

INSECT BIOLOGY
BIOL 348

Note that a more extensive syllabus covering the laboratory in detail will be provided at the first laboratory meeting.

LECTURE

Time: Tuesday and Thursday; 9:15am-10:35am
Location: SCST 231

LABORATORY

Time: Thursday; 2:30pm-6:30pm
Location: SCST 229

INSTRUCTOR

Prof. Geoff Morse
Office: ST479
Laboratory: ST474
Contact: x7914; e-mail: gmorse@sandiego.edu
Office hours:

Tuesdays 3:00pm-5:00pm

Wednesdays 9:00am-11:00am

Fridays 3:00pm – 4:00pm

Also by appointment, **EXCEPT WEDNESDAY AFTERNOON.**

Note: If Prof. Morse is not in ST479 during his office hours, please proceed to his laboratory in ST474.

REQUIRED TEXT: Gullan, P.J. & P.S. Cranston. 2010. The Insects: An Outline of Entomology, 4th Edition. Blackwell Publishing, Malden, MA.

Prerequisites: BIOL 190, BIOL 221, BIOL 221L, BIOL 225, BIOL 225L and BIOL 300 at the Undergraduate level, all with a minimum grade of D-.

Course Description: Spring 2009 (348 Insect Biology / 4 UNITS): An introduction to the biology of insects, including their identification, evolution, structure, function, physiology, ecology, behavior, and conservation. The course includes compilation of an extensive insect collection and an overnight field trip to the desert. Three hours of lecture and one laboratory weekly.

By the end of this course, a student should be able to:

- Apply fundamental concepts in comparative biology, physiology, genetics, behavioral ecology, and phylogenetics to the study of insects;
- Read, evaluate, and discuss primary scientific literature in order to develop the necessary critical abilities to be a scientist;
- Develop and deliver an informative presentation based on research done from primary literature;
- Understand the diversity of insects, recognize major taxonomic groups and ecologically and economically important taxa;
- Demonstrate the ability to apply the scientific method to design a novel test of insect community structure based on synthesizing knowledge about southern California insects;
- Develop skill with field research techniques and field identification techniques;
- Recognize the importance of interactions between organisms as a major force in natural selection.

IMPORTANT DATES (lecture)

Tuesday, January 25th: First day of class.

Wednesday, February 2nd: Last day to enroll in classes and to drop a class without a 'W'. Note that late withdrawals and/or incompletes will ONLY be granted under serious extrinsic circumstances.

USD does not allow late withdrawals for reasons of classroom performance.

Thursday, February 24th: **Midterm Examination #1**

March 14th to March 18th: Spring break.

Friday, April 1st: Last day to withdraw from classes

Thursday, April 7th: **Midterm Examination #2**

April 21st to April 25th: Easter Break

Thursday, May 19th: **Final Examination (8am-10am)**

ASSESSMENT: Note that lecture and laboratory are assessed together one a 4-unit course.

| | Points |
|--|-------------|
| LECTURE | |
| Midterm Exam #1 | 150 |
| Midterm Exam #2 | 150 |
| Final Exam | 200 |
| Presentation | 150 |
| Discussion Section Questions (8 at 10 points each) | 80 |
| Lecture Total | 730 |
| LABORATORY | |
| Pre-laboratory quizzes (9 at 5 points each) | 45 |
| Laboratory Write-ups | |
| 1. Write-up #1: Data presentation | 15 |
| 2. Write-up #2: Methods & Results | 30 |
| 3. Write-up #3: Introduction & References | 30 |
| 4. Write-up #4: Discussion & References | 30 |
| 5. Write-up #5: Results & Discussion | 30 |
| Laboratory Notebook | 40 |
| Insect Collection | 50 |
| Insect Identification Practical | 75 |
| Laboratory Total | 345 |
| INDEPENDENT PROJECT | |
| Independent Project Idea | 10 |
| Abstract & Literature | 20 |
| Progress Meeting | 10 |
| Independent Project Final Presentation | 60 |
| Independent Project Final Paper | 150 |
| Independent Project Total | 250 |
| PARTICIPATION | 50 |
| TOTAL | 1375 |

