**Vector Biology and Vector-Borne Diseases**

**Georgetown University**

**Spring 2023**

**1 credit**

**September 1st – December 10th**

**Instructor:** Oswaldo Villena, [Oswaldo.Villena@georgetown.edu](mailto:Oswaldo.Villena@georgetown.edu)

**Office Hours:** TBD

# Course Description

Vector-borne diseases affects humans, animals, and agriculture more than any other group of infectious disease. This course is both lecture and discussion. This course will introduce students to vector invasion ecology, basic vectors biology, the principals of transmission of pathogens (e.g., viruses, bacteria) to humans, animals, and plants by vectors (e.g., insects, mites, ticks), impact of environmental factors (e.g., temperature, precipitation) on vectors and pathogens. Also, during the course, the main vector-borne diseases in humans (malaria, dengue, chikungunya, West Nile virus, Lyme disease), animals (avian malaria, bluetongue), and plants (potato leaf roll virus, citrus greening) will be presented and discussed with students. This course is designed for graduate and upper-level undergraduate students. The course will consist of lectures, readings, and discussions.

# Course Learning Objectives

At the end of this course, students will be able to:

1. Explain how vector-borne diseases are incredibly dynamic
2. Explain how ecosystem and environmental drivers impacts human, animal, and plant vector-borne diseases
3. Describe individual components of vector-borne disease transmission using specific examples
4. Describe current emergent and re-emergent vector-borne infectious diseases
5. Explain the ecological components of vector-borne disease transmission
6. Demonstrate how vector biology is integral to our public health history
7. Discuss causes of morbidity and mortality, when and where these diseases occur and what populations are affected
8. Discuss environmental and biological drivers of transmission, and how these are impacted by the social, political, and economic dimensions
9. Explain how globalization and human behavior are key drivers for many of these emerging vector-borne diseases

# Course Prerequisites

There are no formal requirements.

# Course Requirements

Course assessment will consist of two short take-home assignments (20% each), a critique paper (40%) and a final project (20%). For the final project, students could work individually or in groups of 2-3 students. Students will select one vector-borne disease, collect open-source data about the topic and elaborate a report to be use by the appropriate organization (e.g., health authorities, agriculture agencies, wildlife agencies). Final project is due by the last day of classes.

# Schedule of Lecture Topics

**Schedule**

|  |  |  |
| --- | --- | --- |
| **Week** | **Topic** | **Readings** |
| Week 1 | Course introduction and vector-borne disease terminology | 1 |
| Week 2 | Invasion Ecology: vector’s transport and pathways in an era of globalization | 2 (chapter 1 and 2) |
| Week 3 | Vector biology: basic biology of U.S. and global vectors that transmits pathogens to humans, animals, and plants | 3 |
| Week 4 | impact of environmental factors (e.g., temperature, precipitation) on vectors and pathogens. | 4,5,6 |
| Week 5 | Vector-borne diseases in humans: vectors, pathogens, and diseases | 7 |
| Week 6 | Vector-borne diseases in humans: malaria, dengue, zika, West Nile fever, and Lyme disease | 7 |
| Week 7 | Vector-borne diseases in animals: avian malaria, bluetongue virus, bovine anaplasmosis, and Schmallenberg virus (SBV). | 1, 8 |
| Week 8 | Vector-borne disease in staple crops: potato virus Y (PVY), potato leaf roll virus (PLRV), corn stunt disease in corn, and citrus greening. | 9 |
| Week 9 | Emerging and re-emerging of vector-borne diseases | 10, 11 |

# Course Materials

There is no required textbook for this course. Some recommended resources are listed below

1. Global Health Impacts of vector-borne diseases: Workshop. <https://www.ncbi.nlm.nih.gov/books/NBK390441/>
2. Invasion Ecology – Lockwood, J. (2007).
3. Vector Biology and Control – Vas Dev (2020).

<http://www.nasi.nic.in/BCIL%20Vector%20Biology%20PDF_%2014th%20Aug%202020.pdf>

1. Thermal biology of mosquito borne-borne disease - Mordecai et al. (2019) <https://onlinelibrary.wiley.com/doi/full/10.1111/ele.13335>
2. Temperature impacts the environmental suitability for malaria transmission by Anopheles gambiae and Anopheles stephensi - Villena et al. (2022)

<https://esajournals.onlinelibrary.wiley.com/doi/full/10.1002/ecy.3685>

1. Impact of recent and future climate change on vector-borne diseases – Caminade et al. (2018). <https://nyaspubs.onlinelibrary.wiley.com/doi/full/10.1111/nyas.13950>
2. A global brief on vector-borne diseases - World Health Organization (2014). <https://apps.who.int/iris/bitstream/handle/10665/111008/WHO_DCO?sequence=1>
3. Ecology and conservation biology of avian malaria – LaPointe et al. (2012). <https://nyaspubs.onlinelibrary.wiley.com/doi/abs/10.1111/j.1749-6632.2011.06431.x>
4. Anthropogenic influences on emergence of vector-borne plant viruses: the persistent problem of potato virus Y - Gray, S. and Power, A. (2018). <https://www.sciencedirect.com/science/article/abs/pii/S1879625718300865>
5. Patterns, drivers, and challenges of vector-borne disease emergence - Swei et al. (2020). <https://www.liebertpub.com/doi/abs/10.1089/vbz.2018.2432>

# Attendance Policies

Illnesses and absence: Note that this is a small course with few scheduled meetings. Absences will be problematic because the classes will build on one another. Lecture notes will be posted on CANVAS. There may be times when you are sick or have to travel; please contact the instructor to make arrangements.

# Student Accommodations

Student Accommodations: Students should speak with their instructors before or during the first week of classes regarding any special needs. Students can also visit or contact the Academic Resource Center ([arc@georgetown.edu](mailto:arc@georgetown.edu)). Students seeking academic accommodations should register with Services for Students with Disabilities (SSD). SSD arranges reasonable and appropriate academic accommodations for students with disabilities. Please visit <https://academicsupport.georgetown.edu/disability/> for more information on student accommodations.

# Letter Grades

Final grades are rounded up to the nearest integer, then assigned as follows:

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| --- | --- |
| A | 95-100 |
| A- | 90-94 |
| B+ | 87-89 |
| B | 83-86 |
| B- | 80-82 |
| C+ | 77-79 |
| C | 73-76 |
| C- | 70-72 |
| D | 65-69 |
| F | <65 |