UF Center for Precollegiate Education and Training
UNIVERSITY of FLORIDA
www.cpet.ufl.edu

CPET Science Fare

Volume 1, Issue 2, February 20, 2009

For the Love of Bugs

IN ADMINISTERING our outreach programs, we are fortunate to work with hundreds of faculty collaborators who enrich the participant experience in each of our programs. Some of the most memorable educational experiences have been a direct result of contributions from the faculty members in UF's Entomology and Nematology Department., from Dr. Phillip Koehler's high-energy presentation *Canine Detection of Termites* to the consistent mentorship by faculty members too numerous to name. The UF Entomology and Nematology faculty and graduate researchers encompass an astonishing array of scientific disciplines — from natural agriculture and emerging pathogens to forensics and evolution of insects and worms. In this issue of ***CPET Science Fare,*** UF postdoctoral researcher Dr. Greg Ragland highlights the unique lives of Pitcher Plant Mosquitoes, Dr. Oscar Liburd shares his insight about the future of entomological research in the Faculty Feature and the UF Entomology Department provides some record-straightening facts about lives and nature of Lovebugs. As always we encourage and even reward feedback. Forward all inquiry and requests to cpet@cpet.ufl.edu with **"Newsletter"** in the subject line.

46th Florida JSEHS —And the Winners Are...

Flys & Fruit Flys groups salute the camera at the UF Cancer Genetics Research Center before splitting up to attend their first lab tours of the day!

...EVERYONE !!! From the CPET staff, which prepared for months prior to the JSEHS, and the faculty members and lab assistants who passionately shared their life's work to the **175** students and **55** adult chaperones from **36** schools in **18** counties across the state. All attendees contributed in their own unique ways to the success of the program.

Whether a 9th/10th grade presenter, 11th/12th grade speaker, a poster presenter or an observant participant, the objective of the JSEHS, to promote original research and experimentation in science, was reached once again this year! The challenges facing science teachers are great . We hope that JSEHS creates an air of excitement and a desire to pursue science at the next academic level as well as a reference point for the inquiry component of science.

At the conclusion of the 2009 JSEHS the top five 11th/12th grade speakers were awarded a trip to the National Junior Science and Humanities Symposium in Colorado Springs, CO. The top three speakers received scholarship money and the top two speakers will represent Florida at the national competition where they will present their research.

2009 JSEHS Speaker Winners (in rank order)

Jonathan Wang , Oak Hall School (Gainesville/Alachua)
Protection of Neurons Against Injury Using Neuroreceptor Targeting Nanoparticles

Nadine Currie, Lake Brantley High School (Altamonte Springs/Seminole)

Featured Faculty

Dr. Oscar E. Liburd

Fruit & Vegetable IPM Specialist
Associate Professor
Department of
Entomology & Nematology

What made you first begin to consider a career in entomology?

My grandfather was a major farmer in the Caribbean where I grew up. He experienced a lot of insect pests problems on his farms. I wanted to help my grandfather control his insect pest problems so I decided to do a degree in agricultural entomology. The plan was to go back and help my grandfather but I stayed in the US and did a Masters and PhD in entomology after I completed my bachelors degree. I later changed my mind from going back to the Caribbean and went into academia.

From an entomology perspective, what do you think are emerging scientific research topics for the next generation of scientist?

Integrated pest management will remain a viable area of research as we progress globally to adopt eco-friendly ways to control harmful pests

What is your favorite insect? Why?

Spodoptera exigua is the insect that comes to mind. It is the first economically important insect that I worked on. In addition, I like to see the metamorphosis of this insect developing from an egg to a larvae then to a pupae and finally a beautiful butterfly emerge.

What was the single most effective/ memorable learning experience for you in high school/undergrad/grad school?

The most memorable experience in high school is getting second prize for my insect collection in the St. Kitts / Nevis science fair competition for high school students.

What would you like our Florida science teachers to know about preparing high school students for a post secondary education (on science track)?

