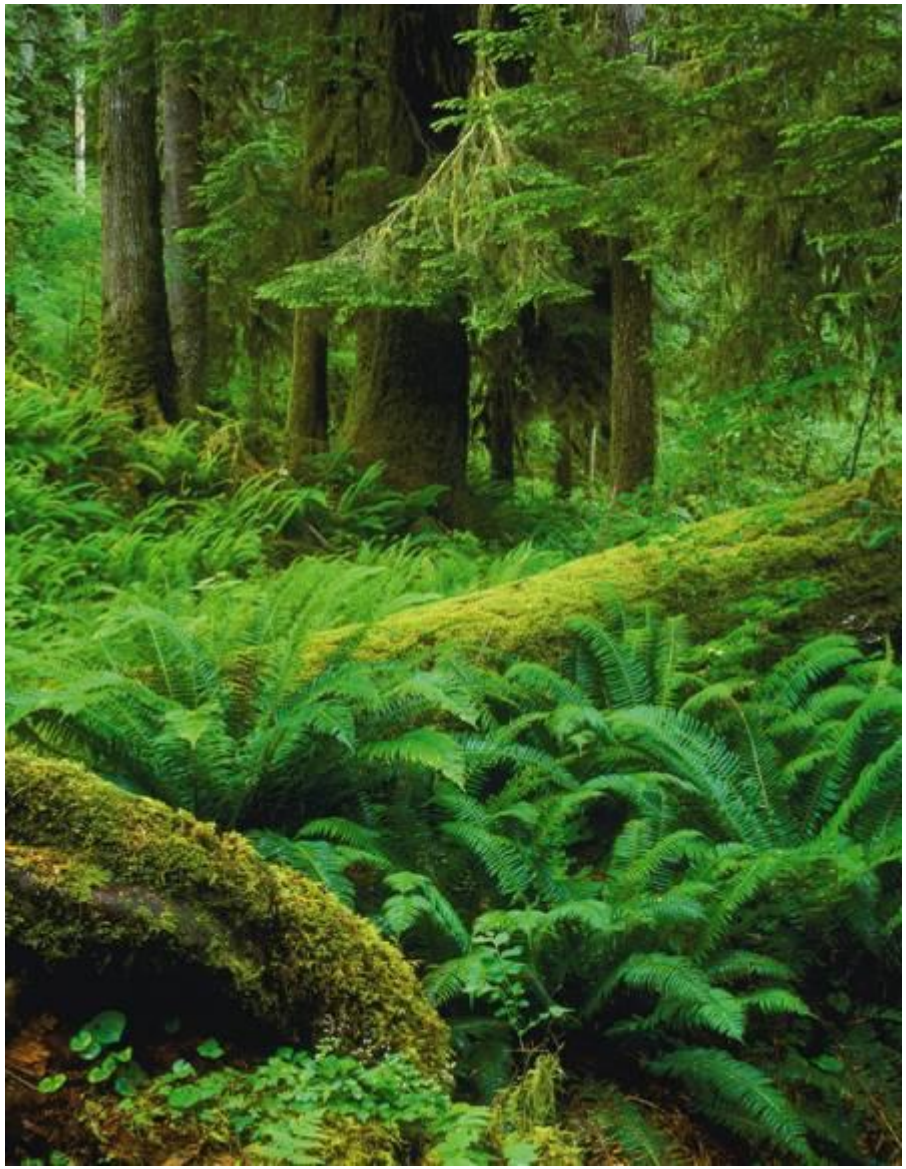
22–3 Seedless Vascular Plants



420 million years ago, mosslike plants on land were joined by taller plants.

Evidence shows that these plants had **vascular tissue**, which is specialized to conduct water and nutrients throughout the plant.

Evolution of Vascular Tissue

The first vascular plants contained **tracheids** which are cells specialized to conduct water.

Tracheids make up **xylem**, a transport subsystem that carries water from the roots to every part of a plant.

Tracheids are hollow with thick cell walls that resist pressure.

They connect end to end to allow water to move efficiently.

Vascular plants have a second transport subsystem composed of vascular tissue called phloem.

Phloem transports solutions of nutrients and carbohydrates produced by photosynthesis.

How is vascular tissue important to ferns and their relatives?

Both xylem and phloem can move fluids through the plant body, even against the force of gravity.

Together xylem and phloem move water, nutrients, and other materials throughout the plant.

In many plants, xylem and **lignin** (a substance that makes cell walls rigid) enable them to grow upright and tall.

