

LAKEHEAD UNIVERSITY

BIOL-1130-FA



**Plant Biology
Laboratory Manual
Fall 2014**

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A. About the cover

This is the Plant Biology class of 2012 posing for the camera while out on their campus walk! How many major groups of plants will you identify on your tour? Could there be a “bonus” quest waiting among them? Attend ALL labs to find out more.

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manual are in large part borrowed, expanded, or shortened versions of lab exercises presented in various published and unpublished lab handbooks and texts.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.

Significant re-arrangement of lab activities for 2014 has (hopefully) aligned the lab material to the lecture material. In addition, a new experiment comprises the content for your scientific poster. Therefore, older versions of the lab manual should be discarded. Back by popular demand are in-class drawings and in-class quizzes!

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 21st century will not be those who cannot read and write,
but those who cannot learn, unlearn, and relearn.

-Alvin Toffler

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C. Laboratory topics for BIOL1130FA

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Table 1: Laboratory schedule. Labs start the week of September 15; NO labs week of September 8! **Tuesday sections are F1, F2, F3, F6 and Thursday sections are F4, F5.** Fall term courses commence Monday September 8 and end Monday December 1. The final date to register is Friday September 19 and the final date for withdrawal is Tuesday November 4. Note: Natural Resource Management and Education programs may differ. Consult the course calendar for further information. Assignment and Quiz due dates appear on the D2L calendar. Additional requirements are found in this lab manual.

PART 1 FORM AND FUNCTION		Tuesday / Thursday
Lab 1	Field of Plant Biology <i>Be prepared to go outside!</i>	Sept. 16 / Sept. 18
Lab 2	Cells, Tissues, Mitosis, Meiosis	Sept. 23 / Sept. 25
Lab 3	Plant Organs (Stems, Roots, Leaves)	Sept. 30 / Oct. 2
Mandatory Attendance		
Lab 4	Practising the Scientific Method	Oct. 7 / Oct. 9
PART 2 SURVEY of PLANTS and THEIR PRE-DECESSORS		
Lab 5	Cyanobacteria and Algae	Oct. 14 / Oct. 16
Lab 6	Non-Vascular Plants	Oct. 21 / Oct. 23
Lab 7	Seedless Vascular Plants	Oct. 28 / Oct. 30
Lab 8	Seed Plants: Gymnosperms POSTERS DUE via D2L	Nov. 4/ Nov. 6 Nov. 11 / Nov. 13
Lab 9	Seed Plants: Angiosperms	Nov. 11 / Nov. 13
Lab 10	Review lab	Nov. 18 / Nov. 20
Lab 11	FINAL LAB BELL RINGER EXAM	Nov. 25 / Nov. 27

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	Textbook chapters
Sept. 8	Introduction, Plant Cells	1, 3
Sept. 15	Tissues, Mitosis	3, 4
	Meiosis, Alteration Generations	12
Sept. 22	Roots	5
	Stems	6
Sept. 29	Stems, Leaves	6, 7
Oct. 6	Classification	16
	Origin of Eukaryotes	17
	Selected Algae	18
WEDNESDAY OCTOBER 8: TERM TEST 1		
Oct. 13	Bryophytes [no class Thanksgiving Monday]	20
Oct. 20	Bryophytes, Seedless Vascular	20, 21
Oct. 27	Seedless Vascular Plants	21
Nov. 3	Gymnosperms	22
FRIDAY NOVEMBER 7: TERM TEST 2		
Nov. 10	Angiosperms	8, 23
Nov. 17	Photosynthesis, Respiration	10
Nov. 24	Water in Plants	9
Dec. 1	Growth	11
As per scheduling: TERM TEST 3		



Quizzes and Assignments are outlined in this lab manual. Check your due dates! Attending lab sessions are the best way to keep up with lab requirements.

