2024

UNDERGRADUATE RESEARCH FORUM

April 3, 2024

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.

THANK YOU

We thank the Dean's Office for supporting the Lima Campus Forum.

2024 UNDERGRADUATE RESEARCH AND MENTORING COMMITTEE

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The Ohio State University at Lima Undergraduate Research
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ABSTRACTS

Agapé Anderson
Research Advisor: Ryan W. Norris

Investigating the evolutionary history of the Kashmir voles in the genus *Hyperacrius*

The voles in the genus *Hyperacrius* are restricted to the alpine regions of Northern Pakistan and Kashmir. Two species of *Hyperacrius* are recognized based on morphological and ecological differences. The Murree vole *(Hyperacrius wynnei)* is the larger species and is found in forest habitat. True's Vole *(Hyperacrius fertilis)* is a smaller species from a more open subalpine environment. 5 subspecies are recognized from these two genera, including two from *H. fertilis* and three from *H. wynnei*. Our objective is to assess the evolutionary history of this genus using genetic data. We sequenced the cytochrome b gene from specimens of *Hyperacrius* (n=49) throughout the known range. We constructed phylogenetic trees using PAUP and used BEAST to estimate divergence time. *Hyperacrius* exhibits substantial genetic variability and deep divergence times. Our results suggest that current taxonomy underestimates the number of species in this genus.

Leah Beraki
Research Advisor: Ryan W. Norris

Reconciling taxonomy with phylogeny in zokors, root rats, and bamboo rats (Myospalacinae and Rhizomyinae: Spalacidae)

Muroid mole-rats (family Spalacidae) are a group of burrowing rodents from the Old World. Norris (2017) divided Spalacidae into the subfamilies Myospalacinae (zokors), Rhizomyinae (root rats and bamboo rats), and Spalacinae (blind mole rats, which are not part of my study). Norris (2017) recognized six species in Rhizomyinae and eleven species in Myospalacinae; however, he argued that there are additional unrecognized species. The focus of my project is to use available genetic data to determine the number of species present in Rhizomyinae and Myospalacinae and the boundaries between these species. I analyzed a large dataset of the cytochrome b gene downloaded from GenBank that consisted of Rhizomyinae individuals (n=87) and Myospalacinae individuals (n=46). I aligned the data by hand in PAUP*4a and constructed a phylogenetic tree using BEAST. I evaluated the different taxonomic hypotheses with regard to monophyly, genetic distance, divergence time, and formal species delimitation analyses. The existing taxonomy of bamboo rats, Rhizomys and Cannomys, and zokors, Myospalax and Eospalax, appears to align with my results. I resolved the inconsistency of the phylogeny of root rats *(Tachyoryctes)*. Norris (2017) recognized two species, *T. macrocephalus* and *T. splendens*, but my results indicate there should be at least four. I recognize *T. splendens* s.s. from northwest Ethiopia, *T. macrocephalus* from the Bale Mountains, *T. somalicus* from northeast Ethiopia and Somaliland, and *T. annectens* from southern Ethiopia and other East African countries. The Ethiopian highlands appears to be the cradle of diversity in this genus.

Elizabeth G. Brown, Ariel S. Kline and Alayna R. Welch
Research Advisor: Zachery T. Beres

Identifying Plants Found in the Tecumseh Interpretative Nature Preserve on the Ohio State Lima Campus

The Tecumseh Interpretative Nature Preserve was established on the northeastern corner of the Ohio State Lima campus in 2017. This 2-acre prairie habitat was planted using seeds of 54 different prairie species sourced from the Tri-Moraine Audubon Society and the Ohio Prairie Nursery. However, there has never been a systematic sampling of the plant species that have established in the prairie since these initial plantings. The goal of this research project is to begin cataloging these established plant species to better understand prairie succession and biodiversity in this habitat that once dominated much of Ohio. Our research methods focused on documenting through photographs flowering plants during late fall of 2023 prior to freezing weather. These photographs were then used to identify plant species using electronic applications and cross-referencing these initial identifications using online and physical field guides of wildflowers. While data analysis is ongoing, this two-step verification has confirmed the presence of at least 3 of the species contained in the original mixtures, and an additional 8 species not initially planted have been identified. An approximately 28 additional species are waiting for second verification of initial identifications. An important caveat of our study is that photographs were limited to fall 2023. We hope to continue photographing and identifying the plants in the prairie throughout spring and summer for a more complete view of the prairie plants. One of the end goals of this research will be the design of a walking field guide for future visitors to the Tecumseh Interpretive Nature Preserve. The structure and composition of the plants in this prairie will also directly impact the biodiversity and abundance of other focal organisms such as insects and birds. This initial cataloging will also be an important component of any future research project involving this vitally important part of our campus.

