A METHOD OF TEACHING THE EVOLUTION OF THE LAND PLANTS

By B. W. Wells.

One of the bêtes noires of elementary botany instruction is the problem of getting across the story of land plant evolution with its complications arising out of the alternation-of-generations situation. I suppose it is safe to say that the majority of students who survive freshman botany do not really grasp the facts of the complete reversal in the food relations of the two generations, the progressive differentiation associated with sex and other fundamental generalities which are familiar to the advanced botanical student.

This failure is primarily due to the fact that the types are taken up one at a time with no genuine opportunity afforded to bring all of the significant types together so they may be automatically compared; for only the comparative method constitutes the vital approach to such an evolutionary problem.

The writer a number of years ago overcame in great part the above mentioned weakness in his teaching by introducing the concentric method of handling the life cycles.

Professor J. H. Schaffner, of Ohio State University, first used the diagrammatic method of presenting the life history of plants by arranging the significant stages at intervals in a circle. These intervals are marked out by radii. And those used by the writer are the ones suggested by him in his Laboratory Guide.

The writer's adaptation of Schaffner's method is involved in requiring the student to draw the life cycles of the type plants in a concentric manner, the lowest in the scale of evolution at the center, the next higher around this, and so on. For this purpose they are furnished a large durable sheet of paper, such as an unfolded genus cover. After the student has finished his laboratory and text study of a liverwort (preferably *Ricciocarpus*) he is introduced to the life cycle method by furnishing him the necessary sketches or the finished cycle, which he is at liberty to copy

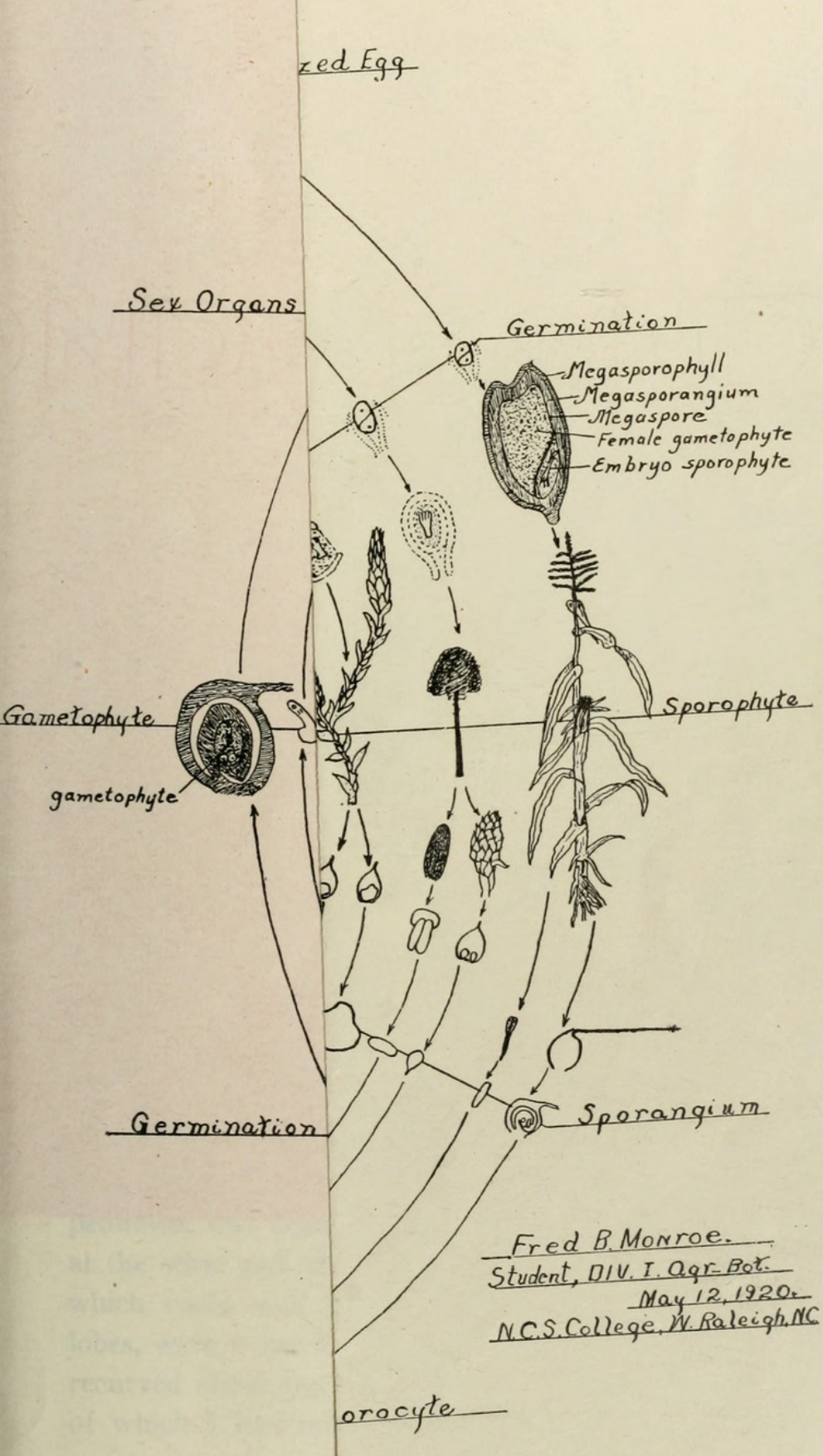
on the innermost guide circle of his large sheet. (The student should have previously drawn lightly the proper number of radii and circles to take care of the types to be offered.) It is well to similarly assist the student with his second cycle until he "catches" the idea. After that he goes it alone. Acquiring his data from all possible sources he organizes it on his sheet where he cannot escape comparing the stages with those of preceding types, with the delightful result that a goodly proportion of the learners really "get the big idea" which is intended for them.

The accompanying plate is the work of an unassisted student, Mr. Fred B. Monroe. Above all it is important that the *students* make this little chart; for the instructor to make a large one (wall chart size) to be used as a basis for mastering the situation would be an unfortunate pedagogical error.

A few comments on some of the desirable features may not be out of place. Homologous structures are on the radii: Opposite radii show contrasting conditions in the two generations, viz., sporophyte *vs.* gametophyte; fertilization *vs.* reduction; sex organs *vs.* sporangia, etc.; on the right of the heavy diagonal line sporophyte structures ($2x$ number of chromosomes) are diagrammed; on the left gametophytic ones (x number of chromosomes). Passing outward along a radius gives a summary of the evolutionary changes in that structure, the sporophyte and gametophyte radii, of course, being of the most significance.

In the higher land plants in which sporophyte and gametophyte tissues remain together it is desirable to indicate this in the drawings on some of the radii by carrying the structures over the dividing line between the generations, differentiating them from each other by drawing one with dotted lines or handling them with different colored inks. Further, as shown in the student's diagram it is desirable to introduce the seed (or grain in the case of corn) in its proper place, diagramming its parts and thus summing up the life cycle structures as they are actually "summed up" in the seed.

The plate as presented is by no means perfect and should not be understood as showing all of the possibilities of the method.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Sex Organs
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Megasporangium
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Female gametophyte
Embryo sporophyte
Gametophyte
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