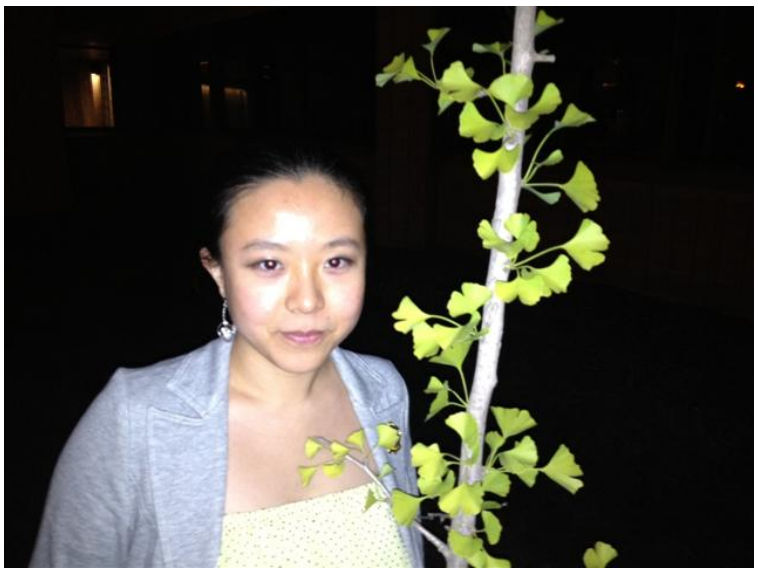
Lakehead University

BIOL-1130-FA



Plant Biology
Laboratory Manual
Fall 2013

Professor:
Dr. Peter Lee

Laboratory Technician:
Dr. Susanne Walford

Contents

A. Cover Image

During a lecture in 2012, students learned they could earn a bonus mark by submitting a photo of themselves with this campus tree! Can you identify it? Hint, this "living fossil" belongs to a clade within the gymnosperms. A larger version of this gymnosperm can be found near the library. Stay tuned for this year's "bonus" quest; it will be announced randomly during lab or lecture!

B. About this Manual

Although many exercises are original and have a "northern" flavour, the contents of this lab manual are in large part borrowed, expanded, or shortened versions of lab exercises presented in various published and unpublished lab handbooks and texts. I would like to express special thanks to James Schaefer, Diana Abraham, and Lynn Ruxton for their efforts on earlier versions of this manual.

Ancient Chinese Proverb:

> I hear and I forget,
> I see and I remember,
> I touch and I understand.

Modern American Proverb:

> The illiterate of the 21^{st} century will not be those who cannot read and write, but those who cannot learn, unlearn, and relearn.
>
> -Alvin Toffler

C. Laboratory Topics for BIOL-1130FA

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Table 1: Laboratory schedule. Labs start the week of September 16; NO labs week 1! **Tuesday sections are F1, F2, F3, F6, F7, F8 and Thursday sections are F4, F5, F9**. Fall term courses commence Monday September 9 and end Monday December 2. The final date to register is Friday September 20 and the final date for withdrawal is Monday November 4. Note: Natural Resource Management and Education dates may differ.

PART 1	**INTRODUCTION and REVIEW**	**Tuesday / Thursday**
Lab 1	Safety, Scientific Method, Field of Plant Biology *Be prepared to go outside!*	Sept. 17 / Sept. 19
Lab 2	Microscopes, Mitosis, Meiosis	Sept. 24 / Sept. 26
Assign. 1	RACER article	Due: TBA
PART 2	**FORM and FUNCTION**	**Tuesday / Thursday**
Lab 3	Cells and Tissues	Oct. 1 / Oct. 3
Assign. 2		Due: TBA
Lab 4	Stems and Roots	Oct. 8 / Oct. 10
Lab 5	Leaves and Photosynthesis	Oct. 15 / Oct. 17
PART 3	**SURVEY of PLANTS and THEIR PREDECESSORS**	
Lab 6	Cyanobacteria and Algae	Oct. 22 / Oct. 24
Lab 7	Non-Vascular Plants	Oct. 29 / Oct. 31
POSTER DUE	Submit to D2L DropBox BEFORE 11:59 pm	**Oct. 29 / Oct. 31**
Lab 8	Seedless Vascular Plants	Nov. 5 / Nov. 7
Lab 9	Seed Plants: Gymnosperms	Nov. 12/ Nov. 14
Lab 10	Seed Plants: Angiosperms	Nov. 19 / Nov. 21
Lab 11	**FINAL LAB BELL RINGER!!**	Nov. 26 / Nov. 28

D. Lecture Topics for BIOL1130FA

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Table 2: Lecture schedule. The following list of topics is subject to change. Students are responsible for material in the chapters indicated. Select lecture materials will be available online. Fall term courses commence Monday September 9 and end Monday December 2. The final date to register is Friday September 20 and the final date for withdrawal is Monday November 4. Note: Natural Resource Management and Education dates may differ.

