

University of Minnesota Morris Digital Well

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Undergraduate Research Symposium Abstract  
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4-2020

### **2020 Undergraduate Research Symposium Abstract Book**

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# Home

Welcome to the **20th Annual University of Minnesota Morris Undergraduate Research Symposium**. The symposium celebrates student scholarly achievement and creative activities. Students from all disciplines participate in the URS. Types of presentations include posters, oral presentations, and short or abbreviated theatrical, dance, or musical performances. Presentations are accompanied by discussions and multimedia. The work can be conducted on or off-campus. We are proud of our scholars and their work. Please feel free to ask questions and dive into their findings.

Due to the COVID-19 disruption to the spring semester. We have decided to allow only seniors to submit their research either in a poster or via a Google Slides link. Unfortunately, we will not be holding a normal in-person event. This is our attempt to honor the work of our graduating seniors.



# Research Abstracts

Abstracts are divided between Feature, Poster, Oral, and Panel presentations and are listed in alphabetical order by the lead presenter.

## Poster Presentations

**Presenter Name:** Amelia Nelson

**Project Advisor:** Rebecca Dean

**Title:** "There's a snake in my boot!": Serpentes remains from the Marana Platform Mound Site

**Abstract:** The Hohokam people lived in the Sonoran desert within Arizona from 100-1400 C.E. There has never been a systematic analysis of snake remains from Hohokam archaeological sites. The Marana Platform Mound site was occupied from 1100 C.E. to 1350 C.E. Among the many faunal remains found adjacent to living spaces at Marana, some belong to snakes. To see whether the presence of snake remains were culturally significant at the Marana site, I gathered data from Marana itself and a larger database of Hohokam sites. Based on the database and my own data from Marana, I found that the snake remains most likely are from the *Crotalus tigris* (Tiger rattlesnake) and/or the *Crotalus atrox* (Western Diamondback rattlesnake). These snakes are found mainly in bajada desertscrub, palo verde-saguaro desertscrub, riparian communities, semi-desert grassland, and mesquite bosque. These are all environments found at the Marana site. Based on habitat preferences, it can be concluded that any presence of snake remains found in the site are most likely there due to happenstance, rather than for ritual paraphernalia or as a result of hunting.

**Link to Poster:** [https://docs.google.com/presentation/d/1WprkDft7wc4CsyhsZlrcB9UnljdH9GRyNPFs\\_kJ9Ycg/edit#slide=id.p1](https://docs.google.com/presentation/d/1WprkDft7wc4CsyhsZlrcB9UnljdH9GRyNPFs_kJ9Ycg/edit#slide=id.p1)

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**Presenter Name:** Drake Egan

**Copresenter(s):** Alex Hernandez and Paige Petty

**Project Advisor:** Heather Waye

- Sponsoring Organization: UMM IUUSE

**Title:** Describing the Eastern Tiger Salamander (*Ambystoma tigrinum*) Stress Response Through the Ratio Of Neutrophils to Lymphocytes Over Time

**Abstract:** We can examine the health of a population in a particular environment by measuring stress in individuals. One indicator of stress is a change in the proportions of white blood cells in circulation, particularly the ratio of neutrophils to lymphocytes (N:L). For amphibians, the change in N:L in response to stress takes many hours, but how many hours is not well known. A better description of the timing of this response would increase our understanding of amphibian physiology and allow us to use this technique to measure chronic stress in amphibians captured in traps. We captured tiger salamanders in June and July 2019 using dipnet and minnow traps. For each salamander we took one blood sample within an hour of first contact, confined the salamander for a set number of hours, then took a second blood sample. At least two of us counted the white blood cells in each blood smear. Although the N:L ratio for most of the salamanders increased after confinement, the blood taken 8 hours after initial sampling of dipnetted salamanders showed a larger increase in stress than blood sampled at 24 hours later. The results are inconclusive due to the small sample size of dipnetted salamanders and not knowing how long each salamander spent in the minnow traps. Future work will focus on capturing salamanders by dipnet to better characterize the time frame of the response to capture and handling stress.

**Link to Poster:** <https://drive.google.com/file/d/1i31uGUx4hDNURPsPUtDpo0-7zS9Kxyfd/view>

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**Presenter Name:** Katelyn Bergstrom

**Project Advisor:** Rebecca Dean

**Title:** Endogamous Population Effects on Child Fertility in French Canada

**Abstract:** Endogamous populations concentrate on rare diseases and birth defects. The small gene pool offers a greater chance for recessive traits to be more commonly expressed, and increases the chance of early mortality. One group known for endogamy is the French Canadian population that settled in Quebec in the beginning of the 17th Century. The population is also known for well-documented life histories from church records, allowing for highly detailed demographic information. In this study, the coefficients of relatedness of French Canadian families

from the start of the 17th century until mid-18th century was compared to the number of offspring to see if there was an effect on the number of children birthed by the couple. It was believed that if the couple had a higher coefficient of relatedness, then they would have less children. Coefficients were calculated, generating pedigrees of families and looking at the number of generations between individuals. Overall the study found relatedness coefficients ranging from 0.000122-0.250977, yet surprisingly there did not seem to be a trend between relatedness coefficient and the total number of children in the French Canadian population. A variety of reasons for this are considered, including the differences in child mortality. However, further investigation in future research could look to see if relatedness had other effects on the population.

**Link to Poster:** [https://docs.google.com/presentation/d/1cK\\_x1EYUkuXHRViOAWj8LdDaL1Btf5tpsOS5qTyqtWU/edit#slide=id.p](https://docs.google.com/presentation/d/1cK_x1EYUkuXHRViOAWj8LdDaL1Btf5tpsOS5qTyqtWU/edit#slide=id.p)

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**Presenter Name:** Trina Vue

**Project Advisor:** Josh Johnson

**Sponsoring Organization:** UROP

**Title:** Composition of a Story Cloth: The Importance of a Personal Expressive Writing Method in Academia

**Abstract:** Traditional notions of academic writing often asks us to employ the "objective voice," while composition scholars such as Peter Elbow argue against that, stating that a writer should not have to detach their identity and voice from something that should be personal. This confusion sets the stage for my work which seeks to include the voices of people from different backgrounds, such as the Hmong. With no outlet to express their struggles in grasping their identities of being Hmong and American, I turn to a method of storytelling that allows for that kind of expression. In this intersection between traditional academic writing and expressive writing, I analyze the Hmong story cloth, a form of textile art that uses embroidery to depict a narrative, in order to build a framework through which to approach storytelling. In doing so, I argue that by understanding the composition of a story cloth, we can help Hmong students work towards a product that both meets the demands of academic discourse and expresses personal voice. Furthermore, it better helps us understand larger theoretical concerns about objectiveness in written academic discourse.

**Link to Poster:** [https://drive.google.com/file/d/1HtG9o8KdSHi8gZAnavRPOZnN0RGWwu3\\_/view](https://drive.google.com/file/d/1HtG9o8KdSHi8gZAnavRPOZnN0RGWwu3_/view)

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Presenter Name:

Copresenter(s):

Project Advisor:

▪ Sponsoring Organization:

Title:

Abstract:

Link to Poster:

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## Oral Presentations

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**Presenter Name:** Sarah Severson

**Project Advisor:** Dr. Ted M. Pappenfus

**Sponsoring Organization:** UROP

**Title:** Direct Arylation Polymerization of Indophenine-Based Monomers

**Abstract:** Indophenine, a deep blue dye and a quinoidal compound, has shown potential as a monomer in donor-acceptor copolymer formation for use in energy and device applications. Despite the barrier of low solubility, we previously polymerized an indophenine-based monomer IQ to form PolyIQ-co-thiophene (PIQ) in a 95% yield using Stille coupling. Although PIQ has desirable electronic properties, Stille coupling is a particularly unsustainable method. In contrast, direct arylation polymerization (DARp) is a more sustainable polymerization method that reduces synthetic steps and toxic byproducts. Therefore, we now report the DARp of IQ to form PolyIQ-co-ProDOT (ProPIQ) in a 96% yield. ProPIQ boasts a low polydispersity index of 1.13 and a molecular weight of 6047 g/mol, indicating the formation of low-mass but uniform polymers. Spectroscopic analysis of ProPIQ in solution and film indicate an absorption of 800-850 nm, approaching the near-IR range. Additionally, ProPIQ has a low band-gap of 1.2 eV, suggesting potential for use in solar cell and device applications. Although optimization attempts to further enhance the solubility of ProPIQ are incomplete, the high yield and desirable electronic properties of ProPIQ demonstrate that DARp is an effective route toward indophenine-based polymers.

**Link to Presentation Slides:** [https://docs.google.com/presentation/d/1uWoKX6JRS\\_9Ur3GyswzLu0-a1i-BaK67LWI83pWCPHg/edit#slide=id.g74e358f56f\\_0\\_53](https://docs.google.com/presentation/d/1uWoKX6JRS_9Ur3GyswzLu0-a1i-BaK67LWI83pWCPHg/edit#slide=id.g74e358f56f_0_53)

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**Panel Presentations**



Presenter Name:

Copresenter(s):

Project Advisor:

▪ Sponsoring Organization:

Title:

Abstract:

Link to Presentation Slides:



# Thank You



Thank you to the students for participating in the 2020 Undergraduate Research Symposium. Additional thanks to faculty advisers and research mentors for their dedication to the Morris student experience.

Heather Waye and Barbara Burke are serving as the faculty chairs. In addition to Heather and Barbara, Nancy Carpenter, Peter Dolan, Kerry Michael, Denise Odello, Angie Vetsch, and Peter Brehmer served as abstract reviewers on a very tight timeline. Thank you for your service in making the abstracts the best they can be for a general audience.