What are the characteristics of the three phyla of seedless vascular plants?

Seedless vascular plants include:

- club mosses
- horsetails
- ferns

Ferns and Their Relatives

The most numerous phylum is the ferns.

Ferns and their relatives have true roots, leaves, and stems.

Roots are underground organs that absorb water and minerals.

Leaves are photosynthetic organs that contain one or more bundles of vascular tissue. Tissue is gathered into veins made of xylem and phloem.

Stems are supporting structures that connect roots and leaves, carrying water and nutrients between them.

Club Mosses

Ancient club mosses grew into trees and produced forests.

Fossilized remains of these exist today as huge beds of coal.

Today, club mosses are small plants that live in moist woodlands.

Horsetails

The only living genus of Arthrophyta is *Equisetum*.

Equisetum has true leaves, stems, and roots.

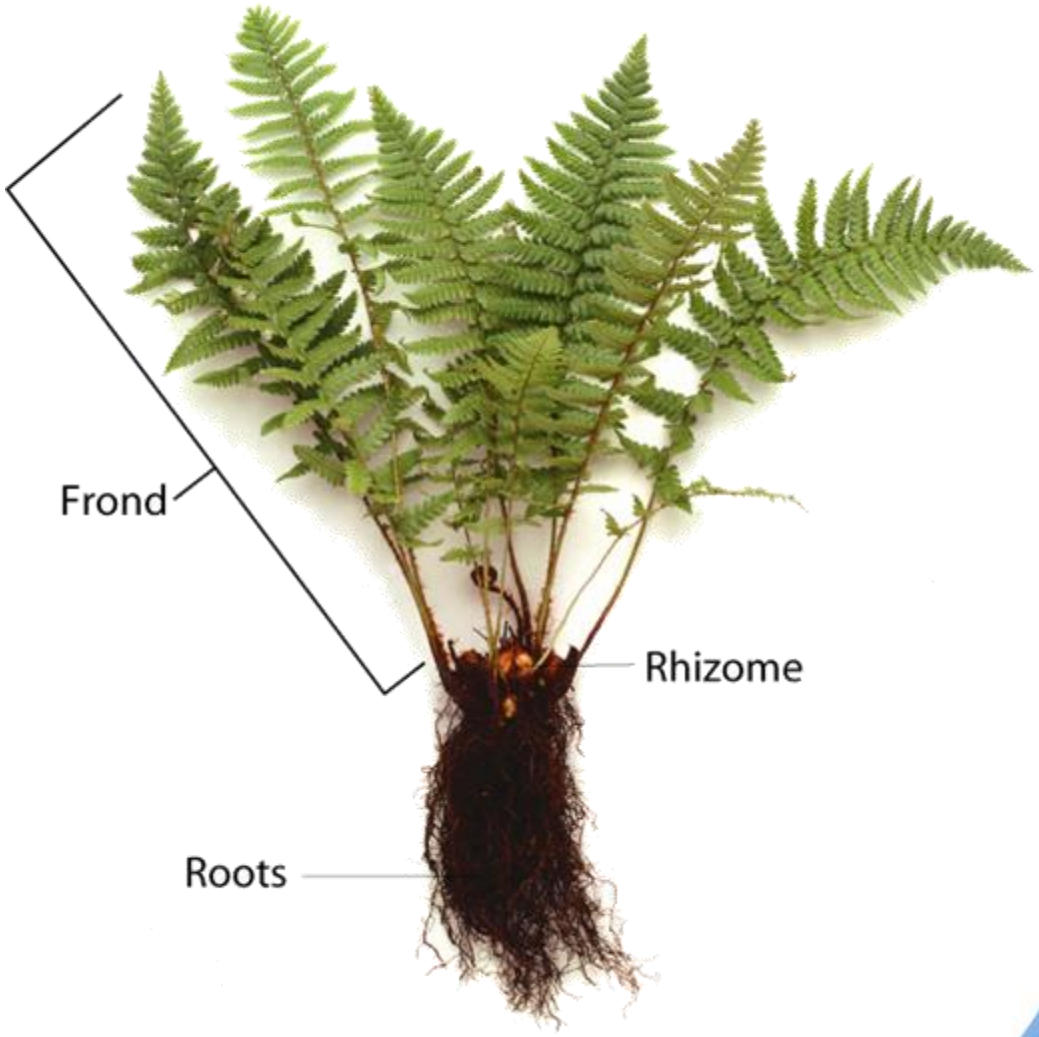
Equisetum is called horsetail, or scouring rush.