Hayat Durrani
Research Advisor: Ryan W. Norris

The unique small mammals in the Spin Ghar mountain range of Pakistan and Afghanistan

The Spin Ghar ("white mountain" in Pashto) mountain range straddles the border between Pakistan and Afghanistan, southwest of Peshawar. This mountain range has unique small mammals compared to other surrounding areas. Research conducted by fellow lab members has identified these mountains to be a potential biodiversity hotspot in the region. Knowledge of small mammals is limited due to a lack of attention and the difficulty of collecting samples in this high-altitude region. I compiled a list of species that may reside in the area using simple range maps (e.g. IUCN) and verified existing records using public databases of museums (e.g. VertNet). Using these data and prior research by fellow lab members, I attempt to characterize the affiliation of these species with populations from adjacent areas. In spite of its proximity to the Hindu Kush in Afghanistan and the mountains of Waziristan, the Spin Ghar range exhibits biodiversity that is most similar to that which is present across the Khyber Pass in the Hindu Kush of northwest Pakistan.

Fatima Mohammed
Research Advisor: Ryan W. Norris

Evaluating the geographic distribution, evolutionary history, and physiological adaptation to arid environments of *Microtus* voles in Northern Pakistan

Rodents are well known to exhibit physiological differences in kidney features depending on aridity. Voles in the highly speciose genus *Microtus* inhabit many habitats across Eurasia and North America and occupy areas that range from arid to wet climates. Prior to this study, only a single species of *Microtus* vole, *M. yuldaschi*, was known from Pakistan, having been collected at only two sites along the northern border. We sequenced the mitochondrial cytochrome b gene for 37 individuals collected in Pakistan and additional specimens from outside of Pakistan and compared these to other *Microtus* sequences found in GenBank. We also examined how our target *Microtus* species samples physically compared to ethanol-preserved kidneys of voles acclimated to dry and wet climates, specifically the gerbil, *Gerbilliscus*, and the rainforest mouse *Praomys*. We recovered *Microtus* in Pakistan as belonging to 3 separate radiations, each of which contain lineages that exhibit magnitudes of divergence that approach species-level genetic differences. Our results extend the range of the juniper vole, *M. (Blanfordimys) yuldaschi* in northernmost Pakistan and recover a divergent isolated lineage from Azad Kashmir. The Afghan vole, *M. (Blanfordimys) afghanus* is found in several sites in northwestern Pakistan and shows patterns of population structuring based on geography. We report the presence of voles in the Safed Koh range that form a clade sister to the Transcaspian vole, *M. (Microtus) transcaspicus*. The mountainous regions of Afghanistan and Northern Pakistan hold great potential as sources of unrecognized small mammal biodiversity. We demonstrate the effectiveness of ethanol-preserved kidneys and how they show apparent physiological differences affected by aridity.

Stephanie Parrish and Sanya Patel
Research Advisor: Ryan W. Norris

Determining Habitat Suitability of *Hyperacrius* Voles using Ecological Niche Modeling

Kashmir voles, genus *Hyperacrius,* are rodents found only in a small area on the border of India/Pakistan about the size of Ohio. Only two species have been recognized, but prior research conducted by a past student, Anna Walker, suggested that many species exist. We explored ecological requirements for *Hyperacrius* voles to investigate habitat preferences among potential species, specific barriers that are contributing to geographic isolation and why the genus is found in such a limited geographic region. We built a database of known localities where *Hyperacrius* has been collected. We used the program Wallace to conduct Ecological Niche Modeling that showed the most suitable regions for the *Hyperacrius* species. We discuss how isolating barriers like rivers may have contributed to species formation in this genus.

