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## Special Feature

# Current Topics in Medical, Urban, and Veterinary Entomology, the 7<sup>th</sup> annual MUVE Roundtable: 62<sup>nd</sup> Mississippi Entomological Association Annual Meeting

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## Introduction

The first roundtable discussion in association with the annual Mississippi Entomological Association (MEA) meeting was held in 2010. From the beginning our goal was to promote interaction across disciplines among people with common interests in medical, urban, and veterinary entomology. We certainly realized that goal this year. We had more attendees than any prior years and the discussion was lively. The 7<sup>th</sup> annual MUVE roundtable discussion took place at the Bost building on the Mississippi State University campus during the 62<sup>nd</sup> annual MEA meeting. To announce the roundtable we published the MUVE mission statement and issued an open invitation again this year to anyone who wanted to attend. At the meeting this year, discussion centered on various interests of the group members. Names and contact information of the participants are provided at the end of this article. The main topics of our discussions are summarized below.

## Undergraduates

The Entomological Society of America (ESA) is the largest group of entomologists in the world and this year at the ESA annual meeting the Department of Biochemistry, Molecular Biology, Entomology, and Plant Pathology (BCH-EPP) was represented by numerous faculty and graduate student research presentations. Our department is also distinguished as sponsoring the oldest Bug and Plant Camp in the world. Two of our undergraduate students, Breanna Lyle and Matthew Thorn, won ESA awards in 2014 for research they conducted in our department with Drs. Krish Krishnan and John Guyton. Also, a high school student and Bug and Plant Camper, Corran Hall, from Iowa, assisted Dr. Guyton with a preconference teacher workshop in 2015. However, there is no undergraduate department of entomology available at MSU. In fact, faculty often receive emails from people seeking research positions. These are often potential graduate students, but also undergraduates looking for meaningful work in research. They are willing to work in a lab doing menial tasks, but strive to find work that is applicable to their fields of interest. One suggestion made by the group was that we work with the department head, Dr. Jeff Dean, to establish a repository for this valuable list of potential undergraduate and graduate students to be kept on file. It was also suggested that an announcement could be made to the Honors College for potential Directed Independent Study (DIS) students who might be interested in working on projects for either credit or wages. For example, there is a \$2000 undergraduate research stipend offered by Dr. John Riggins that is funded by the Office of Research and Development (ORED). Also an Undergraduate Research Scholars Program (URSP) grant from the College of Agriculture and Life Sciences (CALs) for \$5000 is offered to undergraduates for conducting research.

## Trends in MUVE

There is a trend to replace integrated pest management (IPM) and vector management programs with basic health care and vaccination programs. This trend is accompanied by a shift from field to laboratory research focusing mainly on molecular mechanisms. The result is that traditional entomologists such as

field scientists often adopt molecular tools. In fact, this continues to occur much more frequently than the other way around with molecular entomologists performing field research. As medical and veterinary entomologists with traditional training in field research retire, it leaves a lack of MUVE training programs. There are also fewer systematics experts among MUVE entomologists. Key MUVE areas might still be divided into laboratory and field topics. Laboratory topics include molecular genetics, molecular systematics, and vector-parasite interactions. Field topics typically include vector control, ecology, surveillance and monitoring; and epidemiology.

### New topics

There are several topics on the horizon that the MUVE training programs need to address. The following were discussed:

*Proteomics*: The study of the composition, structure and function of proteins in living organisms, both plants and animals. Proteomics studies can help us better understand host-pathogen interactions and can also help identify targets for novel antibody-based diagnostics and epidemiological tools.

*Cox1 and 16S gene for eukaryotic and bacterial "barcoding" and community analyses, respectively*: The recent proposal that the *cox1* gene might be useful as a DNA barcode marker, together with internal transcribed spacer (ITS) rDNA, offers a potential means of identifying arthropods to species as well as identifying cryptic species and helping elucidate population structures. Similar methods can also be used for identifying blood meal contents in ticks and mosquitoes.

*Microbiome*: That is, the microorganisms in a particular environment, including on an organism or within a specific tissue, and their combined genetic material. Microbes are in soil, water, in our bodies and also in the bodies and breeding habitats of vector arthropods. The human skin microbiome has been shown to be important during the production of volatile compounds that attract mosquitoes. Likewise, the gut microbiome of several arthropod vectors has been implicated in modulating their vectorial capacity. There are also several important endosymbiotic bacteria that are included in the microbiome of many insects and are believed to affect everything from behavior to innate immunity and vectorial capacity. The reproductive parasite *Wolbachia* (proteobacteria) is currently the most talked-about example of this and has been shown to affect vectorial capacity against certain pathogens in *Aedes* mosquitoes. It is also being developed as part of population reduction programs in certain mosquito populations as crossing *Wolbachia* strains during mating often leads to the production of unviable eggs. *Wolbachia* can also exist in a seemingly commensal state, as is the case in *Cimex*. A wide array of commensals are also important members of the gut microbiome in many structural pests.