GRADING SCALE. The grading scale that will be used for the course is:

| | | | |
|----|-------------|----|------------|
| A | >93% - 100% | C+ | >77% - 80% |
| A- | >90% - 93% | C | >70% - 77% |
| B+ | >87% - 90% | D | >55% - 70% |
| B | >83% - 87% | F | <55% |
| B- | >80% - 83% | | |

Note that you should NOT e-mail Prof. Morse with course-based questions. These should be submitted to the Discussion Board FAQ on WebCT. If you do e-mail the instructor with course-based questions, you will be directed to the WebCT site. I will address questions on WebCT within 2 days after their posting. I also encourage students to help provide feedback to questions (this will be counted towards your participation grade). In addition, do not expect rapid responses from me via e-mail. I believe strongly in the value of face-to-face conversation: the human face has more muscles and nerves than you can imagine—it's probably nearly as important in the evolution of human communication as speech is. Therefore, I urge you to make use of my office hours. E-mails will be responded to once per week.

DISTURBANCES: YOU WILL BE PENALIZED FOR CREATING DISTURBANCES OR DISTRACTIONS DURING LECTURES. This includes the use of **cellular telephones** or handheld devices in any way, including receiving calls, sending calls, **text-messaging**, or playing games. If you think that you can text-message discretely, you are wrong. If you need to use a laptop to take notes, then you must sit in the first row of the lecture hall. You may not surf the web, check e-mail, or do other activities that are not related to the lecture. In the past I have had numerous complaints from students about the distracting use of these devices during lectures, and perhaps more importantly, *I find them distracting*. For the first offense you will be penalized 50 points, for the second 100 points, and 200 points for each offense thereafter.

WebCT: We will be using WebCT extensively throughout the course. All reading and pre-lab quizzes will be on-line and will be graded there. All written assignments will be turned in via WebCT, and all graded assignments will be returned via WebCT. Review material and other interesting things will be posted. The Discussion Board FAQ mentioned above will also be extensively used.

EXAMS: Exams will be given only at these times, not earlier or later. Any re-scheduling will require: **(1) a written request in the form of a justification and at least two weeks prior notice; or (2) in the case of an emergency and failure to attend an exam, a written justification and note from an appropriate authority (physician, funeral home director, etc.).** The two midterms and final will consist of multiple choice, short answer, and essay or problem questions. The final exam will include material covered during the last 1/3 of the semester (150 points) as well as several comprehensive questions covering material from throughout the semester (25 points). **THE FINAL EXAM IS CUMULATIVE! This means that you should attempt to retain knowledge from the first two-thirds of the course.** Students will be expected to learn examples and principles used in the lectures, as well as those covered in the assigned reading and in discussion sections. Review questions will be distributed prior to each exam and there will be a review session before each midterm. The last class period will be used to finish material and as a review session. In addition, a review session will be scheduled during reading days.

TURNING IN ASSIGNMENTS (Laboratory Write-ups): All assignments will be due by 5pm for the day that they are due. You must turn these in via the Assignments link on WebCT. We will be using software that automatically checks for plagiarism (if you are unsure of what constitutes plagiarism, please review USD's Student Academic Integrity Policy). Note that you can only upload five types of documents: Microsoft Word Document (.doc), Rich Text Format (.rtf), plain text (.txt) files, HTML files, and portable document format (.pdf) files.

LECTURES: Every effort will be made to have outlines of lectures available on-line by the evening before the lecture. In cases where lectures are posted on mornings of lecture class, they will be provided for you as handouts. These will include many of the graphs and figures that will be used in the following lecture(s). *Note that these WILL NOT include the entire lecture, they are meant to only be templates upon which you should take notes.*

LATE WORK: I have a very, very low tolerance for late work. Late work will be accepted at a penalty of 25% per day. Exceptions will only be granted for circumstances similar to those listed above under exams.

