

Edited by Joseph Antwi, Christopher Brennan, Neema John, Gil Shaulsky and Maeva A. Techer.

Upcoming events

BPRI Town Hall Meeting

March 21, 2024

BPRI Integrated Lab Meeting

March 07, 2024 - Angel White (FIST @ SIUE)

March 14, 2024 - Tamir Lichaa (FIST @ ASU)

March 28, 2024 - Jiayi Luo (PhD Student @ BCM)

Spring break (many institutes, many dates...):

March 11 - 15, 2024 - Texas A&M University

March 30 - April 7, 2024 - Baylor College and Medicine

March 4 - 10, 2024 - Southern Illinois University Edwardsville

March 10 -16, 2024 - Washington University

March 2 - 10, 2024 - Arizona State University



S. gregaria black morph last nymphal instar
© B. Woo (Song Lab)

Research Highlights

Gabbiani Lab: Gil Shaulsky presented a poster with voltage clamp experiments in awake locusts characterizing an inactivating potassium conductance involved in the Lobula Giant Movement Detector neuron (LGMD). Next, post-doc Saina Namazifard will help fit those data, which will be used to improve a computational model of the LGMD.

David Bellini has been investigating lncRNA markers that are upregulated in the optic lobe of gregarious locusts relative to their solitary counterparts. Protein folding prediction software AlphaFold was used to characterize protein-coding genes in the *Schistocerca* genomes. With help from trusty lab-tech Dylan Ulloa, there are renewed attempts at creating a *S. americana* cell atlas for both the optic and central brain/olfactory lobes.

Song Lab: Postdoc Seema Rana has studied the RNA interference efficiency of genes identified as differentially expressed in the crowded versus isolated *Schistocerca* sp. The genes include heat shock protein 70 kDa, cAMP-dependent protein kinase catalytic subunit 1, and allergen Cr-PI-like. Double-stranded RNA (dsRNA) corresponding to each gene was synthesized and administered via injection into nymphs. Subsequent assessment via RT-qPCR 72h post-injection revealed a significant knockdown of over 90% for all tested genes. These genes may be involved in swarming behavior, so the next focus is to study the

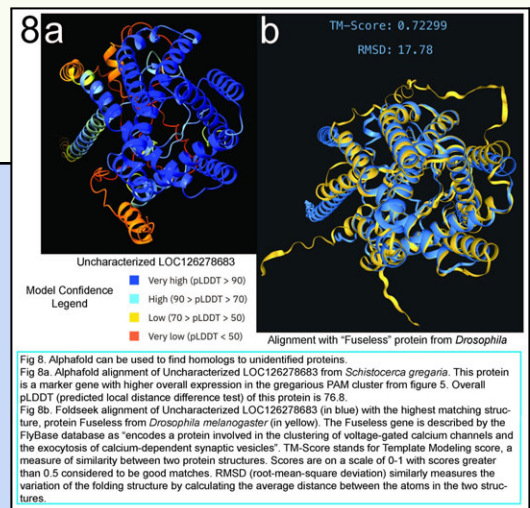
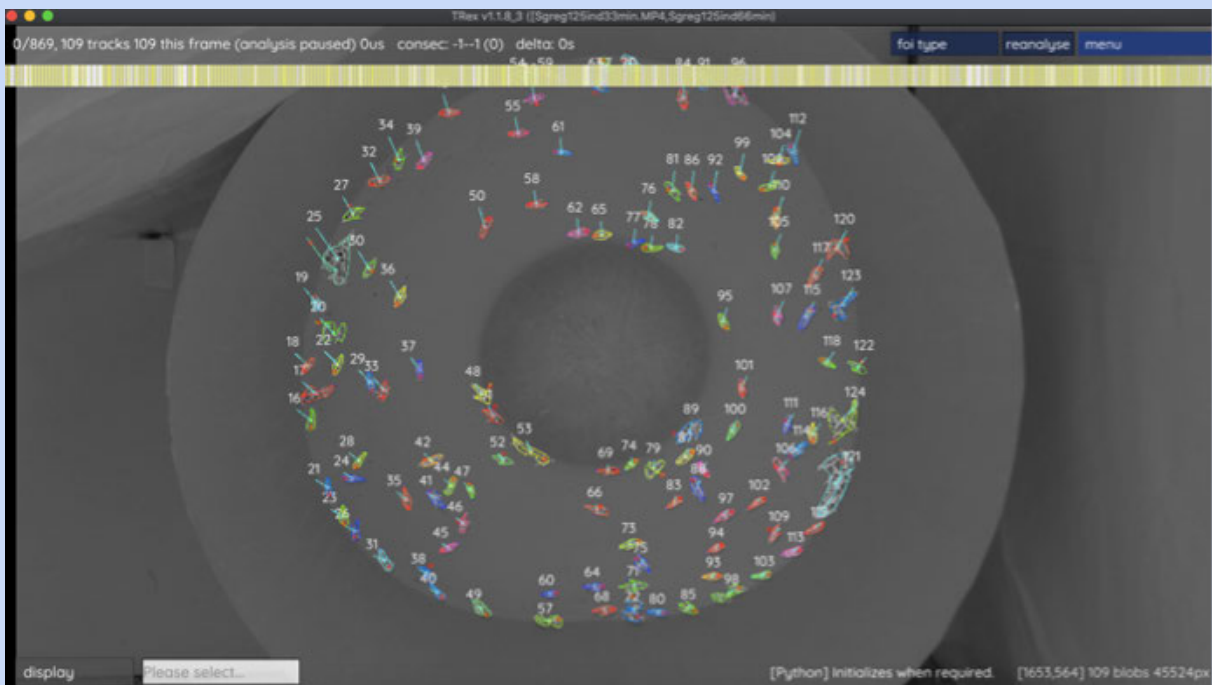


