



Southeast Science Boot Camp for Librarians
2019
Vanderbilt University

Librarian as Scientist

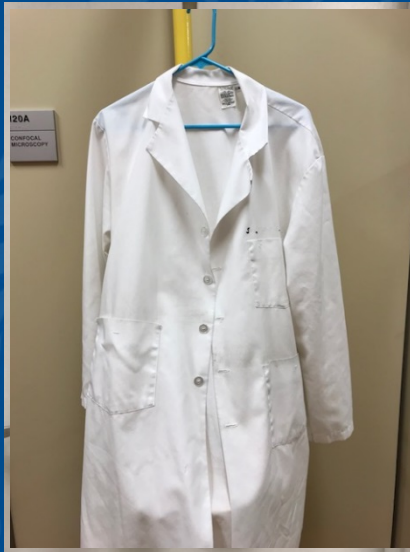
Presented by:
Marcelle Savoy

LMU

DeBusk College of Osteopathic Medicine
LINCOLN MEMORIAL UNIVERSITY

VALUES | EDUCATION | SERVICE

Training the leader of tomorrow

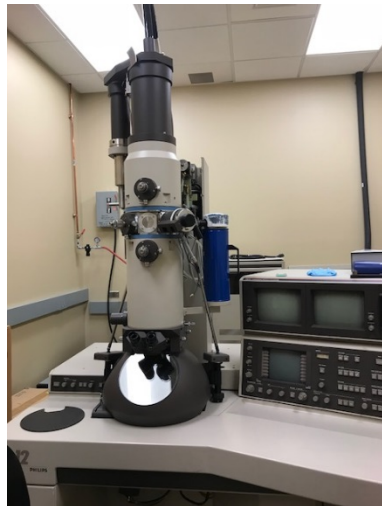


My Background

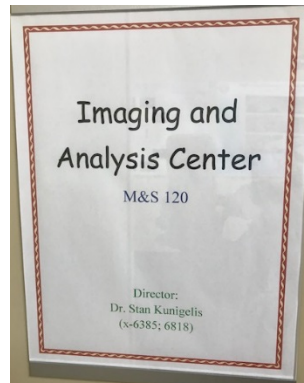
- BS -- Horticultural Science/Botany
- PhD -- Soil and Environmental Microbiology
- MS – Information Science
- High School Biology and Chemistry teacher for 21 years (Retired)
- Currently the Medical Librarian at LMU-DCOM

How did this librarian get involved in scientific research?

- Science is my first love;
- Always had an affinity for microscopy;
- We have an electron microscopy suite;



TEM



SEM

- The director is jointly appointed with the medical school (one of my liaison contacts) and the Masters of Science program;
- Hmm...

Step 1.

- Contact Director
- Express interest in auditing an EM class

Step 2.

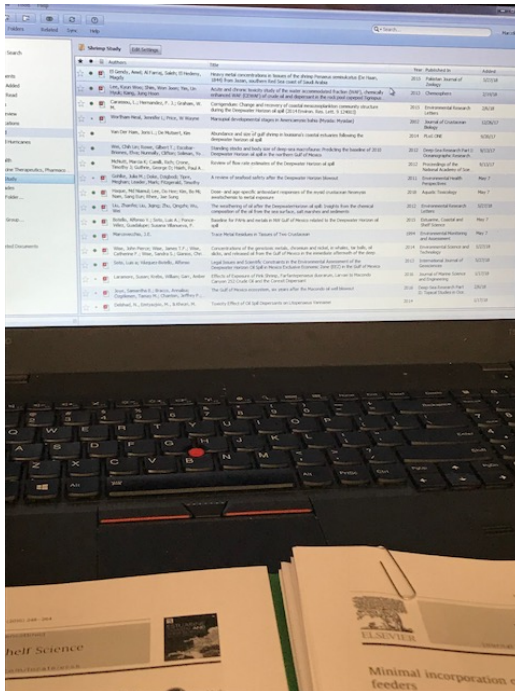
- Apply to graduate school through the admissions department
- Accepted

Step 3.

- Begin Class

My Assignment(s):

- Write a literature review on the topic: “Contaminants in Mysid Shrimp from the Deep Water Horizon Spill” (Scientist)
- Help the class with finding resources for their literature reviews (Librarian)



Contaminants in Mysid Shrimp from the Deep Water Horizon Spill

A Literature Review



sea surface layer were also incorporated into the mesopelagic food web (Quintana-Rizzo et al., 2015).