To prepare students for a science track you should expose students to as many

10 Years of Science Outreach

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Nadine Currie, Lake Brantley High School (Altamonte Springs/Seminole)
Measuring the Partition Coeffiecient of Oil extracted from Algae

Mansfield Burlingame, Lake Brantley High School (Altamonte Springs/Seminole)
Possible Therapuetic Treatment to Block the Action of Plant and Bacterial Toxins: Year Two

Bahar Shah, Canterbury School (Ft. Myers/Lee)
CD11B+ Monocyte Infiltration into CNS Following M1 Activation

William Haber, Dr. Michael M. Krop Senior High School (Miami/Dade)
Adaptive Filtering of Lidar Data to Preserve Stream Bank Morphology

We look forward to seeing you all again next winter. We strongly encourage your questions, comments and concerns about the JSEHS and how to improve the program for next year!

More Details

The Lives of Pitcher Plant Mosquitoes; An ecological and evolutionary study

Contributed by Dr. Gregory Ragland

Wyeomyia smithii
Larvae

My mosquito research has focused on pitcher plant mosquitoes (*Wyeomyia smithii*) native to North America (found from North Florida to Canada). All mosquitoes have a complex life cycle, meaning that the adults (the flying critters) lay eggs, the eggs hatch into aquatic larvae, and those larvae then metamorphose into adult mosquitoes. Most mosquitoes will lay their eggs into just about any puddle of water they can find. Pitcher plant mosquitoes are special in that they will only lay their eggs into the water-filled leaves of the carnivorous purple pitcher plant (*Sarracenia purpurea*).

Although pitcher plants generally capture insect prey that drown in the water-filled leaves and are then broken down to produce nutrients for the plant, mosquito larvae are adapted for an aquatic lifestyle and can therefore survive in the leaves.

Sarracenia purpurea

This particular species actually does not feed on blood or transmit human diseases, but we use it as a model system to ask how mosquitoes in general respond to different climatic conditions. We use this particular species because it has an interesting strategy for dealing with seasonal changes. Anyone living in Florida, or just about anywhere on earth except the Arctic and Antarctic regions has probably noticed that mosquitoes are vicious in the summer (and spring and fall in Florida) but aren't around so much in the winter. So where do they go? The answer in most cases is that they go into hibernation, largely so that they don't freeze to death.

I study how the mosquitoes evolve in a particular environment so that they know when to enter and exit hibernation. If they hibernate for too long, they're missing valuable time when they could be out feasting on blood (at least for blood-feeding mosquitoes), and if they hibernate for too short a time they'll expose themselves to potentially lethal cold temperatures.

I use pitcher plant mosquitoes as a study system because they have a very specific way to determine how long they should hibernate. They enter and exit hibernation based on day length cues. Long day lengths signal warmer conditions, while short day lengths signal colder conditions. Using these cues allows the mosquitoes to enter and exit hibernation at essentially the same time each year, and mosquitoes living in different geographic areas perceive these cues differently to adapt to differences in seasonality.

For example, Florida is an important study population because it has a very short winter, and mosquitoes living in Florida have evolved a particular sensitivity to day length that causes them to hibernate for only a short period of the year when day lengths are very short. In the pitcher plant mosquitoes this is about November to February.

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What would you like our Florida science teachers to know about preparing high school students for a post secondary education (on science track)?

To prepare students for a science track you should expose students to as many hands-on scientific experiences as possible while maintaining the fun and interest in the assignments that they are working on. You should also encourage students to read about science, expose them to field trips and museum collections.

Lovebug Truths

Lovebug nomenclature *Plecia nearctica* Hardy

Lovebugs were NOT genetically engineered by UF researchers to control mosquito populations.

Lovebugs are not native to Florida and most likely found their way here via strong winds, sod transport, expansion of pastures or vehicle transport.

Lovebugs accumulate in relatively warm, humid, sunny areas with chemicals in the atmosphere that mimic feeding and oviposition sites.

Sperm transfer requires an average of 12.5 hours but the pair usually remains coupled for several days during which they feed and disperse. The male ejects a depleted spermatophore after separating from the female and both sexes may mate again.

Macerated lovebugs have a neutral pH of 6.5 but become acidic at 4.25 within 24 hours. A lovebug-coated surface exposed to the sun for an extended period of time, however, may be damaged by the insects and their removal.

