



THE OHIO STATE UNIVERSITY

# **SYLLABUS: ENTMLGY 5605**

## **VECTOR BIOLOGY AND VECTOR-BORNE DISEASES**

### **AUTUMN 2022**

**M/W 11:10AM-12:30PM, JENNINGS HALL 136**

## **Course overview**

### **Instructor**

Instructor: Sarah M. Short, Assistant Professor of Entomology

Email address: short.343@osu.edu

Phone number: 614-247-8023

Office hours: Wednesdays 1:30PM-3:30PM or by appointment (in-person or Zoom)

### **Course description**

An overview of the insect vectors that pose the greatest threats to human health. Learn about their basic ecology and behavior, the pathogens they transmit, the diseases caused by those pathogens, and the fascinating biology behind these vector-pathogen-host interactions. Learn also about current methods being implemented around the globe to control vector borne disease transmission.

### **Course learning outcomes**

By the end of this course, students should successfully be able to:

- Describe the basic biology (life cycle, reproduction, host-seeking behavior) of major insect vectors and pests and the major diseases caused by vector borne pathogens.
- Explain major concepts in vector biology including vector competence, extrinsic/intrinsic incubation period, entomological inoculation rate and vectorial capacity.
- Explain the transmission cycles of pathogens vectored by major arthropod vectors including mosquitoes and ticks.
- Apply information you learn on historical and current vector borne disease to emerging vector borne disease.

- Explain the role of ecology and environmental factors on vector borne disease transmission.
- Explain, discuss, and critique the main findings and implications from scientific publications in the field of public health entomology.
- Compute the probable effects of vector control methods on vector borne disease transmission rates and assess the potential for theoretical vector control methods to impact transmission.
- Thoughtfully and critically assess the potential environmental and social implications of current and future vector control methods.
- Critique and evaluate current and “future” vector control techniques for their merits, feasibility, and ethical and ecological implications.
- Generate your own questions in vector biology and design experiments to test your hypotheses.

## Course Structure

Credit hours: 3

Format: In-person. Lectures combined with review/discussion sessions.

Pre-requisite: BIO 1101 or 1113 or 1113H; or graduate student standing; or permission of instructor.

This course is open to both undergraduate and graduate students. There are no differences in expectations between undergraduate and graduate students.

**How will this course work?** This course will be conducted in-person. It will combine in-person lectures and in-class discussions with readings and written assignments. The course will be broken up into multiple modules, each of which will have a dedicated page in the Carmen class site. For each module, all in-person meetings will be clearly listed, and I encourage you to post questions/thoughts/ideas on the Carmen discussion board. There will also be assigned readings for each module, which may include background reading (to be read in tandem with lectures) and one scientific article relevant to the module. For each module, we will have a class dedicated to discussion, during which time we will discuss the lectures and the scientific article assigned for that module. You are expected to attend all lectures. You are also expected to read all assigned readings in advance of the discussion meeting and come prepared to discuss the article, e.g. by completing the “Scientific Article Write-up” assignments when applicable. In class, I will answer any additional questions you may have about the lectures. We may also engage in active learning exercises such as case studies, discussions, and debates relevant to the material. Many classes will be dedicated to in-depth discussion of articles from the primary literature. These discussions are critical to your comprehension of the material and in helping you learn to digest and interpret the primary literature in the field of vector biology. In addition to completing tasks for each module, students will complete writing assignments in varied styles. These are meant to broaden your understanding of vector biology and hone your writing skills. One mid-term and one final exam will be given, both in-person during normal class times.

## Assignments

- For multiple class sessions, you will be responsible for completing a “Scientific Article Write-up assignment” which entails answering questions about the assigned article from the primary literature.
- You will also be assigned multiple supplemental assignments which will range from problem sets to writing popular science articles.
- Term paper – each student will be responsible for writing a 5-7 page (double spaced) term paper explaining and critiquing a vector control technique. The technique could be currently in use or a proposed technique not yet implemented in the field. Each paper must explain the technique in detail. This should include the basic science behind the technique, its mode of action, what it does to the vector, and the method(s) used to implement it. Each paper must then discuss the merits, pitfalls, and ethical and/or ecological implications of the technique. I expect these papers to be research based, with all statements of fact supported by appropriate citations. Papers will be written in an iterative process, with each student completing a first draft, and then submitting a final draft. The first draft will be evaluated by the professor and 2 or 3 students in the class, who will all provide feedback. The final draft will then be graded by the professor. Students will be graded both on the quality of their final draft as well as the critiques they provide to their fellow students.