CLASSROOM PARTICIPATION: Your active participation in the learning process is essential for success in this (or any) course. You are expected to contribute to classroom discussions and engage in cooperative learning in the laboratory.

DISCUSSION SECTIONS: Most weeks we will be reading and discussing important papers from the primary literature. I will lead the first one. For the rest, YOU will be leading the discussions in pairs! I will have a sign-up sheet in laboratory on Thursday, January 27th. You might have an urge to try to put this off to as late in the semester as possible, but remember that other things tend to pile up in all of your classes at that point. The general topics are given in the schedule below. While I have some specific articles that I may *strongly* urge, you do have the freedom to choose your own research papers. The number of papers may depend on the complexity and length. You are expected to give a presentation lasting approximately 20-30 minutes (I suggest a PowerPoint presentation) and then lead the discussion. You will be graded on both the strength of your presentation and how well you lead the discussion. You will be **required** to meet with me about your presentation no later than the Tuesday before you give it. This will ensure that you have a strong understanding of the topic and the papers that you have read.

In the weeks that you are not leading a discussion, you will still need to participate. Indeed, you will need to turn in to me two discussion questions on the WebCT assignment link no later than 5pm on the night before the discussion section. **Note that you will not receive ANY credit for these if you do not attend class that Friday.** The vast majority of your participation grade will be based on how active you are in these classroom discussions.

LABORATORY AND INDEPENDENT PROJECTS: There will be a more comprehensive syllabus of these handed out in Thursday's laboratory. We will cover the details of the laboratory then.

TIPS, HINTS, AND SUGGESTIONS:

Assignments: Do all the assignments and quizzes on time. Some people skip assignments and/or quizzes and this kills their final grade.

Read the textbook: Try to read through the sections of the textbook that are assigned reading, even if the material in the readings was not specifically mentioned in lecture. Pay particular attention to the graphs as these frequently contain important information. I always ask a few questions on exams that are in the textbook but not in my lectures.

Attend the lectures: Perhaps the simplest way to get a good grade is to attend all of the lectures and pay attention. The lectures will generally include material that is not found in the textbook but will appear on exams. If you miss a lecture you may never be exposed to some information on which you will be tested.

Note taking: The best way to capture a concept in your notes is to draw a graph or figure that illustrates the principle. If I show a graph, make sure you understand what that graph is telling you.

Essay questions: The essay questions on exams are designed to be integrative. That is, they try to make you think about how different concepts and patterns fit together, or they get you to attempt to solve some novel problem. You will usually not be able to simply regurgitate information from your notes to answer an essay question. A very good way to study for essay questions is to practice designing experiments that can be used to illustrate and discriminate among the various ecological concepts you have learned.

KEEP UP: Falling behind is the easiest way to get a bad grade. Do your best to keep up-to-date with lectures, notes, assignments, and readings. It's much easier to read 10 pages of the textbook twice each week than to read 200 pages the day before the exam...

LECTURE SCHEDULE

preliminary lecture schedule

Note that this schedule is subject to change or modification. Specific dates are not given, readings and topics will be announced approximately one week in advance and will be indicated in the on-line syllabus and in the announcements on WebCT.

| Module | Topic | Reading |
|--------|---|------------|
| 1 | <u>Introduction:</u> Importance of Insects Insect Conservation Issues | 1 |
| 2 | <u>Insect Morphology:</u> Integument: Structure & Function Body Organization Mouthparts & Feeding | 2, 3, 6 |
| 3 | <u>Physiology:</u> Digestion, Nutrition, & Excretion Gas exchange & Circulation Sensory Systems & Behavior Movement: Wings & Legs | 3, 4 |
| 4 | <u>Reproduction:</u> Courtship & Mating Sexual Selection, Egg-Laying, Mating Systems, Etc. | 3.8, 5 |
| 5 | <u>Development:</u> Growth, Development, & Hormones | 3.3, 6 |
| 6 | <u>Systematics:</u> Phylogeny, Classification, Macroevolution | 7, 8 |
| 7 | <u>Insect Ecology & Life History:</u> Ground-dwelling Insects Aquatic Insects | 9, 10 |
| 8 | <u>Intraspecific Interactions:</u> Insect Sociality Eusociality | 12 |
| 9 | <u>Interspecific Interactions:</u> Herbivory Mutualism Predation Parasitoids | 11, 13, 14 |