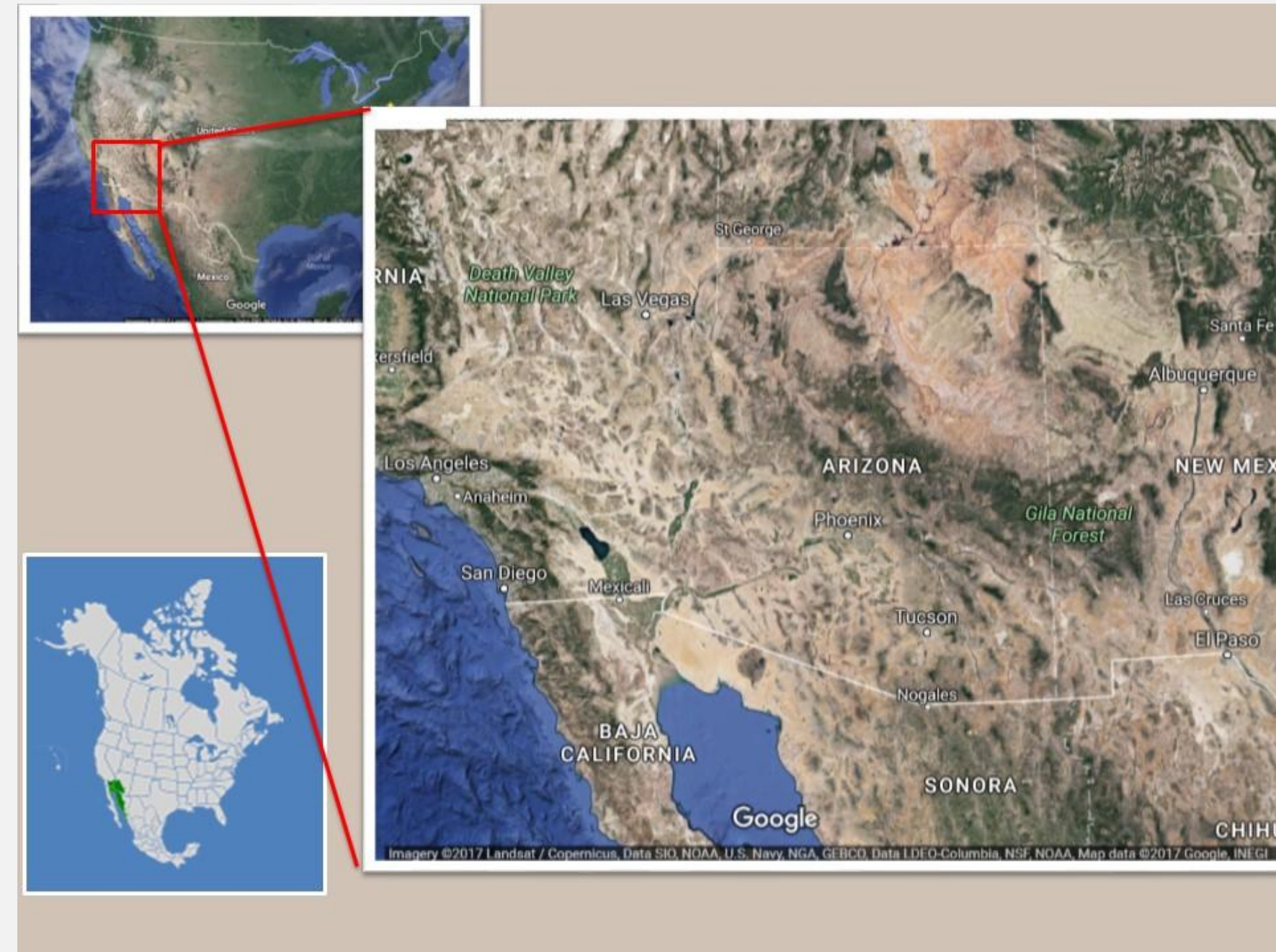
Thank you to current student Michael Small for creating the new URS abstract site!

Thank you to the ACE staff Irene Maloney, Cindy Boe, Charise DeBerry, and Stephanie Ferrian for their assistance in preparing for this event.

# “There’s a snake in my boot!”: Serpentes remains from the Marana Platform Site

Amelia Nelson, Rebecca Dean

University of Minnesota, Morris



Sonoran desert

## Introduction

The Hohokam people lived in the Sonoran desert in Arizona from 100 C.E. to 1400 C.E. This is the current homeland of the Tohono O’odham people. From 1100-1250 C.E., the Marana Platform Mound site was occupied. A way archaeologists learn how the Hohokam lived is by looking at faunal remains. Data from faunal remains show if the animals had cultural significance. For example, at Marana, rabbits were the main food source and artiodactyls, in addition to being food, were part of ritual closing ceremonies of houses.

There has not been a systematic study analyzing the snake remains in Hohokam sites. My research fills this gap. Snake remains have been found at a variety of Hohokam sites including Marana. To see if the presence of snake remains is culturally significant, I examined similar sites and compared the frequency of burning, location of snake remains at Marana, and the biotic communities of snakes. My research suggests that the presence of snake remains is due to chance, rather than being used for rituals or as a result of hunting.

## Methods

Rebecca Dean and I identified around 4,000 faunal specimens from Marana and coded them for species, burning, and location. These were added to a database of about 15,000 faunal specimens already recorded by other researchers. In addition, I looked at the presence or absence of snake remains in a database of 123 Hohokam faunal assemblages.

## Results

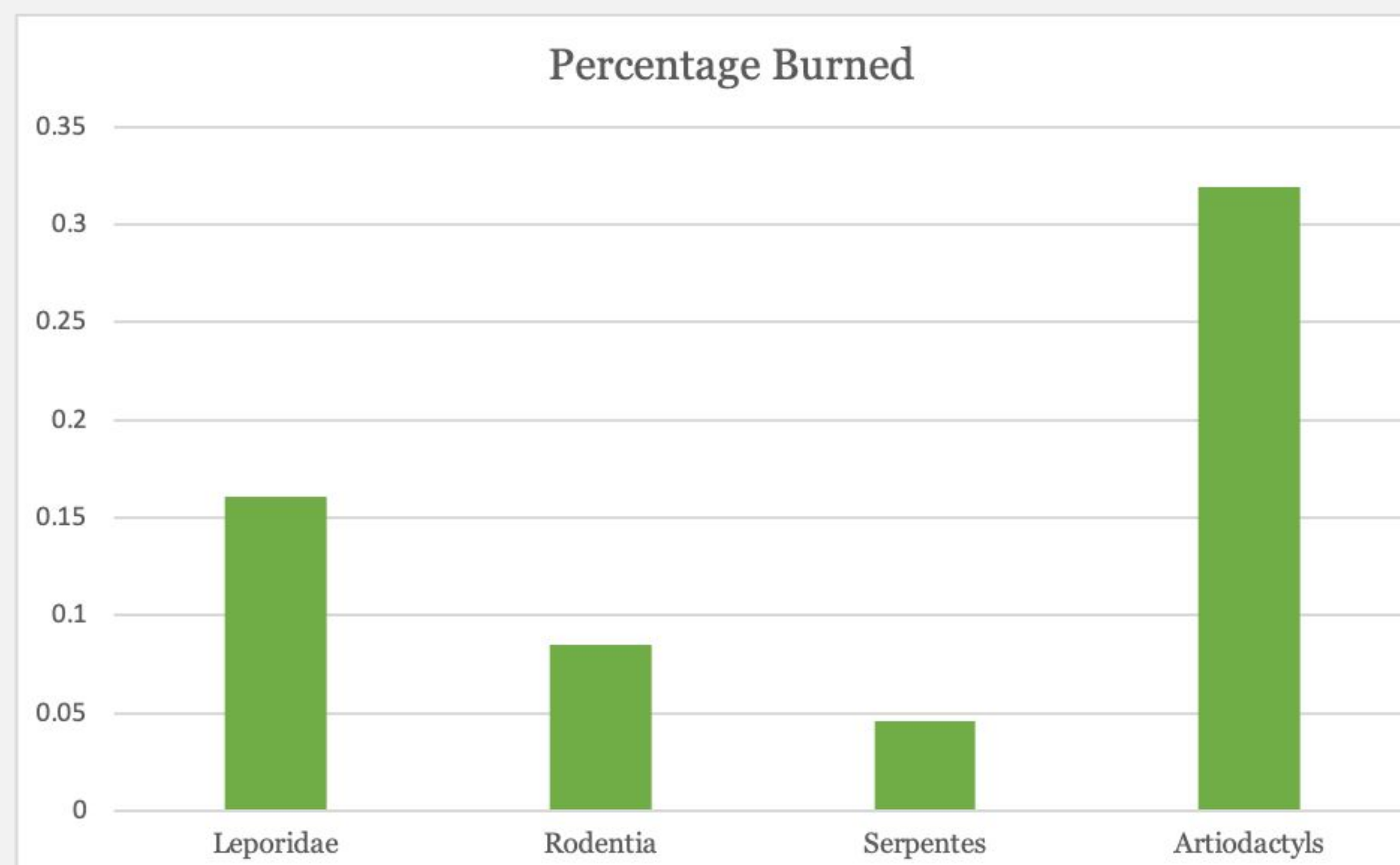
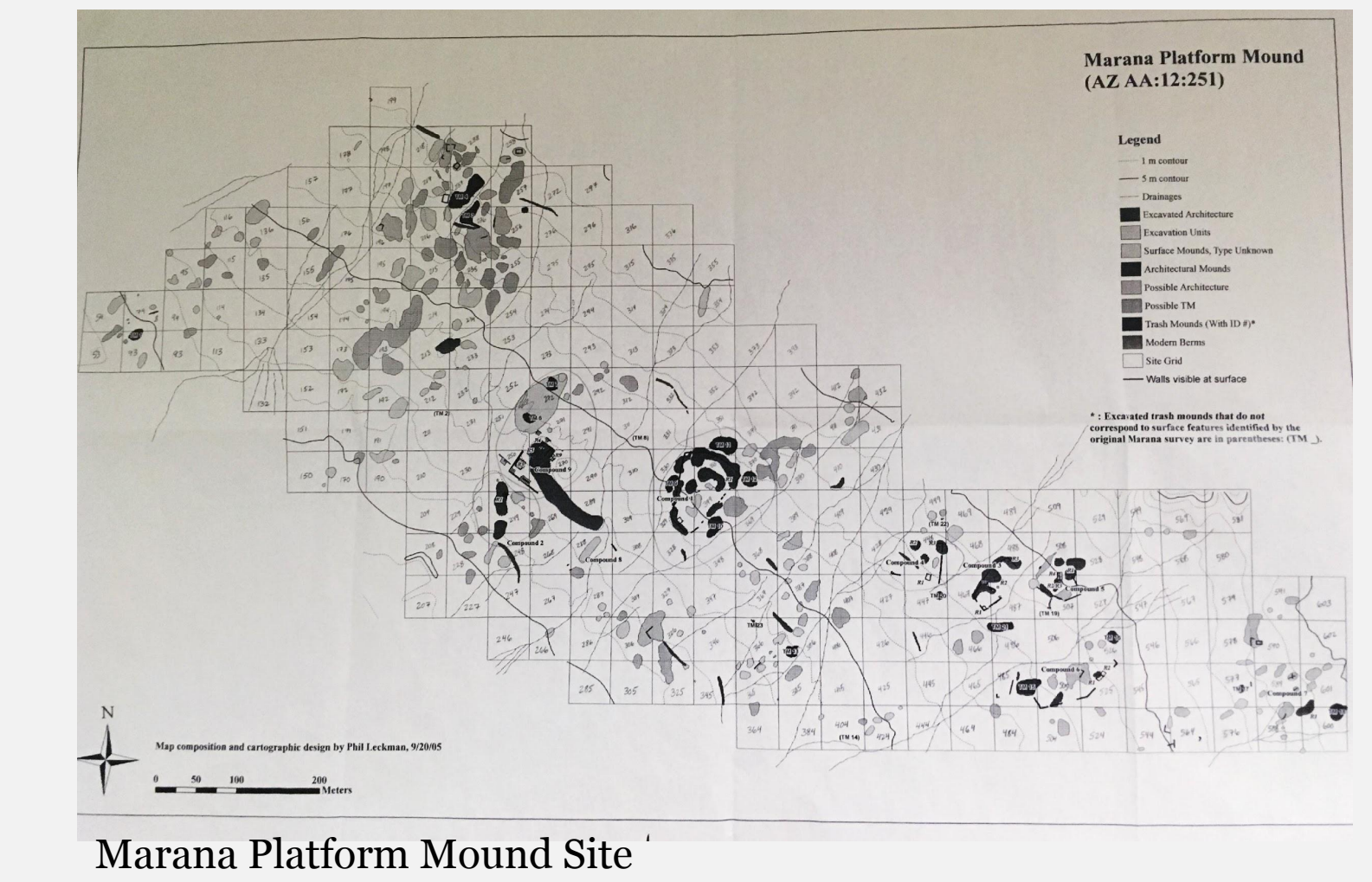