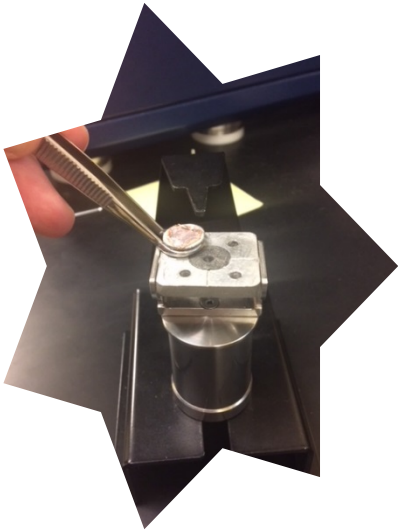
Mysidopsis spp. of shrimp have been shown to be more sensitive to toxic substances than other marine species tested (Nimmo and Hamaker) and it is this responsiveness, together with the phases of

their short life cycle occurring in both benthic and pelagic zones, which make them most suitable for research purposes (Porter, 2016).

Mysid Shrimp Life Cycle

The diversity of species in the order Mysida is exemplified by the range of aquatic habitats in which they are found. Although 90 percent of these species are marine, occurring in intertidal regions and deep sea environments, they are also abundant in estuary nursing grounds and fresh water river

Learning how to use the Scanning Electron Microscope

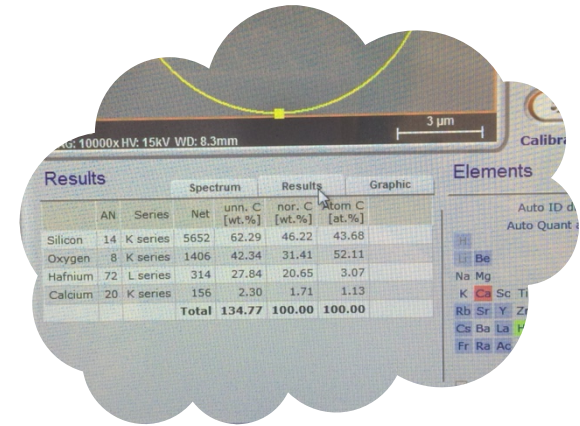


Prepare

**Definitely
Scientist!**



View



Analyze

Step 4.

Was asked to be a faculty member on a research trip to the FSU Marine Lab (Wow!! Scientist)

**2018 LMU OMS-MS-BS
Research Marine Biology:
Copepods, Tardigrades, Mysids**
Apalachicola Estuary, Florida State University Marine Lab.
May 24 – June 04, 2018.
Crystal River Manatees, FL, May 31-June 01, 2018.

Date	Morning (7:45-11:45 am)	Afternoon (1:15-5:30 pm)	Evening (7:00-10:00 pm)
Th-24 th L 0.9' HH 2.3'	Depart LMU for FSU Coastal and Marine Laboratory, 3618 Coastal Highway 98, St. Teresa, FL 32358-2702	Driving and more driving! (660 mi) (81-75-319-98)	Dinner in T-town. Groceries in Crawfordville. Arrive FSUML 9-11pm. Unpack. Good night!
F-25 th L 0.5' HH 2.7'	Collection 1a: Pontoon Boat Coastal Survey of Alligator Harbor, Otter Plankton Trawls, Snorkeling.	Collection 1b: Pontoon Boat Coastal Survey of Lanark Shoal, sandbar, & oyster bar. Otter and Plankton Trawls, Snorkeling.	Clean boat and gear. Dinner. Kunigelis Lecture: Research overview. Tissue fixation overview. Microscopic sorting of copeps, tardigrades, and mysids by genus.
S-26 th L 0.1' H 2.9'	Surgery 1a: Project specific specimen identification, sorting, manipulation, or microsurgery.	Surgery 1b: Project specific specimen identification, sorting, manipulation, or microsurgery.	Dinner. Surgery 1c: Project specific specimen identification, sorting, manipulation, or microsurgery.
-27 th -0.2' 13.0'	What's an estuary? Estuarine orientation.	South shore of estuary. George Island survey. Town of Apalachicola.	Dinner. Savoy Lecture: Professional literature reviews (resources and formatting) and poster preparation.
28 th -0.1'	Classroom activities. Survey FSUML	Wakulla Springs: the Real FL.	Dinner. Smith Lecture 1: Plight of the

Savoy Lecture: Professional literature reviews (resources and formatting) and poster preparation.