Carter Welch
Research Advisor: Zachery T. Beres

Long-Term Water Quality Monitoring of the Lost Creek on the Ohio State Lima Campus

The Lost Creek separates portions of the Ohio State Lima campus from the adjacent Tecumseh Interpretative Nature Preserve and Ohio State Lima Regenerative Farm. Previous research focused on two 150-yard-long sites designated as "Bridge Site" (east and downstream of N. Mumaugh Road) and "Natural Site" (between the prairie and farm plots). Very limited information exists regarding the health of this local aquatic habitat, but results indicated that the Natural Site was a healthier stretch compared to the Bridge Site (Welch and Beres, 2023). However, new water retention ponds are being installed to passively treat surface runoff from the regenerative agriculture fields and serve as an irrigation source in autumn 2024. From November 2022 through February 2024, we have been monitoring various biologically important chemicals in the Lost Creek with the goal of establishing longer term monitoring to measure the impact of these new retention ponds and better understand our local aquatic system. Compared to the Bridge Site, the Natural Site showed significantly increased orthophosphate levels [0.44 vs. 0.18 mg/L PO_4, respectively; *t*-test ($p = 0.024$)] and elevated nitrate levels [7.2 vs. 6.4 mg/L NO_3-, respectively; *t*-test ($p = 0.538$)]. These nutrients are frequently found in agricultural fertilizers and may indicate potential runoff from the adjacent farmland into the Lost Creek. The Natural Site showed significantly less ammonia nitrogen compared to the Bridge Site [0.1 vs. 0.24 mg/L NH_3-N, respectively; *t*-test ($p = 0.022$)]. Increased NH3-N levels at the Bridge Site may be the result of pollution from the roadside or adjacent oil pipe. Future studies will work to further investigate these differences and establish more systematic sampling especially during the summer months, and their potential impacts on organisms found in the Lost Creek. Studies like this are important for understanding the interconnectedness of land management decisions and (quite literally) their effects downstream.

Kinsey Barrows
Research Advisor: Zachary Hines

Redemption of Honor in Medieval Knights

Knights in medieval literature were tempted by all sorts of ideals, from money to companionship. In my research, I researched the temptation of magic upon knights in two medieval texts: *Sir Gawain and the Green Knight* and *The Franklin's Tale*. Both Gawain and Aurelius fall victim to this temptation, but are they able to redeem themselves by the end of their respective tales? In *Sir Gawain and the Green Knight,* Gawain takes part in a Christmas game with the Green Knight. This game involves an exchange of strikes, where Gawain will receive a strike one year and a day after he strikes the Green Knight. His fear leads him to be tempted by a magical girdle that is said to protect him from death. Aurelius, a squire in Geoffrey Chaucer's *The Franklin's Tale,* is also tempted by magical solutions to gain his own desire: love. In his tale, Aurelius makes a deal with Dorigen, a lady already in love with a knight, that should he clear rocks from a cliffside, she will become his beloved. This impossible task leads Aurelius to a wizard who can utilize the magic of illusions to fulfill this promise. Despite their choosing magic over their chivalric codes, the main characters find redemption in the end and retain their honor as knight and squire. Gawain realizes his fault in faith and honor and carries his humiliation upon his person in the object that tempted him: the green girdle. Aurelius, seeing how sorrowful Dorigen appears in fulfilling her promise to him, releases her from her word so she may live happily with the one she truly loves, putting her heart above his desire. My research reveals that these knightly men, through their own errors, redeem their knightly honor and prove they are worthy of being knights.

Leuviah Blakma
Research Advisor: Virginia Tompkins

The Senior-to-Senior Program: The Impact of a Telephone Intervention on Advanced College-Aged Students and Lonely Older Adults

Nearly one-third of older adults worldwide struggle with feelings of loneliness, which were exacerbated by the COVID-19 pandemic. Our study implemented a telephone intervention entitled the Senior-to-Senior program in which senior citizens received weekly phone calls from advanced college-aged students (i.e., the other "seniors") over the span of eight weeks. Students were primarily enrolled in courses for which this fulfilled a research practicum assignment; though some were campus volunteers. This intervention served to demonstrate whether or not weekly phone calls help to alleviate symptoms of loneliness, depression, anxiety, and hopelessness in older adults at risk for loneliness (e.g., because they live alone). It was expected that seniors would respond favorably to the program and display a decrease in adverse symptoms. Seniors responded to an intake survey to measure their initial attitudes and mental health symptoms. The same questionnaire was administered at the conclusion of the study and comparisons were made between preliminary and final assessments. During the eight-week program, students called their seniors for a friendly chat; students submitted a summary of each chat for later qualitative analysis. Students' perceptions of research and attitudes toward older adults were also measured pre- and post-intervention. Results showed that the Senior-to-Senior program led to significant decreases in loneliness and geriatric depression. We also found a significant increase in life satisfaction. Qualitative, thematic analysis of the chats is ongoing and will be completed at the time of the presentation; some emerging themes include family, travel, etc. These findings support the need for similar programs in older communities. Furthermore, such programs have demonstrated to be feasible due to their cost-efficiency, ease of delivery, and relatively quick results. This program was unique because it was implemented by undergraduate students; the results showed that this type of program has significantly impacted students as well.

