# Entomology

## BIOL 3193

### *Instructor Information*

**Instructor:** N. Kirk Hillier (he/him)
Hear my name

**Office:** Biology Building 104

**Office hours:** Monday, Wednesday, 10:30-11:30; 12:30-1:30, *by appointment only*

**E-mail:** kirk.hillier@acadiau.ca

**Lecture:** Mon-Wed-Fri, HSH134, 11:30-12:20 (In person).

**Lab:** BIOL 3190 FA01

Fridays 1:00-3:50 (In person).

**Teaching Assistant/Instructor:**
Carys McMurray
carysmcmurray@acadiau.ca

| Evaluation | Percentage | Due Date |
|---|---|---|
| Mid term 1 | 15% | 26 Oct |
| Seminar | 10% | Between 30 Oct-20 Nov |
| Insect Collection | 40% | 27 Nov |
| iNaturalist project | 5% | 4 Dec |
| Final Exam | 30% | TBD by registrar |

## Part 1: Course Information

### *Course Description*

*This course is an introduction to the structure, function, evolution and taxonomy of the insect, the most diverse and abundant group of animals. Topics also include the ecology, behaviour, and impact of these animals. A collection of insects gathered on field trips during regularly scheduled laboratories and independently is required.*

#### Prerequisite

Prereq: Biol 2073 with a minimum of C-

## *Course Materials and Requirements*

### Required Text

Marshall, S.A. Insects: Their Natural History and Diversity.2nd Edition. 2017. Firefly books.

Ordered for the University Bookstore. Used and older (2006) editions of this textbook may be available at a reduced cost (i.e. Amazon, AbeBooks, etc.) and are also appropriate. Other entomology texts may be useful alternatives, however, note that identifications will be made during the laboratory component using this text as a guide.

**Recommended:** Insect Field Guide of your Choice. Many students also find insect field guides useful tools for this course. It is recommended to double-check any taxonomic determination from a field guide with the proper keys found in the class text.

## *Course Requirements*

Course delivery will be primarily via **powerpoint lectures** which will be shared on Moodle. Students will require access to a laptop to view course material. Ergo, students will need access to a computer, laptop, or equivalent capable of accessing:

- The course Moodle page
- Vaughn Memorial Library's Biology LibGuide
- Microsoft Teams and Office 365

Students will also need to have access to a **smartphone or digital camera** to collect images of insects, which will be used in an assignment to identify insects using the **iNaturalist platform** www.inaturalist.org (again, a laptop or smartphone with access to this internet resource or application installed will be necessary).

Finally, students will need uitable clothing for outdoor lab excursions which will require extensive walking (*i.e.*, durable boots, rain jackets if necessary

## *Course Structure*

Lecture material will be presented in 50min lecture slots.

Lectures will take place **M, W, & F** in **Huggins Science Hall (HSH143)** @ **11:30AM - 12:20PM**

Labs will take place in the Biology Building (**NBB/Mac) Lab 220 on Fridays from 1:00-3:50 pm**. Specific information on lab schedule and requirements are in PART

3 below.

****Labs will begin on Sept 11th, 2026****

### *Student Learning Outcomes*

This course will expose you to concepts in insect ecology and taxonomy. We will cover the material listed below in the approximate number of lectures listed.

- Fundamental knowledge of insect biodiversity and taxonomy
- An understanding of the anatomy, physiology, behavior and life histories of insects
- Skill in basic collection, curation and identification of insects
- Appreciation of impact of insect-humans interactions on the environment and ecosystems broadly.

### *How to Meet the Learning Outcomes*

- Attend lectures on a regular basis, take notes, and ask for clarification when something is unclear. Attendance and participation are expected, but attendance is not documented for lectures and not graded.
- **For student peer seminars (in lab slots), attendance is mandatory and graded.**
- Study on a regular basis
- Evaluation will be via a midterm exam, term project, and one final exam, as well as an insect collection (lab component)

# Part 2: Course Plan

The instructor reserves the right to amend the course plan with reasonable notice, and in consultation with the class.

