

2026

UNDERGRADUATE  
RESEARCH FORUM

April 9, 2026



THE OHIO STATE  
UNIVERSITY

LIMA

# Purpose

The **Lima Campus Undergraduate Research Forum** is designed to showcase the research performed by our students on the Ohio State Lima campus. Lima students also present their research at the Denman Undergraduate Research Forum, the Spring Undergraduate Research Festival and at many discipline-specific events.

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## THANK YOU

We thank Charles River Laboratories for generously sponsoring the Outstanding Student Researcher Award and the Dean's Office for supporting the Lima Campus Undergraduate Research Forum.

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The Ohio State University at Lima Undergraduate Research  
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# ABSTRACTS

## Aubrey Gerten and Anthony Gerten

Research Advisor: Robin K. Bagley

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### **Evaluating parasitoid flies associated with *Neodiprion* sawflies**

When examining the mechanisms and origins that give rise to the diversity of the living world, one potentially under-explored area of evolutionary biology is what role parasites can play in generating biodiversity. Parasites form symbioses with their hosts, such that they benefit while the host is harmed. One system where this occurs frequently are *Neodiprion* sawflies, which are attacked by a wide range of parasitoids, or lethal parasitic insects. The sawflies are agricultural pests, and because of this, information has been compiled on their parasitoids in hopes of discovering a method of biological control. Most of the work, however, has been done on the wasp parasitoids, and substantially less work has been done on their fly parasites (Order Diptera, Family Tachinidae). It is currently uncertain how many and which species of fly parasites are able to attack *Neodiprion*, but here we report the results of a survey of tachinid flies reared as by-catch from ~20 years of sawfly collections. Previously, fourteen potential species were identified on the basis of morphological differences, and are currently being keyed using traditional approaches. To support these morphological identifications, we have generated mitochondrial COI barcodes for representative individuals of each morphospecies. Here we present a phylogeny of the fly specimens as a first step towards determining the complex interactions between these parasites and their hosts.

**Jesse N. Gunsett**Research Advisor: Ryan W. Norris

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**Uncovering relationships among Central Asian white-toothed shrews in the genus *Crocidura***

The genus *Crocidura*, commonly known as white-toothed shrews, is one of the most species rich genera in all mammals with over 180 currently recognized species. However, these shrew species are very difficult to tell apart without the help of genetic data, and the relationships among the species in Asia are not entirely clear. This project aims to discover more about the relationships among *Crocidura* species in and around Pakistan. I've recovered four main clades of *Crocidura*. Clade A contain many Asian species, but only one can be found in Pakistan. Clade D contains most of the relevant species, many of which are not recovered as monophyletic groups. In our lab, we have over 70 tissue samples of *Crocidura* shrews from Pakistan, over half of which are unidentified at the species level. Since last August, I have been working on extracting and amplifying DNA sequences from these tissue samples. In the near future, the extracted DNA will be sequenced so that I can compare the sequence of these shrews and compare their evolutionary relationships on my phylogeny. This final analysis will allow me to identify the tissue samples with known *Crocidura* species and understand within species relationships.

**Aaron Hutchins Jr.**

Research Advisor: Ryan W. Norris

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## **Evaluating convergent evolution of the TP53 tumor suppressor gene in subterranean rodents living in hypoxic environments**

Cancer resistance has evolved independently in several subterranean rodents who have been exposed to chronic hypoxia and environmental pressures.

I investigated molecular evidence for convergent evolution in tumor suppression pathways by comparing homologous genes in the naked mole rats (Heterocephalidae) and the blind mole rats (Spalacidae). I retrieved gene sequences from GenBank for the tumor suppressor gene TP53, which plays a central role in DNA damage response and apoptosis. I examined structure and amino acid sequence in both lineages of subterranean rodents and comparisons in related rodent families. Three-dimensional protein structures were predicted using Alpha Fold 3. These findings explore the potential patterns of convergent evolution under chronic hypoxic environmental pressure, investigating whether the two distantly related species may show adaptations in a shared tumor suppressor gene that could display its contribution to cancer resistance.