Image showing successful alphafold predictions from the Gabbiani lab

behavioral changes resulting from the knockdown of these genes.

Alyssa Canova is finalizing an analysis of the Central American Locust (CAL) population structure, *S. piceifrons*. This study involves double digest restriction-site associated DNA (ddRAD) sequencing of samples collected from 2015-2016. In collaboration with Mario and the Locust Control Program team in the Yucatán Peninsula, 2023-2024 samples were included for Whole Genome Resequencing. This broadened dataset will allow for a thorough comparison of the population structure over time and focusing on gene flow and population size. Concurrently, species distribution models for the CAL are being developed, utilizing occurrence data from iNaturalist and prior research and environmental factors such as humidity and soil composition. This research aims to merge WGR data with environmental variables for a landscape genomic analysis. This integrated approach seeks to predict the CAL's range expansion and identify climate adaptive genes, contributing valuable ecological management and conservation insights.



Sword Lab: The behavioral team at Texas A&M is approaching the completion of a comparison of collective movement behavior between *S. gregaria* and *S. americana*. They have a project in progress analyzing the aggregation behavior of pre-reproductive and mature adult males in the context of lek formation. RNAi experiments targeting candidate behavioral genes in *S. gregaria* final instars are starting, after having built and validated a logistic regression model.

Behmer Lab: Chris Brennan has completed a large-scale experiment comparing the nutritional regulation of *Schistocerca gregaria* over several diet, temperature, and density treatments. The data suggests that temperature and conspecific presence impact how locusts make nutrient regulatory decisions and their overall performance.

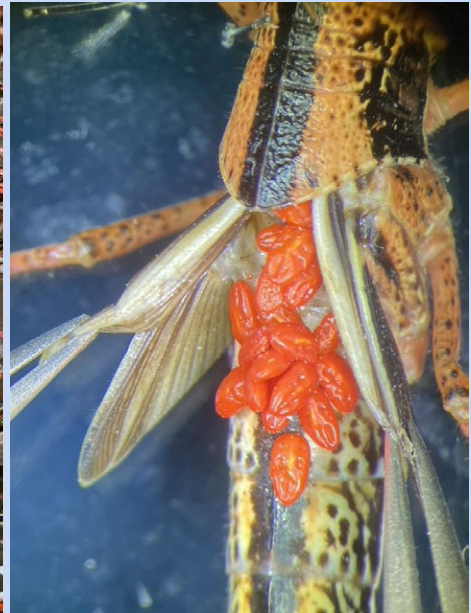
Serena Farrell just gave the first talk of the BPRI-wide Lab Meeting. She focused on her potential PhD research projects, which will focus on the physiology and molecular biology of the grasshopper alimentary canal.



