Spring 2013

BOTANY 305

Plant Morphology & Evolution,

formerly "Principles of Plant Structure"

4 credits. Intermediate. Biological Sciences

Professor: Dr. Ken Cameron

154 Birge Hall, Dept. of Botany

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Teaching Assistant: Mr. Giovanny Giraldo, Ph.D. candidate (Botany)

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Location: B301 Birge Hall

Integrated Lectures: Tues/Thurs, 9:55-10:45am

& Labs: Tues/Thurs, 1:20-3:15pm or 3:30-5:25pm

Texts: Bell, A. 2008. Plant Form. Timber Press, Portland, OR. (hardcover; 431 pages). Retails for $50. Available for $30 (new) from instructor.

Gifford, E. M. & Foster, A. S. 1989. Morphology and Evolution of Vascular Plants. W. H. Freeman, New York. (out of print). pdf copies of chapters posted in Learn@UW

EVALUATION*

2 Take-Home Written Exams	20%	200 pts (100 each)
4 In-Class Practical Exams	20%	200 pts (50 each)
Research Proposal	7.5%	75 pts
Proposal Peer Review	5%	50 pts
Research Paper	20%	200 pts
Research Presentation	10%	100 pts
Lab Exercises & Notebook	5%	50 pts
Attendance & Class Participation	2.5%	25 pts
		900 pts Subtotal**
Comprehensive Final Exam (optional)	10%	100 pts
		1000 pts Total**

* Note: Graduate students enrolled in the course are required to lead an in-class discussion of a scientific paper in order to earn the full 25pts of Class Participation. See Dr. Cameron for scheduling this. Graduate student research proposal must include at least five (not only two) primary literature references in order to earn the full 75 points.

** Note re: Final Exam. If you are happy with your overall performance on the last day of class, you may opt out of taking the final exam. In this case your grade will be computed out of 900 subtotal points only. If you choose to take the final exam, but do poorly, it will not be held against you. Your percentage based on subtotal points (out of 900) will be compared to your percentage based on total points, including the final exam (out of 1000). The higher of the two will be used to assign your final letter grade. In other words, taking the Final Exam can only help you to improve your grade!

GRADES

A	100-91%
AB	90-86%
B	85-81%
BC	80-76%
C	75-70%
D	69-60%
F	<60%

SYLLABUS

Week One: G&F Chapters 1, 2, 3

T Jan 22 Introduction & History

Lab Botany Greenhouse

Th Jan 24 Plant Tissues

Lab Organ & Tissue Review; Microscopy; Description; Comparative Method

Week Two: Bell pp. 36-73 & 74-121

T Jan 29 Leaves 1

Lab Leaves

Th Jan 31 Leaves 2

Lab Scavenger Hunt in Greenhouses

Week Three: Bell pp. 122-141 & 142-169

T Feb 5 Roots

Lab Roots & Stems

Th Feb 7 Stems

Lab Leaves, Roots, & Stems: Jeopardy!

Week Four: G&F Chapters 4, 5, 6

T Feb 12 **Practical Exam 1**

Lab No lab today, but individual help available from TA as needed

Th Feb 14 Sporangia and Gametangia (TA lecture)

Lab Scanning electron microscope training in Plant Imaging Center (PIC)

Week Five: reserve readings

T Feb 19 Hornworts & Liverworts

Lab Hornworts & Liverworts

Th Feb 21 Mosses / **Pass out Take-home Exam 1 (due Feb 26)**

Lab Mosses

Week Six: G&F Chapter 9 pp. 105-125 & 125-153

T Feb 26 Clubmosses: *Lycopodium*

Lab Clubmosses

Th Feb 28 Spikemosses: *Selaginella*

Lab Spikemosses

Week Seven: G&F Chapter 9 pp. 153-173; & reserve readings

T Mar 5 Quillworts: *Isoetes* **/ ** Research Proposals Due ****

Lab Quillworts

Th Mar 7 Devonian fossils **/ ** Peer Reviews of Proposals Due ****

Lab *Prototaxites* fossil Debate

Week Eight: G&F: Chapter 8, Bell pp. 206-215 & 260-285

T Mar 12 **Practical Exam 2**

Lab Vegetative Reproduction

Th Mar 14 Whisk Ferns

Lab *Psilotum & Tmesipteris*

Week Nine: G&F Chapters 10, (11), 12

T Mar 19 Horsetails: *Equisetum*

Lab Horsetails

Th Mar 21 Eusporangiate ferns

Lab Ophioglossoid and Marattioid ferns

SPRING BREAK: Week of March 25 (EASTER: Sunday March 31)

Week Ten: G&F Chapter 13

T Apr 2 Water ferns

Lab Water ferns: Marsiliales & Salviniales

Th Apr 4 Leptosporangiate ferns

Lab Leptosporangiate ferns

Week Eleven: G&F Chapters (14 pp. 327-334), 15; reserve readings

T Apr 9 **Practical Exam 3**

Lab Carboniferous fossils & coal balls

Th Apr 11 Origin of Seeds; Cycads

Lab Cycads

Week Twelve: G&F Chapter 16 & 17

T Apr 16 Ginkgoes

Lab *Ginkgo biloba*

Th Apr 18 Conifers

Lab Conifers

Week Thirteen: G&F Chapter 14, pp. 334-343; & reserve readings

T Apr 23 ** **Research Presentations** **

Lab **** Research Presentations / Research Paper Due ****

Th Apr 25 Fossil Gymnosperms

Lab Mesozoic Garden at WID; tour and discussion

Week Fourteen: G&F Chapters 18 & 19 pp.522-554; Bell pp.170-197

T Apr 30 Gnetophytes

Lab Gnetophytes

Th May 2 Angiosperm Flowers

Lab Angiosperm Reproductive Morphology **/ Pass out Exam 2 (Due May 7)**

Week Fifteen: G&F Chapter 20

T May 7 Angiosperms

Lab Angiosperm Life Cycle

Th May 9 **Practical Exam 4**

Lab Field Trip?