Figure 1. When the frequency of burning found on snake bones was compared to that of artiodactyls, lagomorphs, and rodents found at Marana, 32% of artiodactyls were burned, 16% of lagomorph remains were burned, 8.5% of rodent remains were burned, and 4.5% of snake remains were burned. Lagomorphs and rodents were a food source for the Hohokam, although rodents in a lesser degree. The main food source, lagomorphs, have a moderate amount of burning because when the bones are cooked, they’re typically encased in flesh which protects them. Snakes are a less likely candidate for food, with only 4.5% of the snake bones being burned



## Discussion and Conclusion

I can conclude that snakes do not have cultural significance at the Marana Platform Mound site., because the evidence shows:

- There is nothing unusual about finding snakes here because other Hohokam sites that were occupied during the same time as Marana, also had snakes found in their faunal assemblage.
- Road ridings have shown that many of the snakes found in the Sonoran desert are venomous, which explains the distribution of venomous snake bones found.
- The lack of burning found on snake bones indicate they were not a food source or used for rituals.
- The proveniences where snake bones are found at Marana have concentrations of bones that associate them with trash mounds. Therefore, snake remains found in these places can be classified as trash.
- Marana is also in a suitable environment for snakes in general. People disturbing the ground and environment creates suitable homes and food sources for snakes.

Based on all these factors, I can conclude that snakes do not have cultural significance at the Marana Platform Mound site.

## References

- Beaver, J. E. & Dean, R.M. 2019. Using Euclidean Distance in the Comparative Analysis of Taxonomic Abundance. *Journal of Archaeological Science Reports* 25:331-340
- Brown, D.E. (Ed.). (1994). Sonoran Desertscrub. *Biotic Communities Southwestern United States and Northwestern Mexico* (pp. 181-221). Salt Lake City, UT: University of Utah Press.
- Dean, R. (2017). Fauna and the emergence of intensive agricultural economies in the United States Southwest. In *The Oxford Handbook of Zooarchaeology*. 1-20. DOI:10.1093/oxfordhb/9780199686476.013.36
- Dean, R.M. (2009). The Effect of Cultivation Techniques on Small-Game Populations: An Archaeological Example from the Hohokam Region. In R.M. Dean (Ed.) *The Archaeology of Anthropogenic Environments* (pp. 250-265). Carbondale, IL: Southern University Illinois Press.
- Lazaroff, D.W., Rosen, P.C., Lowe Jr., C.H. (2006). Amphibians and Reptiles. In J.C. Wilder (Ed.), *Amphibians, Reptiles and Their Habitats at Sabino Canyon* (pp. 111-140). Tucson, AZ: University of Arizona Press.
- Sullivan, B.K., Leavitt, D.J., Sullivan, K.O. (2016). Snake communities on the urban fringe in the Sonoran Desert: influences on species richness and abundance. *Urban Ecosystems*, 20, 199-206. DOI: 10.1007/s11252-016-0577-6.

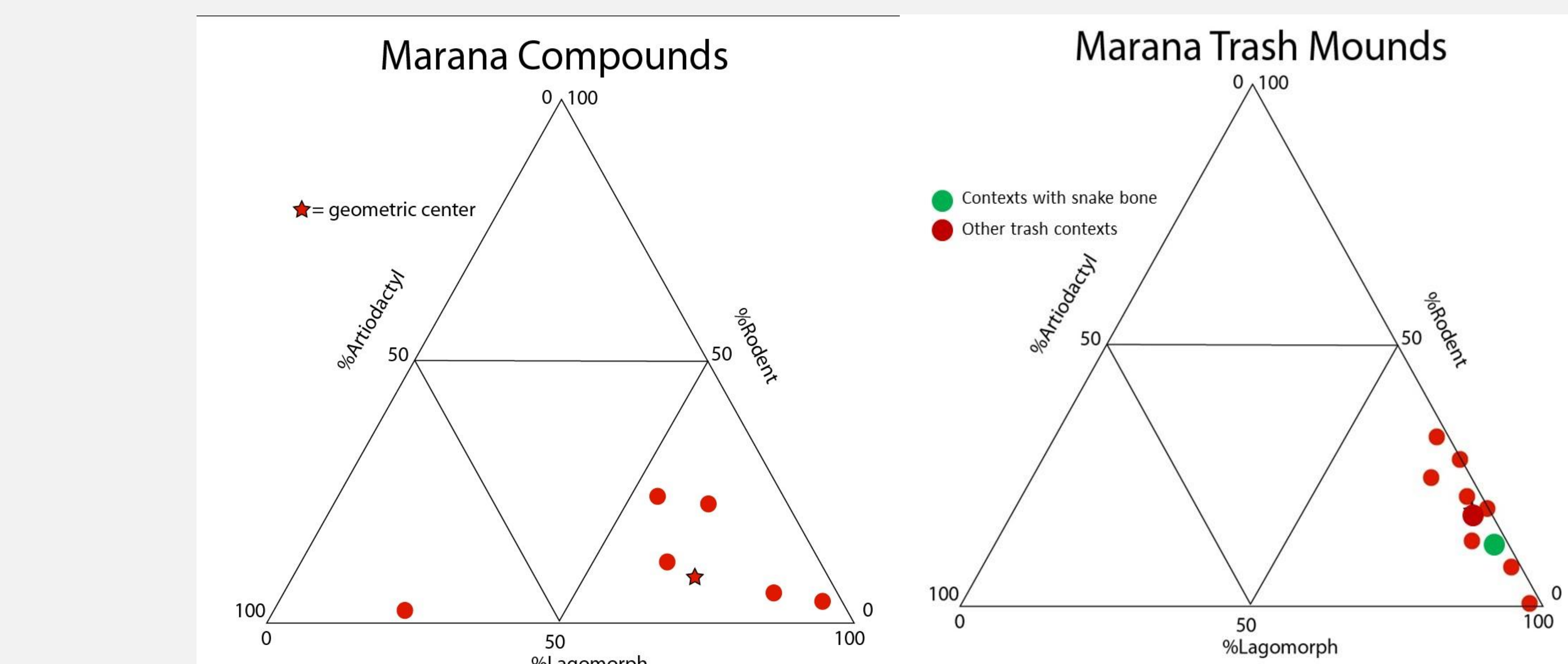


Figure 2. Some of the snake remains were found in proveniences with trash mounds. Animal remains found in trash mounds are trash material. Beaver & Dean (2019) found that there is a difference in the concentrations of fauna found in trash mounds and found in ritual deposits; trash mounds have higher concentrations of rodents and lagomorphs. Snakes located elsewhere within Marana were compared to the concentrations of the faunal troika of other faunal assemblages in Marana. Using the graphs above, the faunal makeup of proveniences with snakes are compared to other locations. The total assemblage had 2% artiodactyl, 82% lagomorph, and 16% rodent which strongly associates it with what is found in the trash mounds.



Paloverde-saguaro desertscrub. [Image source: <https://www.azfrescape.org/ga-lituro/ecosystemdescriptio/n/sonoran-paloverde-mixed-cacti-desert-scrub>]

Another factor that I looked at was the environments snakes are found in and if this corresponds with what is found at Marana. When looking at biotic communities, snakes that live in this location are found in bajada desertscrub, paloverde-saguaro desertscrub, riparian communities, semi-desert grassland, and mesquite bosque (Brown, 1994). These habitats are found at the Marana site. Road riding studies of the Sonoran desert, many snakes found were venomous and rattlesnakes (Sullivan et. al., 2016). Venomous snakes that are most found in these environments are the Tiger rattlesnake and the Western Diamondback rattlesnake (Lazaroff, Rosen, Lowe Jr., 2006). A common nonvenomous snake that is found in this environment is the Coachwhip (*Masticophis flagellum*).

# Describing the Eastern Tiger Salamander (*Ambystoma tigrinum*) Stress Response Through the Ratio Of Neutrophils to Lymphocytes Over Time

Drake Egan, Alex Hernandez, Paige Petty, and Heather Waye, University of Minnesota Morris, MN USA



Eastern Tiger Salamander

**Figure 1.** Ratio of circulating Neutrophils and Lymphocytes in Eastern tiger salamanders caught by dipnet (n=3).

## Introduction

- ❑ Tiger salamanders are members of class Amphibia
- ❑ Live in prairie potholes April-August
- ❑ Elevated neutrophil to lymphocyte (N:L) proportions can indicate physiological stress
- ❑ Continuing research by Heather Waye
- ❑ Important in describing impacts of environmental disruptions and the relative health of a population

