



**The effect of ethylene treatment on tomato ripening.** Tomatoes on the right were treated with 100 ppm (0.01% [v/v])  $C_2H_4$  for 3 d at room temperature, while those on the left were untreated. This demonstrates the climacteric (ethylene-responsive) nature of tomato fruit. From Rost *et al.*, *Plant Biology*, 1998 (fig. 15.16).

## Biotechnology of Plants

Biology 3470 | Winter 2018

### Course objectives

By the end of this course, you will possess the following knowledge:

#### A. Scientific concepts:

- A practical understanding of the cardinal importance of plant metabolism in the biosphere
- Knowledge of how plant metabolism may be manipulated to make products of high agronomic value
- Comprehension of the ethics and realities of plant biotechnology
- Knowledge of techniques used for local food production, and its benefits and challenges
- Knowledge of the benefits of public education about native and exotic plants
- The ability to think critically about ethical issues surrounding food production
- An in-depth understanding of key processes of plant physiology and biochemistry at an advanced level. Examples may include:
  - Photosynthesis and gas exchange
  - Water and nutrient transport and utilization
  - Energy metabolism
  - Carbon partitioning
  - Flowering and reproduction
  - Plant growth regulators and their roles as signaling molecules
  - Plant responses to stress

#### B. Practical scientific techniques:

The ability to perform:

- Plant culture and growth monitoring under a variety of conditions and with different species
- Statistical interpretation of results

C. Broader learner outcomes:

Comprehension of how to:

- Write a scientific paper in the proper format
- Write a “popular” article about a plant that is useful to people, based on information obtained during a field trip
- Read, interpret and extract useful information from a primary scientific journal article and discuss it with your peers

Lectures

Held in the telepresence facility in Orillia (OA 2020) and Thunder Bay.(AT 5041).  
W and F, 10:00 – 11:30 AM, T and Th.

Instructor            David Law  
Office:                OA 3004 (in Orillia)  
Email:                [dlaw@lakeheadu.ca](mailto:dlaw@lakeheadu.ca) (preferred contact method). Please use this email address to contact me, not the email within D2L. I will check my email daily Monday to Friday, and will try to respond to your questions as quickly as possible during those days.  
Phone:                705-330-4008 x2646  
Office hour:        W 11:30 – 12:30 PM. Orillia students can see me in person; TB students can talk to me after class or make an appointment to talk on the phone, FaceTime or Skype. Otherwise, let me know via email if you’d like to talk and we’ll set up a time that works for both of us.

Labs

T, 11:30 AM - 2:30 PM (starting Jan. 16)

|              |                  |  |
|--------------|------------------|--|
| Orillia:     | Location:        | OA 3002  |
|              | Lab coordinator: | Usha Menon ( <a href="mailto:umenon@lakeheadu.ca">umenon@lakeheadu.ca</a> )            |
| Thunder Bay: | Location:        | CB 3012  |
|              | Lab coordinator: | Christina Richard ( <a href="mailto:crichar3@lakeheadu.ca">crichar3@lakeheadu.ca</a> ) |
|              | TA:              | Statton Eade ( <a href="mailto:sfeade@lakeheadu.ca">sfeade@lakeheadu.ca</a> )          |

MyCourseLink/D2L

All course information is available on the course website.

**Calendar description** (from

<http://navigator.lakeheadu.ca/Catalog/ViewCatalog.aspx?pageid=viewcatalog&topicgroupid=12718&entitytype=CID&entityid=57921&loadusercredits=False>)

**Biology 3470 Biotechnology of Plants**

Facts and myths surrounding plant biotechnology, domestication of modern crop plants, photosynthesis and primary assimilation of inorganic nutrients, plant growth regulators, morphogenesis, tissue culture, water relations and transport, and plant movements and directional growth.

Credit Weight: 0.5

Prerequisite(s): Biology 2230 and 2910 or permission of the instructor

Offering: 3-3; or 3-3

Notes: An additional fee (see Miscellaneous Fees) is required for this course.

Course Classifications: Type C: Engineering, Mathematical and Natural Sciences

**Textbook**

No required textbooks, but see the **Supporting material** list below for reference material that should help you understand the course material.