E. Marking scheme

LECTURE:	TERM TEST 1	20.0%
	TERM TEST 2	20.0%
	TERM TEST 3	20.0%
LAB:	ASSIGNMENTS	7.5%
	QUIZZES	7.5%
	POSTER	10.0%
	FINAL LAB EXAM	15.0%

Lecture tests MUST be written during the assigned date and time! Term Test 1 DOES NOT INCLUDE ALGAE. Term Test 2 covers Algae to Gymnosperms. Term Test 3 covers Angiosperms to end of term. Questions are derived from, but not limited to, material presented in lecture, the textbook, and labs.



Quizzes are given this term and administered via D2L. Since missed quizzes cannot be made up, your lowest quiz mark will be dropped. You are allowed 10 attempts for each quiz, with only your highest mark for each quiz recorded. Consider quizzes as an opportunity to test your knowledge of lab material!

Assignments are given this term. Most are due during the lab section for which you have registered and may not be made up. One assignment is a take home one and submitted at a later date. The deduction for take home assignments and your scientific poster (if extension is granted) will be 5% per day (including weekends). Your individual **scientific poster** is worth 10%. It is based on a research experiment which YOU CONDUCT during lab (i.e. you must be present; attendance will be taken!) This poster is submitted online via the D2L DropBox. A poster template will be provided via D2L. Although experiments are conducted in groups, EACH STUDENT must submit an original presentation of their work. A marking rubric will be provided. See Lab 4 for additional details.



With regards to your responsibility as a student, review the [Code of Student Behaviour and Disciplinary Actions](#) for Lakehead University students.

F. Introduction to our laboratory program

a) Welcome

Biology is the **science** of life. A credit course in “Plant Biology” will 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. Significant rearrangement of labs for 2014 means older versions of the lab manual are not accurate. Lab activities provide additional opportunities for you to learn by seeing, doing, and asking questions of yourself,

fellow students, and lab instructors. Do you consider plants as being quite different from “higher” animals? Perhaps this ASAP Science video (<http://www.youtube.com/watch?v=u2GWd2j3qJ8>) will change your view.

Towards the end of the course, please provide feedback on the labs by completing Section B. Forms can be dropped off anonymously in the wooden box next to the microscope cabinets (between CB3012 and CB3013). Thanks!

b) Required texts

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

The required text is “Stern’s Introductory Plant Biology” (Bidlack and Jansky, 2014). Previous students find the images in Rushforth et al. (2012) helpful. Your teaching assistants (TAs) have a copies of both for your review. Caution: Taxonomy in older atlas editions and textbooks may be dated; please refer to the current textbook edition!

PLEASE, WRITE YOUR NAME AND EMAIL IN ALL YOUR BOOKS. If they are left behind in a lab or lecture, this is the only way we return them to you!



c) Overview of lab activities

Nine (9) lab sessions, a review session, and a bell ringer exam are scheduled this term (Table 1). Although all material cannot be displayed during the review, it is all fair for the exam. Therefore, spend YOUR weekly lab sessions wisely! Complete all sketches, questions, and assignments found in this manual. Make summary charts and study cards. Attempt all quizzes. Add additional notes and drawings to help YOU learn the material. Taking pictures of material and leaving early HAS NOT been a successful strategy in the past. If you do take pictures, add names and labels in PowerPoint; design your own quizzes!

Detailed, labelled drawings become invaluable as you learn to recognize similarities and differences in the internal and external anatomies of plant groups. When making drawings, you are compromising between working quickly (so that you can get through all lab material) and providing sufficient 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, labelling phloem, xylem, collenchyma, and ground tissue. Artistic merit is not important; utility is! Label your drawings clearly so that anyone can interpret them (especially important for marks.) Drawing assignments are designed to hone your skills!

Labs begin with a list of objectives, which can be used to verify your overall progress. Review



your lecture notes, textbook, and lab manual as you attempt to answer as many questions as possible BEFORE your lab session. Consider using Google Images to find slides and demos you will view. However, but don't always trust the labels! If you come to lab prepared, your time can be spent studying materials, discussing answers to concepts you are unsure of, and confirming the knowledge you acquire.