Ferns

Ferns probably evolved 350 million years ago, when club moss forests covered Earth.

Ferns thrive in wet areas with little light.

Ferns have vascular tissues, strong roots, underground stems called **rhizomes**, and leaves called **fronds**.



What are the stages in the life cycle of ferns?

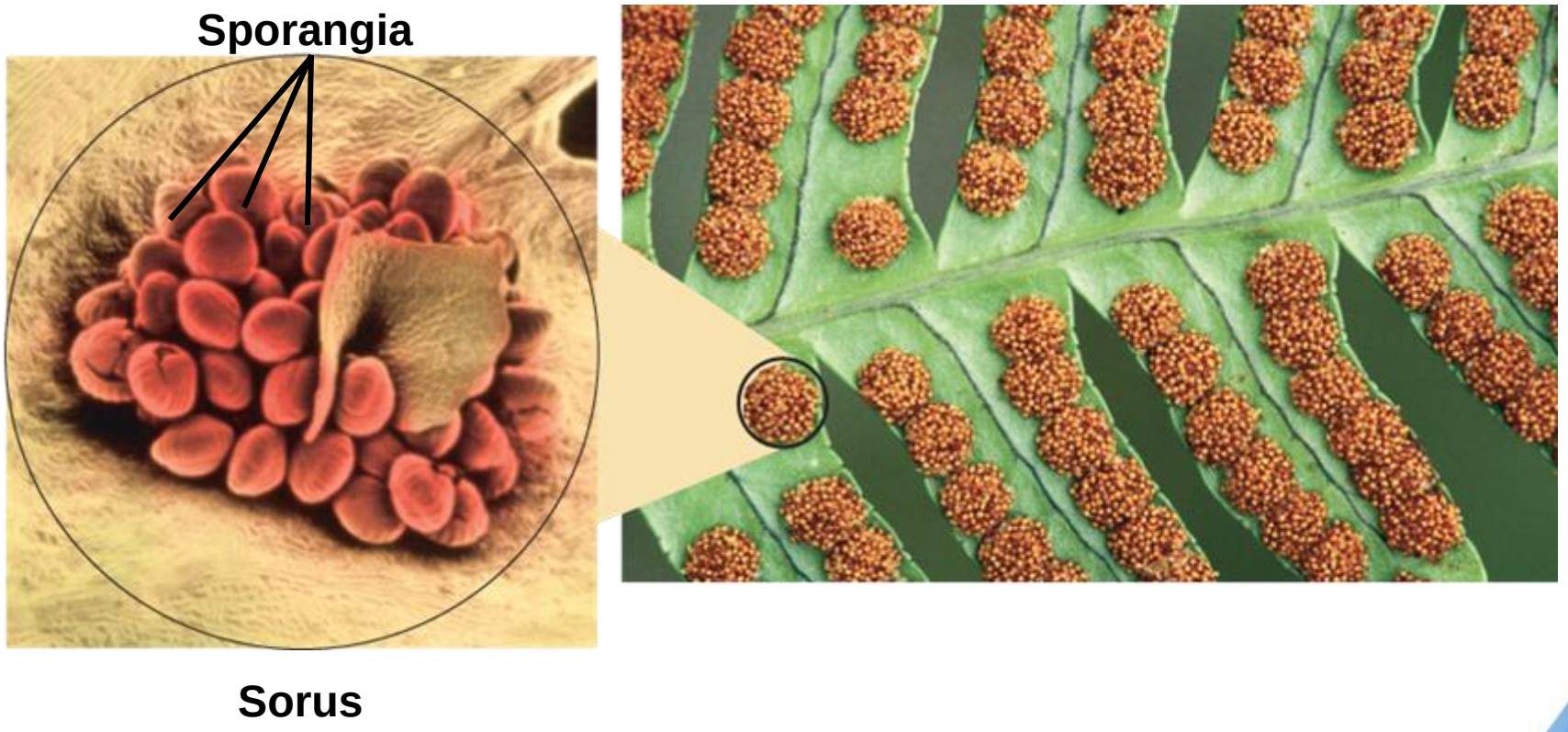
Life Cycle of Ferns

Ferns and other vascular plants have a life cycle in which the diploid sporophyte is the dominant stage.