## Lecture Schedule

| Lectures:* | |
|---|---|
| 9-Sep | Introduction, History of Entomology - Syllabus and brief course outline |
| 11-Sep | Arthropods |
| 14-Sep | Importance and biodiversity of insects |
| 16-Sep | Anatomy, structure and development in insects (I) |
| 18-Sep | Anatomy, structure and development in insects (II) |
| 21-Sep | Anatomy, structure and development in insects (III) |
| 23-Sep | Anatomy, structure and development in insects (IV) |
| 25-Sep | Classification of insects (Hemimetabolous and Holometabolous orders);<br>**DEADLINE TO FINALIZE FAR SIDE TOPICS and submit annotated bibliography** |

| | |
|---|---|
| 28-Sep | Endognathous Apterygota: Collembola; Protura; Diplura |
| **30-Sept** | **Truth and Reconciliation Day – No class** |
| 2-Oct | Ectognathous Apterygota: Microcoryphia; Marine insects; Thysanura |
| 5-Oct | Paleopterous insects: Odonata; Ephemeroptera; Swarming behaviour |
| 7-Oct | Neopterous insects: Exopterygotes and Endopterygotes |
| 9-Oct | Orthopteroid Orders |
| **12-Oct** | **Fall Break** |
| **14-Oct** | **Fall Break** |
| **16-Oct** | **Fall Break** |
| 19-Oct | Order Blattodea; Mantodea; and Isoptera |
| 21-Oct | *Diversion 1: Insect Sociality: Isoptera vs. Hymenoptera* |
| 23-Oct | *Social Insects continued* |
| **26-Oct** | **Midterm exam** |
| 28-Oct | *Diversion 2: Insect communication and behaviour* |
| 30-Oct | Order Orthoptera; Zoraptera; Grylloblattodea; Insects at low temperatures and cold adaptations |
| 2-Nov | "Queen of Trees" – Insect Interactions |
| 4-Nov | Dermaptera; Introduced insects – worldwide travellers |
| 6-Nov | Phasmatodea; Embioptera; Plecoptera |
| 9-Nov | Hemipteroid orders: Pscoptera; Phthiraptera; Hemiptera |
| **11-Nov** | **Remembrance Day** |
| 13-Nov | Guest Lecture (Speaker and subject to be determined) |
| 16-Nov | *Diversion 3: Insect Relationships, Insect Defences* |
| 18-Nov | Thysanoptera; Aphid Life histories |
| 20-Nov | *Diversion 4: Insect Reproduction* |
| 23-Nov | Endopterygota: Megaloptera, Raphidioptera, Neuroptera |
| 25-Nov | Coleoptera; Strepsiptera; Siphonaptera |
| 27-Nov | Diptera; Trichoptera; **Last day to withdraw from a Fall term course and receive a "W"** |
| 30-Nov | Lepidoptera; Hymenoptera |
| 2-Dec | Insects and Human Society: Pests, Beneficials and Pest Control, Applied entomology |
| 4-Dec | Insects and Human Society: Medical and Veterinary ; **iNaturalist submission and IDs due** |
| 7-Dec | Insects and Human Society: Forensic Entomology |
| 9-Dec | Review |

*Guest lectures may substitute for selected topics coverage at points during the term, or content may be shifted.

***All Lecture Sets will be available on Moodle – Note that powerpoint slides on ACORN do not contain all course content as presented in class.*** **The instructor reserves the right to amend the above course plan with reasonable notice.**

## Lab Schedule

**Laboratory outline for Fall Session***

| *Date* | *Lab Week* | *Topic* |
|---|---|---|
| Sept. 11 | 1 | Field Trip 1: Irving Woodland Trail + Equipment pick-up brief orientation |
| Sept. 18 | 2 | Field Trip 2: Wolfville Dykes and Rail Trail |

| | | |
|---|---|---|
| Sept. 25 | 3 | Field Trip 3: Oberland Agrisciences* |
| Oct. 2 | 4 | Field Trip 4: Kentville Ravine and Eaves Hollow* |
| Oct. 9 | 5 | Introduction to Identification and pinning or Flexible collection time |
| Oct. 16 | 6 | **Fall Break – No Labs** |
| Oct. 23 | 7 | Identification and pinning |
| Oct 30 | 8 | Identification and pinning – Seminars (6 slots) |
| Nov. 6 | 9 | Identification and pinning – Seminars (6 slots) |
| Nov. 13 | 10 | Identification and pinning – Seminars (6 slots) |
| Nov. 20 | 11 | Identification and pinning – Seminars (6 slots) |
| Nov. 27 | 12 | Insect Collections Due by 13:00 (i.e. 1:00 pm) |

* All field trips are weather-permitting, pending approved transportation, and sequence may be changed. Students should be prepared for cold or wet weather, if necessary, and rubber boots will be an asset for aquatic sampling or travelling in boggy conditions. We may cancel field trips if the weather is extremely bad, and opt for identification and pinning in the lab on these days.

**Students will need to be actively collecting and curating outside the lab hours, and as early as possible in the semester** (as the semester progresses and cold weather settles in, it will become more difficult to obtain the required diversity for your collection).