Oops! Librarian

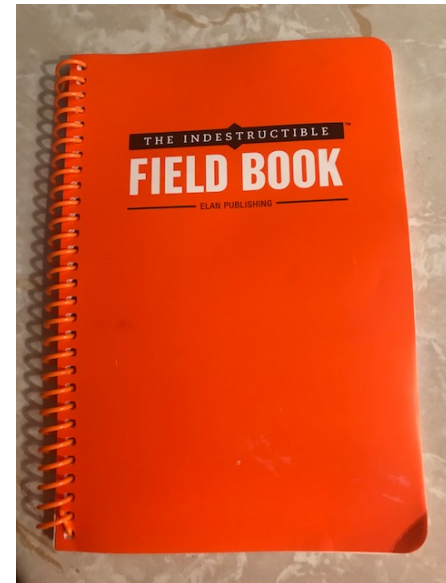
Off to the Florida State University Coastal Marine Lab

Typical Schedule

Morning and Afternoon--- Sample Collection in the Apalachicola Estuary (Scientist)



Alligator Harbor



Collecting Samples

The Otter Trawl for midwater organisms





Nalgene bottles for surface organisms: plankton (Copepods) and juvenile shrimp



Sediment traps for benthic organism or bottom feeders (Tardigrades)



Evening: Instruction with literature sources and bibliographic tools OR
finding answers to questions (Librarian)

- BioOne Complete
- JSTOR
- Discovery (our catalog)
- Mendeley
- ScienceDirect & Life Sciences
- Wiley Online Library
- PubMed

Yes: Even PubMed has over 2000 articles on Copepod Physiology

The screenshot shows the PubMed search interface. At the top, the NCBI logo and navigation links are visible. The search bar contains the query "(copepod) AND physiology", which is circled in red. Below the search bar, the search results are displayed. The "Search results" section is highlighted with a red box and shows "Items: 1 to 20 of 2213". The first two results are listed below, each with a checkbox and a link to the article.

NCBI Resources How To

PubMed.gov PubMed (copepod) AND physiology

US National Library of Medicine National Institutes of Health

Article types: Clinical Trial, Review, Customize ...

Text availability: Abstract, Free full text, Full text

Publication dates: 5 years, 10 years, Custom range...

Species: Humans, Other Animals

Clear all

Format: Summary Sort by: Most Recent Per page: 20 Send to

Search results
Items: 1 to 20 of 2213

<< First < Prev Page 1 of 111 Next > Last >>

- [Molecular physiology of copepods - from biomarkers to transcriptomes and back again.](#)
1. Tarrant AM, Nilsson B, Hansen BW.
Comp Biochem Physiol Part D Genomics Proteomics. 2019 Mar 19;30:230-247. doi: 10.1016/j.cbd.2019.03.005. [Epub ahead of print] Review.
PMID: 30921652
[Similar articles](#)
- [The genome and mRNA transcriptome of the cosmopolitan calanoid copepod *Acartia tonsa* Dana improve the understanding of copepod genome size evolution.](#)
2. Jørgensen TS, Petersen B, Petersen HCB, Browne PD, Prost S, Stillman JH, Hansen LH, Hansen BW.
Genome Biol Evol. 2019 Mar 27. pii: evz067. doi: 10.1093/gbe/evz067. [Epub ahead of print]
PMID: 30918947

RESULTS

An SEM Investigation of Copepod Visual Systems

Paige E. Massey & Stan C. Kungelis
Lincoln Memorial University-DeBusk College of Osteopathic Medicine, Harrogate, TN

Background

While most crustaceans have compound eyes, copepods have three eyes that have been neglected in modern phylogenetic investigations into the visual system (Skafan, 2006). All larval copepods have a tripartite or nasular eye, remaining as such into adulthood in most species. Some species, though, develop a separate transformed eye. A very unique spherical lens lacking most observations makes this eye exquisitely sensitive to movement by sweeping the field of vision forty-five degrees at a time, although research thus far has examined gross structure via light microscopy as early as 1891 (Parke), the details of the exact structure of the visual system remain largely unknown. While the visual system during development was examined in serial cross-section by electron microscopy (Lacati, 2009; Wilson & Hartline, 2011), the adult nasular "retina" (in this case, reticular cells and rhabdoms) and "optic nerves" have yet to be investigated in three dimensions by dissection.