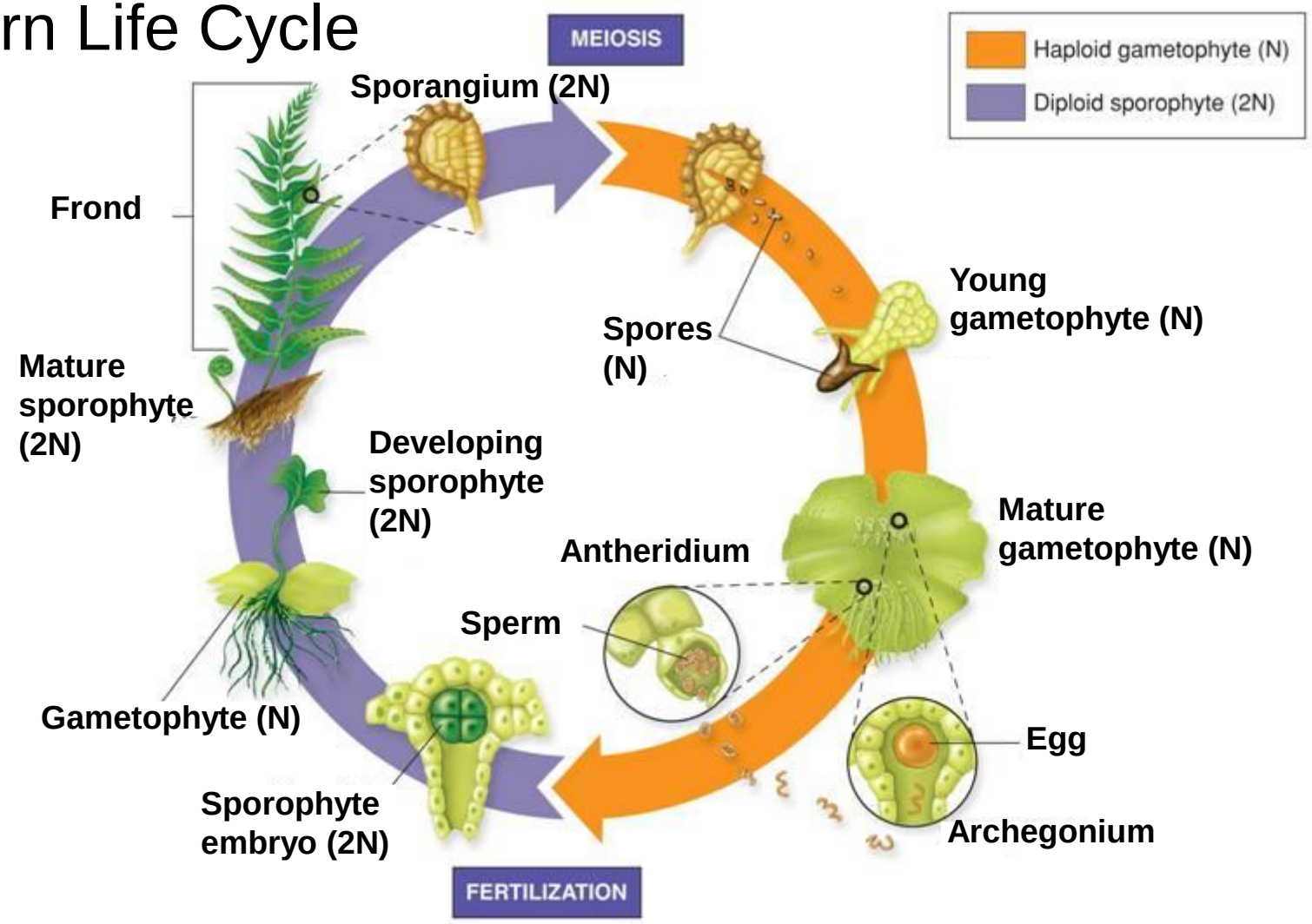
Fern sporophytes develop haploid spores on the underside of their fronds in structures called **sporangia**.

Sporangia are grouped into clusters called **sori**.

The Underside of a Fern Frond



Fern Life Cycle



When the spores germinate, they develop into haploid gametophytes.