## *Laboratory Guidelines*

I hope that your laboratory experience in BIOL3193 (Entomology) proves to be educational, rewarding and fun! To help you settle into the routine in the teaching lab (BIO 109) here are a few guidelines:

### Things you need to bring with you to each lab:

- your lab manual
- a permanent marker pen for writing on plastic bags and vials
- a pencil (a fine-tipped mechanical one is the best) for writing in notebooks
- a lab notebook to cross-reference your specimens and keep notes organized
- appropriate clothing during field trips

### Lab safety:

- do not eat or drink anything (except water) in the lab (we just do not know the cleanliness of the lab benches)
- avoid touching any part of your face during labs
- report any spills or other problems to one of us
- wash your hands at the start of every lab session
- clean your bench at the start of the lab period (especially if there are suspicious spills from the last users of the bench)
- dispose of contaminated material appropriately
- clean your bench (with water and soap if necessary) when you are finished
- wash your hands before you leave (or if you leave partway through a lab)

### Care of microscopes:

- when you are finished with the dissecting microscopes:
- clean the stage (with water if necessary)
- turn off all lamps
- set objective wheel to the lowest power

### Ethics:

- treat all living animals with respect; there is a difference between killing a mosquito that is biting your arm and allowing a grasshopper to die of dehydration because you imprisoned it in a vial and forgot about it for a week
- if you are required to kill insects for the purposes of establishing a collection (as with this course), then freeze them at -20 C for a minimum of 48 hours in a vial or bag
- a second option for killing insects will be the killing jars available from the lab.
- make sure that your insect is dead before pinning them! Many a collection has been destroyed by a rampaging skewered Carabid beetle which was removed from the freezer too soon (Plus, it's very disturbing to see legs moving when grading student collections).

## *Insect Collection (40%)*

The following equipment will be made available for students to make an insect collection:

Specimen box
Insect pins
Killing bottle and ethyl acetate killing agent
Paper points for pinning small specimens
Pinning block for spacing insects and labels on pins
Insect net (aerial and aquatic are available)

Vials and alcohol
Pre-printed labels
Microscope Slides (if necessary)

## *Insect Collection – Evaluation*

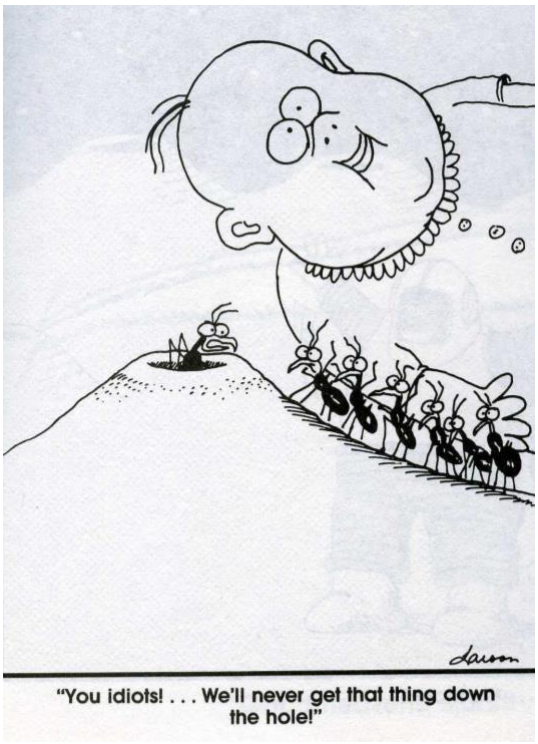
| Element | Value |
|---|---|
| **Diversity:** | 3 |
| Minimum representation:<br>60 pinned specimens;<br>60 species;<br>6 different orders | |
| **Identification:** | |
| Minimum 60 species each correctly identified to family | 30 |
| **Presentation:** | |
| Pinning technique, Labelling (incorrect or dishonest labelling will be penalized) | 4 |
| Presentation and arrangement | 3 |
| **Total** | **40** |

Note: A collection with obviously mislabelled (locality and date) specimens will not be accepted. If there is doubt regarding collection data, it is better to leave the specimen unlabelled. Mislabelling is scientific fraud and has caused problems for scientific research. Labels for most localities from which a significant number of specimens have been collected may be prepared by computer using templates posted on ACORN.

Students may use **SOME** insects collected by friends, family, intra-class trades, etc (these sometimes are the coolest things you can find!) – these **must be labelled** to indicate the correct collector. Because this privilege has been abused in the past, students may have a **maximum of 5 such specimens in their collection**. If students which to include more than 5 specimens collected by others, then they must collect **additional insects** as the primary collector to make up the difference. If you have questions, please ask the instructor or TA.