## Kunashe Makaudze

Research Advisor: Ryan W. Norris

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### **Refining the phylogenetic tree of African horseshoe bats (*Rhinolophus*)**

African horseshoe bats (*Rhinolophus*) are small insect-eating animals with a distinctive horseshoe-shaped fold of skin around their nose, which inspired their name. Recent genetic studies have reshaped our understanding of the evolutionary history of these bats, including redefining the boundaries among species. The Norris lab has 24 *Rhinolophus* tissue samples, including five species from four different African countries. At present, I have constructed a phylogenetic tree using the genetic data from GenBank. Our long-term goal is to integrate the Lima samples into this existing dataset to further refine the phylogeny of African horseshoe bats.

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## Keerthi Merugu and Alayna Welch

Research Advisor: Zachery T. Beres

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### **Carbon Sequestration Potential of Trees on the Ohio State Lima Campus**

Urban trees play an important role in mitigating climate change by acting as carbon sinks that store atmospheric carbon dioxide. Currently, the carbon storage potential of trees on the Ohio State Lima campus is poorly understood. This study examined how tree characteristics influence carbon storage within frequently traveled areas of campus. During 2024–2025, diameter at breast height (DBH) was measured for 90 trees representing 37 species. These DBH measurements were used with established allometric equations to estimate aboveground biomass. This allowed us to estimate overall carbon (C) and carbon dioxide (CO<sub>2</sub>) storage. Trees were classified by wood type (hardwood vs. softwood) and by nativity status (native vs. non-native) to assess potential differences in carbon sequestration. Hardwood trees represented the majority of the dataset and stored significantly more C than softwoods (mean = 1,919.36 kg C vs. 569.32 kg C, respectively;  $p = 0.000167$ ). Peer-reviewed research indicates that softwood species, on average, contain more carbon due to higher lignin content than hardwoods. Our data suggests that hardwoods represent the oldest tree species on campus, which generally aligns with the dominance of hardwood species in the campus landscape. The majority of trees sampled were native and stored significantly more C than non-native species (mean = 2,106.13 kg C vs. 598.54 kg C, respectively;  $p = 0.000119$ ). Collectively, the surveyed trees on campus store 156,584.9 kg of CO<sub>2</sub> (or 156.6 metric tons). Notably, this excludes trees located within the Tecumseh Natural Area, so the overall carbon sequestration on campus is likely substantially higher. These results provide a quantitative baseline for understanding the role of campus trees in carbon sequestration and highlight the importance of species composition in mitigation efforts to combat climate change.

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## Salahuddin Mohammed

Research Advisors: Robin K. Bagley and Sarah V. White

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### **Exploring host-associated and sex-based morphological variation in the *Perilampus neodiprioni* parasitoid.**

Ecological speciation generates biodiversity when divergent natural selection across environments promotes reproductive isolation. In multitrophic systems, the divergence at one level can cascade to associated organism in a process known as sequential divergence. Although sequential divergence remains poorly understood, plant-insect-parasitoid systems provide a promising framework for studying this process. For example, the parasitoid wasp *Perilampus neodiprioni* attacks pine-feeding *Neodiprion* sawflies. Previous broad geographic analyses in the *Pinus-Neodiprion-Perilampus neodiprioni* system suggest host-associated morphological variation in parasitoids, but it remain unclear whether these patterns persist when geographic variation is minimized.

To address this question, we analyzed 30 sympatric by-catch specimens of *P. neodiprioni* reared from three *Neodiprion* host species (*N. lecontei*, *N. pinetum*, and *N. virginianus*) collected in Lexington, Kentucky. We measured total body segment lengths (head, thorax, and abdomen) as well as facial traits including eye height, eye distance, and malar distance. Parasitoid sex, parasitoid color, and *Neodiprion* host sex were recorded for each specimen. We evaluated associations between host species, parasitoid sex, and their interaction with each morphological trait using two-way ANOVAs.

All measured traits varied significantly with parasitoid sex, with females exhibiting larger measurements than males. Host-associated differences were also detected, particularly between parasitoids reared from *N. virginianus* and those from *N. lecontei* and *N. pinetum*. Notably, this divergence pattern parallels host evolutionary relationships, as *N. virginianus* is more distantly related to *N. lecontei* and *N. pinetum*, which are sister species. Consequently, parasitoids from more distantly related hosts exhibited greater morphological differentiation. These findings demonstrate that host-associated morphological divergence in *P. neodiprioni* persists at a fine geographic scale, supporting the potential for sequential divergence in externally feeding insect-parasitoid systems.