Global Locust Initiative (ASU): The GLI has active projects studying locust nutritional ecology, migration, predators and pathogens in lab and field populations. October 2023 was a great field season in Yucatán in collaboration with Mario Poot Pech and CESVY. The field team included Sydney Millerwise, Mehreen Tahir, Chris Brennan (TAMU), Mira Ries, Rick Overson, and Arianne Cease. Locusts and plants were collected from several locations, including solitary and gregarious individuals. Macronutrient preference was tested in both phases and behavior when confined to diets of various protein-to-carbohydrate ratios.



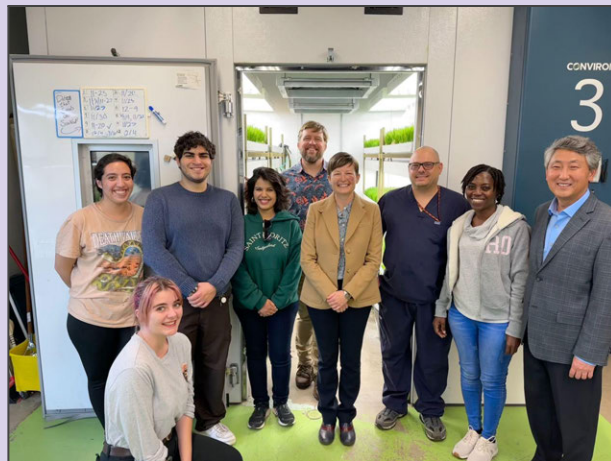
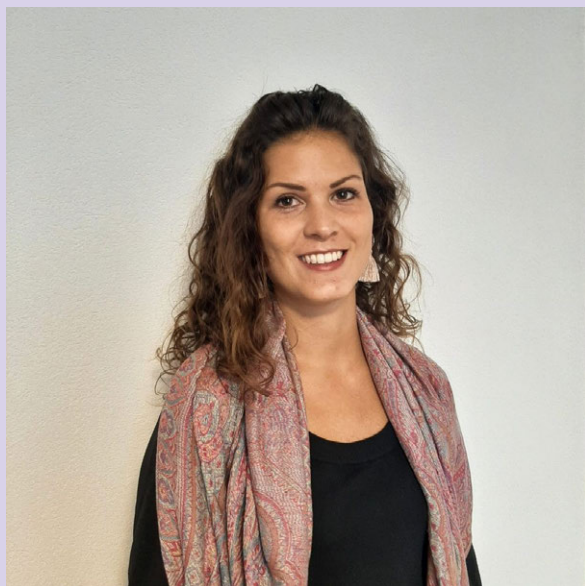
In addition, Sydney collected mites on locusts and will also look at gut viruses in collaboration with Arvind Varsani. Field-caught Central American locusts are being sent to Britt Peterson's team at SIUE for their gut microbiome research. Results from field data to come soon! In lab-based research, Mehreen has shown that high protein diets improve growth rates for desert locusts but also make them more susceptible to the fungal biopesticide *Metarhizium*. Neema John has shown that marching desert locust nymphs increase carbohydrate, but not protein consumption. Additional details are forthcoming in manuscripts under preparation!



Over 800 *S. piceifrons* were brought back to the TAMU Locust Quarantine facility and were quarantined because of the introduction of possible pathogens. The proof with those red mites found on a last nymphal instar during a time course experiment to solitarize the nymphs for bulk tissue RNAseq. Last week, the adults started to lay eggs.

Lab activities and outreach

Cease Lab: Outreach activities include tours of our locust research and rearing facilities for ASU visitors, such as the Novo Nordisk Foundation, and posts on HopperLink. Including updates on locust and grasshopper news around the world and a researcher spotlight on BPRI trainee PhD student Mehreen Tahir.