Note: The use of animals in teaching and research at Acadia University is done in accordance with guidelines on the care and use of animals published by the Canadian Council on Animal Care (CCAC). For more information on the CCAC, please visit their website at http://www.ccac.ca/ .

### *Term Project – The Far Side of Entomology: Why insects do bizarre things (10%)*




A key objective of this course is to outline the importance of insects and their relevance to human activities. Gary Larson's popular cartoon strip "The Far Side" has, for many years, provided a variety of examples of anthropomorphized insect and arthropod cartoons. Despite the entertaining and comical nature of these cartoons, there is often a strong scientific basis for each. For this project, students will investigate the entomological basis of an insect-related Far Side cartoon. Topics can be flexible, as long as they integrate your cartoon, and are focused on an entomology-based theme.

After selecting their theme, students **MUST** provide a one-page outline of their suggested topic with the professor to determine if it is appropriate for this exercise along with an annotated bibliography including 5 references from primary scientific sources (**Required by Sept 25th**).

Students will present their research as a seminar during later laboratory periods.

## *iNaturalist project (5%)*

In concert with traditional insect collections and morphological identifications, we will also conduct a series of AI-assisted identification using iNaturalist. A 'project' will be created in iNat for submissions, and students will be required to submit photographs to attempt correct identification of specimens. A minimum of 20 submissions and

attempted identification to species level will be required. Submissions will only be accepted within the course duration (i.e. not preceding the course).

## Part 3: Assessement and Grading

### *Graded Course Activities*

| Points | Description |
|---|---|
| **Midterm (15%)** | **1 midterm: 15%, 26 Oct.** |
| **Term project (10%)** | **Seminar: 10%, during last 4 lab slots (30 Oct 30- 20 Nov).** Attendance and participation at peer seminars is expected and marked |
| **Lab (40%)**<br>**Insect Collection** | See section 3 for requirements and evaluation; **Due Nov 27 at 1:00pm.** |
| **iNaturalist submissions (5%)** | 20 submissions with correct minimum family level IDs for full marks. **Due by Dec 4th.** |
| **Final Exam (30%)** | Cumulative from lecture material only |
| **100** | **Total Points Possible** |

Make-up tests for either absence, or poor performance, **will not** be provided as an option. In the event that you have a *valid* excuse for missing either of the midterms, the weight from the missed midterm(s) will automatically be distributed across all four tests. Missed midterms without a valid excuse from the registrar will result in a mark of zero. University policies on missing classes, etc. can be found here:

https://registrar.acadiau.ca/RecordsandOtherRequests.html

## Part 4: Course Policies

### *Attend Class (Lectures)*

Students are expected to attend all class sessions as listed above.
**Unwarranted Cell phone use during lectures will result in you being asked to leave the**

**class.**

## Part 6: University Policies

University policies are available in the Acadia University Academic Calendar or through the Registrar's website:
https://registrar.acadiau.ca/welcometotheregistrarsoffice.html

### Equity, Diversity and Inclusion

Acadia University is committed to becoming a culturally safe and anti-oppressive community. This can only be achieved where there are simultaneous efforts to eliminate all forms of discrimination and harassment from our campus community, including the elimination of all discrimination, harassment and violence based on one's identity, including but not limited to, gender, race, class, ethnicity, sexual orientation, disability, gender identity, gender expression, and Indigeneity. The policy against harassment and discrimination, and resources for students who believe they may have experienced, or witnessed, discrimination or harassment, are available here:
https://www2.acadiau.ca/student-life/equity-judicial/equity.html

### Last Drop Day

Last day to drop a course and receive a "W". Please check the Acadia University calendar dates, which are available here:
https://registrar.acadiau.ca/AcademicCalendars.html

### Inform Your Instructor of Accommodations

Acadia University is dedicated to improving access to campus life for all students with disabilities. While we attempt to ensure that all courses are accessible, we recognize that there are barriers that need to be addressed on an individual basis. Students who require accommodations to complete coursework or otherwise fully participate in class should contact Accessible Learning Services directly as soon as possible:
https://www2.acadiau.ca/student-life/accessiblelearning.html.