Week of:	**Topics**	**Text Chapters**
Sept. 9	Introduction, Plant Cells	Chpt. 1, 3
Sept. 16	Tissues, Mitosis	Chpt. 3, 4
	Meiosis, Alteration Generations	Chpt. 12
Sept. 23	Roots	Chpt. 5
	Stems	Chpt. 6
Sept. 30	Stems, Leaves	Chpt. 6, 7
Oct. 7	Classification	Chpt. 16
	Origin of Eukaryotes	Chpt. 17
	Selected Algae	Chpt. 18
WEDNESDAY OCTOBER 9: TERM TEST 1		
Oct. 16	Bryophytes	Chpt. 20
Oct. 21	Bryophytes, Seedless Vascular	Chpt. 20, 21
Oct. 28	Seedless Vascular Plants	Chpt. 21
Nov. 4	Gymnosperms	Chpt. 22
WEDNESDAY NOVEMBER 6: TERM TEST 2		
Nov. 11	Angiosperms	Chpt. 8, 23
Nov. 18	Photosynthesis, Respiration	Chpt. 10
Nov. 25	Water in Plants	Chpt. 9
Dec. 2	Growth	Chpt. 11
As per scheduling: TERM TEST 3		

E. Marking Scheme

LECTURE:	TERM TEST 1	20.0%
	TERM TEST 2	20.0%
	TERM TEST 3	20.0%
LAB:	QUIZZES	12.5%
	SCIENTIFIC POSTER	10.0%
	ASSIGNMENTS	2.5%
	FINAL LAB EXAM	15.0%

Lecture term test 1 DOES NOT INCLUDE ALGAE. Term test 2 covers Algae to Gymnosperms. Term test 3 covers Angiosperms to the end of term material.

There are multiple quizzes this term with ample time for submission. Your lowest quiz mark will be dropped and missed quizzes cannot be made up.

Deduction for late assignments and reports (if granted) will be 5% per day (including weekends). There are two assignments this term.

With regards to assignments, facilitated posters, and test taking, as a student, you are responsible for knowing Lakehead's policies for ACADEMIC MISCONDUCT and ACADEMIC DISHONESTY.

F. Introduction to the Laboratory Program

a) Welcome

Biology is the **science** of life. A biology credit course in "Plant Biology" should familiarize you with the evolution and diversity of plants, bring to your attention their crucial ecological role on this planet, and engage you in the critical thinking practiced by biologists. These are the aims in the labs and lectures of BIOL-1130.

Topics explored in labs and lectures generally coincide. However, labs provide additional opportunities for you to learn by seeing, doing, and asking questions of yourself, fellow students, and lab instructors. To stimulate your interest in plants, be sure to check out a slide show presenting some unusual talents plants possess (http://www.scientificamerican.com/article.cfm?id=what-plants-smell-plant-unusal-talents)!

Towards the end of the course, please provide feedback by completing Section B. These can be dropped off anonymously in the Plant Biology Dropbox near the microscope cabinets (between CB3012 and CB3013).

b) Required Texts

This manual is mandatory for this course as it includes lab and lecture schedules, marking schemes, and rules for writing tests, quizzes, and assignments. Additional handouts are generally not required although additional materials may appear on the D2L course web site (e.g. lecture slides). In addition, a PDF version of this manual will be posted which you can upload to electronic devices. Although you can print any pages required, purchasing a hard copy from the book store is likely more economical.

The required textbook is Bidlack and Jansky (2014). Some students find the images in Rushforth et al. (2012) (or an older version) helpful. Your teaching assistants (TAs) have a copy during each lab; just ask to view it. Caution: taxonomy in older atlas editions and textbooks may be dated; always refer to the current textbook, Bidlack and Jansky (2014)!

PLEASE, WRITE YOUR NAME AND EMAIL IN YOUR BOOKS. If they are left in a lab or lecture, this is the only way they can be returned to you!

c) Overview of the Labs

Ten (10) lab sessions and a bell ringer test are scheduled this term (Table 1). A review session outside lab hours will be available before the final bell ringer test. Since the review is outside regular lab slots, all material cannot be displayed and TAs and lab technicians are not necessarily available the entire time. Therefore, spend YOUR weekly lab sessions wisely! Complete all sketches and questions found in this manual. Make summary charts. Attempt all quizzes. Add additional notes and drawings to this manual to help YOU learn the material.

Detailed, labeled drawings will be valuable later as you try to recognize the internal and external anatomy of plants. When making drawings, you are trying to compromise between working quickly (so that you can get through all lab material) and providing enough detail to later jog your memory. For example, when drawing a stem cross section, it would not be wise to try to draw every cell. Rather, outline and label the general tissue types (e.g., vascular bundle, ground tissue, cortex), then select one vascular bundle to draw in cellular detail, labeling phloem, xylem, collenchyma, and ground tissue. Artistic merit is not important, utility is! Label your drawings clearly so that anyone (even you when you study for the exam) can interpret them.

