Earning a good grade requires STUDYING. This is hard work that results in understanding of concepts and active recall of factual information. You cannot master the content of this course, or any other course worth your tuition, if you only study a few days before an exam. You need to learn this material on a regular, weekly basis. Study in a setting that is not distracting when your mind is fresh and your bodily needs have been met. There are lecture notes provided in advance of each lecture. Spend thirty minutes reading these notes before you come to lecture. During lecture you can follow the lecture notes, highlighting the information and concepts that are new to you. Most of the basic information that you will need to know is already written down for you, but you should also make notes to yourself about what you should study out of class. After each lecture you should review this material again, quizzesing yourself on whether you know the definitions of terms, whether you can explain the concepts and processes, and whether you can compare and contrast the material you have just learned with the material presented earlier in the course. Several days before an exam you can focus on synthesizing the information and concepts. Because you have already studied the material as you went along, the review at this stage allows you to refresh your knowledge of details you may have forgotten while strengthening the larger conceptual framework.

1) Any course worth your tuition should present new material that you must learn. The material presented in this course builds upon itself in a systematic fashion. You cannot earn a good grade without learning this material, and you cannot learn the material without attending lecture and studying the material after each lecture. You will be amazed at how learning material as you go along enables you to get much more out of each subsequent lecture.

2) The evolutionary survey presented in this course systematically progresses through the various groups of plants. There is a taxonomy of scientific names that has a nested hierarchical structure of groups within groups. There is also a set of phylogenetic relationships among these groups. From memory, you should be able to list the taxonomy and you should be able to draw the phylogeny for groups at any given level of hierarchical organization. Although there is a correspondence between the taxonomy and the phylogeny, these are two different aspects. All species have a set of phylogenetic relationships with other species based on their evolutionary history (a system of common ancestry), but the taxonomy selectively represents only the big, bold pattern of relationships and attendant evolutionary innovation. Hence, there are also common (informal) names that are used to refer to certain groups that are not part of the formal classification. You should know how these informal names intercalate between the formal ranks of the taxonomy. The groups that are designated in the formal classification may also have common names, and you should also learn the correspondence of the formal names at a given taxonomic rank with the equivalent informal names. By systematically organizing your knowledge of the names of the plant groups and their phylogenetic relationships, you construct a conceptual framework for organizing the information about the various groups and their representative species.

3) To really learn this material, you must train yourself to recall it actively. There is a fundamental difference between simply recognizing information when you see it written, and being able to provide information from memory. Many students delude themselves into thinking that they know the material because it seems familiar when they read it. If you cannot speak the name, state the definition, draw the phylogenetic relationship, or explain the concept, then you
do not really know the material. The top-down approach to constructing a conceptual framework (describe above) should be complemented by a bottom-up approach of learning the details. Buy a few packs of 3x5 index cards (you can use them whole or cut them in half or thirds), and make flashcards. On one side, write a single new term, concept, or name (e.g., strobilus, or heterosporous, or leptosporangiate ferns). On the other side, write an accurate and meaningful definition or explanation. It is frequently helpful to learn the derivation of a word so that it is easily remembered. Carry the cards with you. Whenever you have a few spare minutes (walking across campus, waiting for an elevator, waiting for the bus), look at the term/concept/name side of the card. Try to supply the answer before reading the other side of the card. Periodically shuffle the cards, and periodically review the cards in reverse orientation (from definition/explanation to term/concept/name). If you are consistently able to make the association both forward and backward, then this information is part of your active knowledge. Remove such cards from the active deck, but save them for review before each exam. This method (1) provides an honest test of whether your mind actively knows the material and (2) enables you to learn many of the details during scraps of time that otherwise are wasted. With relatively few minutes of daily practice you can rapidly build your vocabulary of the technical terminology and your knowledge of plant names. You can then use the large blocks of quiet study time to synthesize these details with the organizational framework provided by the taxonomy and phylogeny, as well as the biological concepts presented in the course by reading the corresponding passages in the text, your lecture notes, and the lab manual.

4) A picture is worth a thousand words. There are many images presented in this course. The textbook has beautiful, color photographs and photomicrographs (photographs taken through a microscope), as well as line-drawing illustrations. The lecture notes and lab manual also have many labeled illustrations. Furthermore, you will see many living and preserved plants during the lab sessions. Study these printed images in a way that you develop good mental images. If you can ‘see’ in your mind’s eye the structure of a plant (for example, a sporangium), then it is easier to remember the name of the structure and its function. During the lab sessions, take the time to draw pictures plants and structures not illustrated in the manual. Drawing a picture helps you refine your observation skills, and the picture itself will serve as a reminder of what you have seen. Some of the figures presented in this course are essentially concept maps (for example, the life cycle diagrams), and you should be able to draw these from memory. To master this, copy the diagram once (to learn the details) before drawing it from memory. Then check your drawing against the original to see that it is complete and accurate. On the following day, draw the diagram again from memory without reviewing it in advance. If your drawing is complete and accurate, then you have committed it to memory, and you only need to review it before the exam.

5) When you study your lecture notes, read them out loud to yourself a few related sentences at a time. Then look away from your notes and explain out loud to yourself what was in that segment of the notes. Once again, the idea is to train your mind for active recall. It is also helpful to know the number of items that you are trying to recall. For example, if you are trying to learn the divisions of vascular plants or the orders of the Polypodiales, you should know that there are four and five, respectively, before trying to list the four divisions or the five orders. Real study involving active recall is harder than passive reading because it requires your mind to be actively engaged in the learning. This approach yields real results when it comes to exams and grades.
6) When you think you have studied your notes sufficiently (quietly and without distraction), put away the notes and take out a piece of blank paper. Using your mind's active recall, list the main points and important new terms and concepts of that lecture. Next, add as much explanation and detail as you can. Compare what you have written to your notes. Whatever is missing isn't in your head yet. It is also helpful to compare and contrast the features of different groups of plants. Such higher-level synthesis frequently obviates the need to remember the same details for various groups individually. For example, there is only one group of ferns (the Polypodiales) that produce leptosporangia; all other ferns, and in fact all other vascular plants, produce eusporangia. In contrast, heterospory has evolved independently in three different groups of vascular plants (the Isoetopsida, the water ferns, and seed plants). By knowing this you simultaneously know that all other vascular plants are homosporous.

7) A week or so before an exam, it may help to get together with someone who (like you) has conscientiously studied for this course. Quiz each other, requiring active recall. Remember that reviewing for an exam means reviewing material you already learned, not learning it for the first time. This is your opportunity to really synthesize what you have learned. There is far too much material to learn it all the week before an exam (and other courses will tend to schedule their exams at about the same time this course does). Procrastinating and then cramming just before an exam greatly increases stress level, and rarely results in good grades. By learning the material as the course progresses, you will find it relatively easy to understand the installment presented in each lecture, you will find it easy to incorporate new terminology and concepts into your growing knowledge, and you will find the exams very straight-forward.