DISCUSSION SECTIONS

DISCUSSION SECTIONS: Most Thursdays we will be reading and discussing important papers from the primary literature. The general topics are given in the schedule below. While I have some specific articles that I may *strongly* urge, you do have the freedom to choose your own research papers. The number of papers may depend on the complexity and length. You are expected to give a presentation lasting approximately 25-30 minutes (I suggest a PowerPoint presentation) and then lead the discussion. You will be graded on both the strength of your presentation and how well you lead the discussion. You will be **required** to meet with me about your presentation no later than the Tuesday before you give it. This will ensure that you have a strong understanding of the topic and the papers that you have read.

In the weeks that you are not leading a discussion, you will still need to participate. Indeed, you will need to turn in to me (at least) two discussion questions on the WebCT assignment link no later than 9pm on the night before the discussion question. These questions will be graded for their quality and insight. The vast majority of your participation grade will be based on how active you are in these classroom discussions. Note that if you do not attend a discussion section, you will get a zero for discussion questions (whether you turn them in or not), and you will have points automatically deducted from your participation grade.

Grading of your discussion section is based on your understanding of your topic, your preparation for the presentation, and your generation of discussion:

| Level | Understanding/Content | Preparation | Presentation |
|------------------------------|---|---|---|
| <i>Excellent</i> (A) | Can clearly and succinctly explain content and demonstrate understanding by relating ideas to those from outside the papers and making insightful comments. Understands what background material is relevant to presentation. Has put papers into broader relevant context. | Has met with Prof. Morse by Tuesday on the week of the presentation <i>having already read the articles</i> . Student has a good idea of how to present the papers, has notes and ideas on figures. | Well organized with logical flow. Structure is apparent but not overbearing. Few if any errors. Topic is made interesting to the audience. Good delivery with little or no reference to notes. Generates discussion during presentation and afterward, often by incorporating give-and-take techniques or utilizing submitted discussion questions. |
| <i>Good</i> (B) | Accurate, but without insight. Demonstrates an understanding of material presented but lacks a synthesis of multiple clearly related literature sources. Requires major assistance in organization and/or interpretation of data presented. | Has met with Prof. Morse by Tuesday on the week of the presentation. Student has clearly read paper but does not have ideas on presentation or delivery. | Overall, a clear and logical presentation, but with some weaknesses. Some reading of slides, reference to notes, volume problems, “ums”, etc... Talk is mostly engaging. Generates discussion in less interactive manner, but leads discussion well. |
| <i>Adequate</i> (C) | Some minimal understanding, but significant deficits remain in understanding of material. Little data presented, mainly or entirely from papers assigned. Presentation is simply a review of papers. | Student has met with Prof. Morse by Tuesday on the week of the presentation but has clearly not yet read the papers in detail. | Organization haphazard, logic is difficult to follow. Frequent referral to notes. Cannot effectively answer most questions. Talk may be boring/uninspiring. Discussion is lacking, student simply reads from submitted questions. |
| <i>Not adequate</i> (D-F) | Clearly little understanding of material. Student is unable to answer questions. No establishment of larger framework | Student fails to meet with Prof. Morse by Tuesday on the week of the presentation. | Slides poorly constructed, numerous errors. Clearly no interest in presenting material nor in generating discussion |

DISCUSSION SCHEDULE

Do not forget to meet with me by Tuesday of the week that you are giving your presentation.