Methods

Sample organisms were collected in Apalachicola estuarine waters near Florida State University Marine Lab, sorted and identified by species, and dissected by free-handed microsurgery. All images are from the genus *Lobocera*. Specimens were then fixed with glutaraldehyde and osmium tetroxide and prepared for SEM examination by either a Hitachi TM-3000 SEM or a LEO 962 field emission SEM.

Literature Consulted

1. Skafan, S. (2006). The evolution of crustacean compound eyes and the evolution of the visual system. *Journal of Experimental Biology*, 119, 1-10.
2. Lacati, M. (2009). The evolution of crustacean compound eyes and the evolution of the visual system. *Journal of Experimental Biology*, 122, 1-10.
3. Wilson, R. & Hartline, D. (2011). The evolution of crustacean compound eyes and the evolution of the visual system. *Journal of Experimental Biology*, 124, 1-10.

Figure 1: The whole structure of the eye on the eye stalk.

Figure 2: Top of the three spherical lenses, field of view with depth and perspective view. SEM.

Figure 3: Close-up view of the eye structure, SEM.

Figure 4: Close-up view of the eye structure, SEM.

Results & Discussion

Large spherical lenses are the most readily visible feature of the visual system. Delicate dissection and handling are required to keep them in situ. These large spherical lenses are the most readily visible feature of the visual system. Two lenses sit dorsally and one sits ventrally, each surrounded by the secretory cells that produced them. These lenses sit in one case that contain the reticular cells, and from each of those cells, an axon is sent to the protocerebrum. The evolutionary novelty of this system is that the retinal surface doesn't quite contact the lens, but moves around it in a wide field of about forty-five degrees in any direction, giving a wider field of vision from each of the three eyes.

While the transformed eye was not observed *in vivo*, the examination of fixed samples is a necessary prerequisite for these further studies. Further study *in vivo*, including behavioral and electrophysiological investigation, would shed light on many functional aspects of the copepod visual system.

Clinical Potential

Revolutionary new retinal prostheses or "bionic eyes" are already functional to some 100 patients around the world, replacing the faulty photoreceptors on the retinas of patients with some diseases like retinitis pigmentosa. Currently, expanding field of vision and acuity is proving very challenging, as surgical limitations prevent larger implants. Potential innovations inspired by the parsimonious structure of the copepod transformed eye may include a "reverse scanning retina", allowing different areas of the visual field to be alternately projected onto the same small retinal prostheses. Even as these retinal devices become more sophisticated, they still limit prosthetic acuity severely. As science looks to evolve our bionic eyes, any of these innovations may greatly simplify the technical demands of an increasingly accurate prosthetic. Perhaps the simplicity of the copepod transformed eye can shed new light on future solutions for human vision.

Toxin Accumulation of a Bioindicator Shrimp Species: *Palaemonetes pugio*

Allison Strong¹, Kaiser Kabir², Stan Kungelis, Ph.D.²
¹LMU Master's of Biomedical Professions; ²DeBusk Osteopathic College of Medicine
Lincoln Memorial University, Harrogate, TN 37752

Introduction

Palaemonetes pugio, also referred to as grass shrimp, is a benthic species of shrimp. As a benthic macroinvertebrate, *P. pugio* experience the breakdown of organic and inorganic energy transfer from producers to consumers. Their survival also indicates the health of the ecosystem. Any significant changes in the population will impact the entire ecosystem. Toxic metals in the species of shrimp will cause their population to decline. They are toxic substances to consumers, such as heavy metals, pesticides, and other anthropogenic sources, than other crustaceans. This sensitivity makes *P. pugio* an ideal species for toxicity testing.