Lab descriptions contain words in **bold** type. Although some are titles, subtitles, and safety precautions, many are **important biological terms** and concepts. Learn these by the end of each lab. Try listing bold words, define them, draw them, and come up with a plant related example. The prefixes and roots of common biological words are included in Section J.; studying these now will help you with basic definitions later!

Some words in the lab manual are in *italics*. These are typically 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! Therefore, from this nomenclature, humans are referred to as *Homo sapiens*. If you are hand writing the genus and species (as on a quiz or assignment), you **MUST** underline (separately) both names (e.g. Homo sapiens), otherwise, marks will be deducted.



Labs conclude with a “Check list”. Ensure you have completed all the items listed before you leave. Information on quizzes and assignments has been inserted at relevant locations in this manual. Please record due dates into your personal day planner (free planners, with coupons, are available from the LUSU office in the tunnel!) A calendar MAY be utilized 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 “SURVEY of PLANTS and THEIR PREDECESSORS”. An Excel version will be posted on D2L. Additionally, large charts will be posted in the lab for each lab section. Students are expected to contribute to filling these in each week. Your TA will help, but not give you all the answers! Charts will compare major similarities and differences amongst the taxonomic groups and aid your studying for the final bell ringer. Trends will become apparent. If you like, add additional columns and notations; use whatever means necessary to learn the material!

d) Getting yourself organized for success

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

- Read this lab manual, answering as many questions as possible PRIOR to lab. This will help you to take advantage of the lab period itself and organize your studying. Pre-lab talks by TAs will highlight important items for the section, not reiterate material from the lectures.
- Review relevant textbook chapters; use the glossary for definitions.
- ATTEND ALL LABS! Don't miss out on useful hints and tricks.
- Make additional notes and sketches for each lab as appropriate; don't rely solely on the fill-in-the-blank figures!

- Use lab time as study time! Study 3 h per week now, or attempt to study 27 h later while trying to finish your poster and cram for other classes.
- Refrain from carrying out activities simply to satisfy instructors. Don't rush to finish as quickly as possible. You will gain the most of this experience by becoming actively involved in YOUR learning process!
- First attempt an online quiz with your book closed? How did it go? Adjust your studying time appropriately!
- Make educated guesses about experiments; hypothesize; think outside the box! Consider how you could alter an 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 2. Consider the similarities and differences among phyla before the bell ringer. Look for trends which make remembering information easier.
- Be on time for your lab section! Important information and reminders are presented at the beginning.
- Attempt all online quizzes until you get perfect! These questions 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 quizzes and submit assignments as per the lab section YOU registered for, whether this is in D2L or in-class. Quizzes WILL NOT be marked otherwise.
- If a report or quiz is due, submit it in ON TIME! Rules that applied in high school DO NOT APPLY HERE. D2L quizzes and DropBoxes close promptly as scheduled. Post early; your computer or Internet connection breaking down during the final hour IS NOT a valid excuse.
- You CANNOT “make up work” or “do extra work” at the end of the term to pass this course or get a better grade.
- 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 on-line. Marks are 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).
- Refer to the course calendar with regards to Lakehead's regulations for Special Examinations (<https://www.lakeheadu.ca/current-students/examination/special-examinations>). A special exam in BIOL-1130FA is CUMULATIVE (i.e. it covers course content for the ENTIRE TERM!) Application reminders typically appear under MyInfo. NOTE: The university charges a fee.