Lovebugs appear in excessive abundance throughout Florida as male-female pairs for only a few weeks every April-May and August-September. Lovebugs signal changes in the seasons from spring to summer and again from summer to fall

Lovebugs are actually beneficial as larvae because they help to decompose dead plant material

Calendar

March 2

2009 SSTP application review begins

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I study how the mosquitoes evolve in a particular environment so that they know when to enter and exit hibernation. If they hibernate for too long, they're missing valuable time when they could be out feasting on blood (at least for blood-feeding mosquitoes), and if they hibernate for too short a time they'll expose themselves to potentially lethal cold temperatures.

I use pitcher plant mosquitoes as a study system because they have a very specific way to determine how long they should hibernate. They enter and exit hibernation based on day length cues. Long day lengths signal warmer conditions, while short day lengths signal colder conditions. Using these cues allows the mosquitoes to enter and exit hibernation at essentially the same time each year, and mosquitoes living in different geographic areas perceive these cues differently to adapt to differences in seasonality.

For example, Florida is an important study population because it has a very short winter, and mosquitoes living in Florida have evolved a particular sensitivity to day length that causes them to hibernate for only a short period of the year when day lengths are very short. In the pitcher plant mosquitoes this is about November to February.

In contrast, populations of mosquitoes living in Maine remain in hibernation even when day lengths are relatively long because winter lasts much longer in New England. A typical population of pitcher plant mosquitoes in Maine remains in hibernation from late July until early June.

Some research by another lab at the University of Oregon has shown that some populations of pitcher plant mosquitoes have evolved different day length sensitivities in the last 25 years, evolving from relatively long hibernation times to relatively shorter hibernation times. This corresponds to one of the major impacts of global climate change: summers are becoming longer, while winters are becoming shorter.

I study factors that set the limits on how long the mosquitoes must stay in hibernation. For example, you might imagine that a mosquito that could still fly relatively well even when temperatures were around 40 degrees Fahrenheit might not have to hibernate at all in Florida, where average temperatures rarely dip that low. Fortunately for us this does not appear to be the case in the pitcher plant mosquito or in any of the species that do bite humans.

We collect data by first collecting mosquito larvae from populations all over the eastern US and creating lab colonies. These colonies are reared in cages that contain pitcher plants (grown in a greenhouse) into which the adults can lay eggs. We then transfer the eggs to water-filled petri dishes and rear the larvae in those dishes until they pupate and metamorphose.

Once we have the animals in the lab we expose them to simulated environmental challenges. We expose them to sub-zero temperatures and determine survival. We expose them to cold conditions that cause them to enter a chill-induced coma, then measure the threshold temperature for coma induction and how long it takes them to recover from the coma. We also measure their ability to mate and produce eggs in cold, intermediate, and warm conditions.

One hypothesis we have tested posits that because mosquitoes from northern regions don't exit hibernation until conditions are relatively warm they may not be any better adapted to the cold than mosquitoes from Florida (Even though on average northern areas such as New England are clearly much colder than Florida). By examining cold survival, chill coma, and low temperature egg production in mosquitoes from different geographic populations we have found that northern populations, while slightly more cold tolerant than southern populations, are not really all that different in cold temperature responses. Thus, we do find support for our hypothesis.

Sadly I do not have a model mosquito of the future, although I don't expect it will look much different than the mosquito of today. The main difference will be that the beautiful late fall and early spring weather we have here in north Florida may become a lot more mosquito infested. In fact, these hibernation mechanisms occur in many insects, and changing climates may make our cooler seasons buggier in general. The one saving grace is that climate change proceeds more rapidly at higher latitudes, so winter

More Details

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March 2
2009 SSTP application review begins

March 31
Science Quest Application Deadline

April 16
Summer A/C Dual Enrollment Orientation

April 29—May 3
National Junior Science and Humanities Symposium

ICORE information now available!

SSI information now available!

Selected Links

CPET Home
UF Outreach
Florida Science Teacher Grants
Visualizing Chemistry
Contribute your favorite links!

Fare Share

In the March issue of ***CPET Science Fare*** we will feature physics research and it's application. We will also feature practical tools for professional development.
As Always —Contribute your effective labs, science riddles, best practices etc. So please start sending them NOW. If we use your contribution we will send you a one-of-a-kind CPET t-shirt, specially designed for ***CPET Science Fare*** contributors !!!

Program Updates

2009 SSTP & Science Quest applications have been rolling in early this year. Applications **cannot** be evaluated until all parts are completed and have been received by the CPET office.