## Course materials

### Required materials

I will provide some reading to you in the form of PDFs throughout the semester. In addition, you will be responsible for locating articles from the primary literature we will be reading in class (all are accessible for download through the University Library) as well as the following documents:

Public Health Significance of Urban Pests (online, free PDF available through World Health Organization [http://www.euro.who.int/\\_data/assets/pdf\\_file/0011/98426/E91435.pdf](http://www.euro.who.int/_data/assets/pdf_file/0011/98426/E91435.pdf) ).

Core vector control methods: (online, free PDF):

[https://www.who.int/malaria/areas/vector\\_control/core\\_methods/en/](https://www.who.int/malaria/areas/vector_control/core_methods/en/)

Supplementary vector control methods:

[https://www.who.int/malaria/areas/vector\\_control/complementary\\_methods/en/](https://www.who.int/malaria/areas/vector_control/complementary_methods/en/)

Ethical issues associated with Vector Borne diseases:

<http://apps.who.int/iris/bitstream/handle/10665/259687/WHO-HTM-NTD-VEM-2017.07-eng.pdf?sequence=1>

### Optional textbook:

Medical and Veterinary Entomology, 3<sup>rd</sup> Edition. Edited by Gary R. Mullen and Lance A. Durden. (print). This text is not required for the course, but you may find it useful for context and additional background information.

## Course technology

For help with your password, university e-mail, Carmen, or any other technology issues, questions, or requests, contact the OSU IT Service Desk. Standard support hours are available at <https://ocio.osu.edu/help/hours>, and support for urgent issues is available 24x7.

- **Self-Service and Chat support:** <http://ocio.osu.edu/selfservice>
- **Phone:** 614-688-HELP (4357)
- **Email:** [8help@osu.edu](mailto:8help@osu.edu)
- **TDD:** 614-688-8743

### Technology skills necessary for this specific course

- Basic computer and web-browsing skills
- Navigating Carmen (<https://carmen.osu.edu/>)
- The syllabus, recorded lectures, reading assignments, and written assignment instructions will all be posted on Carmen.
- Proficiency with word processing software (e.g. Libre Office Writer, Microsoft Word), presentation software (e.g. Libre Office Impress, Microsoft Powerpoint).
- Uploading documents and assignments to Carmen.
- OneDrive account, ability to use OneDrive.
- Proficiency in using Zoom.

### Necessary equipment

- Computer: current Mac (OS X) or PC (Windows 7+) with high-speed internet connection and access to Carmen. If you plan to attend office hours remotely, you will need a microphone and ideally a webcam (or a phone capable of making video Zoom calls).

### Necessary software

- Word processing software (e.g. Libre Office Writer, Microsoft Word)
- Slide presentation software (e.g. Libre Office Impress, Microsoft Powerpoint).
- PDF reader (e.g. Adobe PDF reader)
- Zoom with webcam and microphone
- Video player with ability to play .mp4 files. (VLC is a good free one)

- Note: All Ohio State students are now eligible for free Microsoft Office 365 ProPlus through Microsoft's Student Advantage program. Full instructions for downloading and installation can be found at [go.osu.edu/office365help](http://go.osu.edu/office365help).

## Grading and general policies

### Grades

Assignment or category	Points	Percentages
Scientific article write ups (N = 4, 20 points each)	80	15%
Supplemental assignments (N=3, 50 points each)	150	27%
Final term paper	100	18%
Term paper peer reviews (N = 2, 10 points each)	20	4%
Midterm Exam (100 points)	100	18%
Final Exam (100 points)	100	18%
Total	550	100 %

See course schedule, below, for due dates

### Late assignments

Scientific article write-ups, supplemental assignments, and term paper peer reviews will be docked 5 points per day late. Final term papers will be docked 25 points per day late. Points will continue to be docked until zero points remain. "Day" in this context includes weekends and holidays. Exams missed due to unforeseeable circumstances (illness, family emergency, COVID-related issue) must be made up before the next exam or, in the case of the final, before the third week of the next semester.