G. Grading policy

a) Tests and quizzes

- The final bell ringer **MUST** be written in pen to be eligible for mark revision.
- All in class quizzes **MUST** be written in pen for mark re-evaluation. Drawing assignments may be done in pencil (refrain from using colour), although final labels should be in ink.
- Electronic marking forms (ParSCORE sheets or Scan-Trons) for lecture tests **MUST** be filled in using a soft lead pencil, enabling you to erase and correct any mistakes. The student must supply both pencil and a suitable eraser. See Fig. A.1 for an example. If you have quite a few corrections, please fill in a new sheet. You should also circle answers on the test paper itself. There is no penalty for incorrect answers (so guess!)
- Lectures and labs are **NOT** separate courses; you are responsible for all material covered for ALL quizzes, tests, assignments, and the poster.
- Addition errors in marking are to be given to the lab technician for correction **THE SAME DAY** as they are handed back.
- If you feel you deserve additional marks for a question, be prepared to argue why! Submit your written argument to the lab technician for re-marking. **Warning:** Your **ENTIRE** paper will be remarked and your new mark may end up lower!
- If a quiz, assignment, test, poster, or due date is missed, the lab technician or professor (lab or lecture, respectively) must be notified **within 24 hr** before you will be **considered** for any “make up” test, quiz, or assignment! After initially notifying the instructor, if ill, a doctor’s certificate **MUST** be presented within seven (7) days of the original test date. Sleeping in, forgetting, or being “too busy” with other work **DO NOT** warrant consideration for a “make up” test, assignment, or quiz.
- The use of cell phones and other electronic devices is **FORBIDDEN** during in class quizzes, tests, and exams. Please turn them off!
- During in class quizzes and tests, **ALL** books, water bottles, and miscellaneous paraphernalia **MUST** be stored **UNDER THE DESKS**; the desk **MUST** be cleared before quizzes and tests begin. Do not remove **ANY** items until the time has ended and TAs have collected all papers.
- For the bell ringer, a schedule will be posted outside the labs (grey cabinets) **AND** on D2L. Your specific writing time will occur during your regular lab section; there will be no conflicts! Arrive 5 min early and line up outside CB3015.
- During the bell ringer all bags, water bottles, jackets, and hats **MUST** be stored on the back bench as instructed by TAs. **YOU ONLY NEED A COUPLE PENS WHEN GOING FROM STATION TO STATION!** Valuables should never be left in the hallways. The department is not responsible for lost or stolen items.

b) Assignments and poster

Assignments are due throughout the semester. Some assignments are due **BEFORE** you leave the lab and **MUST** be handed to TAs at the time. Other assignments are reliant on material learned in the lab and will require further refinement. All assignments have due dates that will be strictly adhered to. See above for late assignments and posters with regards to illness. A 5% per day deduction (including weekends) will be applied to take-home assignments and the poster.

H. Safety guidelines

The **Department of Biology Safety Policy** is included at the end of this manual (Appendix D). Please review it. Updates will be posted in the lab rooms. Additional precautions for BIOL1130-FA labs are listed below. Further information will be conveyed during your first lab (Section 1.2.2).

- A fire extinguisher, fixed eye wash station, and first aid kit are located in the prep hallway (CB3014; between the teaching labs CB3013 and 3015). Additional eye wash bottles are in each lab room (CB3013, CB3015), nearest the front sinks.
- An emergency shower is in front of the prep room door (CB3014). Additional showers are found throughout the third floor.
- Emergency information is available by each exit in the lab.
- You **MUST** notify TAs and lab technicians **immediately** if you have injured yourself.
- Phones for emergencies are located in CB3014A and CB3011A. An emergency push button station is near the double elevators on the third floor.
- Lakehead University: Nurse/Doctor: 343-8397.
- Lakehead University Emergency: 8911 (if using cell phone dial 343-8911). Note that calling from an LU phone ensures that security immediately knows your location. Security is in the best position to help fire and first aiders find your location on campus (i.e. you will not need to give directions).
- Clean your glassware and slides when done.
- **THROW COVER SLIPS AWAY IN THE GLASS DISPOSAL BOX PROVIDED!** Wash and dry slides and return them to folders at the front (be respectful of classmates in other lab sections). If you are not sure, **ASK!**
- **NEVER** discard glass in sinks or garbage cans where someone else can cut themselves! Discard broken glass in designated glass disposal bins. Don't pick up broken glass from the floor; a dustpan and broom are located in CB3014.

