

SYLLABUS

BILD 87 (James C. Nieh)

Full title: Saving the bees: the science behind bee declines and what you can do about it

Short title: The science of saving bees

Course Description

Many species of bees, including honey bees, face declines due to multiple factors. We will learn the latest scientific research on these problems and design innovative ways to improve public awareness and deal with these issues. Students with the best practical ideas and inventions will be encouraged to implement them in subsequent quarters.

Course Goals

My goal is to facilitate group discussion and learning of the problems that face bees. These include problems with diseases, parasites, pesticides, and human management practices. We will read the primary literature and discuss these problems. We will mainly focus on honey bees, because much more is known about this group, but we will also discuss other types of bees such as bumble bees and the many species of solitary bees. My hope is that we can also brainstorm ways of addressing some of these issues. Solutions can range from ways to increase public awareness to practical, creative ways to deal with some of the problems that we discuss. I encourage you to be bold and creative. We will not have time to implement these ideas in our 10 meetings this quarter, but this can be a jumping off point for you to make a difference and implement your ideas in future quarters. Above all, our goal is learning, but I am excited to see what new ideas and questions you have.

Grading

Grading for this seminar is P/NP (pass/no pass)

Your grade is based upon the following:

- 1) Course participation (attendance and discussion participation)
- 2) Final project
- 3) Please note that there are **no exams** and there is **NO FINAL EXAM** for this course.

Course Time Conflicts

You **may not** enroll in this course and in another course or courses that meet at the same day and time. You need to participate in this course and we only have 10 meetings. Thus, missing any of these meetings poses a problem.

What you need to buy

You do not need to buy any books or course readers for this course! All of the course materials are available for your online from the official UCSD Ted website. All online materials can be accessed from home, if you have the correct software configurations. If you cannot access these materials, please use a campus computer.

Sections

There are no sections.

Excused absences

If you may miss a class for a valid reason (such as a medical issue or a sporting event in which you are actively participating). To avoid losing points, you will be required to provide official **WRITTEN** documentation of an unavoidable emergency (e.g. serious illness) or a valid excuse (such as a note from your coach for a sporting event).

Academic Misconduct Policy

Students are expected to do their own work, as outlined in the UCSD Policy on Academic Integrity. **Academic misconduct** is broadly defined as any prohibited and dishonest means to receive course credit. Academic misconduct misrepresents your knowledge and abilities, which undermines the instructor's ability to determine how well you're doing in the course. *This course does not have exams, but plagiarism, such as on your final project, will not be tolerated.* **I will fail any student caught engaging in academic dishonesty and report the case to the UCSD Academic Integrity Review Board. Punishment for cheating is severe, including possible suspension.** Please do not risk your future by cheating.

The course website

The course will be using web learning software called "TED". Your USERID and Password for your UCSD email account should work. However, if you are a recent transfer student or do not yet have a UCSD email account, please contact Academic Computer Support.

PLEASE CHECK THE COURSE WEBSITE FREQUENTLY! All of the **READINGS** are available through this site and can be downloaded as PDF files or viewed directly on the web. **Exam keys** and **grades** are also on the website.

IMPORTANT! How to resolve issues with TED

If you are having **problems viewing the pdf** files, please make sure that you have downloaded the latest version of whatever browser you are using.

Podcasting

Because of the small size of this course and its open discussion format, it will not be podcast.

BILD 87 Syllabus

The Science of Saving Bees

Please note: information in this syllabus is subject to change. **Any schedule changes will be posted on the course web site.** Make sure to frequently check the web site to keep updated.

READINGS

All readings are **required**, unless they are labeled “**optional**,” please check what is listed for each meeting. The course is dynamic and new readings will be posted online. Required readings will be posted one week before the discussion meeting date.

CONTACT INFORMATION & OFFICE HOURS

Instructor: James C. Nieh

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Office Hours: *Fridays at 5:00 pm in Muir Biology Room 1103*

Please note that the items below are subject to change. It is best to check the course Ted website frequently.

Discussion 1. Course introduction: The problems facing bees.

The instructor will talk about how the course is organized and outline the four major problems facing bees. This is one of the few discussions with a more formal lecture-like component.