| # | Date | Topic | Presenters |
|---|---------------------------|---|-------------|
| 1 | January 27 th | <p>The importance of insect biodiversity</p> <ul style="list-style-type: none">• Winfree <i>et al.</i> 2007. Native bees provide insurance against ongoing honey bee losses. <i>Ecology Letters</i> 10: 1105-1113.• Bromenshenk <i>et al.</i> 2010. Iridovirus and microsporidian linked to honey bee colony decline. <i>PLoS ONE</i> 5(10): 1-11. | Prof. Morse |
| 2 | February 3 rd | <ul style="list-style-type: none">• The Evolution of the Insect Body Plan | |
| 3 | February 10 th | <ul style="list-style-type: none">• Diversification of Feeding in Insects | |
| 4 | February 17 th | <ul style="list-style-type: none">• New Insights into Insect Physiology | |
| 5 | March 3 rd | <ul style="list-style-type: none">• Sexual Selection in Insects | |
| 6 | March 10 th | <ul style="list-style-type: none">• The Evolution of Insect Wings | |
| 7 | March 24 th | <ul style="list-style-type: none">• Current Views on Insect Relationships | |
| 8 | March 31 st | <ul style="list-style-type: none">• The Evolution of Insect Genetic Systems | |
| 9 | April 14 th | <ul style="list-style-type: none">• The Evolution of Eusociality | |

INSECT BIOLOGY LABORATORY (BIOL 348)

LABORATORY

Time: Thursday; 2:30pm-6:30pm or as otherwise noted in the syllabus.

Location: SCST 229

INSTRUCTOR

Prof. Geoff Morse

Office: ST479

Laboratory: ST474

Contact: x7914; e-mail: gmorse@sandiego.edu

Office hours:

Tuesdays 3:00pm-5:00pm

Wednesdays 9:00am-11:00am

Fridays 3:00pm – 4:00pm

Also by appointment, **EXCEPT WEDNESDAY AFTERNOON.**

Note: If Prof. Morse is not in ST479 during his office hours, please proceed to his laboratory in ST474.

Insects are by far the most diverse group of multicellular organisms that have ever lived on earth. This diversity is united by a remarkable uniformity in overall body plan (or Bauplan) while simultaneously being reflected in the numerous means by which insects interact with their environment in terms of their morphology, physiology, and ecology. The laboratory portion of this course has 4 primary goals:

1. To familiarize you with the biology of insects including their morphology, life history, anatomy, and diversity.
2. To integrate the study of insects with the scientific method. This will allow you to develop the ability to generate and test hypotheses; and it will expose you to the methods and types of questions that can be asked using insects as model systems. Many of the laboratory and field laboratories will involve an hypothesis-testing component that YOU will develop.
3. To develop an appreciation of integrating field and laboratory research and to introduce you to challenges, opportunities, and experience of getting into the field.
4. To recognize the value of scientific research collections. The collection that you make in this course will not be a 'stamp-collecting' exercise. It will document your independent project and it will serve to initiate a long-term biodiversity inventory of Mission Trails Regional Park.

See the full lecture syllabus for a course description, prerequisites, the required text, grading scale, assessment, and disturbances. Assessments that are specific to laboratory are:

| | |
|---|------------|
| Pre-laboratory quizzes (9 at 5 points each) | 45 |
| Laboratory write-ups | |
| 1. Write-up #1: Data presentation | 15 |
| 2. Write-up #2: Methods & Results | 30 |
| 3. Write-up #3: Introduction & References | 30 |
| 4. Write-up #4: Discussion & References | 30 |
| 5. Write-up #5: Results & Discussion | 30 |
| Laboratory notebook | 40 |
| Insect collection | 50 |
| Insect identification practical | 75 |
| Total | 345 |

Assessments that are specific to the independent projects are:

| | |
|--|------------|
| Independent Project idea | 10 |
| Abstract and literature | 20 |
| Progress meetings (2 at 5 points each) | 10 |
| Independent Project final paper | 150 |
| Independent Project final presentation | 60 |
| Total | 250 |

IMPORTANT DATES (Laboratory)

- Thursday, February 24th: Insect identification practical
- Laboratory write-ups due:
 - Friday, March 4th (Data presentation)
 - Friday, March 11th (Methods & Results)
 - Friday, April 1st (Introduction & References)
 - Friday, April 8th (Discussion & References)
 - Friday, April 15th (Results & Discussion)
- Thursday, May 5th: Insect collection due
- Tuesday, May 10th: Laboratory notebooks due