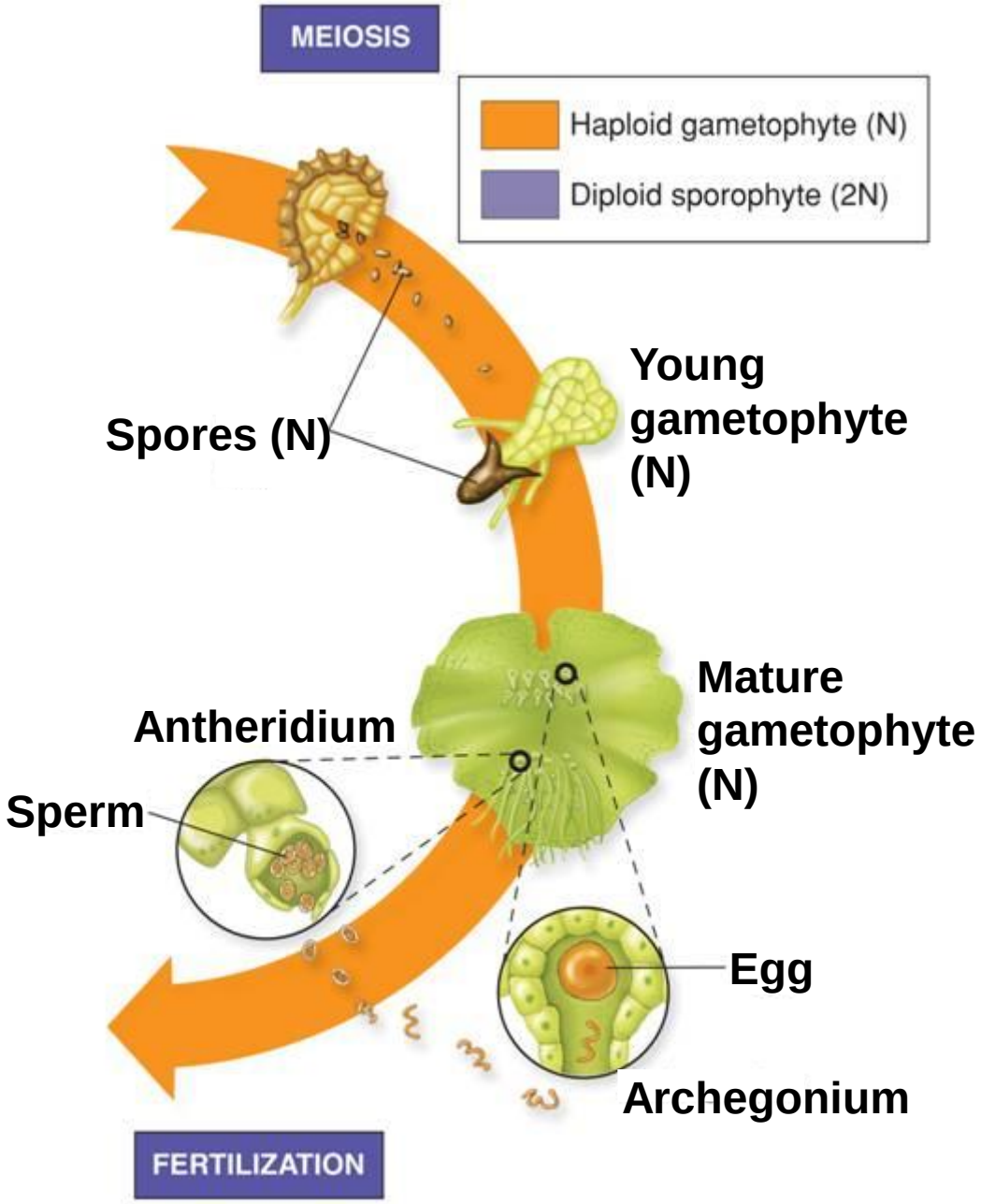
The gametophyte first grows a set of rootlike rhizoids.

It then flattens into a mature gametophyte.

The gametophyte grows independently of the sporophyte.

The antheridia and archegonia are found on the underside of the gametophyte.

Fertilization requires water, which allows the sperm to swim to the eggs.