Lab tours of the ASU locust facility

Sword Lab: Audélia has been involved in BPRI outreach activities by featuring members on various social media platforms since 2021.

Gabbiani & Dierick Labs: Training a high school student in genome annotation and promoter identification.

Research Milestones

Behmer Lab: Serena Farrell had a first-author paper published in the **Journal of Experimental Biology**. She conducted this work as an undergraduate (molecular physiology in mosquitoes). She has been featured in early career researcher spotlight, you can read more about it here: <https://tinyurl.com/mtk5jcff>

Sword Lab: Audélia is taking her preliminary exams (late Feb – early March). She will conduct collaborative research on locusts at Max Planck Institute of Animal Behavior in Konstanz, Germany in June of this year.

Gabbiani Lab: Madeline Severson was accepted into multiple graduate programs, including BCM.

Song Lab: Alyssa Canova's undergraduate honors thesis has been submitted to the Annals of the Entomological Society of America, now under the revised title 'Comparative linkage mapping to investigate synteny and recombination in social Vespidae'.

Cease Lab: Mehreen presented a lightning talk at the NSF BII institutes meeting, showcasing her research findings on the correlation between high protein intake and increased growth in locusts, along with heightened susceptibility to biopesticide infection while emphasizing the impact of interdisciplinary scientific research on personal and professional development as an early career scientist.

Recent Publications

Locust and BPRI research projects

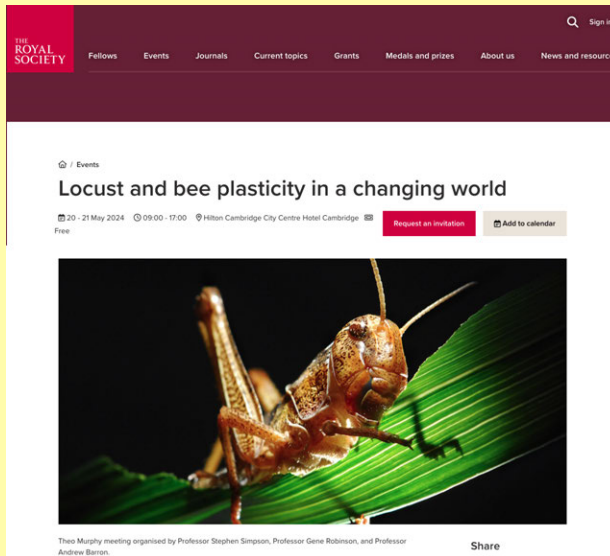
- **Cease, Arianne J.** "How Nutrients Mediate the Impacts of Global Change on Locust Outbreaks." Annual Review of Entomology 69, no. 1 (January 25, 2024): 527–50. <https://doi.org/10.1146/annurev-ento-120220-110415>.
- Weinburd, Jasper, Jacob Landsberg, Anna Kravtsova, Shanni Lam, Tarush Sharma, Stephen J. Simpson, **Gregory A. Sword**, and Camille Buhl. (2024) Anisotropic interaction and motion states of locusts in a hopper band. Proceedings of the Royal Society B 291:20232121. <https://doi.org/10.1098/rspb.2023.2121>

Other research projects and non-locust species-related output

- **Farrell, S.**, Dates, J., Ramirez, N., Hausknecht-Buss, H., Kolosov, D., 2024. Voltage-gated ion channels are expressed in the Malpighian tubules and anal papillae of the yellow fever mosquito (*Aedes aegypti*), and may regulate ion transport during salt and water imbalance. Journal of Experimental Biology 227, jeb246486. <https://doi.org/10.1242/jeb.246486>

Conference and Social Opportunity

- Maeva Techer will present the time course transcriptome results on *S. gregaria* at **TAGC24**, taking place from **March 6th to 10th in Washington, DC**.
- Spence Behmer, Hojun Song, Gregory Sword, and Maeva Techer will participate in the upcoming **Theo Murphy meeting**, "Locust and bee plasticity in a changing world", sponsored by the Royal Society from **May 20-21 in Cambridge, UK**.



The random corner

Some grasshopper bloopers from the TAMU quarantine.