"Lost" assignments: In this age of cloud services, there is NO EXCUSE for losing a document. All your work should be saved in OneDrive (or other cloud-based service) then uploaded to Carmen. OneDrive is a free service for OSU students and automatically syncs changes with the remote server so that you do not lose changes you made to your work. It also saves all previous versions. There are other free options as well, including Google Drive and Dropbox. I will not accept "I forgot to save my file" as an excuse for a late assignment.

### Grading scale

93–100: A  
 90–92.9: A-  
 87–89.9: B+  
 83–86.9: B

80–82.9: B-  
77–79.9: C+  
73–76.9: C  
70 –72.9: C-  
67 –69.9: D+  
60 –66.9: D  
Below 60: E

## Faculty communication:

If you have questions throughout the course please contact me as follows: (Remember that you can call **614-688-HELP** at any time if you have a technical problem.)

### E-mail

Please e-mail me as a first option, at [short.343@osu.edu](mailto:short.343@osu.edu). In general, you can expect a reply within 24 hours on weekdays.

### Carmen messaging and Discussion board

I will check and reply to Carmen messages and those in the discussion boards often, but this should not be used for time sensitive issues.

# Attendance, participation, and discussions

## Student participation requirements

As this course is advanced level and highly interactive, attendance is mandatory. Occasional absences are understandable, but I reserve the right to deduct points from your final grade for chronic absenteeism. If you find yourself in a situation where you expect to miss multiple classes (e.g. serious medical issue) please contact me as soon as possible to discuss.

Participation in classroom discussions is strongly encouraged, as it will make the experience more valuable for everyone.

Students who need to miss class or who are not able to participate due to illness (COVID-19 or other illnesses), exposure to COVID-19, care for family members exposed to COVID-19 or other reasons are expected to contact the instructor as soon as possible to arrange for accommodation. Students in special situations or those requiring specific, long-term or other accommodation should seek support from appropriate university offices including but not limited to: Student Advocacy, Student Life Disability Services and the Office of Institutional Equity.

## Discussion and communication guidelines

The following are my expectations for how we should communicate as a class. Above all, please remember to be respectful and thoughtful.

- **Style:** When writing emails or composing messages on discussion boards, please use good grammar, spelling and punctuation. Please also avoid slang and idioms (e.g. “Are we all on the same page?”), as they can prevent clear communication.
- **Tone and civility:** Please treat your fellow students with respect. This means listening to them when they are speaking, not interrupting, and being polite in your discourse. It’s important that everyone feels safe to participate in classroom discussion. Remember especially that sarcasm and kidding don’t always come across as such online or in email.

## Other course policies

### Academic integrity policy

#### Policies for this course

- **Assignments and term paper:** These assignments must be your own, independent work. You are encouraged to discuss the general ideas in your written assignments with me or other students and to ask a trusted person to proofread your assignments before you turn them in, but no one else should revise or rewrite your work.
- **Citing your sources:** For any written assignments or discussion board conversations that involve statements of fact, you must provide citations to support what you say.
- **Collaboration and informal peer-review:** I encourage discussion among students about the topics and assignments in class. However, simply comparing answers or using an answer provided by a fellow student is not allowed. Please feel free to check with me if you are unsure about how this applies to a specific situation.

#### Ohio State’s academic integrity policy

Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research, and other educational and scholarly activities. Thus, The Ohio State University and the Committee on Academic Misconduct (COAM) expect that all students have read and understand the University's Code of Student Conduct, and that all students will complete all academic and scholarly assignments with fairness and honesty. Students must recognize that failure to follow the rules and guidelines established in the University's Code of Student Conduct and this syllabus may constitute Academic Misconduct.