## Methods

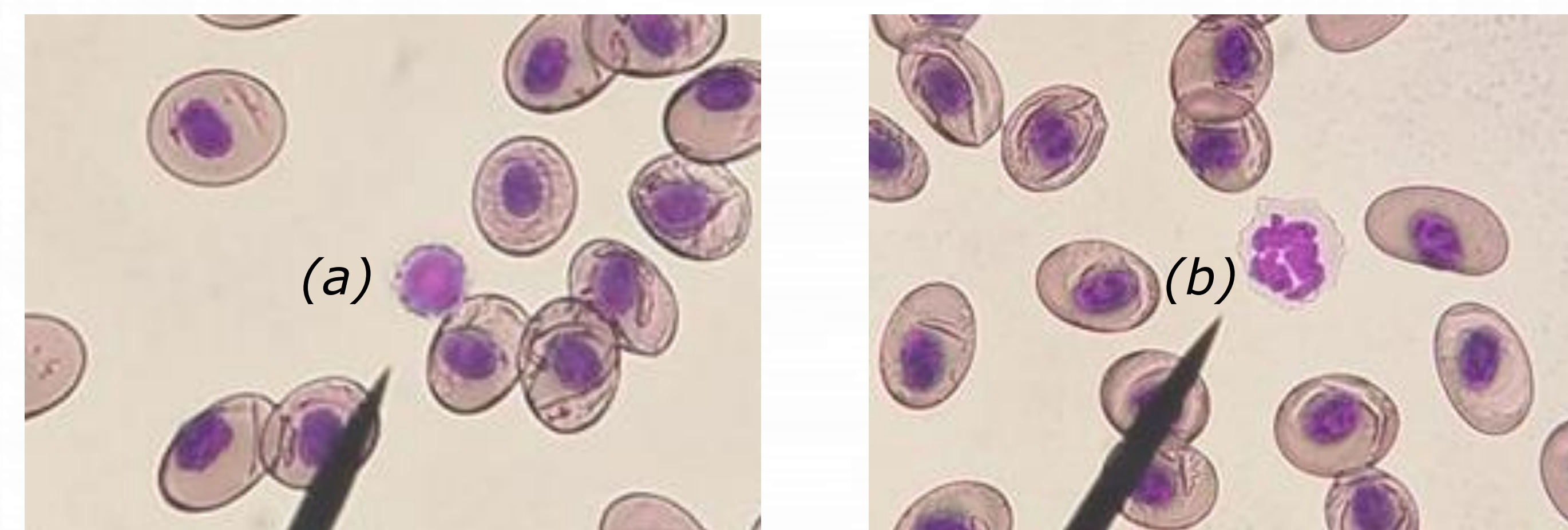
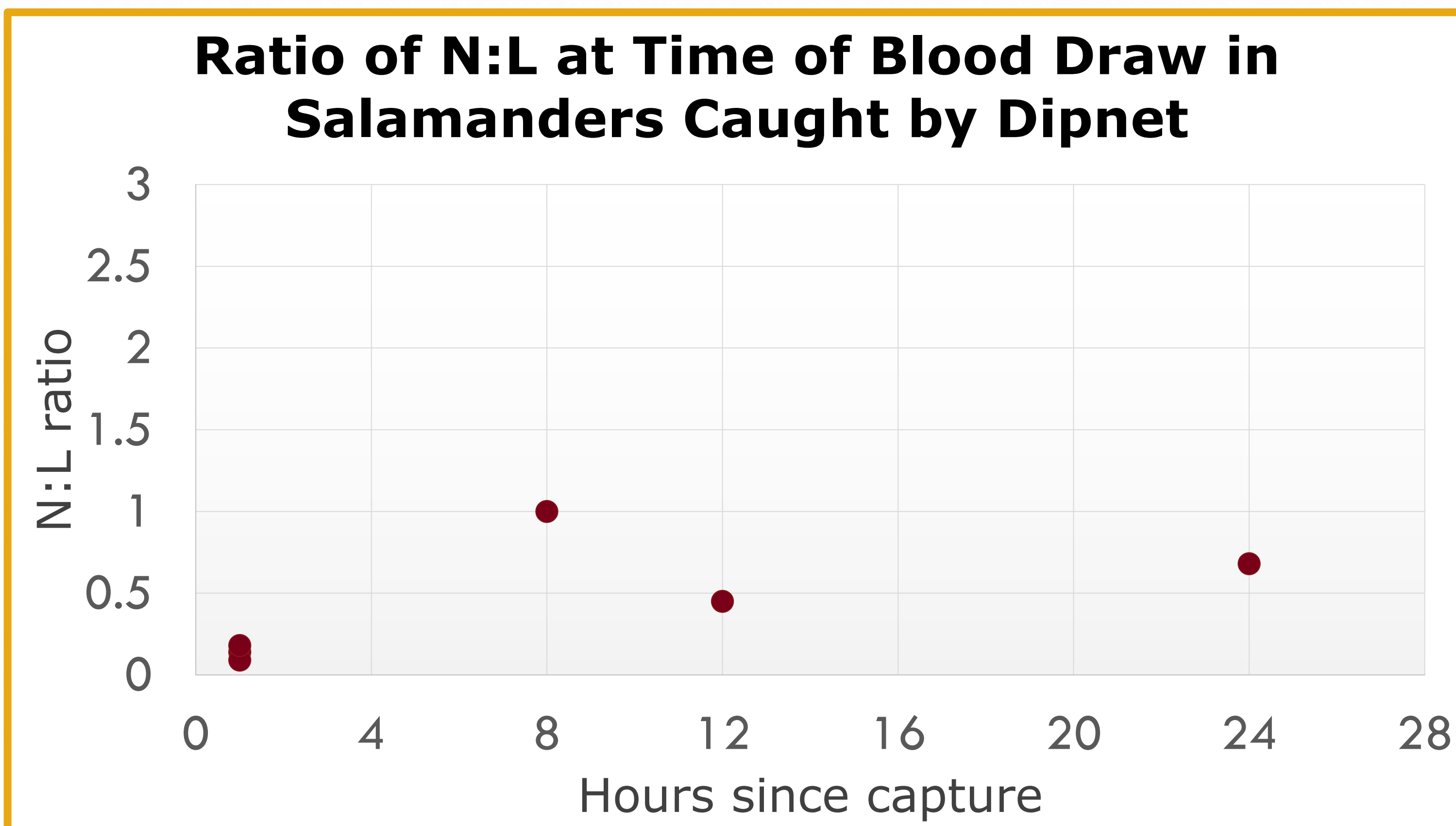
- ❑ In continuing study, we captured salamanders with minnow traps at the Pepperton Waterfowl Production Area in several ponds
- ❑ They could have got in the minnow traps any time between 24 hours
- ❑ Addition of new method: capture the salamanders by net so we have the exact time
- ❑ Salamanders were anesthetized and had blood drawn from the caudal vein within an hour of capture
- ❑ Then salamanders were confined in a bucket to create a stressful environment for a set number of hours, then had blood drawn again
- ❑ We counted and identified the first 100 leukocytes (white blood cells) seen in each slide under microscope
- ❑ Compared the before and after neutrophil to lymphocyte ratios

## Results

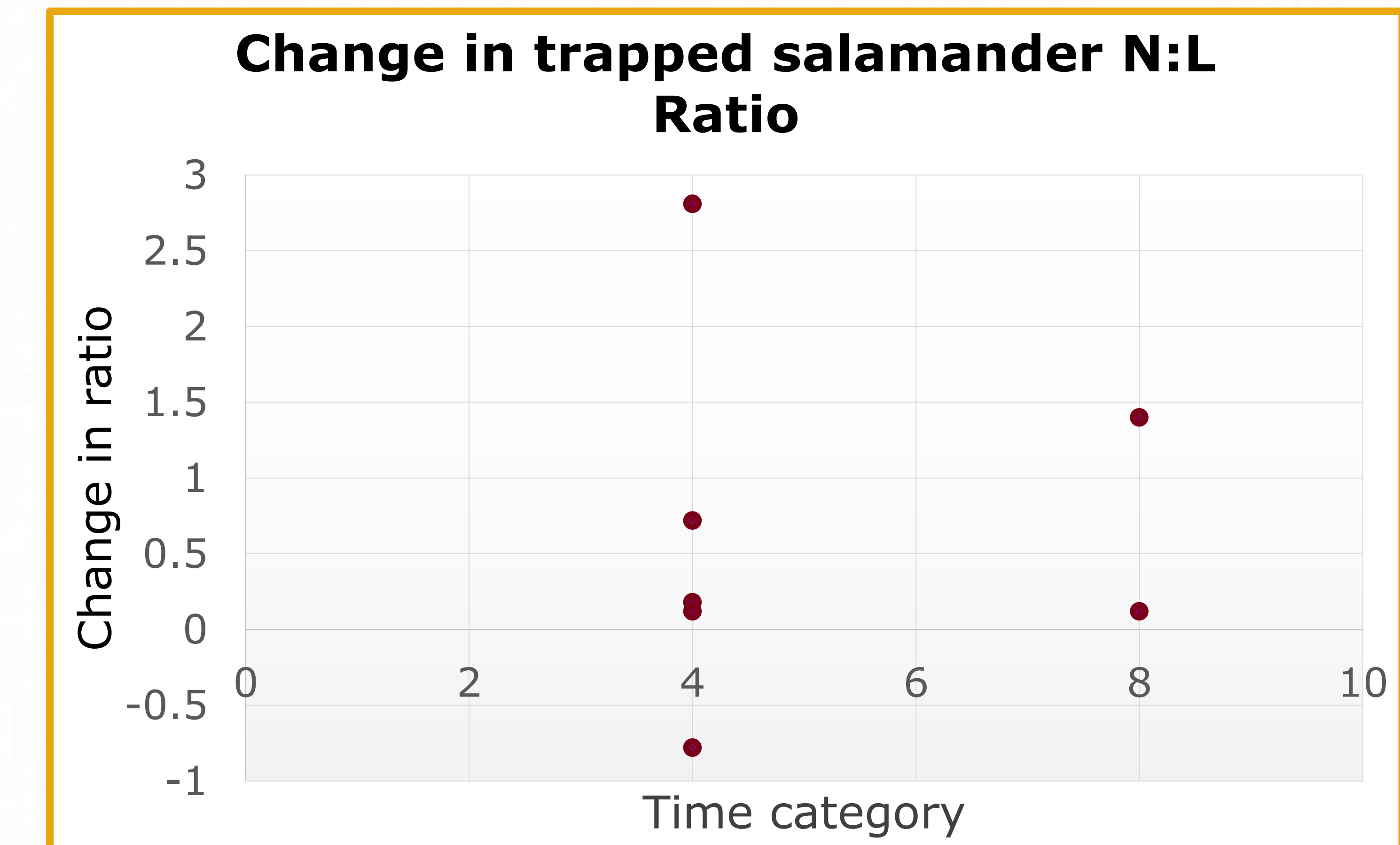
- ❑ All salamanders had a measurable rise in stress
- ❑ But too small of a sample size to draw any timeline conclusions

## Discussion

- ❑ The blood taken 8 hours after initial sampling of dipnetted salamanders showed a larger increase in stress than blood sampled at 24 hours later
- ❑ Under assumption of equal stress during time in bucket
- ❑ Maybe they are initially stressed, but once the human factor is removed, they calm down
- ❑ Need to catch more salamanders
- ❑ Try to apply timeline for salamanders in traps anywhere from 0-24 hours after
- ❑ Important for conservation efforts and captive management



Tiger Salamander (a) Lymphocyte (b) Neutrophil



**Figure 2.** Change in Neutrophil to Lymphocyte N:L ratios between two blood profiles of Easter tiger salamanders caught in minnow traps

## References

- Bennett, M., Gaudio, C., Johnson, A., & Spisso, J. (1972). Changes in the blood of newts, *Notophthalmus viridescens*, following the administration of hydrocortisone. *Journal Of Comparative Physiology*, 80(2), 233-237. doi: 10.1007/bf00696493
- Davis, A., & Maney, D. (2018). The use of glucocorticoid hormones or leucocyte profiles to measure stress in vertebrates: What's the difference?. *Methods In Ecology And Evolution*, 9(6), 1556-1568. doi: 10.1111/2041-210x.13020
- Davis, A., Maney, D., & Maerz, J. (2008). The use of leukocyte profiles to measure stress in vertebrates: a review for ecologists. *Functional Ecology*, 22(5), 760-772. doi: 10.1111/j.1365-2435.2008.01467.x
- DuRant, S., Hopkins, W., Davis, A., & Romero, L. (2015). Evidence of ectoparasite-induced endocrine disruption in an imperiled giant salamander, the eastern hellbender (*Cryptobranchus alleganiensis*). *Journal Of Experimental Biology*, 218(14), 2297-2304. doi: 10.1242/jeb.118703
- Narayan, E., & Hero, J. (2011). Urinary corticosterone responses and haematological stress indicators in the endangered Fijian ground frog (*Platymantis vitiana*) during transportation and captivity. *Australian Journal Of Zoology*, 59(2), 79. doi: 10.1071/zo11030
- Waye, H., Dolan, P., & Hernandez, A. (2019). White Blood Cell Profiles in Long-Term Captive and Recently Captured Eastern Tiger Salamanders (*Ambystoma tigrinum*). *Copeia*, 107(1), 138. doi: 10.1643/cp-18-126

## Acknowledgements:

This project was supported by The UMM IUSE: Encouraging the participation of Native Americans in the Interdisciplinary Environmental Sciences and Sustainability at the University of Minnesota Morris. Work with the salamanders was carried out in accordance with standard animal care protocols and approved by University of Minnesota Animal Care and Use Committee (IACUC #1601-33284A). We thank the Morris Wetland Management District for a Special Use Permit (#2014-23357) to work at Pepperton Waterfowl Production Area.