IMPORTANT DATES (Independent projects)

- Monday, March 7th to Friday, March 11th: First independent project meetings
- Friday, March 11th: Independent project idea due
- Tuesday, March 22nd: List of supplies for independent project due
- Thursday, April 7th: Initiation of independent project
- Monday, April 25th-Friday, April 29th: Second independent project meetings
- Friday, April 29th: Independent project abstract and literature due
- Friday, May 6th: Independent project final paper due
- Tuesday, May 10th: Independent project presentations

FIELD LABORATORIES:

- Some laboratory activities will require outdoor physical exertion, including walking on and off trails. These activities are a necessary part of studying insect biology. Students should dress appropriately for fieldwork. Appropriate clothing and a hat are recommended. Closed-toed shoes appropriate for hiking are **mandatory**.
- Transportation to and from the field sites is the responsibility of the students.
- Bring plenty of water for all field exercises.
- If you have a medical condition that places you at an increased risk of harm, please bring documentation and suggestions for minimizing risk to the instructor.
- **Only students enrolled in the course may attend.** Friends or children cannot be allowed to attend laboratory exercises because of insurance policies and to ensure an uninterrupted learning environment for all students.

ATTENDANCE:

- Attendance is mandatory—there are no laboratory make-ups!
- Students must check in with the instructor when they arrive at the laboratory field site.
- Should medical or personal reasons prevent you from attending the laboratory, a written note from a doctor or other evidence must be submitted. A written report may then be substituted for the missed exercise. This option may be used only in extreme circumstances and at the discretion of the instructor. Please contact the instructor as soon as possible if you must miss a laboratory period. Attendance at all laboratory exercises is essential to performing well in this course.
- Tardiness to laboratory will not be tolerated. It disrupts the lesson, and can be especially disruptive of student work. If it is unavoidable, please inform the instructor in advance. Otherwise you will lose 5 points of your final grade for coming to lab late.
- Reasonable accommodations will be made in cases of religious holidays or other emergency situations. It is the student's responsibility to provide the instructor with documentation of holidays and or emergencies and a plan to cover the missed course material.

ASSIGNMENTS AND COURSE POLICY:

- Late work will be accepted at a penalty of 25% per day. Exceptions will only be granted for circumstances similar to those listed under exams in the course syllabus.
- Attendance will be taken. Each report is to be based upon your personal observations and measurements in the field and lab, and so if you are absent for these exercises you cannot submit a report for these activities (i.e. you will receive a zero).
- Lab handouts will be on WebCT well before the day of the lab activity, and you must print your copy and bring it to lab. Many laboratory activities will be conducted in groups.
- Although I encourage you to discuss assignments and lab activities with classmates, lab write-ups are to be written and turned in as individual assignments and not as group projects.
- There will be 9 pre-laboratory quizzes. You will need to complete these by noon on the day of the lab. They will cover the laboratory handout for that week.

Laboratory Reports: Students are responsible for assignments following each lab. Specific instructions will be provided for each lab and most of the assignments will take the form of different parts of a *formal* laboratory write-up. They will be due by the following Friday the week after the laboratory period and must be turned in via WebCT.

Classroom Participation: Active participation of the student in the learning process is essential for success in this course. Students are expected to contribute to classroom discussions and engage in cooperative learning in the laboratory.

Insect identification practical: There will be a laboratory practical concerning many of the taxa that we have studied.

Independent Project: Students will conduct an independent project for the last third of the semester. Student project results will be presented in the form of a research article and 20-25 minute oral presentation to the class. More specific instructions for the independent project will be provided elsewhere. An **Insect Collection** will be kept *as part of your independent project*. These specimens must be curated and identified appropriately and will be turned in the last day of lecture.

