land, Australia, and other islands of the area. Their stems bear minute emergences which lack vascular tissue. They are too small to be called true leaves, but they may represent the precursors of the kind of leaf we find in the next group (Lycopsida). The three-lobed sporangia are borne on the tips of short branches which are in the axils of the emergences. Spore mother cells undergo meiosis to form haploid spores which are liberated when the sporangium breaks open. The spores germinate in the soil and produce subterranean, nongreen gametophytes, each of which is a few millimeters long. Associated with the gametophytes are fungi, especially certain Phycomycetes, which probably nourish the gametophytes (Fig. 36-3). Flask-shaped archegonia and globose antheridia develop on the same gametophyte. When mature, an antheridium opens and releases the sperms, each with many flagella, which swim to the archegonia. As usual, one sperm fertilizes an egg.

While still contained in the archegonium, the zygote develops into a young sporophyte consisting of a foot anchored in the gametophyte and a shoot. The foot absorbs nourishment from the gametophyte and passes it on to the sporophyte. After the sporophyte is well developed, with aerial stems and an underground rhizome, an abscission layer separates the foot from the shoot and the sporophyte becomes an independent plant. Later the gametophyte dies and shrivels.

Fig. 36-3. Life cycle of Psilostling.
Whisk fern, *Psilotum*

Figure 24.14

- **sporangia**
- **scale**
- **aerial stem**
- **rhizome**

*ce whisk fern*
strobili

branches

aerial stem

leaves (microphylls)

rhizome

SPOrophyte

root

Club moss, Lycopodium
Figure 24.12
Fern life cycle

1. Sporophyte
2. Leaflet
3. Sorus cross section
4. Prothallus (underside)
5. Egg
6. Young sporophyte on gametophyte
7. Fiddlehead

Fertilization:
- Zygote

Meiosis:
- Haploid (n)
- Spores
- Germinating spore
- Gametophyte
- Rhizoids
- Antheridium
- Archegonium
- Sperm

Figure 32.10
Fern Life Cycle
Figure 26.14

1. Fiddlehead (2N)
2. Frond or leaf
   - Leaflet
   - Undersurface of leaflet
3. Sori
4. Cross section of sorus
5. Sporangium (2N)
6. Spores (N)
7. Undersurface of prothallus (N)
8. Gametophyte
   - Archegonium
   - Antheridium
9. Egg
10. Sperm
11. Sporophyte embryo (2N)
12. Sporophyte (2N)
13. Rhizome
14. Roots

Fertilization and formation of zygote

SEE P. 144