# Endogamous Population Effects on Child Fertility in French Canada

Katelyn Bergstrom and Rebecca Dean



## Introduction

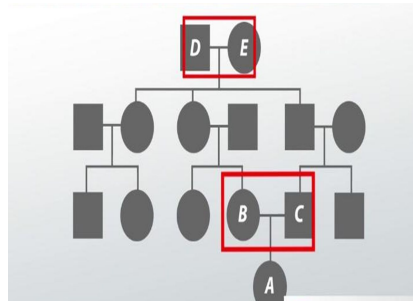
Endogamy is the practice of marrying someone within the same ethnic, social, religious, or cultural group. In endogamous populations, every person descends from the same small gene pool. It is seen in various communities throughout the world. Endogamous populations are sometimes referred to as isolated populations. They have been seen to have numerous rare diseases and birth defects as the small gene pool offers a greater chance for recessive traits to be more commonly expressed and increase the chance of early mortality (Danubio 1999; Reddy 2007; Lopes 2017)

One group in particular that is known for endogamy is the French Canadian population that settled in Quebec in the beginning of the 17<sup>th</sup> Century. French Canadians at this time mainly practiced Roman Catholicism; marrying within the church was very important to French Canadians at this time, and became even more important as time passed when new French families were not able to journey to Canada after the British took control of the region. Over time this made the gene pool for the French Canadian population small and isolated.

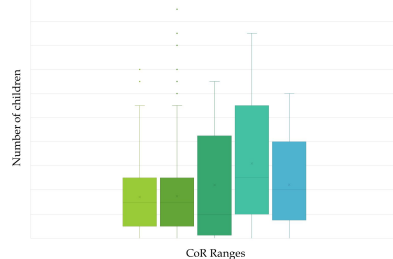
## Acknowledgements

\*Danubio, M. E., Piro, A., & Tagarelli, A. (1999). Endogamy and inbreeding since the 17th century in past malarial communities in the Province of Cosenza (Calabria, Southern Italy). *Annals of Human Biology*, 26(5), 473–488. doi: 10.1080/030144699282589  
\*Lopes, L., Hou, L., Boldt, A., Kassem, L., Alves, V., Nardi, A., & Memahan, F. (2016). Finding Rare, Disease-Associated Variants in Isolated Groups: Potential Advantages of Mennonite Populations. *Human Biology*, 88(2), 109. doi: 10.13110/humanbiology.88.2.0109  
\*PRDH-IGD. (n.d.). Retrieved from <https://www.prdrh-ind.com/fr/Bibliographie/Articles/Revises>  
\*Reddy, T. P. K., Reddy, K. K., & Reddy, P. G. (2007). Ancestral Consanguinity and Mortality Among Three Endogamous Populations of Chittoor District, Andhra Pradesh, India. *Human Biology*, 79(4), 413–425. doi: 10.1353/hub.2007.0052

## Canada



Number of children throughout CoR ranges



Box and whisker plots were graphed by ranges of relatedness, from left (less related) to right (more related), as the following: 0.000122-0.00098, 0.00098-0.002197, 0.002197-0.007813, 0.007813-0.125244, and 0.125244-0.250977.

## Aim

If endogamous populations reduce the gene pool and increase the chance of mortality then could having an isolated population also have an effect on the number of children a couple could have? In this study, we calculated the coefficient of relatedness of French Canadian families from the start of 17<sup>th</sup> century until the mid-18<sup>th</sup> century, then compared this to the number of children to see if relatedness affected the number of children birthed by a couple.

## Methods

The relatedness coefficient was calculated at the University of Minnesota Morris on a database of French Canadian families gathered by Dr. Rebecca Dean. The data was already cleaned of duplicates and sorted prior to analysis. After the relatedness coefficient was determined, coefficients were grouped into quadrants and data was organized into a box-and-whisker plot. The relatedness coefficient was calculated by generating pedigrees of families' and counting the number of generations between individuals. Once the number of generations is determined that amount was raised to  $\frac{1}{2}$  to calculate relatedness coefficient. If both male and female had ancestors within the pedigree then amounts raised to  $\frac{1}{2}$  were then added together to get total relatedness coefficient.

## Conclusion

- Isolated populations had relatedness coefficients ranging from 0.000122-0.250977
- There does not seem to be a trend between relatedness coefficient and number of children
- This could be due to coefficients being too low valued or possibly that humans are not as greatly affected by relatedness coefficient as other animals
- Even if couples with higher related coefficient did have several children, children may not have survived to the next generation, however that data was not available in this study and could be investigated more in detail in the future

# Composition of a Story Cloth: The Importance of a Personal Expressive Writing Method in Academia

Trina Vue, Professor Joshua Johnson, Department of English  
Undergraduate Research Opportunities Program - University of Minnesota Morris

## Introduction

The Hmong, having always been a community of people who were constantly relocating and running, hold onto the only things that keep them grounded: their history and culture. When a massive wave of Hmong refugees immigrated to the United States after The Secret War in 1975, their strength to hold onto that heritage became weaker when introduced to American school systems that enforced western teachings in writing. That included using an "objective" voice. With no outlet to express their struggles in grasping their identities of being Hmong and American, I turn to a method of storytelling that allows for that kind of expression. In this intersection between traditional academic writing and expressive writing, I analyze the Hmong story cloth, a form of textile art that uses embroidery to depict a narrative, in order to build a framework through which to approach storytelling. In doing so, I argue that by understanding the composition of a story cloth, we can help Hmong students work towards a product that both meets the demands of academic discourse and expresses personal voice.

## Objectives

- Build a framework through which to approach storytelling

- Examine if by understanding a story cloth, we can help Hmong students better grasp their identity in their own academic writing.

- Explore how the two forms of composition (traditional Hmong story cloth and academic writing) can work together towards a product that both meets the demands of academic discourse and expresses the voice and identity of the author.

## Background

### Who are Hmong people?

- The Secret War
  - 1961: CIA begins recruitment of ethnic minorities, trained to stop the spread of Communism
  - Waves of Hmong people cross the border into Thailand
  - 1975: Collapse of Royal Lao Government
    - Hmong refugees begin arriving in the US

## Methodology

### Literature Review

- To fully understand the context of my research, I delved into the scholarship of academic discourse in relationship to identity, voice, the personal, and objectivity.
- Scholarly research also involved learning more about a story cloth. This included understanding more about what its purpose is, what it represents, and the general process of its creation.

### Story Cloths

- In Hmong culture, they serve as a historically significant way to record not only traditional folklore, but also everyday life, and important events in Hmong history.
- This was the perfect template in my research because it provided an accurate representation of how to tell a story from this specific group of people.
- I used it as a framework to study storytelling → then analyzed the links between personal voice, academic discourse, and how to use storytelling to encompass all three

### Hmong Voices

- Semi-structured interviews of 30-45 minutes duration were constructed with five participants who identified as former or current Hmong students.
- They represented students in both California and Minnesota, which are the two states with the largest Hmong population.



Figure 1. Traditional Hmong Story Cloth depicting the events of The Secret War.

Introduction

Body Paragraph 1

Body Paragraph 2

Body Paragraph 3

Conclusion

Figure 2. Visual representation of a traditional academic essay.



Figure 3. Close-up of a story cloth depicting folklore.



Figure 4. Close-up of a story cloth depicting a woman in an every day life village.

## Results

### Interviews

- All five of the participants reported that their experience with writing reflected what traditional academic discourse encourages: using an impersonal voice and writing in third person.
- All five of the participants expressed that identity is connected to writing, while also stating how imperative it was to be able to express their identity in their work.

### Analysis

- Storytelling and academic writing are similar in many ways, even if it's not explicitly said.
- A story cloth is something already easily recognizable to Hmong students.
- We can use it as a way to teach them about the techniques that are critical in writing.
- Storytelling as a method for writing allows for not only "academic writing" done *well*, but also invokes a personal aspect of the writer that promotes a certain reflection.
- The personal and emotional is a strength: Acknowledging and more importantly, *valuing* the experiences and realities of a student's life.

• *"The words that I write appear from my hands—it is from my mind, and from my heart [that] they were born. My writing is my self-expression; if it does not sound like me, it is not my creation."* – Lucy, 23, California

• *"There was this sense of freedom that came [from being asked to include my experiences in writing.] Like, 'Oh god, I can finally express myself and be able to fully articulate myself in a way that I haven't prior.' It released me in a way where I could write authentically."* – Stephane, 26

## Conclusions

### Teachers need to recognize:

- There is a need for a discourse that *does* admit voice and identity.
- It is their responsibility to provide a space for students to comfortably use their voices and experiences, instead of suspending them.
- Storytelling is just one way to do that, in order to reframe the narrative of academic writing.

### For the Future

- I want to look at how storytelling can help not only Hmong students in writing, but students overall.
- In addition to that, I want to be able to take storytelling and apply it to aspects outside of just writing.

## Acknowledgements

This project was supported by the University of Minnesota's Undergraduate Research Opportunities Program. Thank you to the Hmong students who shared their stories with me in the hopes of making change for future Hmong students. Most importantly, thank you to my faculty mentor Joshua Johnson for always believing in my work and giving me a space to pursue my research interests.


## References

1. Her, Vincent, and Louise Buley-Meissner. "Hmong Voices and Memories: An Exploration of Identity, Culture, and History through Bamboo among the Oaks: Contemporary Writing by Hmong Americans." *Journal of Asian American Studies*, vol. 13, no. 1, 2010, pp. 35–58.
2. McCall, Ava L. "Speaking through Cloth: Teaching Hmong History and Culture through Textile Art." *Social Studies*, vol. 90, no. 5, Sept. 1999, pp. 230–236. EBSCOhost, doi:10.1080/00377999909602421.
3. McDrury, J., & Alterio, M. (2003). *Learning through storytelling in higher education : Using reflection & experience to improve learning*. London ; Sterling, Va.: Kogan Page.