*Next generation sequencing (NGS)*: Or massively parallel sequencing, is a catch-all term used to describe a number of different modern high-throughput sequencing technologies. Most notably here, NGS can be used for microbial community analysis by sequencing millions of 16S sequences from one sample. These 16S sequences can then be compared to existing databases and identifying, or approximating, the species of bacteria present in a sample along with their relative abundances. There is also a newer NGS technology named "nanopore" sequencing that is portable and promises to eventually become more affordable. However, it still currently comes with several other major technical drawbacks.

### Entomology-related web sites

The group discussed several web sites that are good resources for information about entomology, public health, and vector-borne diseases. For example, Vector Map (<http://vectormap.si.edu/>) states:

"VectorMap is a product of the Walter Reed Biosystematics Unit based in the Smithsonian Institution. VectorMap provides disease maps, and mapped collection data and distribution models for arthropod disease vector species, including mosquitoes, ticks, sand flies, mites, and fleas, as well as the hosts/reservoirs of vector-borne disease pathogens. Collection records are searchable and downloadable, users can map and contribute their own georeferenced collection data or distribution models, and all contributions have full attribution."

This site provides a valuable source of information regarding vector-borne diseases.

Another site with valuable information is the Louisiana Mosquito Control Association (LMCA) (<http://www.lmca.us/>). The LMCA has several annual achievement and research awards and also funds a

scholarship for students in Louisiana, Arkansas, Mississippi, Oklahoma and Texas. For example, a \$1,500 scholarship, known as the C. Lamar Meek Memorial Scholarship, is offered annually to either an undergraduate or graduate student to promote and encourage academic pursuits relating to medical and veterinary entomology.

The Center for Food Security and Public Health (<http://www.lmca.us/>) whose mission is “to increase national and international preparedness for accidental or intentional introduction of diseases that threaten food production or public health” has numerous resources regarding vector-borne diseases which are available online and for downloading.

### **Specialty in Veterinary Entomology**

The Entomological Society of America also recognizes a MUVE section which deals with insect interactions with other animals (including humans). Similar to the MEA MUVE roundtable, topics for the ESA MUVE group include medical entomology, urban entomology, and veterinary entomology; but also forensic entomology, epidemiology, integrated disease management, human and veterinary parasitology, public health pest management, mosquito control, management of structural pests (e.g., termites, ants), and others. Since our discussions continue to include these additional areas, we might need to make sure MEA MUVE explicitly encompasses them in its mission statement.

This year we had several people from the College of Veterinary Medicine (CVM) participate in the MUVE roundtable discussion. However, we would like to have a larger group of veterinarians and veterinary students interested in participating. Veterinary entomology strategies are guided by their IPM program and functions in conjunction with dairy and field crops programs. The Veterinary Entomology program at Cornell serves as a good example. The program provides resources to the entire New England region and is the only program in the U.S. which continuously works to improve IPM strategies on dairy farms. Mississippi State University BCH-EPP informally works with veterinarians on entomology-related issues, but could benefit from formalizing this relationship by creating a Veterinary Entomology program similar to the one at Cornell in order to support producers throughout the state and the southeastern region and generate interest and support from students, staff, and faculty at the CVM.

### **Future Issues**

Vector-borne diseases often affect people and animals. Nipa Virus is a prime example. There are other arthropod-transmitted viruses that pose a potential threat such as yellow fever, La Crosse, eastern equine encephalitis, Chikungunya, and Zika. Chikungunya and Zika viruses are transmitted by mosquitoes common in the southern US and are considered an imminent threat to the US. The range of Lyme disease is increasing and many tick-borne diseases pose potential threats in Mississippi and the southern region, including Rocky Mountain Spotted Fever, ehrlichiosis, anaplasmosis, and Dengue fever. MEA MUVE is poised to address these and other threats as part of its mission.

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**Table - 7th Annual Medical Urban Veterinary Entomology (MUVE) Roundtable Mississippi State University (MSU) 63rd Annual Mississippi Entomological Association (MEA) Meeting**

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