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**Sophia T. Walker**Research Advisor: Ryan W. Norris

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## **Reconstructing the evolutionary history and pseudogenization of a retinal protein in blind mole rats (*Spalacinae*)**

Blind mole rats (subfamily *Spalacinae*) are a group of subterranean rodents and are completely blind, possessing the most degenerate eyes among placental mammals. Molecular evidence of their vision loss can be seen in the loss of function of proteins associated with vision. Native to Eastern Europe, Western Asia, and the Middle East, the subfamily is divided into two genera: *Spalax* and *Nannospalax*. Norris (2017) recognized eight species within *Spalax* and three within *Nannospalax*, though argued that 11 species is likely an underestimate. This study aims to refine the classification of *Spalacinae* by analyzing molecular data from two markers and attempt to estimate the timing of retinal degeneration. Using cytochrome b (*Cytb*) gene sequences from GenBank (n=183), we assessed genetic relationships among individuals within the subfamily, plotted geographic distributions, and constructed a phylogenetic tree using BEAST to infer evolutionary relationships. To further resolve relationships within the subfamily, we downloaded the Interphotoreceptor retinoid binding protein (*Rbp3*) gene for 113 samples, including 38 *Nannospalax*, 29 *Spalax*, and 47 outgroup taxa. Phylogenetic analysis of *Cytb* indicated that *Spalax* generally aligns with the taxonomy of Norris (2017), whereas *Nannospalax* contains substantial diversity extending beyond the three recognized species. The *Rbp3* analysis revealed a pseudogene with a premature stop codon present across all *Nannospalax*, providing evidence that retinal degeneration was in place prior to the divergence of species within *Nannospalax*. Together, these findings support the need for taxonomic reassessment within *Nannospalax* and shed new light on the evolutionary history of *Spalacinae*.

## **Enki White, Jerriah Benton and Elaila White**

Research Advisor: Ryan W. Norris

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### **Bat activity and species diversity on The Ohio State University at Lima campus**

Bats play an important role in maintaining ecosystem health through insect control and supporting plant life. Many species are experiencing population decline due to habitat loss, environmental change, and white nose syndrome. Using acoustic monitoring technology this project investigates bat activity and presence of species on The Ohio State University at Lima campus. The goal of this project is to determine which bat species emerge on campus, when they are most active, and where they are located on campus. Answering this question provides greater insight into how to protect the bat population soon. Data was collected during evening and nighttime hours from October 3, 2025, to October 10, 2025, using a Titley Chorus bat detector. These calls were analyzed in Anabat Insight based on their frequency ranges, allowing the data to be matched with known echolocation profiles of bat species native to Ohio. These findings will enhance knowledge of bat activity, patterns and the diversity of bat species on the Ohio State Lima campus.

## Paris Prichard

Research Advisor: Zachary Hines

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### **Women Brewers in the Middle Ages**

Although modern brewing culture in the United States is dominated by men, many women in the past earned an income from brewing ale. However, media portrayals and public understanding of medieval women's lives have misunderstood women's contributions to this important social activity—erasing them from brewing culture. Medieval women brewers had autonomy over their businesses and its productions. They earned income through their craft, and some women were the dominant providers for their households. Women supplied the majority of the ale their communities consumed. Through scholarly research on historical women, I have uncovered evidence of women in the brewing culture and their autonomy. Assumptions about medieval women are often oversimplified, suggesting that they can only serve three possible roles in society: mother, wife, and a life of religious devotion. My study of medieval women brewers teaches us that women had, and continue to have, career aspirations and ambitions of their own. Women's entry into the workforce is not a 20th century phenomenon: as they had been there before during the Middle Ages. Women have always had dreams and goals for themselves, and the middle ages were no different.