The Ohio State University's Code of Student Conduct (Section 3335-23-04) defines academic misconduct as: Any activity that tends to compromise the academic integrity of the University, or subvert the educational process. Examples of academic misconduct include (but are not limited to) plagiarism, collusion (unauthorized collaboration), copying the work of another

student, and possession of unauthorized materials during an examination. Ignorance of the University's Code of Student Conduct is never considered an excuse for academic misconduct, so I recommend that you review the Code of Student Conduct and, specifically, the sections dealing with academic misconduct.

If I suspect that a student has committed academic misconduct in this course, I am obligated by University Rules to report my suspicions to the Committee on Academic Misconduct. If COAM determines that you have violated the University's Code of Student Conduct (i.e., committed academic misconduct), the sanctions for the misconduct could include a failing grade in this course and suspension or dismissal from the University.

If you have any questions about the above policy or what constitutes academic misconduct in this course, please contact me.

Relevant resources on academic integrity:

- The Committee on Academic Misconduct web pages ([COAM Home](#))
- *Ten Suggestions for Preserving Academic Integrity* ([Ten Suggestions](#))
- *Eight Cardinal Rules of Academic Integrity* ([www.northwestern.edu/uacc/8cards.htm](http://www.northwestern.edu/uacc/8cards.htm))

## Safe and Healthy Buckeyes:

Health and safety requirements: All students, faculty and staff are required to comply with and stay up to date on all university safety and health guidance (<https://safeandhealthy.osu.edu>). Non-compliance will result in a warning first, and disciplinary actions will be taken for repeated offenses.

## Counseling and Consultation Services/Mental Health

We will be discussing infectious diseases, their symptoms, and the impacts they have on vulnerable communities around the world. Some may find this content upsetting. If needed, please practice self-care while learning about these issues (take a break, discuss with a friend) or seek counseling by calling Counseling and Consultation Services at 614-292-5766.

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. The Ohio State University offers services to assist you with addressing these and other concerns you may be experiencing. If you or someone you know are suffering from any of the aforementioned conditions, you can learn more about the broad range of confidential mental health services available on campus via the Office of Student Life Counseling and Consultation Services (CCS) by visiting [ccs.osu.edu](http://ccs.osu.edu) or calling (614) 292- 5766. CCS is located on the 4th Floor of the Younkin Success Center and 10th Floor of Lincoln Tower. You can reach an on-call counselor when CCS is closed at (614) 292-5766 and 24 hour emergency help is also



available through the 24/7 National Suicide Prevention Hotline at 1-(800)-273-TALK or at [suicidepreventionlifeline.org](http://suicidepreventionlifeline.org)

For students in the College of Food, Agricultural, and Environmental Sciences, David Wirt, [wirt.9@osu.edu](mailto:wirt.9@osu.edu), is the CFAES embedded mental health counselor. He is available for new consultations and to establish routine care. To schedule with David, please call 614-292-5766. Students should mention their affiliation with CFAES when setting up a phone screening.

## **Creating an environment free from harassment, discrimination, and sexual misconduct**

The Ohio State University is committed to building and maintaining a community to reflect diversity and to improve opportunities for all. All Buckeyes have the right to be free from harassment, discrimination, and sexual misconduct. Ohio State does not discriminate on the basis of age, ancestry, color, disability, ethnicity, gender, gender identity or expression, genetic information, HIV/AIDS status, military status, national origin, pregnancy (childbirth, false pregnancy, termination of pregnancy, or recovery therefrom), race, religion, sex, sexual orientation, or protected veteran status, or any other bases under the law, in its activities, academic programs, admission, and employment. Members of the university community also have the right to be free from all forms of sexual misconduct: sexual harassment, sexual assault, relationship violence, stalking, and sexual exploitation.