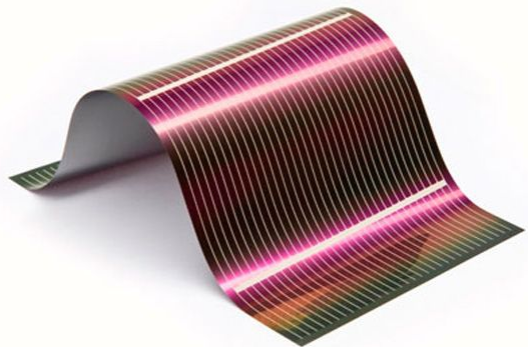
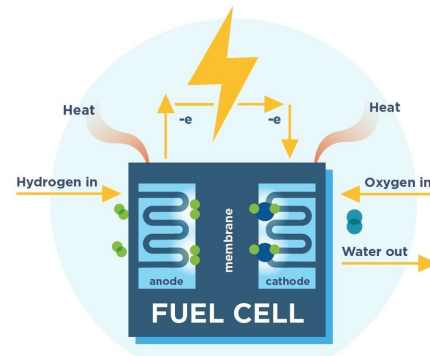
# Direct Arylation Polymerization of Indophenine-Based Monomers

Sarah Severson  
Spring 2020 UROP  
Under the direction of Dr. Ted M. Pappenfus

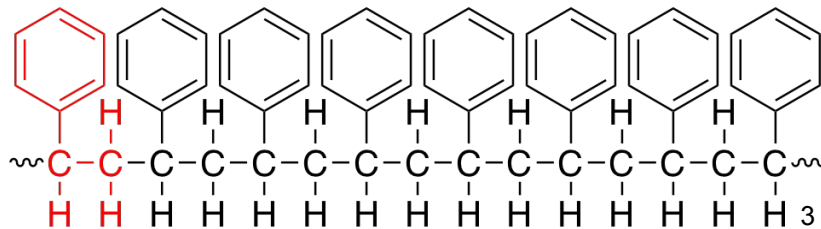
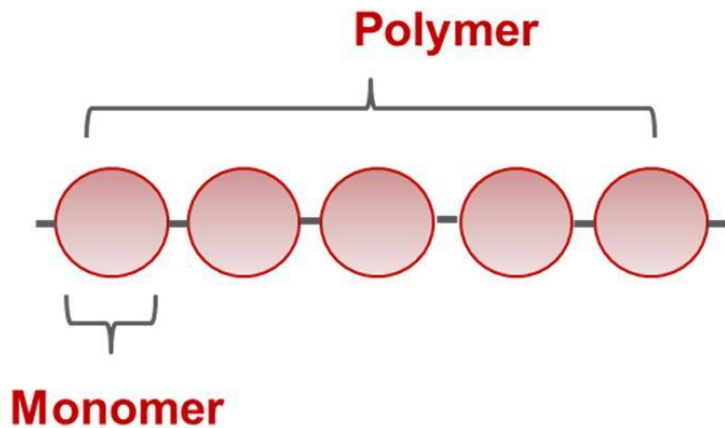


# Organic redox materials

- Low-cost carbon materials
- Unique electronic properties
- High tunability/flexibility

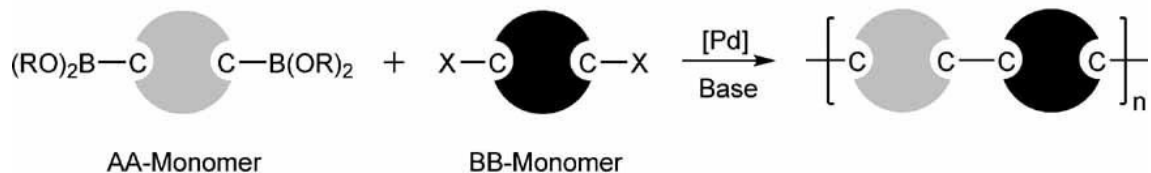


# What do all these devices have in common?

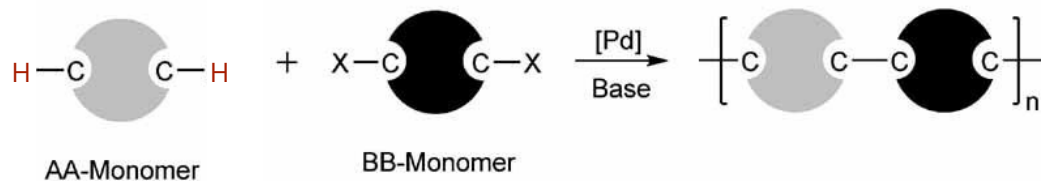


# Polymerization methods

Step-growth polymerization via transition metal-catalyzed coupling (example: Stille)

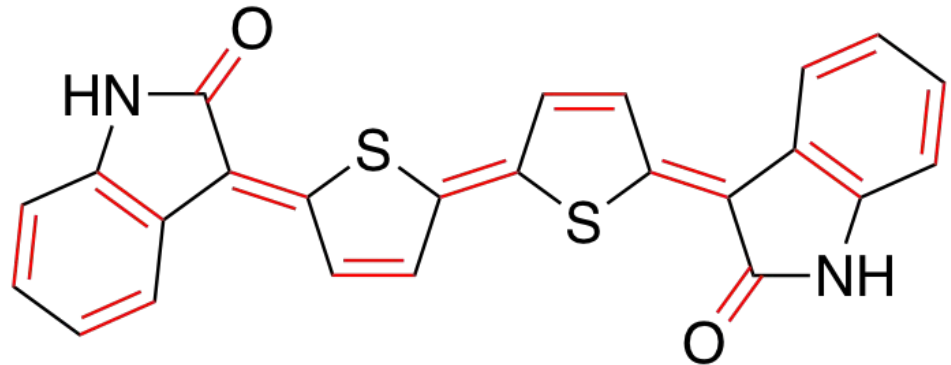


Step-growth polymerization via direct arylation polymerization (DArP)



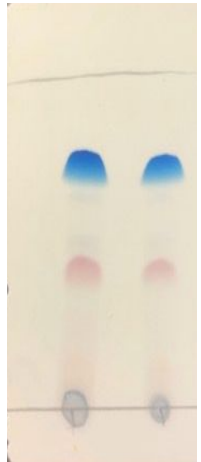
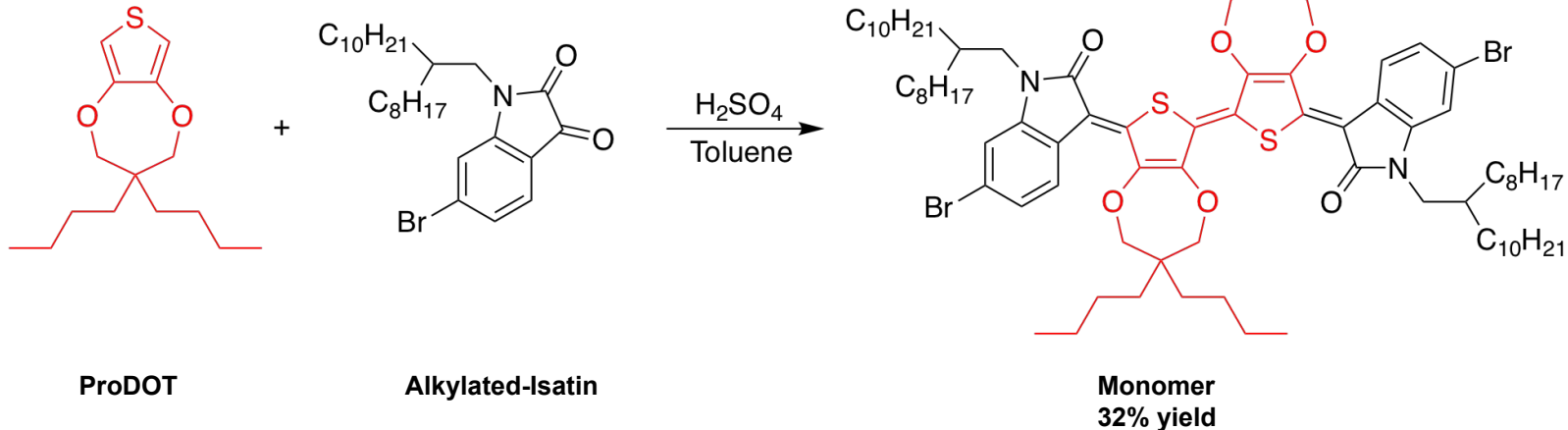
# Indophenine as a monomer for polymerization

- History:
  - **1879:** indophenine was discovered by Alfred Baeyer
  - **1882:** indophenine is made from thiophene (Meyer et al.)
  - **1924:** correct structure identified (Heller et al.)
- Indophenine shows promise for electronic applications due to its...
  - Quinoidal structure
  - Conjugated character
  - Synthetic modifiability



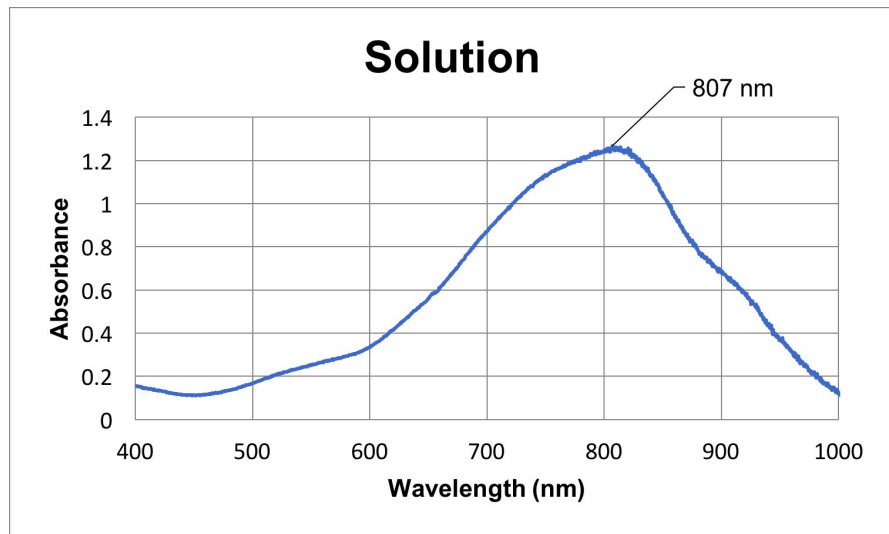
# Indophenine-based monomer

- Modified with ProDOT substituents to enhance solubility and eliminate isomerism (Pappenfus et al.)
- Facile synthesis with acid catalyst (Cava et al.)
- Easily polymerized via Stille coupling