COMPREHENSIVE FINAL EXAM (Optional): Saturday, May 18 10:05-12:05pm

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Botany 305 Principles of Plant Structure
Independent Research Guidelines

Premise: The study of plant morphology is one that embraces several alternative scientific methods. Practitioners use methods of description, comparison, experimentation, or combinations thereof. As an upper level course in the biological sciences, it is appropriate that the students enrolled in Bot305 not only be exposed to the terminology, specimens, facts, theories, and controversies in the subject, but also its methodology. The study of plant morphology is not a passive science, but an active one. Furthermore, the active process of scientific inquiry in today's world involves several steps, including the development of research proposals, justification of those proposals, peer-review, proposal refinement, data collection, interpretation in a historical context, consideration of others' published work, repeatability, and dissemination of information through written and oral means.

Assignments and Deadlines:

	Points	**% of Grade**	**Deadline**
Written Research Proposal	75 pts	7.5%	Tues a.m., March 5
Proposal Peer Review	50 pts	5%	Thurs a.m., March 7
Research Presentation	100 pts	10%	Tues, April 23
Research Paper	200 pts	20%	Tues, April 23

I. RESEARCH PROPOSAL

At this point in the semester you have been exposed to a variety of different ideas and examples about the ways in which plant cells, tissues, and organs may be modified – usually with some proposed adaptive significance. You have also been exposed to several lineages of land plants: their form, life cycles, and diversity. You have used light microscopy, low magnification stereoscopic microscopy, high magnification scanning electron microscopy, and macromorphological observation by eye. We have not had the luxury of time to observe plant development, but this is possible.

You are asked to develop a research project that can be completed either by yourself or with a single partner. The project must address an aspect of gross, external, plant morphology (as opposed to internal anatomy or genetics). Direct observations and/or data collection must be made - no projects based solely on readings. Some examples are provided below in addition to those from prior students.

The research proposal should be 2-4 single spaced pages. It must incorporate information from at least two outside references (books or journal articles), and address the following questions: 1) What plant or plants will your research focus upon? 2) Where will you access these plant specimens and where do you expect to complete your research? 3) What hypotheses will you be testing or questions will you be addressing? 4) Have others published papers on this subject, what is the historical context for the research? 5) What is your proposed timeline of activities? Can the work be completed in 4-6 weeks? 6) What are the broader scientific implications of your proposed research?

II. PROPOSAL PEER REVIEW

Your proposal (with your name removed) will be randomly assigned to an anonymous peer reviewer, who will be asked to read it and **prepare a 1-2 page written evaluation** of it based on the following criteria: 1) Does the proposal present a testable hypothesis or set of questions to be addressed that are reasonable? 2) What is the likelihood that the researcher will be able to accomplish what they have proposed? 3) Has the researcher shown at least some evidence that s/he has looked into the background of the subject? 4) Is the proposal well written? 5) How might the proposed research be

improved? Are there aspects that should be dropped or added? 6) What are the strengths and weaknesses of the proposal?

III. RESEARCH PAPER

Your final research must be written **in the form of a standard scientific paper** with Title, Abstract, Introduction, Materials & Methods, Results/Descriptions, Discussion, Literature Cited, and supporting figures and tables as appropriate. There is no set page minimum or maximum, but **10-12 double spaced pages of text** seems a reasonable goal. If you have never written a paper in this format, Dr. Cameron and/or the TA can help guide you. Plant morphology tends to be a highly visual science, rather than computational, for example, and so it is likely that you will want to include photographs, drawings, graphs, or other forms of documentation/comparison in your paper. If you choose to work with a partner, you may submit a joint co-authored paper that represents an equal contribution from both researchers.

IV. RESEARCH PRESENTATION

We have nearly 5 hours (i.e., 300 minutes) set aside on April 23 for research presentations. Assuming that some students will present as co-authors, this mean that we have **approximately 10 minutes** available per research presentation. The schedule of speakers will be made in advance depending on which lab section you attend. Everyone is encouraged to attend the full day-long "symposium".

Powerpoint or an equivalent program must be used to deliver your presentation. In general it is best to follow the same format as a scientific paper: Background, Methods, Results, Implications, and Conclusions, but the organization is up to you. With only 10 minutes to speak, you are advised to create no more than 5 slides, and rehearse in advance. Trust me on this!

Not everyone is a gifted public speaker, so your presentation will be evaluated more on its organization, clarity, and layout than on your delivery (although that matters, too).

Just a very few potential research examples for inspiration:

- A comparative study of five North American *Isoetes* species spore morphology using ESEM
- Distribution and density of stomata on the sporophyte of three Wisconsin lycopods
- Comparative phyllotaxy among three succulent plants from different families, evidence for the Fibonacci series
- Elaters and pseudoelaters among horsetails, hornworts, liverworts, and ferns. Are they homologous? How are they similar /different.
- A study on the effect of different soil types on the root morphology and growth of carrot seedlings
- Top to bottom, inside to out – a study of epidermal features of the carnivorous pitcher plant
- Toward the development of a catalog of plant fossils within the Bot305 teaching collection
- Descriptions and comparisons of trichome morphology among species of bromeliads in the genus *Tillandsia*
- Anther structure and modes of dehiscence among six different flowering plants
- A photographic guide to Wisconsin conifers in the winter condition: detailed comparisons among bark, cone, and leaf morphology
- The value of spore morphology in classifying fern genera into families
- Ant domatia: an example of extreme plant structural modification
- Long and short shoots in *Ginkgo biloba*, a unique form of tree architecture