To report harassment, discrimination, sexual misconduct, or retaliation and/or seek confidential and non-confidential resources and supportive measures, contact the Office of Institutional Equity:

1. Online reporting form at [equity.osu.edu](http://equity.osu.edu),
2. Call 614-247-5838 or TTY 614-688-8605,
3. Or Email [equity@osu.edu](mailto:equity@osu.edu)

The university is committed to stopping sexual misconduct, preventing its recurrence, eliminating any hostile environment, and remedying its discriminatory effects. All university employees have reporting responsibilities to the Office of Institutional Equity to ensure the university can take appropriate action:

- All university employees, except those exempted by legal privilege of confidentiality or expressly identified as a confidential reporter, have an obligation to report incidents of sexual assault immediately.
- The following employees have an obligation to report all other forms of sexual misconduct as soon as practicable but at most within five workdays of becoming aware of such information: 1. Any human resource professional (HRP); 2. Anyone who supervises faculty, staff, students, or volunteers; 3. Chair/director; and 4. Faculty member.

## Disability and COVID-19 accommodations

### Requesting accommodations

The university strives to make all learning experiences as accessible as possible. In light of the current pandemic, students seeking to request COVID-related accommodations may do so through the university's request process, managed by Student Life Disability Services. If you anticipate or experience academic barriers based on your disability (including mental health, chronic, or temporary medical conditions), please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. SLDS contact information: [slds@osu.edu](mailto:slds@osu.edu); 614-292-3307; [slds.osu.edu](http://slds.osu.edu); 098 Baker Hall, 113 W. 12th Avenue.

### Diversity Statement

The Ohio State University affirms the importance and value of diversity of people and ideas. We believe in creating equitable research opportunities for all students and to providing programs and curricula that allow our students to understand critical societal challenges from diverse perspectives and aspire to use research to promote sustainable solutions for all. We are committed to maintaining an inclusive community that recognizes and values the inherent worth and dignity of every person; fosters sensitivity, understanding, and mutual respect among all members; and encourages each individual to strive to reach their own potential. The Ohio State University does not discriminate on the basis of age, ancestry, color, disability, gender identity or expression, genetic information, HIV/AIDS status, military status, national origin, race, religion, sex, gender, sexual orientation, pregnancy, protected veteran status, or any other bases under the law, in its activities, academic programs, admission, and employment.

To learn more about diversity, equity, and inclusion and for opportunities to get involved, please visit:

- <https://odi.osu.edu/>
- <https://odi.osu.edu/racial-justice-resources>
- <https://odi.osu.edu/focus-on-racial-justice>
- <http://mcc.osu.edu/>

In addition, this course adheres to **The Principles of Community** adopted by the College of Food, Agricultural, and Environmental Sciences. These principles are located on the Carmen site for this course; and can also be found at <https://go.osu.edu/principlesofcommunity>. For additional information on Diversity, Equity, and Inclusion in CFAES, contact the CFAES Office for Diversity, Equity, and Inclusion (<https://equityandinclusion.cfaes.ohio-state.edu/>). If you have been a victim of or a witness to a bias incident, you can report it online and anonymously (if you choose) at <https://studentlife.osu.edu/bias/report-a-bias-incident.aspx>.