This study aims to determine the current status of an estuarine environment from the 2010 Deep Water Horizon oil spill using *P. pugio* in the Zone I stage. Even though the oil spill occurred in open water, chemical dispersants introduced oil particles into the water column, allowing the oil particles to travel downstream to coastlines. The muscle tissue was examined using elemental analysis. The elements at the top of category represent the average composition of the muscle tissue from the spill. Heavy metal elements were selected to determine and analyze the level of support toxicity that is not related to the oil spill.

Specific Aims

1. Specimen will be prepared through freeze cracking and serial sectioning.
2. Specimen will be imaged on SEM and LM.
3. External and internal anatomy will be examined.

Muscle cross-sections will be analyzed for heavy metals and oil spill elemental signatures.

Methodology

All grass shrimp were collected using plankton tows, in the Apalachicola Estuary using 100 Micron Mesh neuston, all specimens were then killed according to a set of specimen were subjected to freeze cracking to observe the elemental composition of the muscle tissue. This was performed using a Hitachi TM-300 scanning electron microscope coupled with an Bruker Quantax F1 software and an EDX detector. Two sets of elemental analysis were completed: Heavy Metals (As, Cd, Co, Cu, Fe, Pb, Ni, and Ni) and Crustal (Al, Ar, Ba, Ca, Cl, Cr, Cs, Cu, Fe, K, Mg, Mn, Na, Ni, P, K, Se, Ag, Ni, and Zn). A statistical program, QPSP, allowed an ANOVA test to determine statistical significant difference between the elements.

Another set of specimen was subjected to serial embedding and serial sectioning to visualize external and internal anatomy. This was performed using a Leica WM SM20 light microscope affixed a WD-4000S AP2700M 1.8 lens from Marlin Microscopy and a Canon EOS/DM2 2.0 camera.

Image 1: SEM image of shrimp muscle cross-section.

Results

An ANOVA analysis between the crude oil and heavy metal elemental groups of all studied muscle tissue revealed a statistical difference between the following elements: Al, As, Cd, Co, Cu, Pb, Ni, Ni, N, P, Se, Ag, Ni, and Zn.

An ANOVA analysis between the crude oil elements of all studied muscle tissue revealed a statistical difference between the following elements: Al, As, Cd, Co, Cu, Fe, Pb, Ni, Ni, N, P, K, Se, Ag, and Ni. The elements that did not show a statistical difference were Ba, Ca, Cr, Mg, and Zn.

An ANOVA analysis between all groups of elements of all studied muscle tissue revealed a statistical difference between the following elements: As, Cd, Cu, Pb, and Ni. The elements that did not show a statistical difference were Co, Fe, and Mn.

Figure 1: Average percentages for the elemental composition of muscle tissue.

Figure 2: Average percentages for the elemental composition of heavy metals.

Acknowledgments

Field Collection Site
Florida State University Marine Lab
Former Researcher
Dr. William Pappas, D.O.
Graduate Lab Assistant
John Nelson, B.S.

Conclusion

It can be stated that the Zone I stage of most of the elements analyzed in the muscle tissue of the studied *P. pugio* are to be considered, the previous statement would be required due to the process in which the elements are selected in the elemental analysis program. It can also be stated the percentages between most of the elements of each category are different from one another.

Without statistical values of the elemental composition for *P. pugio* in the Zone I stage of their toxicity threshold, there is no definitive answer as to the health of this species and the entire estuarine environment. However, it can be concluded that the sheer amount of this species collected can speak volumes on the wellbeing of both.