## Levi Luke and Oscar Webb

Research Advisor: Sabine Jeschonnek

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### **Computational Analysis of Planetary Orbits Using the Euler-Cromer Method**

Gravity is a force that governs the motion of celestial bodies and determines the stability of a planet in orbit. This study investigates the orbits of planets within the solar system, specifically examining how gravitational dynamics dictate orbital stability. By writing code in the Python programming language, we modeled the motion of the planets. This project required solving differential equations to describe the motion of a planet around the sun, and we employ the Euler-Cromer method to do so. By changing the values of initial position, and initial velocity, our results highlight the relation of sensitivity and orbital trajectories to initial conditions. We demonstrate that even slight deviations in initial velocity or position can lead to significant shifts in the orbit, up to losing orbital stability. We perform simulations for Earth, Pluto, and Halley's Comet. The latter two are especially interesting due to their highly elliptical orbits. This makes them strong test cases for the investigation of the numerical stability of the simulation using different time steps. These findings show the precision required in numerical simulations of orbital mechanics, while also providing groundwork for future simulations of the orbits of two planets around the sun.

# Salahuddin Mohammed, Peter Harrington and Gavin Fegley

Research Advisor: Joseph P. Green

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## **Smartphone Addiction and Suggestibility: A Replication Study**

Kwon et al. (2013) developed a 10-item Smartphone Addiction Scale-Short Version (SAS-SV) to assess problematic smartphone use, including excessive time spent on the phone (e.g., during class or to the extent that others comment on overuse), compulsively checking and difficulty concentrating due to phone use, and distress when away from phone. Olsen and colleagues (2020) reported a small association between smart phone addiction and hypnotizability ( $r = .17$ ) across samples of Canadian undergraduate students. Furthermore, his team found a moderate correlation ( $r = .48$ ) between the SAS-SV and general suggestibility (Olson, 2024, personal communication). In the present investigation, we administered the SAS-SV via an online survey to  $N=107$  undergraduate students ( $n=69$  females,  $n=38$  males:  $M_{age}=20.22$ ,  $SD=3.88$ ). We replicated Olson et al.'s finding of a positive association between smartphone addiction and general suggestibility. In addition, SAS-SV scores were positively correlated with dissociation, interpersonal anxiety, need to belong, and the expectancy of being a good hypnotic subject. Our results are also similar to those reported by Jmiai & Green (2025).

# Gavin Fegley, Salahuddin Mohammed and Peter Harrington

Research Advisor: Joseph P. Green

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## **Examining the Potential Link Between Smartphone Addiction and Hypnotizability**

Olson and colleagues (2024, personal communication) reported a positive correlation ( $r=.48$ ) between the Smartphone Addiction Scale-Short Version (SAS-SV; Kwon et al., 2013) and the Short Suggestibility Scale (SSS; Kotov et al, 2004). Jmiai & Green (2025) similarly found an association between these measures ( $r=.58$ ). Olson et al. (2020) also examined the potential connection between smartphone addiction and hypnotizability. They obtained a small positive correlation across multiple samples of Canadian undergraduate students (average  $r=.17$ ). In the present study, we administered the SAS-SV and the SSS to undergraduate students at Ohio State Lima via an online survey, along with other measures of personality. A total of  $N=43$  ( $n=23$  females,  $n=20$  males:  $Age=19.23$ ,  $SD=1.62$ ) students who completed the survey then later returned for an in-person, group-administered test of hypnotizability. Consistent with previous findings, we found a positive correlation between scores on the smartphone addiction scale and general suggestibility ( $r=.38$ ). Across our total sample, we failed to find a significant association between smartphone addiction and hypnotizability. We discuss our findings in light of previous work in this area.

## Kris Fields

Research Advisor: Virginia Tompkins

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### **The Relation Between Narrative Comprehension Question Type (Inferential vs. Literal) and Preschoolers' Theory of Mind Development**

Theory of mind (ToM) refers to the ability to understand one's own and others' beliefs, emotions, and intentions. ToM is closely linked to narrative comprehension because understanding stories often requires reasoning about characters' mental states. Although prior research has examined associations between ToM and narrative comprehension, findings regarding differences between literal and inferential question types remain inconsistent. This distinction is theoretically important because researchers argue that ToM and narrative comprehension are related due to their shared reliance on inference (e.g., explaining why a character acted in a certain way). However, studies also find that literal questions (i.e., information explicitly stated in the text) relate to children's ToM. Additionally, few studies have examined potential bidirectional associations between ToM and narrative comprehension.