Each lab begins with a list of objectives. Read them over before and after the lab session to verify your progress. Try to answer as many questions as possible ahead of time. Review your text and lecture notes. Go on the internet (e.g. Google Images) to see if slides and pictures you will look at during lab are available. If you come prepared, your lab time can be spent reviewing materials, discussing answers to concepts you are unsure of, and confirming your knowledge.

Each lab contains words in **bold** type. Some are titles and subtitles. Some are safety precautions. However, many are **important biological terms**. You must be familiar with these by the end of each lab. A useful practice is listing bold words, defining them, and coming up with a plant related example. A list of the roots of common biological words is

included (Section J.); learning these will help you with basic definitions.

Some words in the lab are in *italics*. These are usually the Latin genus and species names which are unique to the organisms we study. The genus name is ALWAYS capitalized; the species name is ALWAYS in lower case! Following this nomenclature, humans are referred to as *Homo sapiens*. If you are not typing the genus and species (as in a quiz, test, or assignment), you **MUST** underline it (e.g. Homo sapiens), otherwise it is incorrect and part marks are NOT awarded.

Each lab concludes with a "Post-Lab Check List". Ensure you have completed all the items listed before you leave the lab. Information on quizzes and assignments has been inserted at relevant locations in this manual. Transfer dates into your personal day planner (you can get a free planner, with coupons, from the LUSU office)! A calendar MAY be set-up on D2L.

This manual concludes with a chart summarizing characteristics of the phyla we study (Appendix C). You will benefit by completing the chart after each lab in "Part 3: SURVEY of PLANTS and THEIR PREDECESSORS" and revising it at the end of term. An Excel version will be posted on D2L. This chart can be used to compare major similarities and differences amongst the taxonomic groups thus aiding your studying for the final bell ringer. Feel free to add additional columns and notations; whatever helps you learn the material!

d) Getting Organized

Your knowledge of plant biology will improve if you take a systematic approach.

- Read this lab manual and answer as many questions as possible PRIOR to lab. This helps you to take advantage of the lab period itself and organizes your studying.
- Review relevant textbook chapters; use the glossary for definitions.
- Make additional notes and sketches for each lab as appropriate; don't rely solely on the fill-in-the-blank figures!
- Use your lab time as study time!
- Refrain from carrying out activities to the satisfaction of instructors. Don't rush to finish as quickly as possible. You will gain the most by becoming actively involved in YOUR learning process!
- Make educated guesses about experiments; hypothesize! Consider how you could alter the experiment to answer a different research question. What other questions does your experiment raise? Start thinking like a scientist!
- Work on the taxonomic summary chart each week of Part 3. Consider the similarities and differences among phyla before the bell ringer.
- Be on time for your lab section! Important information and reminders are presented at the beginning.

- Attempt all quizzes until you get them right! These are VERY similar to the bell ringer exam. To practice for the Bell Ringer, try writing out your answers to multiple choice type questions BEFORE looking at the possible choices. Spelling counts on the Bell Ringer!

- You **MUST** write your quiz in your assigned lab section of D2L. Quizzes cannot be marked otherwise.

- If a report or quiz is due, submit it in ON TIME! The rules that may have applied in high school DO NOT APPLY HERE. The D2L quizzes and DropBoxes close promptly as scheduled. Post early; your computer or internet connection breaking down that day is not a valid excuse.

- You CANNOT "make up work" or "do extra work" at the end of the term to pass this course.

- Retain all term work, quizzes, tests, and assignments in case there is a discrepancy between the mark you think you have and the one posted online. Marks will be posted to the course site for you to confirm. Bring discrepancies to the attention of the lab technician immediately (i.e. NOT at the end of term).

- See the course calendar with regards to Lakehead's regulations for Special Examinations http://mycoursecalendar.lakeheadu.ca/pg37.html. Any special exam in BIOL-1130FA is CUMULATIVE (i.e. it covers course content for the ENTIRE TERM!)

G. Grading Policy

a) Lab and lecture tests and quizzes

- The final bell ringer **MUST** be written in pen to be eligible for mark revision.

- Lab reports or assignments **MUST** be typed unless they are due during lab.

- Electronic marking forms for lecture tests/exams **MUST** be filled in using a soft lead pencil so that you can correct any mistakes. The student must supply both pencil and suitable eraser. See Fig. A.1 for example.

- Lectures and labs are **NOT** separate courses; you are responsible for all material covered in both for ALL quizzes, tests, and assignments.

- Adding mistakes are to be given to the lab technician for correction THE SAME DAY as handed back.

- If you feel you deserve additional marks for a question, be prepared to argue why! Submit your written arguement to the lab technician for re-marking. **Warning:** Your ENTIRE paper will be remarked and your new mark may end up lower!