### Acadia's Policy for Students with Disabilities can be found here:

https://senate.acadiau.ca/tl_files/sites/senate/Senate%20Policies/Jan%202015%20Revised%20Policy%20Regarding%20Support%20for%20Students%20with%20Disabilities.pdf

### The Use of Animals in Teaching and Research

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## Commitment to Integrity

It is standard practice in Biology to check exams and assignments for cheating and plagiarism. Cheating in the class and/or lab, including plagiarism, will not be tolerated. Please read the appropriate sections of the current Acadia University Academic Calendar:
https://registrar.acadiau.ca/AcademicCalendars.html
Information on copy-write and course content from Acadia University is available through the Vaughan Memorial Library:
http://libguides.acadiau.ca/c.php?g=433650&p=5027078
The spoken and written course content (including the syllabus, handouts, lectures, presentations, labs, assignments, quizzes, tests, and exams) are the intellectual property of the instructor and may only be copied for personal use. Sharing these materials or uploading them where they may be accessed by others is a violation of copyright. If you wish to make audio, video, or photographic recordings in class, you must first obtain the consent of the instructor and of any other persons (e.g., guest speakers, other students) who may be captured in such recordings. The instructor's consent shall not be unreasonably withheld.
Use of artificial intelligence tools by students to assist with their learning is allowed only if: prior permission has been given by the course professor/instructor, and the student properly credits/cites how the AI technology was used in their work. AI must be used in an ethical and responsible manner as a positive learning tool. AI may not be used in ways that violate Acadia's Academic Integrity Policy. Students are reminded that plagiarism, or other forms of cheating, are both types of academic dishonesty.

## Share the Air Policy

In consideration of the difficulties that exposure to scented products causes individuals with sensitivities and allergies, all students, faculty, staff, employees of any companies working on university property, visitors, and guests of Acadia University, or of members of the University community are asked to refrain from wearing scented personal care products such as perfumes / aftershave, lotions, hair spray and deodorant. In addition, users of tobacco and cannabis are asked to be aware that odours associated with product use may impact individuals with sensitivities and allergies. Acadia University in consultation with its contracted cleaning staff, have agreed to use products that do not leave residual odors that may cause difficulties for individuals with sensitivities and allergies. https://hr.acadiau.ca/employment/university-policies.html

## Appendix 1: Learning Outcomes

The Biology Department maps Program Learning Outcomes (PLOs) in each course throughout our program in order to identify where learners develop *Discipline Knowledge*, *Lab and Field Skills*, and *Transferable Skills*, and to align content and skills across courses. PLOs are primarily Introduced or Reinforced in this course. The table below only includes Sub-outcomes for BIOL 3193; as you take other courses, you will see additional Sub-outcomes, depending on course material.

| **Foundations of knowledge** | **Explanation** | **Course specific examples** | **Proficiency**<br>1-Introduction<br>2-Reinforcement<br>3-Proficient |
|---|---|---|---|
| Scientific method, inquiry and hypothesis testing | Find, understand and apply information from the literature; understand how to use the scientific method to examine problems from different perspectives | Observation of living things, use of dichotomous keys, literature review for seminars | 2 |
| Biodiversity and ecology | Understand the genetic, taxonomic and ecosystem levels of biodiversity; focus on SW Nova including the Acadian Forest and Bay of Fundy ecosystems | Key focus on regional insect fauna and taxonomy. | 2 |
| Genetics and evolution | Understand the chemical basis of heredity, genetics and genomics; integrate concepts across disciplines to understand evolution | Some evolutionary concepts | 2 |
| Human and environmental health | Understand form and function in health and disease within a One Health framework, integrating human and environmental health | Several examples explored regarding human-insect conflict | 2 |
| **Lab and field skills** | **Explanation** | **Course specific examples** | **Proficiency**<br>1-Introduction<br>2-Reinforcement<br>3-Proficient |
| Safety | Work safely and productively in lab and field settings | Field and lab safety | 2 |
| Lab skills | Gain experience with basic and advanced lab techniques and understand their application in research, health science and industry | Key training and practice in insect identification and curation | 2 |
| Field skills | Gain experience in basic and advanced field skills and understand their application in ecology, conservation biology and environmental change | Field collection via passive and active methods from a variety of habitats | 2 |
| **Professional skills** | **Explanation** | **Course specific examples** | **Proficiency**<br>1-Introduction<br>2-Reinforcement<br>3-Proficient |
| Ethical practices | Demonstrate ethical conduct, apply principles of academic integrity, and understand the principles of EDI in science | Ethical treatment and euthanizing of collected insects | 2 |
| Collaboration and group work | Work effectively in groups within and across disciplines | Group collection activities and field trips | 2 |
| Scientific Communication | Communicate science effectively to both scientific and general audiences | Preparation of outreach seminars and public presentations | 2 |