Parents and their 3- to 5-year-old children participated in a three-wave study. Data collection is ongoing, but currently 100 children have participated in all three waves, six months apart. At each wave, children completed a ToM assessment (seven items measuring understanding of characters' beliefs, emotions, and intentions). They also listened to a standardized narrative followed by 12 comprehension questions categorized as literal (e.g., characters, setting, outcome) or inferential (e.g., beliefs, emotions, predictions).

Across the three waves, and consistent with our hypothesis, both inferential and literal question types were similarly associated with preschoolers' ToM. Because both question types related to ToM, all questions were summed to examine longitudinal relations. All cross lagged correlations were significant. Earlier ToM predicted later narrative comprehension, and earlier narrative comprehension predicted later ToM.

These findings suggest ToM and narrative comprehension are meaningfully and bidirectionally related during early childhood, linking ToM to understanding both explicit and implicit story information.

**Victoria Sibert**Research Advisor: Virginia Tompkins

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## **Parents' Mental State Talk and Children's Executive Functioning**

Executive functioning (EF) refers to a set of higher-order cognitive processes that support goal-directed behavior, including working memory, inhibitory control, and cognitive flexibility (Zelazo, 2006). These skills develop rapidly during early childhood and are associated with important developmental outcomes such as academic readiness, social competence, and emotional regulation. A growing body of research has demonstrated that parents' mental state talk—language referring to thoughts, beliefs, desires, and emotions—plays an important role in children's theory of mind development. However, relatively little research has examined whether parents' mental state talk is also associated with children's executive functioning. The present study examined relations between parents' mental state talk and preschoolers' cognitive flexibility using data from a longitudinal project examining early environmental predictors of children's cognitive development. Participants included 126 preschool-aged children (M age = 4.45 years) and their parents. Parents' mental state talk was assessed through responses to storybook scenarios, which were coded for references to mental states across several categories (e.g., cognitive, desire, emotion, and perception). Children's cognitive flexibility was assessed using the Dimensional Change Card Sort task at two time points approximately six months apart. Hierarchical regression analyses examined whether parents' mental state talk predicted children's later cognitive flexibility after controlling for child age, vocabulary, parent education, and initial cognitive flexibility. Results indicated that cognition and modulation mental state language from the *Black Rabbit* storybook significantly predicted children's Time 2 cognitive flexibility, although overall mental state talk proportions did not reach statistical significance. These findings provide preliminary evidence that specific types of parental mental state language may contribute to the development of cognitive flexibility during early childhood.

**STEP PROGRAM**  
SECOND YEAR  
TRANSFORMATIONAL EXPERIENCE

## Aimee Kloeppe

STEP Program Advisors: Ian Breidenbach and Alyssa Brown

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### **Scuba Certification**

Scuba diving provides access to marine environments that are otherwise inaccessible from the surface. This opens a wealth of research opportunities for me as I'm interested in studying marine life, behavior, and ecosystems up close. Observing animals in their natural habitat can offer insights that cannot be gained through laboratory or observational studies alone. With the small scope of aquatic tanks, I work with daily, scuba diving offers me a chance at a larger sight of aquatic environments.

Perhaps most importantly, scuba diving fosters a deep appreciation for the fragility of our oceans and the importance of conservation. By witnessing firsthand, the beauty and diversity of marine life, divers are inspired to become guardians of the ocean, advocating for its protection and preservation for future generations. In essence, scuba diving offers a transformative experience that transcends the boundaries of the everyday world. I can contribute to conservation efforts by studying marine biodiversity, monitoring ecosystem health, and advocating for the protection of vulnerable species and habitats in my future studies.

Scuba certification can enhance my resume and increase my competitiveness in the job market. Many employers in the fields of marine biology, conservation, and research prefer candidates with scuba diving experience, especially for positions that involve fieldwork or underwater research. By taking the extra lesson of scuba diving, my skillset will put me above other candidates in aquarium or research jobs. Scuba certification often involves training and diving with instructors and fellow students, providing opportunities to network with professionals in the field of marine science. Building connections within the scuba diving community can lead to mentorship opportunities, job referrals, and collaborations on research projects. I can connect to other peers within the scuba diving course to benefit me for future jobs.





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