Laboratory 2 - Vascular Plant Reproductive Morphology

Although the mosses and liverworts are not true vascular plants, they display patterns of reproduction which are exactly similar to land plants and which will present us with a starting point for our study of reproductive morphology. Using bryophytes for this lab also provides an excellent perspective for us to make future comparisons on the evolutionary reduction of the gametophyte.

I. Nature and Ontogeny of the Archegonium

A. *Marchantia*

Orient yourself by studying the mature archegoniophore in the liverwort *Marchantia*. What is the nuclear condition (ploidy level) of the leafy body of the liverwort? Of the archegoniophore? Archegonia are formed underneath the umbrella-like splash platform. Study a microscope slide of the archegonia of *Marchantia*. First examine a mature archegonium and locate the neck cells, neck canal cells, ventral canal cell and the egg. Which portion of this mature archegonium constitutes the venter? After you have found all of these, begin looking for all phases in the development of the archegonium. Can you find evidence of the primary cover cell and inner cell? How about the primary ventral cell and the primary canal cell? Describe and draw the ontogeny of an archegonium and list the cells that comprise the axial row.

B. *Mnium*

The moss genus *Mnium* possesses archegonia which are considered by some to be among the most primitive types of archegonia in the "Embryophyta". Notice that the segmentation which was obvious in *Marchantia* is missing in *Mnium*. Locate the archegonial stalk, the venter and the axial row. As you did for *Marchantia*, locate the neck cells and the neck canal cells. Study the slide and locate formative stages in the development of the archegonium. Can you be sure that what you have identified as primary cover cell and central cell are not just early precursors of the archegonial stalk? What characters lead you to believe that the *Mnium* archegonium is primitive?

II. Nature and Ontogeny of the Antheridium

A. *Mnium*

In contrast to most vascular plants, the antheridium of *Mnium* is formed externally and not embedded in gametophytic tissue. Examine a slide of the genus *Mnium* and locate the jacket cells and the spermatogenous tissue. During the ontogeny of this type of antheridium, the initial division between the jacket cell and primary spermatogenous cell occurs after formation of the initial antheridial stalk. In this respect, how does the antheridium of *Mnium* resemble the archegonia? Try to locate a developing antheridium at approxiamately the 8-16 cell stage to see if you can observe the initial segmentation of the jacket and spermatogenous cells. Where is the operculum?

B. *Marchantia*

The antheridia of *Marchantia* are borne within antheridial chambers embedded within the tissues of the antheridiophore. Obtain a slide of an antheridial splash platform and study the antheridia. Locate the spermatogenous tissue and the jacket cells. Did you notice how the immature antheridia are attached to the base of the chamber wall early in their ontogeny? Diagram the stages of antheridial

development. Do you notice the very regular arrangements of the spermatocytes? What happens to this regularity as the sperm are produced?

III. Embryo

A. *Marchantia*

The early development of the sporophyte in *Marchantia* is a good example of an exoscopic embryo. In embryos which are exoscopic, the initial division of the zygote yields an apical pole and a basal pole. In higher plants, whole organ systems can be traced back to certain initial divisions within the zygote. Observe a slide of the young embryo of *Marchantia*. Notice that the archegonium itself is covered by a sheath of tissue which protects the archegonium and the developing embryo. Can you detect which groups of cells arose from the initial division? Obtain a slide of older sporophytes of *Marchantia* and notice that almost the entire sporophyte is one large sporangium that contains sporogenous cells.

IV. Sporophyte and Sporangium

A. Mature Sporophyte of *Psilotum*

We will study the sporophyte of *Psilotum* in greater detail later. For now, observe the living specimen of *Psilotum nudum* in the lab and make a rough sketch of its organography. Where are the leaves, if any? Pay particular attention to the large three-lobed sporangia which are located laterally along the shoot. What type of branching pattern does the sporophyte exhibit?

B. Mature Sporangium of *Psilotum*

In most vascular plants, the sporangium is a eusporangium which is characterized by its initiation from a superficial patch of initials. At maturity the sporangium of *Psilotum* is actually a three-lobed structure called a synangium which is composed of three fused sporangia. Obtain a slide of the sporangium of *Psilotum*. Observe the segmentation of the sporangium into wall cells and sporogenous cells. If the sporangium is mature, numerous spores will be present. Is their nutritive tissue present? Can you tell whether the tapetum is plasmodial or secretory in nature?