After the lecture, please think about the problem that you would like to work on. In the coming weeks, you will be organizing yourselves into four groups, each based upon one of the problems we will discuss.

Assignment: watch the movie “More than Honey”

Discussion 2. Management practices (part 2)

Big Beekeeping. Bees as another agricultural mass commodity.

Assigned reading: **Aizen and Harder (2009).**

This paper focuses on the importance of honey bees for agriculture.

Discussion 3. Bee Parasites

Social parasites such as *Varroa destructor* and wax moths. We will also consider problems posed by predators such as wasps and hornets.

Assigned reading: **Le Conte, Ellis, and Ritter (2010).**

The parasitic mite, *Varroa destructor*, is the leading cause of bee colony death. This paper explores the global role of *Varroa*.

Discussion 4. Bee Pathogens and Diseases (part 1: bacteria and viruses)

American Foul Brood, IAPV, deformed wing virus, and other disease agents.

Assigned reading: **Evans and Spivak (2010).**

This paper delves into many different aspects of how honey bees resist diseases and is a good way to begin our discussion of how pathogens and diseases affect honey bees.

Discussion 5. Bee Pathogens and Diseases (part 2: *Nosema*)

Nosema ceranae and other species of *Nosema*.

Assigned reading: **Higes et al. (2013)**.

This paper summarizes most of what we currently know about how *Nosema* affects honey bees.

Discussion 6. Management practices (part 1: crop pollination)

Modern agriculture and its effect on bee pollinators.

Assigned reading: **Krupke et al. (2012)**.

This study focuses on the pesticides that bees can be exposed to in agricultural settings.

Discussion 7. Effect of pesticides and contaminants (part 1: neonicotinoids)

The diverse effects of neonicotinoids.

Assigned reading: **Blacquiere et al. (2012)**.

Although this paper is fairly long and detailed, it provides a good summary of our current knowledge. In reading it, I suggest that you focus on each the section headings and then try to get a summary sense of the main point of the section. For example, read the section “Residues in bee-collected pollen, bees, honey and wax” and try to come up with a main point that you can clearly explain to a friend.

Discussion 8. Effect of pesticides and contaminants (part 2: other pesticides and pollutants)

Synergistic effects of multiple chemical contaminants and pesticides on bees.

Assigned reading: **Glavan and Bozic (2013)**.

This is a current, very readable summary of how interactions between multiple contaminants can affect honey bee health.

Discussion 9. Creative solutions

There is no assigned reading for this week, but you will need to prepare to discuss some creative solutions for one of the problem topics that we discussed.

Discussion 10. Course summary and group presentations

There is no assigned reading for this week. Instead, each group will give a brief Powerpoint presentations of their problem and suggested solutions. Each group will have 10 min to present and 2-3 min for questions.

REQUIRED READINGS (these are all available on the course website)

Aizen, M. A. & Harder, L. D. 2009. The global stock of domesticated honey bees is growing slower than agricultural demand for pollination. *Current Biology*, **19**, 915–918.

Blacquière, T., Smagghe, G., van Gestel, C. A. M. & Mommaerts, V. 2012. Neonicotinoids in bees: a review on concentrations, side-effects and risk assessment. *Ecotoxicology*, **21**, 973–992.

Evans, J. D. & Spivak, M. S. 2010. Socialized medicine: Individual and communal disease barriers in honey bees. *Journal of Invertebrate Pathology*, **103**, S62–S72.

Glavan, G. & Božič, J. 2013. The synergy of xenobiotics in honey bee *Apis mellifera*: mechanisms and effects. *Acta Biologica Slovenica*,

Higes, M., Meana, A., Bartolomé, C., Botías, C. & Martín-Hernández, R. 2013. *Nosema ceranae* (Microsporidia), a controversial 21st century honey bee pathogen. *Environmental Microbiology Reports*, **5**, 17–29.

Krupke, C. H., Hunt, G. J., Eitzer, B. D., Andino, G. & Given, K. 2012. Multiple routes of pesticide exposure for honey bees living near agricultural fields. *PLoS ONE*, **7**, e29268.

Le Conte, Y., Ellis, M. & Ritter, W. 2010. *Varroa* mites and honey bee health: can *Varroa* explain part of the colony losses? *Apidologie*, **41**, 353–363.