## Course schedule (tentative)

	Date	Module	Module name	Topics	Readings	Due dates
Wed	8/24/22	1	Intro	Syllabus discussion, course navigation, reading a scientific article, preparing for discussions. Basic introduction to arthropods and insects	The biology of blood sucking insects, pp. 7-14	
Mon	8/29/22			Basic introduction to arthropods and insects	The biology of blood sucking insects, pp. 7-14	
Wed	8/31/22			Intro to arthropods review and paper discussion	League et al., 2019: <a href="https://www.cell.com/action/showPdf?pii=S0960-9822%2819%2930144-7">https://www.cell.com/action/showPdf?pii=S0960-9822%2819%2930144-7</a>	Scientific article write-up 1 due 8/31
Mon	9/5/22			<b>Labor day, no class</b>		
Wed	9/7/22	2	Vector borne disease transmission	Fundamentals of vector borne disease transmission	Mullen and Durden, Chapter 4, pdf provided	Supplemental assignment 1 due 9/7
Mon	9/12/22			Fundamentals of vector borne disease transmission, cont.	None	
Wed	9/14/22			Fundamentals of vector borne disease transmission review, questions, paper discussion	Lambrechts et al., 2011 <a href="https://www.pnas.org/content/pnas/108/18/7460.full.pdf">https://www.pnas.org/content/pnas/108/18/7460.full.pdf</a>	Scientific article write-up 2 due 9/14
Mon	9/19/22	3	Vector biology and behavior	Mosquito biology, ecology and behavior; Tick biology, ecology, and behavior	Mullen and Durden, Chapter 14, pp 261-279; Chapter 26, pp 603-618, pdf provided	
Wed	9/21/22			Mosquito/tick biology review, paper discussion	McBride et al., 2014: <a href="https://www-nature-com.proxy.lib.ohio-state.edu/articles/nature13964">https://www-nature-com.proxy.lib.ohio-state.edu/articles/nature13964</a>	Scientific article write-up 3 due 9/21
Mon	9/26/22	4	Vector control	Vector control and prevention of vector borne disease transmission	WHO "Core Vector Control Methods" and "Supplementary vector control methods"	
Wed	9/28/22			Vector control and prevention of vector borne disease transmission	WHO publication: Ethical issues associated with Vector Borne diseases (pp 3-7, 14-25)	
Mon	10/3/22			Review and discussion on vector control, paper discussion	O'Neill et al., 2018: <a href="https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6305154/">https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6305154/</a>	Email to Dr. Short outlining basic premise for term paper due 10/3

Wed	10/5/22	5	Bacterial pathogens	Introduction to pathogen types, Ticks and <i>Rickettsia</i> , Ticks and <i>Borrelia</i>	None	Supplemental assignment 2 due 10/5
Mon	10/10/22			Bacterial pathogens discussion, paper discussion	Ostfed et al., 2006: <a href="https://doi.org/10.1371/journal.pbio.0040145">https://doi.org/10.1371/journal.pbio.0040145</a>	
Wed	10/12/22			Supplemental discussion, exam review		
Mon	10/17/22			<b>Midterm Exam</b>		
Wed	10/19/22	6	Viral pathogens:	Mosquitoes and Togaviridae/Bunyaviridae	None	
Mon	10/24/22			Mosquitoes and <i>Flaviviridae</i> , ticks and viruses	None	
Wed	10/26/22			Viral pathogens review, paper discussion	Liu et al., 2017: <a href="https://www.nature.com/articles/nature22365">https://www.nature.com/articles/nature22365</a>	Scientific article write-up 4 due 10/26
Mon	10/31/22			Catch-up supplemental discussion day	TBD	
Wed	11/2/22	7	Protozoan pathogens:	Mosquitoes and Plasmodium	None	First draft of term paper due 11/2
Mon	11/7/22			Kissing bugs and trypanosomes	None	
Wed	11/9/22			<i>Plasmodium</i> and kissing bugs review, paper discussion	Lahondère et al., 2017: <a href="https://elifesciences.org/articles/26107">https://elifesciences.org/articles/26107</a>	Supplemental assignment 3 due 11/9
Mon	11/14/22			<b>No in-person class!</b> Pre-recorded lecture: Tsetse flies and trypanosomes	None	
Wed	11/16/22			<b>No in-person class!</b> Pre-recorded lecture: Sand flies and trypanosomes	None	Critiques of term papers due 11/16
Mon	11/21/22	8	Nematode pathogens	Mosquitoes and filarial worms	None	
Wed	11/23/22			<b>Thanksgiving – no class</b>		
Mon	11/28/22			Sandflies/tsetse flies review, filarial worms review, paper discussion	Hockmeyer et al., 1975: <a href="https://doi.org/10.1016/0014-4894(75)90031-4">https://doi.org/10.1016/0014-4894(75)90031-4</a>	
Wed	11/30/22	9	Pests:	Cockroaches, Bedbugs	Pub. Health Sig. of Urban Pests, pp 53-75, 131-151	Final term paper due 11/30
Mon	12/5/22			Pest review, paper discussion	Siva-Jothy et al., 2019: <a href="https://www.pnas.org/content/116/29/14682.long">https://www.pnas.org/content/116/29/14682.long</a>	
Wed	12/7/22			<b>Final Exam</b>		