Laboratory notebook: You are required to maintain a laboratory notebook in the form of a three-ring binder throughout this course. It should contain all drawings you make, all data that you collect, and all pertinent field notes. It should develop as a written record of your ongoing work in the course. You are asked to write/draw only on the right hand page (left page consistently if you are left handed and want to use the left page). The facing page not immediately used will be used later for instructor comments, your further reflections, and possibly responses from fellow students.

Written Paper Format: For all written assignments in this course, the following format guidelines will be strictly enforced. Failure to follow guidelines can result in a 10% penalty per violation. Papers will be typed, in 12-point Times, Times New Roman or Arial font, on 22 x 28 cm (8.5 x 11 in.) white paper. Margins will be 2.54 cm (1 inch) top, bottom and both sides. Citations will follow the format of the journal Ecology.

Computers and this course: The vast majority of class materials will be posted on the course WebCT website.

Laboratory Schedule (meet at ST 229 unless otherwise noted):

*****The following schedule is subject to modification based on weather conditions and supplies. If modifications occur, they will not be substantial*****

Laboratory 1 (27 January)

1. Laboratory Introduction: Laboratory & Field Safety
2. Introduction to insect orders
3. Introduction to insect morphology & anatomy
4. Introduction to insect development

Laboratory 2 (3 February)

1. Insect collecting techniques
2. Insect curation techniques
3. Taxonomic characters and systematics
4. Sorting and curation of insects

Laboratory 3 (10 February)

1. Sorting and curation of insects
2. Hemimetabolous insect orders

Laboratory 4 (17 February)

1. Sorting and curation of insects
2. Holometabolous insect orders

Laboratory 5 (24 February)

1. Insect identification practical
2. Discussion of Independent Projects and walkthrough of Tecolote Canyon
3. Physiology and allometry (Laboratory write-up #1 due 4 March)

Laboratory 6 (3 March)

1. Why are reports of ant pollination rare? (Laboratory write-up #2 due 11 March)

Laboratory 7 (10 March)

1. The incidence of the intracellular parasite *Wolbachia* in seed beetles: the effects of temperature clines.

- | |
|--|
| <ol style="list-style-type: none">2. You must meet with me about your independent project ideas this week3. Independent project ideas are due to me by Friday, 11 March4. You must give me a list of the supplies you will need to me by Tuesday, 22 March |
|--|

Laboratory 8 (24 March; Saturday & Sunday, 26-27 March)

1. Completion of *Wolbachia* laboratory (Laboratory write-up #3 due 1 April)
2. Prepare equipment and complete checklist for field trip
3. Discuss trapping for forensic entomology laboratory
4. 26-27 March: Anza Borrego field trip

Laboratory 9 (31 March)

1. Aquatic insects and non-target effects of Bt toxin (Laboratory write-up #4 due 8 April)
 - a. Check survivorship over course of a 24 hour time period
2. Prepare traps for forensic entomology laboratory
 - a. Collect samples over the course of the following week

Laboratory 10 (7 April)

1. Forensic entomology laboratory (Laboratory write-up #5 due 15 April)
2. Presentation of independent project ideas
3. Initiation of independent project

INDEPENDENT PROJECTS WILL RUN FROM APRIL 7TH TO MAY 5TH.

- Do not put these off until the last minute!
- Ideally, both the April 28th and May 5th laboratory times will be for identifying and curating specimens for your project and insect collection.

Laboratory 11 (14 April)

1. Continuation of independent project data collection.

Laboratory 12 (28 April)

1. Continuation of independent project data collection.
- Assignment: Independent project abstract and annotated literature (due April 29th)

You must meet with me about your independent project ideas this week. You will be required to have preliminary data at this point. Your field work *should* be done.

Laboratory 13 (5 May)

1. Insect collections due in laboratory
- Assignment: Final papers due by 5pm on Friday, 6 May

Laboratory 13 (Tuesday, 10 May)

1. Presentations of independent projects.
- Assignment: PowerPoint presentation must be submitted electronically by noon on May 10th (Tuesday) so that they can be loaded onto the laboratory computer and double-checked for glitches.
-