Future Research

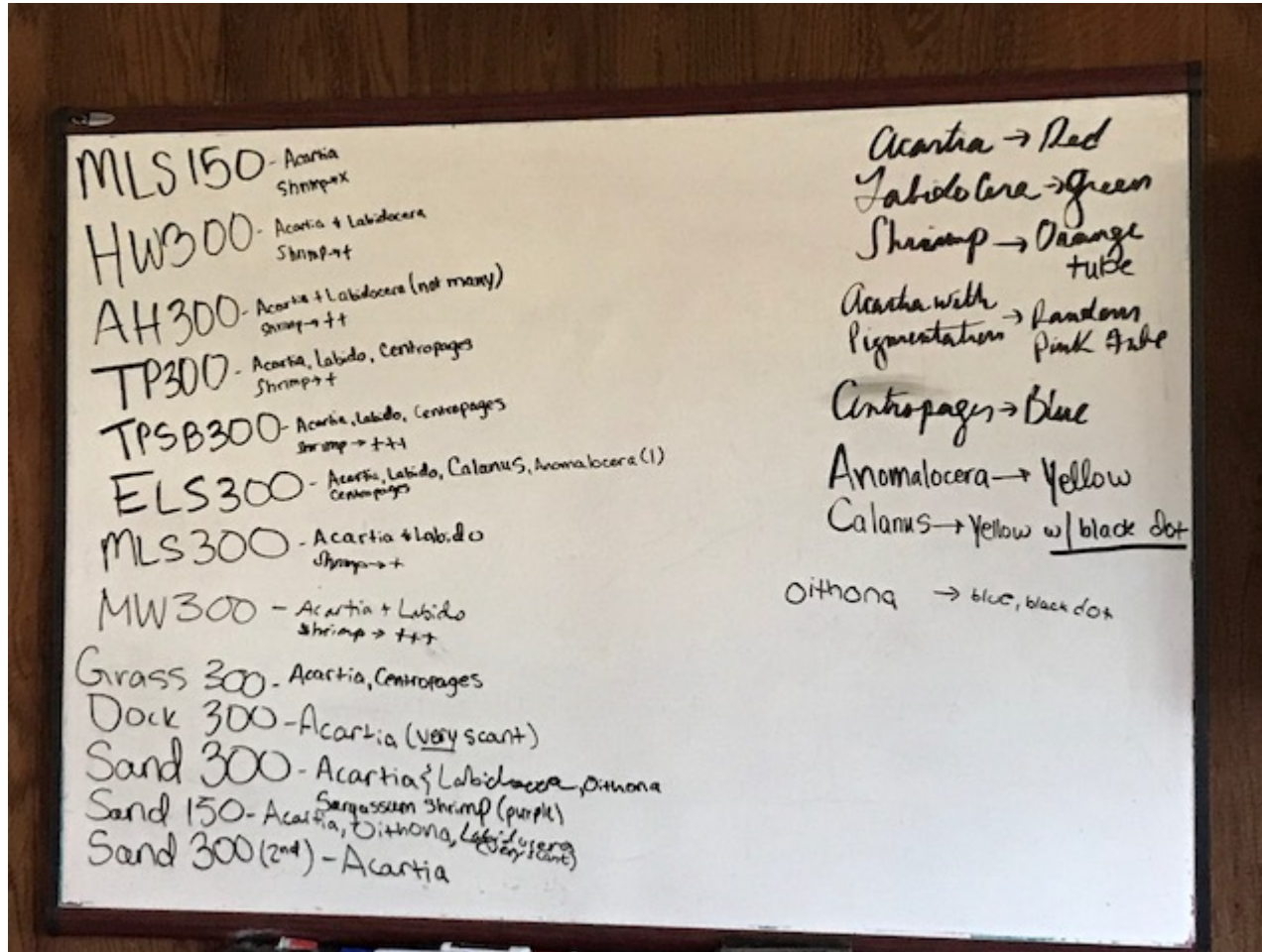
Statistical values for the elemental composition for unaffected *P. pugio* Zone I stage must be determined. This will allow the health of this estuarine environment to be assessed. Once collected, these standard values would then be compared to the data discovered on this study.

Once that phase is complete, further research can be dedicated to testing additional toxicity from other anthropogenic sources, such as pesticides, insecticides, herbicides, and other chemicals and biochemical elements.

References

1. Skafan, S. (2006). The evolution of crustacean compound eyes and the evolution of the visual system. *Journal of Experimental Biology*, 119, 1-10.
2. Lacati, M. (2009). The evolution of crustacean compound eyes and the evolution of the visual system. *Journal of Experimental Biology*, 122, 1-10.
3. Wilson, R. & Hartline, D. (2011). The evolution of crustacean compound eyes and the evolution of the visual system. *Journal of Experimental Biology*, 124, 1-10.

Future Plans as a Librarian-Scientist... Data Management!!



SERENDIPITY

..Perhaps in part

- The director was in my liaison area (medicine);
- Audited his class and wrote a literature review;
- Over half of the students completed their first year of medical school;
- The grant money was provided by the College of Medicine;
- The school year was completed...a bit of a lull.
- It probably helped to have a science background;
- A field librarian