**Marking scheme**

The lab component will count for 35% of the course's marks and the lecture component 65%, as follows:

**A. Laboratory**

See mark breakdown in lab manual.

|                  |           |
|------------------|-----------|
| ● Total for labs | <b>35</b> |
|------------------|-----------|

**B. Lecture**

|                 |          |
|-----------------|----------|
| ● Participation | <b>5</b> |
|-----------------|----------|

|                  |           |
|------------------|-----------|
| ● Midterm exam 1 | <b>15</b> |
|------------------|-----------|

|                  |           |
|------------------|-----------|
| ● Midterm exam 2 | <b>20</b> |
|------------------|-----------|

|              |                  |
|--------------|------------------|
| ● Final exam | <b><u>25</u></b> |
|--------------|------------------|

|                    |            |
|--------------------|------------|
| <b>TOTAL MARKS</b> | <b>100</b> |
|--------------------|------------|

### Student participation

All course participation will be done using a “clicker” system. You will need to [buy from i>clicker](#) an i>clicker/REEF app for your smartphone (choose your portable device’s operating system under “Student Apps”; this will take you to the Android or iOS app stores). Bring your device with the app on it to each class. You will use it to answer questions in class and receive participation marks.

To link your app to the course, search for the course under my name at Lakehead-Orillia: “BIOL 3470 2018W”, then add it to your list of courses. The cost is around \$21 for a 6-mo subscription, which is cheaper than a physical remote.

Five percent of your final mark is allocated to participation. In each lecture, you will use the clicker to answer questions that are based on the course material using the i>clicker during my lectures. The 5% participation mark will be equally weighted for

- attendance (2.5%), and
- correct answers (2.5%).

Therefore, to receive a high participation mark, you have to be both physically and mentally present in class!

You may miss a maximum of 3 lectures without penalty. Additional information on the technology will be given in the first class.

**Lecture schedule and important dates** (tentative and subject to change)

| Week of: | Topics  | Reading                           |
|----------|---|-----------------------------------|
| Jan. 8   | Introduction  | slides                            |
|          | History of agriculture  | slides                            |
| Jan. 15  | Examples of plant biotechnology   | slides                            |
|          | Local food production   | slides                            |
| Jan. 22  | Water and water relations   | H&H chp 1; 2.1 to 2.3             |
|          | Food crop in focus: bananas   | slides                            |
| Jan. 29  | Case study: Schmeiser vs. Monsanto  | slides                            |
|          | <b>Midterm exam #1: Fri. Feb. 2</b>   |                                   |
| Feb. 5   | Mineral nutrition   | H&H chp. 3.3 to 3.3; 4            |
|          | N assimilation  | H&H chp. 11                       |
| Feb. 12  | Study break   |                                   |
| Feb. 19  | Food crop in focus: the potato  | slides                            |
|          | Organic agriculture   | slides                            |
| Feb. 26  | The business of plant biotech   | slides                            |
|          | <b>Midterm exam #2: Fri. March 2</b>  |                                   |
| March 5  | Photosynthesis - light-dependent reactions  | H&H chp. 7                        |
|          | Photosynthesis: the light-independent reactions<br><i>Final day for course withdrawal: Friday March 9</i> | H&H chp. 8                        |
| March 12 | Starch and sugar synthesis  | H&H chp. 9.1 to 9.3               |
|          | Food crop in focus: maize   | Slides                            |
| March 19 | Plant biotech ethics  | slides                            |
|          | Flowering and reproduction; Terminator technology   | H&H chp. 25.1 to 25.2;<br>handout |
| March 26 | Stress responses  | H&H chp. 14, 15                   |
|          | Plant productivity  | H&H chp. 12                       |
| April 2  | Secondary metabolites   | H&H chp. 27.1 to 27.4             |
|          | Case study: StarLink maize<br><i>Last day of class: Friday April 6</i>                                    | slides                            |

**Supporting material**

There are no required textbooks, but the following textbooks will likely be useful. Note that even if a physical textbook is on the Thunder Bay campus, Orillia students can check it out; see Orillia library staff for more information.

**Most useful...**

On one-day [overnight] reserve at both the Thunder Bay and Orillia libraries:

1. Plant Biotechnology and Genetics : Principles, Techniques, and Applications. Neal C. Stewart, 2<sup>nd</sup> edition. Available as an ebook through the Lakehead library:  
<http://eds.a.ebscohost.com/eds/detail/detail?vid=11&sid=dcf48b00-99d3-4de2-93f8-4dca3f4acdee%40sessionmgr4010&bdata=JnNpdGU9ZWRzLWxpdmUmc2NvcGU9c2l0ZQ%3d%3d#AN=1194558&db=edsebk>
2. Plant biotechnology: the genetic manipulation of plants. Adrian Slater, Nigel W. Scott, Mark R. Fowler. TP 248.27 P55S59 2008
3. Introduction to plant physiology. William G. Hopkins and Norman P.A. Hüner, 4<sup>th</sup> edition. QK 711.2 H67 2009

**Also useful...**

Not on reserve, but in the stacks in the Thunder Bay (TB) or Orillia (OR) libraries, or available as ebooks:

4. Introduction to plant physiology. Hopkins and Huner 3<sup>rd</sup> edition. QK 711.2 H67 2004 (TB)
5. Biochemistry & molecular biology of plants. Bob B. Buchanan, Wilhelm Gruissem, Russell L. Jones, eds. QK 861 B45 2000 (TB).  
Second edition (2012) available as an ebook through the Lakehead library:  
<http://eds.a.ebscohost.com/eds/detail/detail?vid=14&sid=dcf48b00-99d3-4de2-93f8-4dca3f4acdee%40sessionmgr4010&bdata=JnNpdGU9ZWRzLWxpdmUmc2NvcGU9c2l0ZQ%3d%3d#AN=1021695&db=edsebk>
6. Plant physiology, Hans Mohr. QK 711.2 M6413 1995 (TB)
7. Plant biology. Thomas L. Rost ... [et al.], 2<sup>nd</sup> ed. QK 47 P57 2006 (TB)
8. Plant biotechnology : current and future applications of genetically modified crops. edited by Nigel G. Halford. SB 106 B56P582 2006 (TB)  
Available as an ebook through the Lakehead library:  
<http://eds.a.ebscohost.com/eds/detail/detail?vid=1&sid=7667ef20-d6b0-4e15-b564-5bf14909c0a5%40sessionmgr4009&bdata=JnNpdGU9ZWRzLWxpdmUmc2NvcGU9c2l0ZQ%3d%3d#AN=159671&db=edsebk>
9. Plant development and biotechnology. edited by Robert N. Trigiano, Dennis J. Gray. QK 725 P58 2005 (TB)  
Available as an ebook through the Lakehead library:  
<http://eds.a.ebscohost.com/eds/detail/detail?vid=1&sid=86d80e45-15af-445b-bab9-6f4f5da3d235%40sessionmgr4007&bdata=JnNpdGU9ZWRzLWxpdmUmc2NvcGU9c2l0ZQ%3d%3d#AN=110791&db=edsebk>
10. Plant biology. Linda E. Graham, James M. Graham, Lee W. Wilcox. QK 47 G68 2006  
Second edition (2014) available as an ebook through the Lakehead library:  
<http://eds.a.ebscohost.com/eds/detail/detail?vid=3&sid=86d80e45-15af-445b-bab9-6f4f5da3d235%40sessionmgr4007&bdata=JnNpdGU9ZWRzLWxpdmUmc2NvcGU9c2l0ZQ%3d%3d#AN=1418760&db=edsebk>
11. Biology of plants. Peter H. Raven, Ray F. Evert, Susan E. Eichhorn. QK 47 R25 2013 (TB)

12. Botany : an introduction to plant biology. James D. Mauseth QK 47 M38 2017. (OR)  
The BIOL-1130: Plant biology textbook in Orillia.
13. Introductory plant biology. Kingsley R. Stern, James E. Bidlack, Shelley H. Jansky. 11<sup>th</sup> edition.  
QK 47 S836 2008. (TB)  
The BIOL-1130: Plant biology textbook in Thunder Bay.

Note also that I have many other plant biotech texts that I am willing to lend out; see me to discuss.

### **Midterm exams** (dates indicated above)

These cover the lectures as indicated above. They are written in class and are 1 h long. Other details will be given in class.

### **Final exam** (date TBA)

Covers material between last test and the end of the course. However, any material that students had difficulty answering on the midterm test may be included on the final. I will let you know what this material is in advance.

### **Classroom policies**

1. **Arriving/departing from class:** If you arrive late or must leave during class time, please make sure that you close the classroom door quietly.
2. **Computer/cell phone usage:** I recognize that many students use their laptops/tablets to take notes electronically. These are permitted, but as a courtesy to me and your peers, I ask that there is **no texting or IMing** in class, please. They are distracting for both students and me.
3. **Talking:** Please refrain, unless you're collaborating (e.g., on i-clicker answers) or asking or commenting on questions. Comments or questions are always very welcome during lecture; please raise your hand first.

### **Statement on academic dishonesty:**

The full version of Lakehead University's policy on academic dishonesty is available [online](#). This policy makes up part of the [Code of Student Behaviour and Disciplinary Procedures](#). All students in this course should read this policy and become familiar with it.

In summary, the penalty for plagiarism or cheating on any part of this or any other course is a mark of **zero** for the work where the student is caught. Serious or repeated plagiarism, including cheating on an examination or test, will result in a mark of zero for the course and may result in expulsion from the University.

For the purposes of this course, there are in particular several places where cheating may occur:

1. using written or electronic notes or through conferring with another person in a test or examination;
2. voting electronically in place of another person for the participation component of the course;

3. handing in written work that is in whole or in part not your own.

Note that the presence of a student's REEF polling device remote in the classroom when the student is not present will result in a participation mark of **zero**.

To ensure academic fairness for students who work hard, rest assured that the course instructors will take **every precaution** to ensure that potential cheaters are caught and subjected to the appropriate penalty.