil to improve it

B. Burning sphagnum
    1. Flavours *scotch whiskey*
    2. Peat is used as *fuel*

III. Ferns: Ecological Role

A. Common in the shadows of *forest trees*, because they: *require little light*

IV. Ferns: Uses by Humans

A. Gardening

1. Used as plants

B. Food

1. Some species eaten when young; fronds called fiddleheads