# Stille copolymer

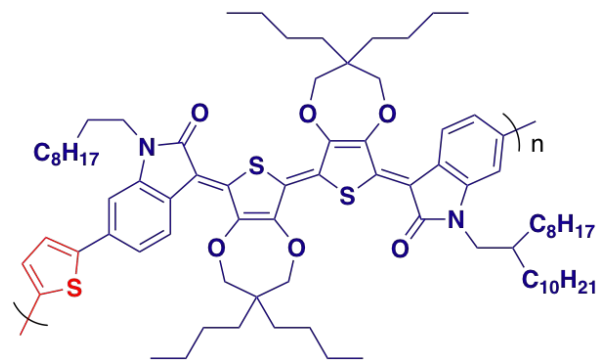


$\lambda_{\text{max}}$  (solution) = 807 nm

$\lambda_{\text{max}}$  (film) = 771 nm

Bandgap = 1.2 eV

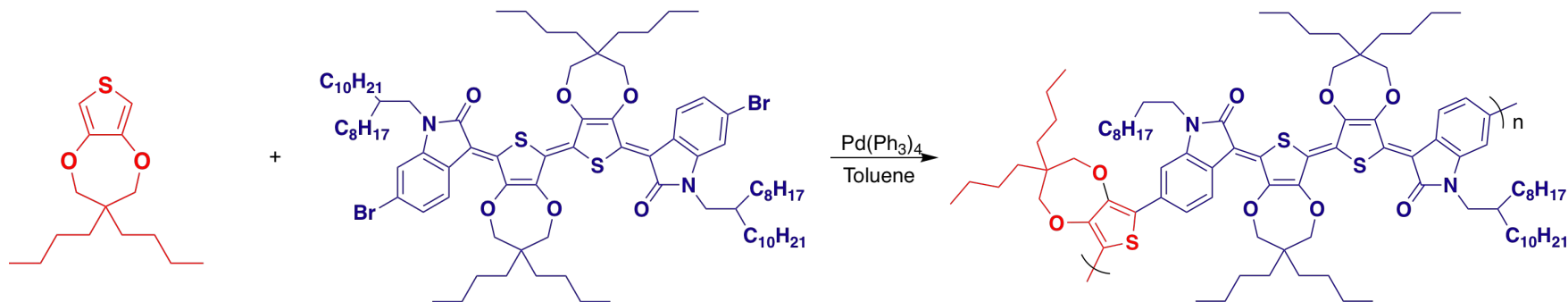
<b>Mw</b>	7000 g/mol
<b>Mn</b>	5222
<b>PDI</b>	1.34



Stille Copolymer  
95% yield

# A greener route: DArP

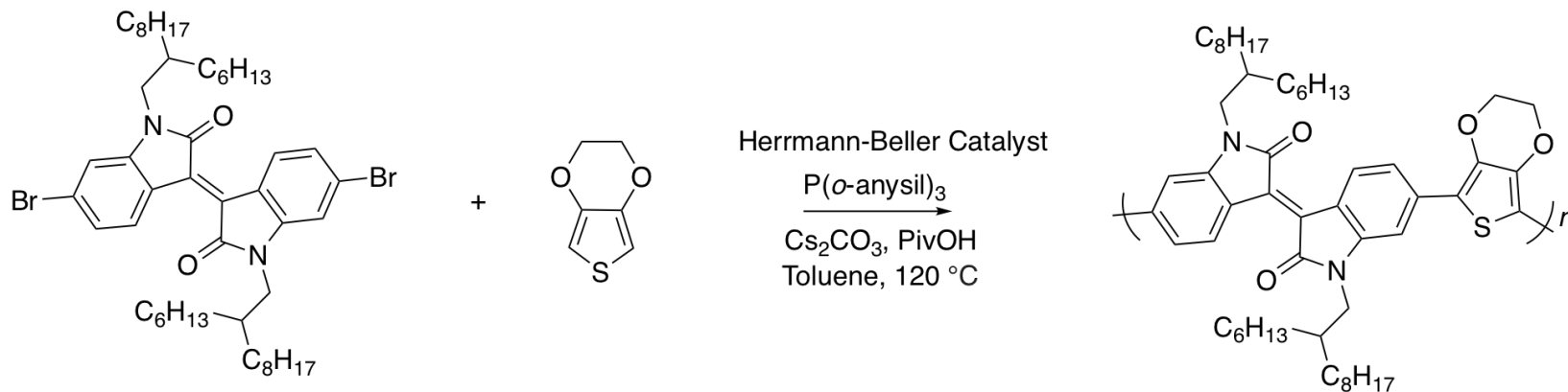
- Requires the functionalization of only *one* coupling site (halide)
- Other coupling site is a C-H bond that is “activated”
- DArP with indophenines has not been previously reported



Preparation of indophenine-based polymer using DArP

# Related DArP polymers

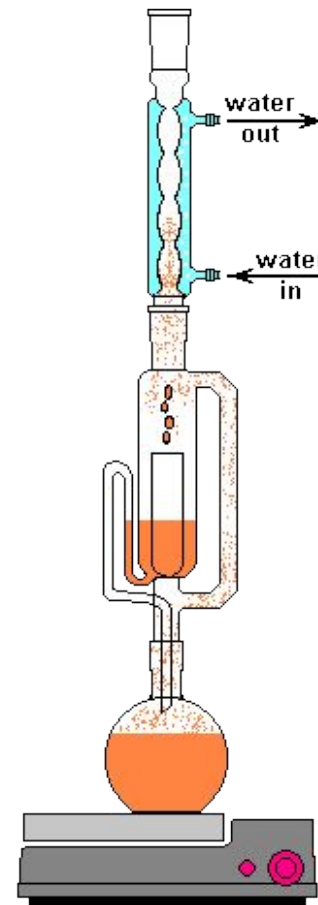
- Grenier et al. (2015) synthesized a similar polymer via DArP with:
  - 95% yield,  $M_w = 210,000$  g/mol, PDI = 2.31



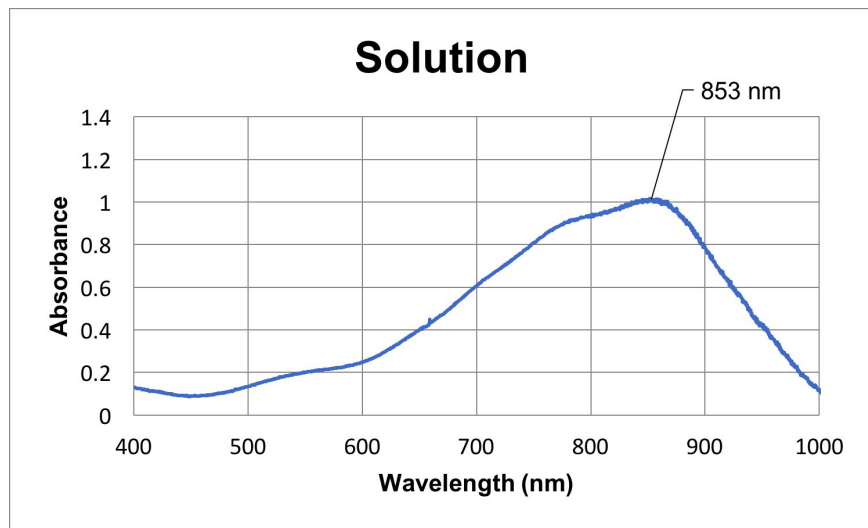
# DArP polymer: purification

Methanol  
Acetone  
Hexanes (33%)  
Chloroform (62%)  
**Combined yield of 95%**

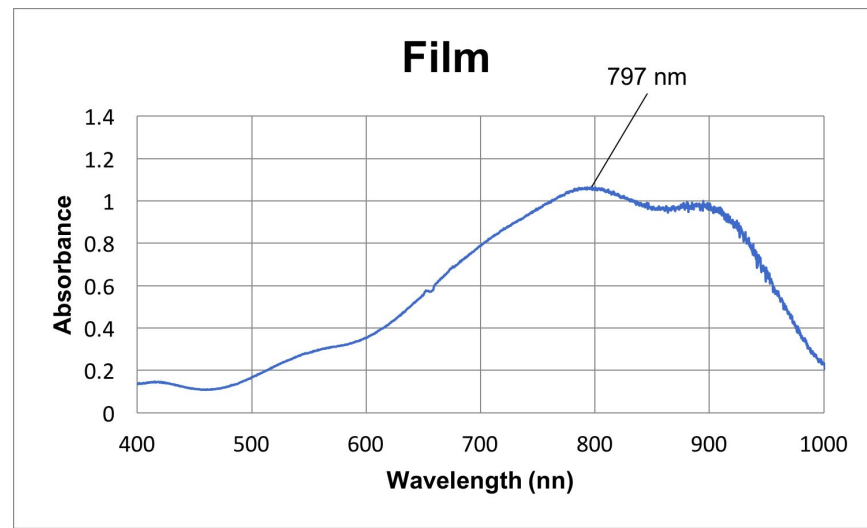
<b>Mw</b>	6047
<b>Mn</b>	5287
<b>PDI</b>	1.13



# DArP polymer: UV-Vis

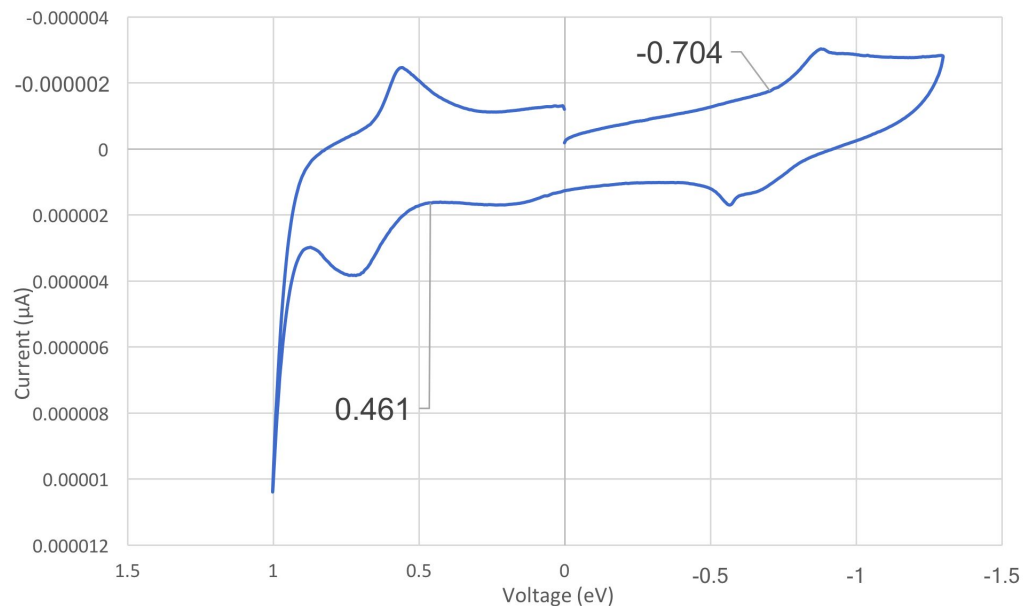
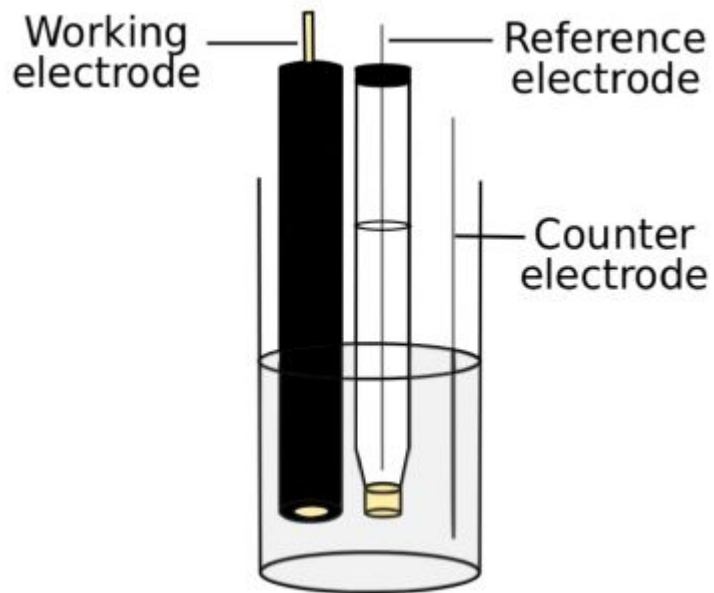


