



# Florida International University



## Department of Biological Sciences

### Arthropod Vectors of Emerging Diseases – “*The world’s most dangerous animals*”

The mosquitoes that transmit Zika, Dengue, Yellow, and Chikungunya Fevers and Malaria are found in S. Florida. The insects that transmit Leishmania, Bubonic plague and other tropical diseases pose serious health risks throughout the tropics. This course will investigate the ecology and physiology of arthropod vectors and the diseases they transmit within the context of the urban environment.

Humans notwithstanding, *a handful of mosquitoes species are responsible for two to three million deaths every year, untold morbidity and economic burden.* Urban populations of the southeastern United States are at risk of arbovirus infection and global climate change will likely increase this risk. The major vectors of Dengue, Yellow, Zika, and Chikungunya Fevers are endemic to these areas and the increased frequency of outbreaks of these diseases abroad coupled with frequent international air travel will only increase this risk. In addition, the major vector species for malaria and West Nile virus, as well as other mosquito borne diseases are also present in So. Florida. The biology and ecology of mosquito borne diseases and how they are likely to affect South Florida in the near future along with other relevant arthropod vectors (fleas, ticks, and flies) will also be discussed. This course will be delivered in a hybrid manner with 50% of the content provided online and 50% in a traditional classroom.

Prerequisites: BSC 1010, BSC 1010L and BSC 1011, BSC 1011L

**Instructor:** Dr. Mario H. Perez

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**Office Hours:** Th and Fri 1- 4 pm

#### **COURSE GOALS and LEARNING OUTCOMES:**

The goal of this course is for you to learn the basics of the science of urban vector ecology by studying the fundamentals of how the organisms involved in vector ecology (pathogen, vector, host *etc.*) interact with their abiotic and biotic environment. The readings and lectures will lead you through a progression of ecological concepts from the level of the individual, organism, to populations, communities and, finally, ecosystems so that you can:

- Be familiar with fundamental epidemiological and ecological theories in order to understand and explain patterns observed in nature
- Learn epidemiological and ecological terminology and be able to use it in the proper context in order to communicate intelligently these concepts
- Be aware of important studies and the historical development of the discipline in order to understand contemporary epidemiological and ecological issues as they pertain to South Florida
- Be able to critically evaluate primary vector ecology literature and interpret case studies in this context
- Be able to apply vector ecology theory to formulate solutions to modern urban epidemiological problems

**TEXTBOOK:** Although there is no textbook required for this course there are required readings from the text cited below and selected primary literature. PDFs of published papers will be provided.

**Ecology of parasite-vector interactions**

Author: W Takken; C J M Koenraadt  
 Publisher: Wageningen : Wageningen Academic Publishers, 2010.  
 Series: Ecology and control of vector-borne diseases, vol. 3

**Arthropods as Vectors of Emerging Diseases**

Heinz Mehlhorn, Editor  
 Springer Books, 2012 (PDF) (~\$30 to print out)

Selected papers: TBA

The reading sequence is provided in the schedule.

**ASSESSMENT:**

There will be on-line quizzes at the end of each unit, a midterm and a final exit assessment. There will also be a term project using actual Miami Dade County Mosquito Control Board data. Students will analyze the data and write their findings in the form of a short communication (1 page) worthy of submitting to a peer review journal.

<b>Grade</b>	Letter (A: 95-100, A-: 90-94, B+: 85-89, B: 80-84 C: 70-79, D: 60-69, F: ≥ 59)
	<b>Quizzes 22.5% at end of each unit</b>
	<b>Midterm 22.5%</b>
	<b>Final Exam 22.5%</b>
	<b>Term Project 22.5%</b>
	<b>Attendance/Participation 10% (iclicker)</b>

**Attendance Policy:** Attendance is mandatory, as is class participation. Since we only meet once a week attendance and participation are all the more important. **Only one** unexcused absence will be allowed. Attendance and participation will be assessed via iclicker.

**Honor Code:** All students are bound by an academic honor code that includes serious sanctions for academic dishonesty (including but not limited to plagiarism and cheating). We will follow the university code ([www.fiu.edu/~jms](http://www.fiu.edu/~jms), follow link to student code of conduct) when a student is suspected of academic dishonesty\*. In addition, students will be expected to behave in a professional manner. *You are expected to behave as the professions you are preparing to become.*

### **Course Summary**

If asked, what is the world's most dangerous animal, most would respond lions, tigers, bears, sharks, or maybe people. Humans notwithstanding, *a handful of mosquito species are responsible for two to three million deaths every year, untold morbidity and economic burden.*

Urban populations of the southeastern Atlantic and Gulf coast states of the United States are at risk of arbovirus infection and global climate change will likely increase this risk. The major vectors of Dengue, Yellow, and Chikungunya Fevers, *i.e.*, the *Aedes aegypti* and *Aedes albopictus* mosquitoes, are endemic to these areas and the increased frequency of outbreaks of these diseases abroad coupled with frequent international air travel will only increase this risk. In addition, the major vector species for malaria and West Nile virus, as well as other mosquito species responsible for other diseases are also present in So. Florida; Taken together, this will only increase the risk of mosquito borne epidemics.

### **Unit I - Introduction to Vector Ecology**

- What is Vector Ecology anyway?
- *Vector Ecology of Major vector spp.*
- *Physiology of Major vector spp.*

### **Unit II - A brief survey of mosquito borne diseases likely to affect South Florida**

Malaria

Dengue

Chikungunya

West Nile

Eastern Equine Encephalitis

Heartworm

Other urban arthropod vector borne diseases

Plague

Lyme disease

Leishmaniasis

Sleeping sickness

Chagas disease

***Unit III - Vector Capacity***

- What is vector capacity? And how do we estimate it.
- The MacDonald equation

***Unit IV “Can mosquitoes transmit HIV?” Mosquito Myths: Misconceptions about Mosquitoes and Their Diseases***

Urban myths regarding mosquitoes will be discussed and dispelled.

***Unit V – Term Project - Urban vector ecology, global climate change and vector ecology***

*Increased risk S. Fla. What can we do about it?*

*A proposed study of the adult community structure and surveillance of Dengue vectors in Miami-Dade and how it relates to Miami’s urban ecology*

*Is insecticide resistance evolving in Miami Dade County?*

*Are GMO mosquitoes safe?*

***Unit VI - Increased risk S. Fla. What can we do about it?***

GMO mosquitoes, mosquito abatement/control strategies

***Unit VII Beyond South Florida – a lesson in Global Health***

*Global climate change and urban vector ecology*

**Final Exam during finals week and Term project due.**

**This syllabus is tentative and subject to change.**