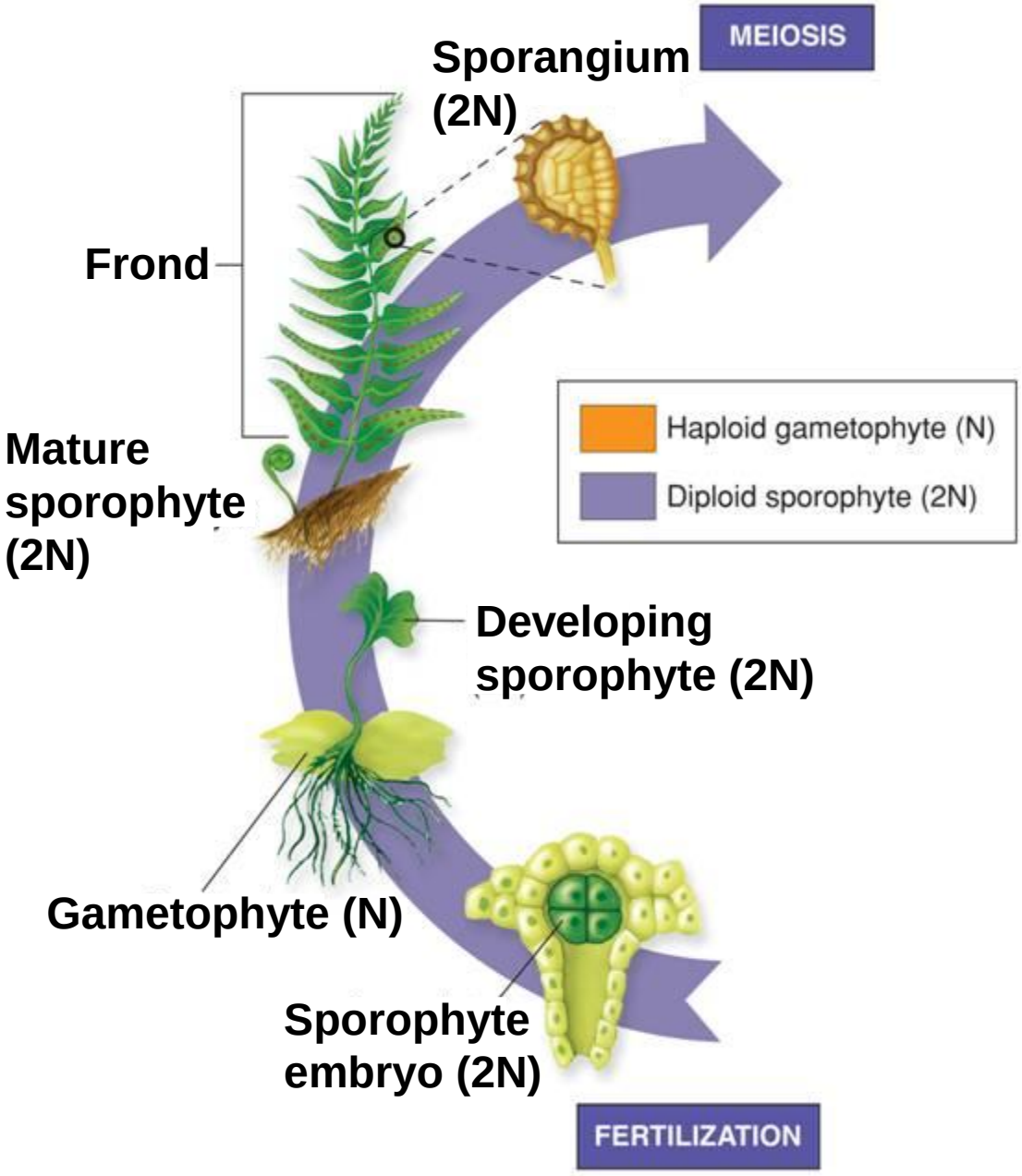
The diploid zygote formed by fertilization, develops into a new sporophyte.

As the sporophyte grows, the gametophyte withers away.

Fern sporophytes often live for many years.

In some species, fronds die in the fall, but rhizomes live through the winter and produce new leaves in the spring.

22-3 Seedless Vascular Plants ➡ Life Cycle of Ferns



22–3 Section QUIZ

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22–3 Section QUIZ

1 Plant cells specialized to conduct water are called

A a. tracheids.

b. veins.

c. sori.

d. phloem.

2 The presence of vascular tissue enables a plant to

a. carry on photosynthesis.

b. carry on lactic acid fermentation.

A c. conduct water and nutrients.

d. make chlorophyll.

3 Ferns are different from mosses because they

a. carry out photosynthesis using chlorophyll.

A b. have vascular tissue to conduct water and nutrients.

c. help expose more of the plant's surface area to sunlight.

d. exchange carbon dioxide and oxygen with the atmosphere.

4 Club mosses and horsetails are similar to ferns because they have

A a. vascular tissue.

b. seeds.

c. sori.

d. fronds.

5 When fern spores germinate, they develop into

a. diploid gametophytes.

A b. haploid gametophytes.

c. haploid sporophytes.

d. diploid sporophytes.

END OF SECTION