$\lambda_{\text{max}} = 853 \text{ nm}$



$\lambda_{\text{max}} = 797 \text{ nm}$   
*Band gap = 1.22 eV*

# Cyclic voltammetry of DArP polymer



***Electronic Band Gap = 1.17 eV***

# DArP versus Stille Coupling

	Stille polymer	DArP polymer
Yield	95%	95%
Solution $\lambda_{\text{max}}$	807 nm	853 nm
Solution Bandgap	1.2 eV	1.2 eV
Mw	7000 g/mol	6047 g/mol
Mn	5222 g/mol	5287 g/mol
PDI	1.34	1.13

***Direct arylation polymerization is a viable route to produce indophenine polymers with desirable electronic properties.***

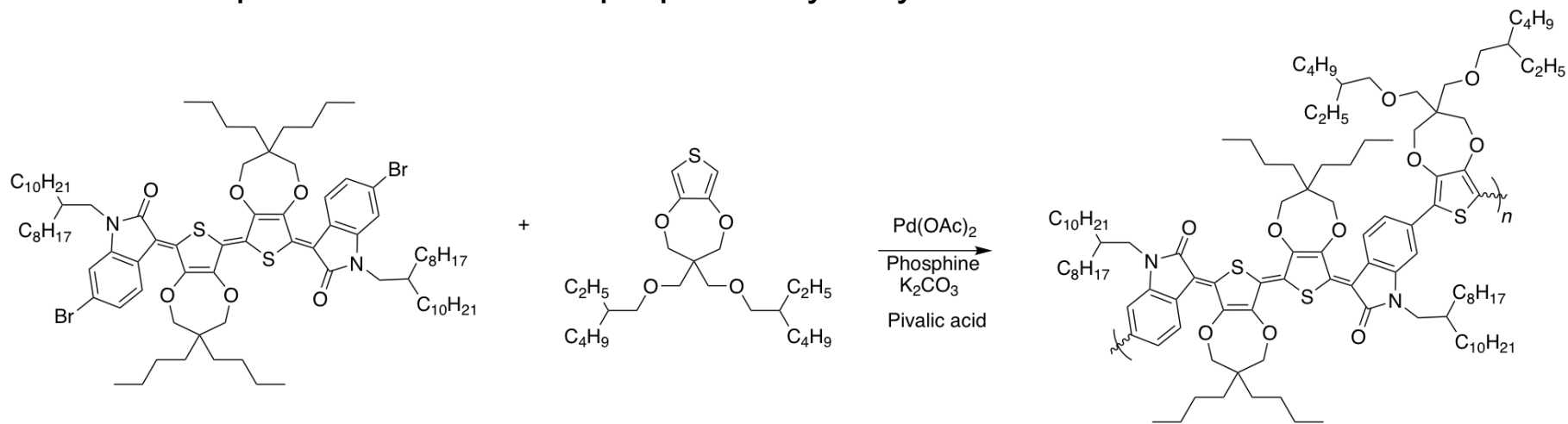
# Optimization

- Improving molecular weight by:
  - Enhancing solubility to prevent premature polymerization termination
  - Using already-synthesized alternative monomers with improved solubility
  - Designing new monomers with enhanced solubility
- Increasing sustainability by using alternative solvents
- Exploring new catalytic systems



# Enhancing solubility: thiophene monomer

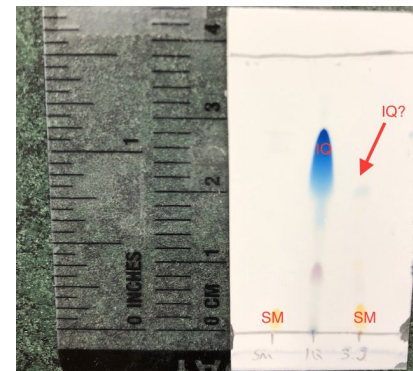
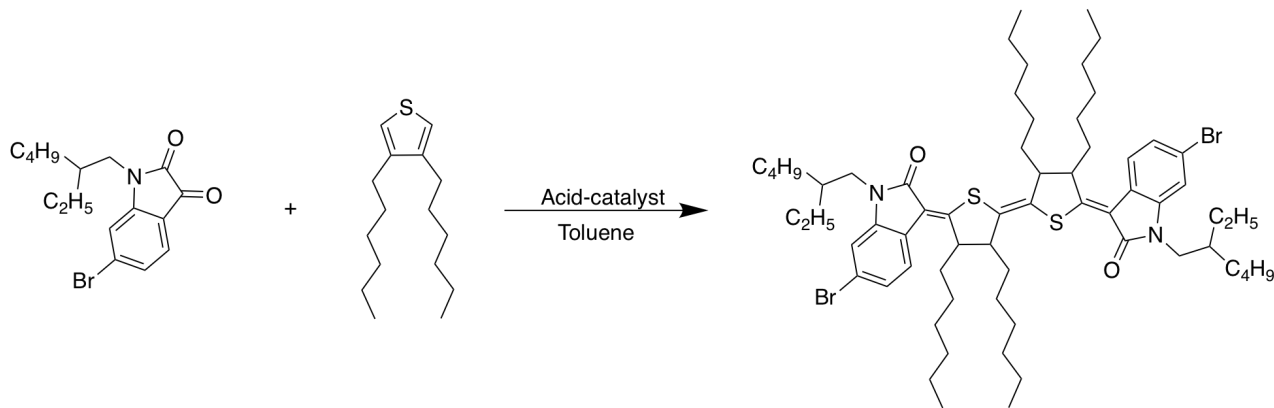
- Replace ProDOT monomer with a more soluble thiophene monomer
- Used optimized conditions proposed by Meyers et al.



***No visible color change occurred and TLC indicated formation of no product.***

# Enhancing solubility: indophenine monomer

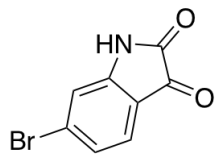
- Design a new indophenine monomer with hexyl substituents rather than ProDOT substituents.



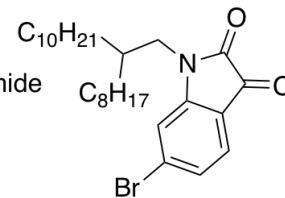
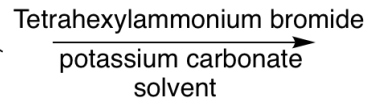
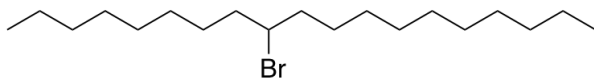
***No visible color change occurred and TLC indicated formation of almost no product. Steric and/or electronic effects likely make the reaction less favorable.***

# Enhancing sustainability: solvent

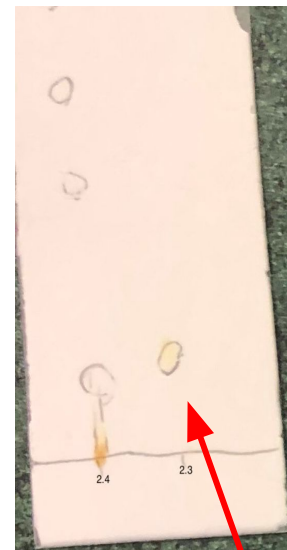
- A key starting material is an alkylated isatin.
- The conventional reaction uses DMF as a solvent, which...
  - Complicates purification
  - Reduces sustainability
- Attempt same reaction with acetone as solvent



+



***In DMF, the reaction formed the desired product in 60% yield. In acetone, no product formed.***



**Only starting material in acetone**

# Conclusions and Future Work

- Direct arylation polymerization is a sustainable and effective route toward indophenine polymers with desirable electronic properties
- Further optimization needed to:
  - Increase the molecular weight of indophenine polymers
  - Enhance the solubility of indophenine monomers and polymers
  - Improve the sustainability of the synthesis of starting materials
- Future work includes:
  - Theoretical calculations to understand energy barriers of failed reactions
  - Continued exploration of more soluble indophenine monomers
  - Continued testing of different catalytic systems

# Acknowledgements

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- University of Minnesota Undergraduate Research Opportunities Program
- UROP facilitators

# References

1. Baeyer, A. Untersuchungen über die Gruppe des Indigblaus. *Ber. Dtsch. Chem. Ges.* **1879**, *12*, 1309–1319.
2. Meyer, V. *Ber. Dtsch. Chem. Ges.* **1882**, *15*, 2893–2894
3. Heller, G. Zur Konstitution des Indophenins. *Angew. Chem.* **1924**, *37*, 1017–103.
4. Tormos, G. V.; Belmore, K. A.; Cava, M. P. The Indophenine Reaction Revisited: Properties of a Soluble Dialkyl Derivative., *J. Am. Chem. Soc.* **1993**, *115*, 11512–11515.
5. Pappenfus, T. M.; Helmin, A. J.; Wilcox, W. D.; Severson, S. M.; Janzen, D. E. ProDOT-Assisted Isomerically Pure Indophenines. *J. Org. Chem.* **2019**, *84*, 11253-11257.
6. Grenier, F.; Aich, B. R.; Lai, Y. Y.; Guerette, M.; Holmes, A. B.; Tao, Ye.; Wong, W. W. H.; Leclerc, M. *Chem. Mater.* **2015**, *27*, 2137-2143.
7. Ludwiczak, M.; Majchrazak, M.; Bayda, M.; Marciniak, Br.; Kubicki, M.; Marciniac, Bo. *J. Organomet. Chem.* **2014**, *750*, 150-161.