Rease Haley
Research Advisor: Patrick Carroll

Naive beliefs and ADHD

The purpose of this study was to determine if an individual's beliefs about ADHD (Attention Deficit and Hyperactivity Disorder) would affect the likelihood of seeking medical treatment. We looked at future behaviors involving treatment. Our hypothesis was that an individual's actual level of ADHD would have a large impact on their intention to seek treatment. We also predicted that their beliefs about ADHD (malleability vs. fixedness) as well as the extent to which it has caused them problems, would predict their intention to seek out treatment. We used a survey methodology, starting with a commonly used screening questionnaire for ADHD, followed by questions gauging an individual's perception of their level of ADHD, their attention span, and their beliefs about the malleability of ADHD, in relation to their likelihood of seeking treatment. As predicted we found that an individual's actual level of ADHD correlates with future behavior in regards to seeking treatment. We also found that an individual's perception of their own level of ADHD, and their beliefs about the malleability of ADHD, also correlate with their intention to seek treatment. These findings show that an individual's perception of the disorder should be gauged with diagnoses and treatment, as this could lead to possible false negative and false positive diagnoses.

Keywords: Introspection, ADHD, Attention, Perception, Treatment Seeking Behavior

Adam F. Jmiai
Research Advisor: Joseph P. Green

Practice with Probabilities, Combinatorial Functions, and Odds

In order to gain practice with combinatorial functions and learn probability statistics, we downloaded archived data from the State of Ohio's lottery website. Our dataset included all drawings of Keno during the months of January, April, July, and October of 2013 and 2023 (N=80832). Keno is a game of chance where 20 numbers are randomly selected from a possible lot of 80. A multiplier (aka, "booster"; values range from 1 to 10) follows each game. From the online site, we copied the drawing ID, date of the drawing, draw sequence number, booster, and each of the 20 drawn numbers per game. We observed that the number of draws increased from 2013 to 2023 (from 307 to 351 draws/day). We observed 3 dates in 2023 (i.e., 7/2, 10/1, and 10/8) where there were 317 drawings. To create an approximate time of day variable, we categorized draws by their sequence number into three groups: a) first 100, b) middle 100, and c) last 100 draws per day.

Though a series of Chi-square tests, we examined whether each of the 80 numbers occurred within chance levels. Assuming p=.05 and 80 tests, we expected 4 tests to be significant by chance alone (reflecting the likelihood of Type I error; .05x80=4). We observed 3 significant tests. We conducted a follow up assessment examining the frequency of these three "unique" numbers by examining an additional month's worth of results (August, 2023; N=10881). None of the retests were significant. Results from additional Chi-square tests showed that the booster did not vary by day of the week or by our time of day variable. As expected, our observations suggest that drawings and booster frequencies are random.

Elyjah Roa
Research Advisor: Virginia Tompkins

The impact of storybook character characteristics on story comprehension in preschool aged children

Previous research has shown that storybook character characteristics can have a varying level of impact on children that read the storybook. It has been demonstrated that realistic characters in storybooks improve storybook comprehension in preschool aged children (Kotaman and Balci, 2016). Also, attributing human like characteristics to animal characters negatively impacts novel fact learning about the animal being altered (Ganea et al., 2014; Pinkham et al., 2014). Despite these findings, there is very little to no evidence comparing human characters, animal characters with human names, and animal characters in terms of story comprehension. We initially predicted that human storybook characters would result in the best comprehension followed by anthropomorphic characters and then animal characters. Our research tested this relationship on 55 preschool aged children who were randomly assigned to 3 story groups: human, animal with human name, or animal. Data is still being collected at this time and more data will be added at the time of presentation. Preliminary results have shown that there is nearly no difference in story comprehension score between human and animal with human name groups (8.41 vs 8.4, respectively). The animal group showed a difference in story score compared to the aforementioned groups (7.39), but it was not found to be a statistically significant difference. On an individual storybook level this difference in comprehension would likely have a very small effect, but over time the type of storybooks that a parent buys for a child could have a compounding effect. Further research should be conducted to confirm if a difference exists in storybook comprehension between human and animal characters.

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